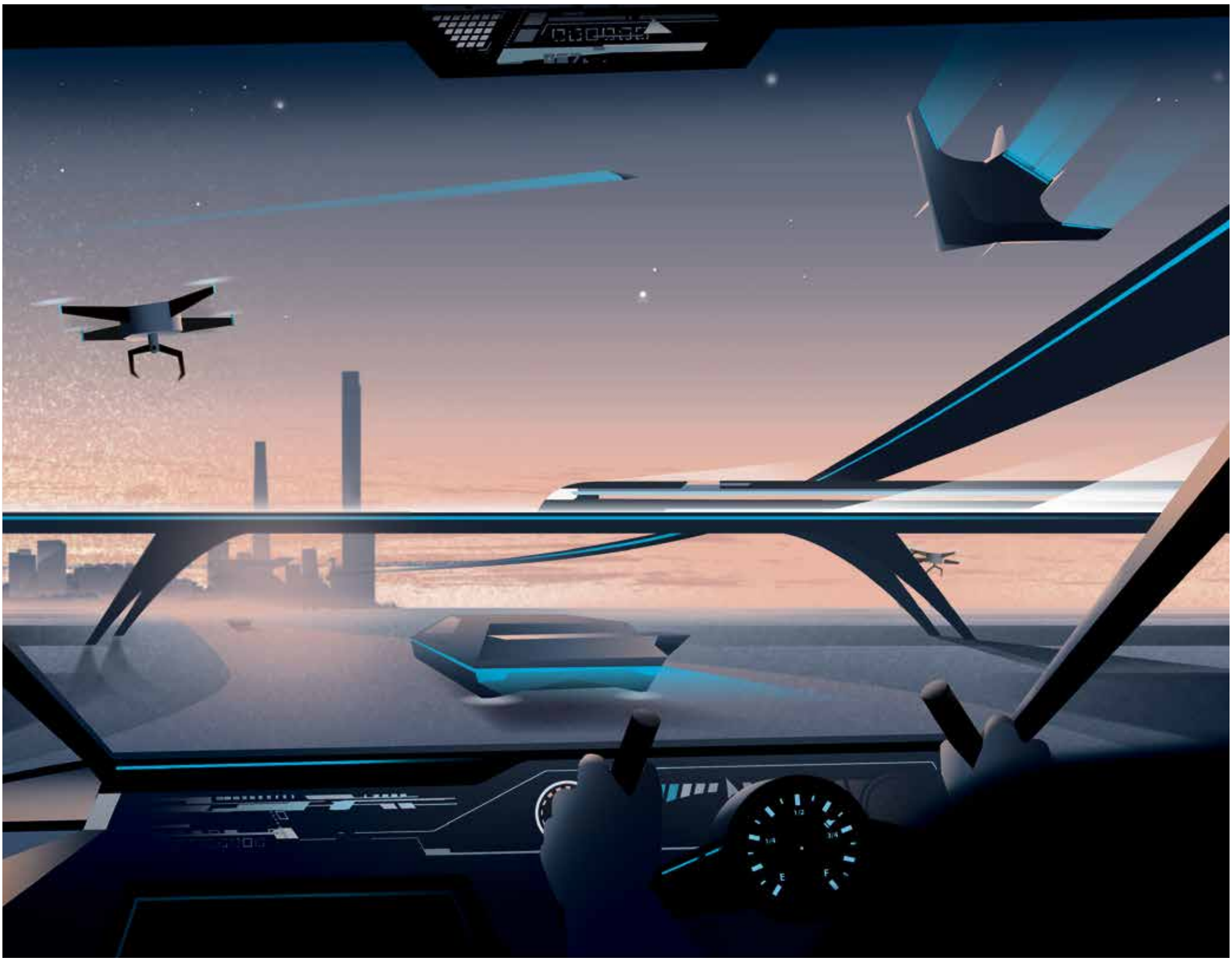
FUTURE OF TRANSPORT



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Hyperloop One

Artist's illustration of the Hyperloop electric propulsion transport system, which moves pods at high speeds through tubes in a low-pressure environment

Travelling towards challenging times

Transport is changing fast with the rapid development of electric and self-driving vehicles as well as high-speed public transportation

OVERVIEW
FELICIA JACKSON

The transport industry is facing unprecedented challenges. Notably, technology is having an impact on consumer and industrial travel, from the development of autonomous vehicles to the planned Hyperloop with people and goods travelling at high speed in pods propelled inside tubes.

