IoD *Inspiring* **business**

The future of connected business

MAKING THE UK THE WORLD'S BEST LINKED BUSINESS ENVIRONMENT

Overview

- The UK has many strengths as an economy. When it comes to infrastructure, however, we are only in a mid-table spot among industrialised countries, and towards the bottom of the group of G7 nations.
- The transformation of UK infrastructure is a huge and ambitious agenda, but with the right and long-term approach, the Government's aim should be for the UK to be the best connected country in the world.
- World-beating infrastructure, which can cope with projected population growth and technological change, as well as keep pace with economic needs, can't be built overnight. It will require vision, but also for policy-makers to take hard decisions.
- The UK has major gaps to fill now – from broadband and mobile, to digital signalling on the trains and road prioritisation for space-efficient buses.
- We must also capture more and better data about our roads in order to drive intelligent investment decisions to reduce accidents, pollution, congestion and maintenance costs.
- The next generation of infrastructure investment must build spare capacity and lift the trend growth rates of all regions and devolved administrations.
- In the longer-term, step-change technologies and projects must be considered, such as a radial motorway for the East of England, a radial Hyperloop for the Northern Powerhouse, the conversion of regional airports into drone cargo and personal air vehicle ports and the creation of a number of spaceports.

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Executive summary

The UK has many strengths as an economy, ranking 8th in this year's World Economic Forum Global Competitiveness Index[1]. When it comes to infrastructure, however, we are only in 11th place, behind European rivals such as the Netherlands, France and Germany. For transport specifically, we fall to 15th.

In many cases, we are failing to get the basics right. Congestion on our roads, which are often in poor-repair, is the worst in Western Europe[2]. Mobile coverage is so patchy that phone users can't make voice calls or send text messages on all four mobile networks in 30% of the UK's landmass[3]. Broadband speeds lag well behind many countries because the UK's legacy copper-based network, in places over 100 years old, still dominates our communications network.

Meanwhile, frustration about poor transport connectivity is adding to resentment about regional imbalances. Business welcomed the creation of the Northern Powerhouse and Midlands Engine initiatives, but even where infrastructure is planned, the benefits are seemingly far-off and uncertain.

High Speed 2 (HS2) will not be finished for over a decade, poses value-for-money questions, and in its first phase provides a better link between Birmingham and London, rather than between Northern and Midlands centres. Transport for North's Northern Powerhouse Rail project meanwhile, between Liverpool, Manchester, Sheffield, Leeds, Newcastle and Hull, is not expected to be fully completed until as late as 2050.

All of this would be challenging enough if the population were not expected to grow by another 7 million people by 2041. This paper asks the question, how can we make the UK the best-connected country in the world? We break the question into two parts:

1. **Priorities for the short to medium-term:**
   These include speeding up the rollout of fibre broadband, making more use of under-valued bus and coach travel, enabling universal 5G coverage, legalising Personal Light Electric Vehicles, rapid digitisation of rail signalling and optimising road investment through better data capture.

2. **Ideas for long-term, transformational change:**
   Potential long-term projects such as Hyperloop for the Northern Powerhouse, revamping regional airports into hubs for autonomous air vehicles and the designation of as many as 3 UK spaceports should all be on the agenda.

Some of the technologies outlined in the final section may sound fantastical, but they are far from being science fiction. Futuristic developments, particularly in areas like commercial space travel, are rapidly becoming reality. The task for the UK is to balance the immediate challenges, with the need for long-term ambition at a fast enough pace to move to the front of the pack.

[1] World Economic Forum, 2017. *Global Competitiveness Index*, UK. [online] Available at: https://goo.gl/5v3Pqy [accessed: 02.03.18]

[2] INRIX, 2017. *Global Traffic Scorecard*. [online] Available at: http://inrix.com/scorecard/ [accessed: 02.03.18].

[3] Ofcom, 2017. *Connected Nations*. [online] p.17. Available at: https://goo.gl/oFHLkJ [accessed: 02.03.18].