To understand how this will play out, it's important to look not at the elements of transportation, but at the trends and challenges transportation faces overall.

Professor Nick Reed, academy director at the UK's Transport Research Laboratory (TRL), says: "With existing transport systems under pressure to meet growing demand and to achieve targets for air quality, accessibility and inclusion, we see the emergence of four key megatrends driving change and growth in the transport industry: electrification, automation, connectivity and shared mobility."

As Lesley Slater, operations and business development director at LeasePlan UK, says: "One of the biggest concerns is that the infrastructure for electric vehicles hasn't been reliable enough. But as of February 2016, nearly 4,000 UK locations have installed public charging points."

Electric vehicles are now a viable option for consumers, fleets and city-based deliveries. Professor Reed adds: "Electric road systems will also be considered, particularly for heavy-duty vehicles on highways."

A range of trials examining public trust and acceptance of automated vehicles for the movement of people, goods and services are planned in the UK, such as the GATEway project, which is led by the TRL.

"Vehicle manufacturers, technology providers, research groups and transport operators are working towards increasingly sophisticated automated vehicles," says Professor Reed.

The increase in automation highlights one of the biggest challenges to deployment, which is standards and regulation. News of the recent crash between a municipal bus and Google's self-driving Lexus RX 450h in California demonstrates that we still have numerous hurdles to overcome. The autonomous car raises the issue that not only do we lack agreed standards, but there is also no agreed way of validating systems.

> We see the emergence of four key megatrends driving change and growth in the transport industry: electrification, automation, connectivity and shared mobility

John Cusano, senior managing director of global insurance at Accenture, says: "Even now, in the current early stages of automation, liability becomes cloudy if you consider a situation where a driver still controls the vehicle, but the automated braking system fails: does the liability lie at the feet of the manufacturer or the driver?"

It is the combination of automation with a massive increase in data access and analytics that creates the potential for the growth of connectivity and shared mobility. Nic Farhi, partner at OC&C strategy consultants, says: "Mass transit will change enormously. Currently travellers have to fit preordained train and bus timetables; in the future driverless buses will be able to plan routes in response to real-time journey requests, like UberPOP [ride-sharing] is starting to do today. Supply will fit demand, as opposed to demand having to fit supply."

Everything from fleet management, logistics, rail, shipping and air will be affected. As John Davies, retail director at Trainline, points out, rail passenger numbers have reached an all-time high, with more than 1.65 billion journeys being made annually. "We can expect new forms of rail to emerge, such as Hyperloop, dramatically shortening travel times and providing cheaper, faster and safer alternatives to high-speed rail and air for long-distance travel," says Mr Davies.

Gordon Wakeford, managing director at Siemens Mobility, says the digitisation of areas such as signalling or ticketing will undoubtedly increase capacity and frequency across rail networks.

"However, it is the change in the ways in which we incorporate data and communication in transport that will be revolutionary, and is what the industry should be focusing on. We are already seeing the increasing use of smart data in apps, which prioritises the needs of the customer. The innovative use of data will be central to the improvement of customer mobility, be it by train, bus, tram or even bike," he says.

The challenges faced by the transportation industry, such as data management and analysis, automation, connectivity, cyber security and consumer security, are only likely to be exacerbated by Brexit. While Chris Jackson, head of the transport sector group at Burges Salmon, says most UK transport is "unlikely to be substantially affected by changes to direct funding from Europe", he warns that the indirect impact may be a freeze on the time and resources available for UK projects, including HS2, Crossrail 2 and south-east airport expansion.

He adds: "Increased connections between road and vehicles, influence in developing the technical and cyber-security standards will be key. Many of those standards will be developed at an EU and global level, so the UK will need to work very hard not to be sidelined in this critical phase. There is also a concern that loss of access to the EU Single European Sky means that UK operators may no longer be sure of obtaining equal access to capacity and frequency."

The necessary skills required to address the infrastructure and technological needs of the transport sector are also a concern post-Brexit. Mr Wakeford says an estimated 4,000 engineers will be needed over the next five years in the rail industry alone.

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Driverless buses, drone ships and more

The most futuristic and ambitious projects in the transport industry are no longer a far-flung and distant vision

INNOVATION
DAVID APPLEYARD

If you find your daily commute something of a chore then here's some good news: things are about to change for the better. Advances in autonomous systems such as object recognition, lightweight materials and propulsion are manifesting themselves in a host of new transportation solutions. These will transform not just the way we think about travel, but how we conduct business, and how and where we live our lives too. Just last month Mercedes-Benz launched its semi-automated city bus. The premiere of the CityPilot took place on a 20km-long route linking Amsterdam's Schiphol Airport with the town of Haarlem and during the journey the driver was not required to steer, accelerate or brake. If a driverless bus sounds like an attractive prospect then welcome to the future of transport.

01 Tesla's Model S all-electric saloon vehicle

02 Prototype of Sea Hunter, an autonomous anti-submarine vessel, being trialled by DARPA

03 Test site for the Hyperloop electric propulsion transport system

04 Mobile working space concept by IDEO

05 Tesla's Model S all-electric saloon vehicle

06 First powered flight of Virgin Galactic's SpaceShipTwo over the Mojave Desert in 2013

01 ELECTRIC VEHICLES

Central to the success of electric vehicles is battery technology and the battery in your laptop uses the same lithium ion chemistry as the current generation of electric vehicles. But it is a technology with significant room for improvement.

Cosmin Laslau, energy storage senior analyst at Lux Research, says: "We can further cut costs and improve performance by another 20 to 40 per cent at least before the technology is done for. Until the early to mid-2020s, lithium ion is still the one to beat.

"In our view there are only two that really have a chance at deposing lithium ion in the next decade or so. The first are solid state batteries and the second are lithium sulphur batteries."

David Greenwood, professor of advanced propulsion systems at WMG, University of Warwick, also highlights a number of likely contenders for the lithium-ion crown. "For applications where you need a lot of energy, but you're not particularly sensitive to the volume of the battery, the kind of thing going into say trains, then the lithium sulphur family of chemistries is quite interesting. Some of the lithium air families of chemistry are showing some very good energy density and we have sodium ion rather than lithium ion," says Professor Greenwood.

02 AUTONOMOUS SHIPPING

Crewing a marine vessel is expensive and it's not just a matter of wages. Ships have to be designed to accommodate crew and equipped with cabin space, heating, ventilation, lighting, and the provision of food and drink for a long voyage. The possibility of more efficient ship designs is one reason why autonomous vehicle technology is also coming to the marine sector.

As Oskar Levander, vice president of innovation in the marine division at Rolls-Royce, says: "This is happening. It's not if, it's when." Mr Levander was speaking at the first Autonomous Ship Technology Symposium in Amsterdam in June, but autonomous marine vessels already exist.

A number of smaller navy vessels are in service or are under development. For example, the 132ft Sea Hunter, an autonomous anti-submarine vessel, is being trialled by the US Defense Advanced Research Projects Agency following its launch in May.

Rolls-Royce is working with VTT Technical Research Centre of Finland on its Advanced Autonomous Waterborne Applications Initiative, in which a land-based control centre with a small crew monitors and controls a fleet of autonomous vessels across the world.

As VTT senior scientist Mikael Wahlstrom explains: "You have flying drones already, you have the satellites and you have object recognition. You don't need technological breakthroughs anymore."

03 HYPERLOOP

A radical new concept for the high-speed transport of people and cargo is the Hyperloop One. Backed by PayPal founder Elon Musk, the system is based on a magnetic levitation vehicle operating in a vacuum tube and driven by an electric linear motor.

But perhaps more significant, without air resistance such vehicles are expected to travel close to the speed of sound – faster than a commercial jet aircraft.

Rob Lloyd, chief executive at Hyperloop One, says: "We see Hyperloop as a new mode of transportation something that follows on with equal or greater impact than what we saw with trains and the individual mobility that was enabled by the automobile."

Mr Lloyd highlights breakthroughs in tunnelling technology as one of the keys to Hyperloop development, and with the commissioning of the world's longest and deepest rail tunnel due later this year – the 57km-long Gotthard Base Tunnel between Switzerland and Italy runs up to 2.3km deep – he emphasises the reality of Hyperloop technology.