Priorities for the short to medium-term

Broadband

According to the SpeedTest Global Index for April 2018, the UK has a world ranking of 30, with an average download speed of 51.06 Mbps and a much lower one for an upload speed of 11.12[4]. This is against a global average of 45 and 21 respectively. The final stage[5] of digitising the fixed telephony infrastructure – by replacing copper with fibre optic cable to all 30 million premises of the UK has only just begun. By world standards, we are far behind and it is going very slowly with just 3% of premises reached, compared to 60% in Spain or higher in nearly every other country in Europe[6]. A consultation response by INCA (trade body for the alternative network providers), anticipated that it would take 15-20 years at the current pace[7]. There are 3 reasons why:

- The historically high cost of accessing BT's physical infrastructure of ducts and poles -costs which are not present in other countries many of whom are far ahead of the UK in fibre optic cable rollout. So high in fact is the cost of accessing Openreach poles – at £10 per pole per year- that one company in Scotland, Comms World, which had planned to connect up homes with "aerial fibre" – wrapping it round telephone lines and poles and thus avoiding the cost of digging – realised it was cheaper to erect their own poles at £500 each.

- BT's pension deficit is £14 billion, so the main cash cow of the BT group, Openreach needs to hold onto and sweat as long as possible its copper assets and will not gain any new revenue with fibre optic replacement which will have to be done at cost.

- Openreach is planning to extend the lifespan of the legacy copper network with upgraded but non-symmetrical G.fast technology, crowding out Alternative Network providers offering full fibre.

We propose 4 solutions:

1. Lower access charges to all Openreach ducts and poles to zero for third parties. This open access should only be applied if the 3rd party agrees to resell usage of the fibre to other third parties[8], including BT and Openreach. This would transform the build-rate for fibre optic cable, particularly in the more remote areas where the cost per premise served could fall from £2,000 to £200-£400. It would also tap into a lot of investment capital (that BT simply does not have) to pay for the fibre optic cable upgrade – particularly in the lowest yielding part of the network – rural areas. Shared, and low-cost, open access to pre-existing infrastructure would drive next generation fibre optic competition and investment, as Lithuania was able to do 14 years ago, leading to its current top-rated e-infrastructure in the EU.

2. Increase and expand the remit of the government's UK Full Fibre Network Fund to target investing in new ducts and poles as well as their upgrades and maintenance. Lowering access charges to the physical infrastructure to zero eliminates the incentive to build new ducts and erect new poles. It also removes the incentive to invest in maintenance and upgrading of the capacity of the existing infrastructure. How good the existing physical infrastructure is also not totally known with large areas only serviced by ductless buried copper cables. But it is clear that it does not have adequate capacity for expansion and will require ongoing maintenance and upgrading.

3. Government should set a copper switch-off date of 2025. Though an ambitious deadline, this would create certainty for investors and has a precedent with the switch-off of analogue TV signals. From an engineering point of view, this is straightforward. From a scale-up and labour force perspective, it is more difficult. A mandated switchover will run into problems of those who don't want to switch from copper and ISPs reluctant to handle a surge in customer gripes when invariably it fails to run smoothly. Regardless, this is an investment that will have to happen and running a hybrid network copper and fibre network will be much more expensive and less efficient and translate into a drag on the British Economy vis-à-vis its competitors.

4. There is a wide disparity of investment suitability for fibre to the premises (fttp) across the country. Divide the country's network areas into 3 different levels; competitive areas – where 2 or more network operators can build and compete with each other, monopoly – where only one competitor could operate and uncommercial – where the costs of fttp are prohibitive. The first two areas will require some scaled investment covering areas reached by up to 5,500 exchanges. For uncompetitive areas working with much smaller shapes like remote communities, villages and streets connected by a green cabinet or a distribution point, we need a bottom up approach. Once that community has 50% of residents ready signed up to an ultrafast switchover, they could outsource to a big range of network

[4] Speed Test, 2018. *United Kingdom - Fixed* [online]. Available at: https://goo.gl/BwpSQZ [accessed 02.03.18].

[5] The fibre optic backbone of the telecoms network that ran to all exchanges was laid down in the early 1980s. The superfast connection, which replaced copper wiring from the exchange to the green cabinet, has only just been completed. The final stage is to lay fibre optic cable from the cabinet into the building/premises.

[6] ISP Review, 2017. See https://www.ispreview.co.uk/index.php/2017/05/2017-eu-broadband-progress-report-puts-uk-bottom-full-fibre-cover.html

[7] INCA, 2016. Response to Future Telecoms Infrastructure Review. [online] Available at: https://goo.gl/D9AMvY [accessed: 02.03.18].

[8] On 23rd February Ofcom proposed lower access charges and more open access to enable cheaper fibre optic cable build. This is meant to lead to 20% rollout by 2020. However, we do not believe this goes far or fast enough to make the UK the best connected country in the world. See https://www.ofcom.org.uk/about-ofcom/latest/features-and-news/new-rules-boost-full-fibre-broadband

providers, including Openreach, which can bid competitively to do the work. Councils should be given freedom to subsidize contracts to increase speed of deployment and coverage at their own discretion.

Bus and coach road prioritisation to reduce congestion

Bus and coach road prioritisation to reduce congestion.

Unlike trains, buses and coaches can change their routes in a matter of weeks. Yet in many cases, the most space-efficient and cleanest users of our roads are getting slower. We are also seeing new innovations like Chariot[9] – that aim to Uberise bus services by ending fixed routes and running routes on demand. Improvements to bus service reliability can be made very cheaply with paint and kerbs. Further improvements that can be made are with more guided buses that use special wheels to track the road and kerb and drive much closer to the side, freeing up space and mandating priority at traffic lights, so that when buses approach stop lights, they turn green.

Update the law to legalise the use of Personal Light Electric Vehicles on roads, pavements and cycle lanes

Personal Light Electric Vehicles (PLEVs) are set to take off as falling battery costs and capacity revolutionize the speed, cost and convenience of personal surface transport at pennies per mile. Currently PLEVs take the form of kick scooters or unicycles with up to 1200w of power, 80km of range and speeds up to 35 kmph. They are currently only legally allowed on private land but other European nations have made provision for them, setting speed limits on pavements and allowing them on roads and in cycle lanes. A law similar to that existing with electric bikes that enabled their legal passage, some speed restrictions (12 kmph on pavements, 35 kmph on roads and cycle paths), mandating helmets and insurance would go a long way to opening up a new vector of transport.

Towards universal 4G and 5G coverage by 2025

The UK has a poor world ranking of 51 for its mobile speeds of download 26.32 Mbps and upload 10.62[10].

Along with broadband, we believe that mobile connectivity is a rare case where faster speeds and capacity trigger additional demand and growth. No one would experience the levels of smartphone use we see today without the 3G and 4G masts dotted around the country. It seems that 4G auctions were successful in raising taxes and engendering competition, but poor in achieving the outcome of universal coverage, in a reasonably short period of time.

The UK was also late to the 4G party, launching its first auction in 2013, 5 years after the USA in 2008. Similarly to the problems of fixed broadband, where shared infrastructure can lower costs and speed up deployment, it was only last year that Vodafone and O2 agreed to share 4G masts. According to MobileUK, most Local Authorities and Local Enterprise Partnerships have also often failed to plan adequately for new masts as a part of basic infrastructure. That needs to change.

5G's challenges are so much greater because the range per cell is only 100-200 metres. That would require 500,000 base stations (macro, micro and pico-cells) in London alone. However, the opportunities run far beyond mobile phones. There are potential benefits for connected and autonomous vehicles, smart utilities connecting up 700,000 transformers and sub-stations, artificial intelligence, real time supply chain management, monitoring from millions of sensors, connected health wearables and implants, as well as many new network providers offering services. This is possible because the latency – the speed at which data takes to travel between its source and the destination – is just 1 millisecond – against 50 for 4G. 5G also means download/upload speeds of between 400-10,000 Mbps, as opposed to 10-40. This will unleash many opportunities and capabilities, some of which we cannot even imagine.

Last December, the first specification of 5G standards was agreed[11]. We also recently saw the first 5G auction in the UK which raised £1.35 billion for the government. 5G will struggle to work indoors without an FTTP (Fibre-to-the-Premises) connection. So the government should aim to have a universal 5G rollout by 2026. Going forward, the government should be less concerned about raising tax revenues from the auction proceeds. Instead, they should focus on increasing competition and new entry at a lower level, the speed of deployment, how accommodating local authorities are and the ability of operators to share infrastructure. A future auction needs to align government interests in raising revenues with public interest in network coverage and the speed of its deployment. The government also needs to help create a 5G spectrum on demand market for new entrants to price and trade spectrum as and when they need it. Right now, major sporting or entertainment events like Aintree, Silverstone or Glastonbury will need major mobile capacity for a few days a year at most. But this is not commercially viable for mobile operators who buy 20 year spectrums and so they are often ill-served. Other new entrants to the market could also be Landlords who become owners of the base stations, unleashing additional investment capital, who then sell usage to mobile operators at say, pennies per gigabit to their respective customer bases. Finally other potential players – like Transport for London – that have network connectivity for their CCTV and power, should be permitted to enter the spectrum wholesale market, if they choose to bolt on 5G small cells to their existing kit. This would have the added benefit of preventing the visual impact of multiple cells in new locations around London.