"We're building the first prototype system; we'll demonstrate that to the world in the early part of 2017. We expect that we'll begin construction in 2017 and 2018 of the first production Hyperloops, probably freight first, passengers second, coming to fruition in 2020 for freight and 2021 for passengers."

04 AUTOMOBILITY OFFICE

As confidence in driverless vehicles grows, new phases of automobility are anticipated. One concept explored by design consultancy IDEO considers the inverse commute: working spaces that will come closer to where people live instead of commuters heading to work at a fixed urban location.

Interlocking pods that could be configured for specific requirements would navigate to a pre-determined location, say a transport hub like a railway station or airport, perhaps at a location between two teams.

Luis Cilimingras, managing director of IDEO's London studio, explains: "These are not self-driving offices; they were never intended to be places people work in while they're moving. Instead, they're making a workplace much more flexible because they can be parked anywhere.

"The future of a much more creatively productive workforce is also a much more flexible workforce and this is starting to loosen our dependence on real estate. But the time that you need to spend with a team, face to face, is still absolutely necessary and very precious – the inverse commute concept addresses that.

"The number of parking spaces we're going to need is dropping because there are fewer cars being owned privately and there's much higher utilisation of cars. Peak areas become vacant and they could become places where these driving offices settle," says Mr Cilimingras.

05 PERSONAL AERIAL VEHICLE

The idea of a flying car is at least as old as powered flight, but breakthroughs in a number of technological areas are now expected to make that dream a reality. "The level of technology available – carbon fibre, lightweight materials or power density of the new engines – allows us to design and develop an entirely new type of efficient vehicle," says Stefan Vadocz, of Slovakia-based AeroMobil.

AeroMobil is already trialling its 3.0 prototype, a two-seater flying roadster. "Our plan is to commercialise AeroMobil in 2017, with manufacturing in 2018," says Mr Vadocz. "We believe the category of vehicles which is often referred as a flying car or a personal aerial vehicle (PAV) will be a natural extension or alternative to the set of cars, aeroplanes and helicopters we use today."

He is not alone in this belief, several companies are now looking to commercialise PAVs in the coming decade, among them are outfits reportedly backed by Google founder Larry Page.

Initially a niche product aimed at buyers of new technology, supercars and small aeroplanes, it will be followed later with vehicles for wider public use and could be offered through transportation-as-a-service scenarios, possibly as a shared or fractionally owned vehicle.

"AeroMobil can become an inspiration and a new stage in the future of personal transportation," Mr Vadocz concludes.


05 AeroMobil


06 MARS Scientific

06 SPACE FLIGHT

Advances in space technology have already transformed transportation with the advent of satellite navigation. However, the next generation of space tech could open the heavens to all of us.

A host of privately funded space ventures are busy developing technologies that will not only open up the possibility of low-cost, sub-orbital space travel to individuals, but also to those wishing to deploy space technology.

As Virgin Galactic boss Sir Richard Branson says: "The future will see many sustainable space businesses that improve livelihoods, bolster communities and grow economies. We created Virgin Galactic to open access to space.

"By lowering the cost of flexible, reliable and dedicated flights to orbit for small satellites, we are creating an opening for satellites from emerging designers that feature their fresh take on engineering possibilities.

"Like other technologies, with practice we will be able to make our forays to space cheaper and more frequent while increasing performance."

Like Virgin, XCOR Space Expeditions is offering seats aboard its Lynx craft on future space missions, while Elon Musk's SpaceX has struck a deal with Nasa to transport astronauts aboard its Dragon craft. In 2012, Dragon became the first commercial spacecraft to deliver cargo to the International Space Station.