[9] See Chariot, https://www.chariot.com/. Now also planning to come to London, see: Titcomb, J. (2017). Ford applies to launch six 'Chariot' bus routes in London. *Daily Telegraph* [online]. Available at: https://goo.gl/XG671R [accessed: 02.03.18].

[10] Speed Test, 2018. *United Kingdom – Mobile* [online]. Available at: https://goo.gl/dtkLuA [accessed 02.03.18].

[11] Gartenberg, C. 2017. The first real 5G specification has officially been completed. *The Verge* [online]. Available at: https://goo.gl/e6vEvq [accessed: 02.03.18].

Prioritising digitisation of railway signalling

Better signalling allows trains to run faster and closer together and has the potential to double capacity. You would also not need separate lines for fast and slow trains travelling the same route because faster services could stop at different stations[12]. It may come as a surprise to some, but the UK still has some 500 manned mechanical signalling boxes that date back to the Victorian era. On top of these are 200 larger power signal boxes dating from the nineteen-sixties and -seventies using old electrical equipment. Network Rail does have a plan to digitise all of the signal boxes but it is not expected to be complete until 2040[13], with 70% of them completed by 2033.[14] This is far too slow and should be a priority upgrade. Other suggestions involve moving trackside signals effectively onto the trains themselves, using the 4G network, to pinpoint each train's locations and adjust accordingly. This seems to be a much better adaptive and iterative approach. This may also have the benefit of lower running costs, as remote signalling equipment will not have to be protected and serviced by maintenance crews[15]. The success of the Victoria line in London which thanks to digital signalling is now the second most frequent metro line in the world (with a train running every 100 seconds) shows just what can be done.

Capturing data on our roads for optimal intelligent investment

Easily the UK's greatest infrastructure asset is its 246,000 miles of roads. Unfortunately, we know little about them.

As is not the case with crime or property price data. We are unable to query roads geospatially to find out some invaluable information. For example:

- Where do the most and least types of accident happen, and at what time of the day or year do they happen relative to traffic volumes and road length?
- Which roads have the most or least accidents, and what kind of street furniture relative to traffic volumes and road length do they have?
- Which roads have been treated for the most or least potholes and when?
- What is the annual cost of maintenance for each road, then weighted for traffic and road length?
- Which areas have the most/least pollution relative to road traffic and at what times?
- Which local authorities have the highest and lowest annual road repair and maintenance costs relative to the length of roads and volume of traffic?

To their credit, the Department for Transport does release annual locations for 130,000 road accidents and other data,that could answer some of these questions. But it has not yet translated into data-driven policy at the national and local level. The upside to collecting and analysing this data so as to make intelligent interventions are huge. Today motoring taxes equate to some £48 billion but expenditure on roads runs to just a quarter of that or £12 billion. The other side of the balance sheet for the UK's roads are the external costs, and they are considerable. The highest are road accidents, running to £35 billion per annum[16], followed by congestion at approximately £8 billion15 and road-transport derived air pollution which has been estimated to cost somewhere between £3 and £12 billion per year[17]. Many small sensors linked to a 5G network would be able to offer this information in real time. The Motor Insurance Industry, as well as companies like Google and Apple should also do more to open up the data they are already collecting. Government should lean on the Ordnance Survey to release more free data, and local authorities should publish their O&M costs per road, so that they can be compared nationally.

This openness will drive down costs and increase competition through greater public awareness.

[12] See Vidago, T. 2014. How to double railway capacity without building new track. *Infrastructure Intelligence* [online]. Available at https://goo.gl/k8G8eV [accessed: 02.03.18].

[13] Paton, G. 2016. End of the line for signal boxes after 150 years. The Times [online]. Available at: https://goo.gl/HjoQXE [accessed 02.03.18].

[14] See https://www.networkrail.co.uk/feeds/millions-set-to-benefit-as-railway-technology-transformation-takes-off/

[15] Department for Transport, 2016. Reported road casualties Great Britain: 2015 annual report [online] p.28. Available at: https://goo.gl/uHsrYf [accessed 02/03/18].

[16] INRIX/CEBR, 2014. The future economic and environmental costs of gridlock in 2030 [online]. Available at: https://goo.gl/SoaBvB [accessed 02.03.18].

[17] Yim, S. and Barrett, S., 2012. Public Health Impacts of Combustion Emissions in the United Kingdom. Environmental Science & Technology 2012 46 (8), 4291-4296.

Ideas for long-term, transformational change

Radial motorway for the East of England

The East of England is uniquely ill-served by motorways; it doesn't have any. A particular choke point is the A12 and A14 around Ipswich. Either a completely new motorway or upgrading existing roads to motorways, linking up Ipswich, Norwich, King's Lynn, Peterborough and Cambridge with a high capacity, fast radial motorway, would transform the economic fortunes of East Anglia. Care would have to be taken to build sensitively and tunnel where possible. East Anglia is flat, has lots of open space and it should be possible to do this relatively quickly and cheaply.

Radial hyperloop or maglev trains for the Northern Powerhouse

The basic idea of the Northern Powerhouse is to link up the siloed populations of the Northern Cities of 9 million people and match the agglomerative impact of London. It is a good idea. Transport obviously has to be a key component of the project. Unfortunately, Northern Powerhouse Rail or HS3 as it was earlier known, may not be completely finished until 2050 according to Transport for the North (TfN).

More than that, the improvements in journey times and the time it will take to complete all the work are far from radical enough to make an impactful difference. There are 2 reasons for this. Firstly, moving large volumes of people between these cities is much more challenging than in London because outside of the centres of these cities, the population is much more dispersed. So the agglomerative effect is not as great.

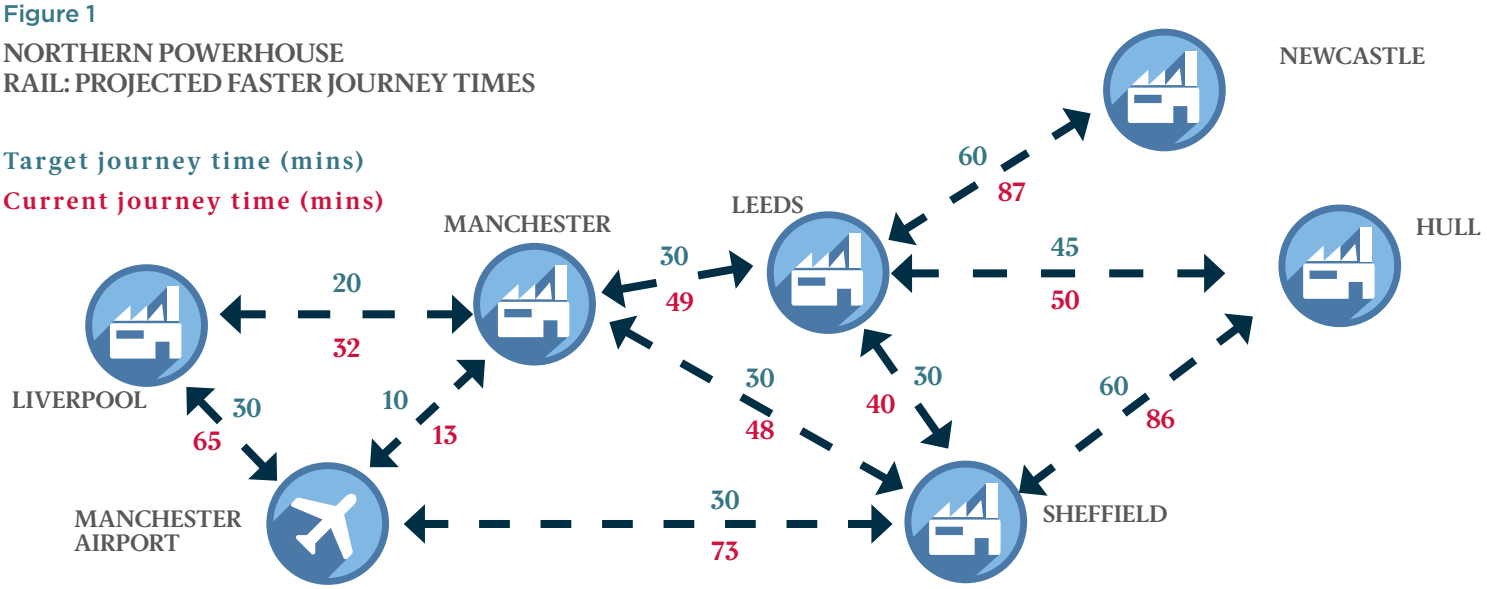
Secondly, unlike with London, you will have to create demand with the new service - rather than cater to pre-existing demand - which carries much more risk. To close this gap, this is where a major step-change in speed is called for - hyperloop. Hyperloop works by moving pods containing goods or people through a near-vacuum tube at speeds up to 740mph. The first 10km demonstration line is likely to be built by 2020 between Abu Dhabi and Al Ain by Hyperloop Transportation Technologies Inc. for the World Expo. The other main company, Virgin Hyperloop One, has already built a full-scale hyperloop system for testing.

Essential to making this work for the Northern Powerhouse will be tunnelling. Tunnelling is one of the few areas of infrastructure where the cost is actually falling and projected to fall faster. The areas that will see the greatest efficiency gains are automation of tunnel lining, using the spoil as bricks, increased power (and speed), ground penetrating radar anticipating obstacles and reducing tunnel diameters. This last point is crucial – cutting the diameter from 8.5m for a 2 lane road tunnel to 4m can cut costs by up to three-quarters[18]. Maglev Trains or hyperloop pods, as well as moving faster, can also work in much narrower spaces than road vehicles. At the same time, tunnels are always weather-proof and can be built in straight lines, avoiding curves and gradients that may be necessary on the surface.

What drives the cost of HS2 so high compared to other High Speed Train lines around the world is the land acquisition cost. The rolling stock costs a mere £7 billion or just one-eighth of the expected final cost of £55.7 billion. Including Phase 1 and 2, with a total line length of 330 miles, this equates to a cost of £170m per mile[19]. There is, however, no land acquisition cost for tunnels that run deeper than 9 metres. That is because they are entitled through the Transport Works Act (TWA) planning process, to be granted compulsory rights of way as long as there is no inconvenience to

Figure 1

NORTHERN POWERHOUSE RAIL: PROJECTED FASTER JOURNEY TIMES



[18] Economist, 2017. The search for quicker, cheaper ways of tunnelling. *Economist* [online]. Available at: https://goo.gl/Qxt5Zi [accessed 02.03.18].

[19] Official cost of HS2 put at £55.7 billion in 2015 prices. Total length in miles of phase 1 and 2 is 330 miles equating to £168.4 m per mile. See Department for Transport, 2016. *Strategic Outline Business Case*, [online]. Available at: https://goo.gl/zs8Xr6 [accessed 02.03.18].

the landowners on the surface. One British company, Direct City Networks, believe they can tunnel and connect up either a magnetic levitation train (300 mph +) or even a hyperloop (up to 740 mph), by using a tunnel at a cost of £60-104m[19] per mile, including the cost of the tunnel, track, stations and systems.

A maglev train running from Liverpool to Hull would only take 29 minutes and would, at their estimate, cost £11.6 billion. Maglev is proven technology and can point to over 10 years of safe Maglev operation in Shanghai[20], running 19 miles between Shanghai Pudong International Airport and Logyang road station (further Maglev development in China has proven less attractive mainly due to the relative inexpensiveness of land acquisition for High Speed Trains).

A hyperloop would do it in 17 minutes – both are well within acceptable commuting times and could serve the role of turning Northern City Centres into Metro stops and effectively creating a super-city. A further stage would be to link in a radius a southern branch from Hull through Scunthorpe, Doncaster, Sheffield, Manchester Airport to Liverpool. This would double the cost but would increase the opportunities to the second tier cities as well as offer greater efficiencies through a radial network. A radial network has the advantage that pods can keep circling 24 hours, without stopping and run a higher frequency service with less need for stables and platforms. Either would be a game-changing improvement on the current 3 hours or more involving up to 2 changes, or the 40 minute improvement expected by Northern Powerhouse Rail when it arrives, eventually.

In any event, the Indian State of Maharashtra certainly seems to have taken note and aims to deploy hyperloop at a much larger scale. Virgin Hyperloop One recently announced plans to build a 10 km test track there by 2021 with a longer term aim of connecting up Mumbai with Pune or 26 million people. This would reduce the journey time from over 3 hours by train to 25 minutes[21] – roughly the same time saving between Liverpool and Hull.

Whether it is Maglev or hyperloop, the Northern Powerhouse is a clear opportunity to leapfrog existing transport systems that are only capable of marginal improvements. Above all, it would be the kind of infrastructure that can prove to be inspirational.

New regulated airspace for personal air vehicles and re-awakening of regional airports

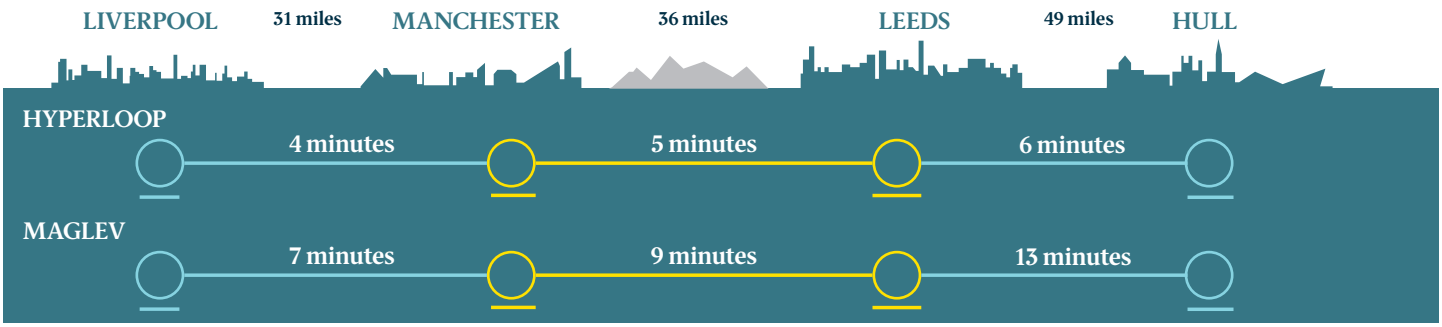
On-demand, auto-piloted Personal Air Vehicles are coming and so are much smaller package carrying drones pioneered by the likes of Amazon Air. Navigating through the air to a pre-set route is much easier than the demands of self-driving cars coping with pedestrians, traffic and the built environment.

Progress is being made most noticeably by Lilium, a vertical take-off and landing aircraft, with multiple electric jets that transition to level flight. Elsewhere, people-carrying quadcopters, like scaled-up drones, are being built around the world[22]. Until unmanned traffic management is made possible by ubiquitous 5G and ultrafast connectivity, the difficulty will until then be regulating the airspace and designing the air corridors that they will move through. It cannot be too far off before they are deemed safe enough to fly over and land within a UK City centre. Sensor-driven connectivity between all modes of transport will eventually create a visible live map of real time traffic that will transform the efficiency of moving everyone and everything from A to B.

There is also a major opportunity for the UK's 500 regional airports – many of which are in public ownership and making a loss – to operate more like in the USA, To do this, we need to see a new market emerge for 50 seat small regional jets that offer regional point to point journeys and short check in-times of 30 minutes or less,

We should also aim to make viable another related part of the future aviation market – largely autonomous personal air vehicles and cargo drones between the regions or even the near abroad. To do this, the UK must move faster to enable a regulatory regime for passenger air vehicles between regional airports and even near-abroad locations within a 300 km range. As well as massively improving connectivity between regions, the opportunity is there to create new regional logistics hubs based around local drone-ports.

Figure 2
NORTHERN POWERHOUSE JOURNEY TIMES USING MAGLEV OR HYPERLOOP PODS THROUGH TUNNELS



[19] DCN300, 2017. *Direct City Networks* [online]. Available at: http://dcn300.co.uk/ [accessed 02.03.18].

[20] Virgin Hyperloop One, 2018. *Route estimator – Liverpool to Hull* [online]. Available at: https://goo.gl/V5jhFM [accessed: 02.03.18].

[21] Virgin Hyperloop One, 2018. *Indian State of Maharashtra Announces Their Intent to Build First Hyperloop Route in India* [online]. Available at: https://goo.gl/4L6BfB [accessed: 02.03.18].

[22] See Ehang, 2017, Ehang 184 [online]. Available at: http://www.ehang.com/ehang18 [accessed: 02.03.18] Volocopter, 2017. Volocorapter [online]. Available at: https://www. volocopter.com/en/ [accessed: 02.03.18].

Spaceports

In 2012, the IoD called for an enabling regulatory regime for spaceflight and the designation of some future potential spaceports[23]. The Space Industry Bill that has just passed through the Houses of Parliament has made this possible[24]. To be better connected with Space, though, the UK will need more than 1 spaceport – maybe even 3, for suborbital operations, satellite launch and vertical heavy launch and recovery. There may also be a need to have some overlap in the facilities to enhance competition and hedge against bad weather or new kinds of vehicle, cargo and orbital and suborbital destinations.

Since the IoD paper of 2012, the number of suborbital vehicles requiring a horizontal take-off and landing site, has dwindled from several to just one. However, there has been much progress in vertical rockets and increased demand for UK-based satellite launch. The rapid advances being made by SpaceX and Blue Origin in reusable rockets is turning the conventional launch market upside down while the market for deploying micro-satellites for communications is mushrooming. Not many analysts saw reusable vertical launch reusable suborbital vehicles coming either. There is a still to be determined question over what relationship the UK has with other European Space Partners and beyond post-Brexit which impacts deeply on future space access requirements.

The typical criteria for suborbital airports requiring horizontal take-off and landing remain the following;

- A long enough or easily extendable runway to 9,500 feet
- Close to the sea / unpopulated areas
- In regulated airspace up to 24,500 ft (LFIR)
- Next to a danger area
- No interference with Upper Airspace Traffic – up to 66,000 ft

What this means is that very likely, of the Government's shortlisted sites, for suborbital operations, Llanbedr (now Snowdonia Aerospace Centre) and Newquay are prime contenders. Whereas a site in Scotland could work well for vertical launch to polar orbit to perform earth observation. For large rocket launch like the SpaceX Falcon Heavy rocket or even the muted future interplanetary Big Falcon Rocket (BFR), with sufficient demand, the UK might want to start to think about establishing a spaceport at Ascension Island just as Europe launches Ariane rockets from French Guiana. Placed as Ascension is on the equator, a rocket could lift 15% more cargo into orbit than from Cape Canaveral – a huge advantage. We urge the Government to keep a number of sites open to hedge for the future and for the UK to have easy access to space, as and when it materialises, in any form.

To be the best connected country in the world in the long-term, it is imperative that the UK has easy access to space.

SpaceX Big Falcon Rocket

[23] Lewis, D. 2012. Space: Britain's New Infrastructure Frontier [online]. Available at https://goo.gl/efmeMS [accessed 02.03.18].

[24] Space Industry Bill HL Bill (2017-19).

Conclusion

While there is no sign that economic globalisation will be reversed, and the UK will have to focus on strengthening ties with markets all across the world in the coming years, that does not mean we can neglect the domestic infrastructure that enables connections between businesses, consumers and different parts of the country. In areas ranging from broadband to buses, the UK is failing to take advantage of technology that is already available to us.

We are only creeping forwards in terms of transport and communications infrastructure, and it will require a change of attitude if the UK is to embrace any of the transformative potential of exciting prospects such as hyperloop or reusable space rockets. Some of the technologies outlined above may seem far-fetched, but that is always true until new ideas are tested and proven. The prize is potentially enormous, not only in terms of the UK's general economic competitiveness, but also in what these projects could do to address imbalances across the country. Long-term transformation is not quick or easy, so the time to start thinking big is now.

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Dan has been working with the IoD since 2011 on Energy Policy. Since March 2014, his brief has been expanded more broadly to include Infrastructure.

Policy wins 2017

Every month we seek IoD members' views on key policy issues affecting their organisations through our Policy Voice panel. Here are just some of the many ways we influenced government policy and successfully lobbied for changes to the law on the back of Policy Voice surveys of our members in 2017.

Brexit

Securing a transition period before Brexit went top of the Government agenda after sustained pressure from the IoD, informed by Policy Voice members. A transition period was agreed with the EU in principal in December with the precise details set out in March 2018.

Employment

The rights of EU citizens to remain in the UK after Brexit came top of Policy Voice member priorities. Most of those rights were guaranteed by the Government in December 2017 following consistent and vocal lobbying by the IoD.

Taxation

Budget 2017 provided more help for SMEs with business rates after the IoD raised the concerns of Policy Voice members directly with the Chancellor.

Infrastructure

Ofcom reformed the communications market after consistent lobbying from the IoD on the need for more and faster fibre optic broadband provision, informed by Policy Voice surveys.

Education and skills

Skills shortages have consistently been one of the top concerns raised by IoD members in Policy Voice. Retraining was placed at the centre of the Government's Industrial Strategy after the IoD spearheaded a campaign to boost lifelong learning.

Start-ups

The IoD successfully pushed the Government to retain SEIS/EIS tax reliefs for start-up businesses in the 2017 Autumn Budget after plans they would be scrapped. The IoD has been appointed as the UK representative to the G20 on behalf of entrepreneurs.

GDPR

Policy Voice members expressed concern about GDPR compliance and a new helpline was launched by government to help SMEs understand the new rules.

Gig Economy

The IoD members called for greater clarity in employment law and it became a cornerstone recommendation in the Government's Taylor Review.

Labour Mobility

The IoD helped force a Government U-turn on plans for a proposed £1,000 per EU worker immigration tax on employers after Policy Voice members raised concerns about access to migrant labour.

Join Policy Voice

for your chance to influence Government!

www.iod.com/policyvoice

Institute of Directors

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The Institute of Directors

The IoD has been supporting businesses and the people who run them since 1903. As the UK's longest running and leading business organisation, the IoD is dedicated to supporting its members, encouraging entrepreneurial activity and promoting responsible business practice for the benefit of the business community and society as a whole.

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