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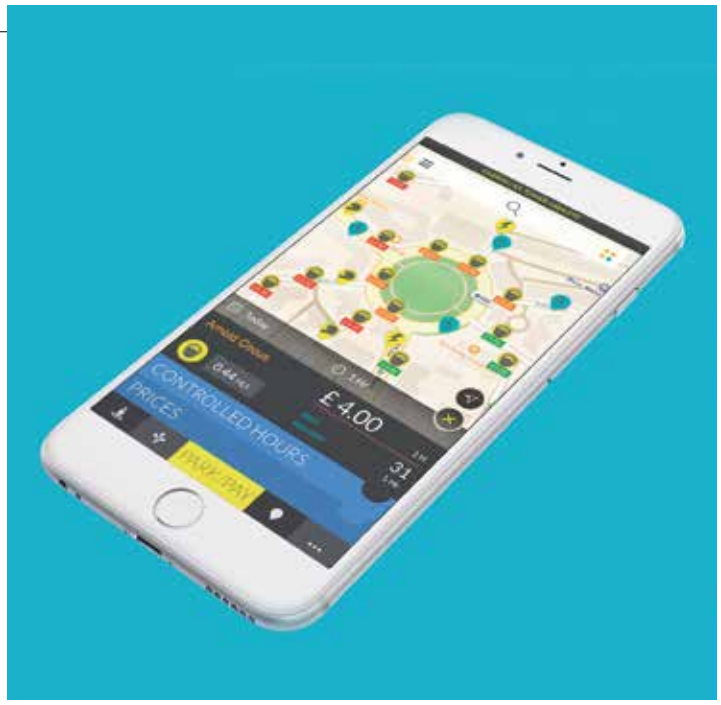
COMMERCIAL FEATURE

MAKE PARKING AN 'APPY' EXPERIENCE

The future of parking is an integrated online portal directing drivers to the nearest or cheapest space in a matter of seconds

appyparking
ONE PLACE FOR EVERY SPACE



Developments in transport technology mean automated vehicles and smart cities are now starting to become a reality. But there is one area which remains behind the times – and that's parking. Some 30 per cent of inner-city congestion is caused by vehicles looking for parking spaces, which accounts for 10 per cent of a vehicle's CO_2 emissions. This isn't just environmentally damaging, but economically too; 60 per cent of drivers say they have abandoned activities because they couldn't find a parking space.

With the technology that exists, it should be possible for drivers, whether business users or private individuals, to access information as they enter a city centre directing them to the nearest parking space, alerting them to prices, distance and availability, as well as letting them filter between off and on-street parking.

Developing this "last-meter navigation" would see a significant reduction in the amount of traffic in city centres, and make businesses and individuals much more productive. The average UK driver wastes 347 days and £37,000 in fuel in their lifetime trying to find somewhere to park, so there are huge benefits for both individuals and the businesses which employ them in developing a more efficient operation.

Part of the reason why such a solution does not yet exist is due to the fragmented nature of the UK parking market. Private providers have traditionally been unwilling to give transparent pricing information, while local councils are reluctant to share data in a format that could be accessed by anyone.

What is required is a fundamental change of mentality, which would see providers make data accessible to all in an open format, which could then be used to develop an intelligent mobility system with real-time information around all types of parking, such as car parks, on-street, disabled, electric, motorbike and loading bays.

AppyParking is the UK's leading parking solution company and is creating such an ecosystem. Its free national app and website acts as a shop window for people looking for parking, showing any parking restrictions that apply, and directs drivers to the nearest or cheapest registered spot. Unlike other parking apps, it acts as a marketplace for paid-for locations, allowing drivers to pay any of the cashless parking providers.

And AppyParking is set on driving forward innovation in its sector. By supplying high-definition traffic management data to car manufacturers, vehicles can effectively become self-enforcing vehicles, telling owners if it's parked illegally. This could also be used by private companies, which find themselves paying significant fines in busy city centres, as well as reducing time looking for spaces. In time, this could reduce the number of traffic wardens, and be used by councils and consumers to provide a fairer and more positive parking experience for all.

> The average UK driver wastes 347 days and £37,000 in fuel in their lifetime trying to find somewhere to park

Last year AppyParking joined forces with Vodafone and Westminster City Council, and turned cars into sensors in a solution called One Click Parking™. Sharing a vehicle's location means that automatic start-stop parking sessions occur, allowing drivers finally to experience near-frictionless parking.

"It's as easy as getting an Uber," says Dan Hubert, chief executive and founder of AppyParking. The trial was a world first and reduced parking times from 20 minutes to 30 seconds. The Department for Transport is now supporting the trial for a commercial rollout at the end of this year.

In short, AppyParking is building stepping stones towards a much bigger intelligent mobility system, which will homogenise the various parts into one connected-car, smart-city solution further down the line. Its work has already been recognised; earlier this year AppyParking was awarded the Parking Future Award at the British Parking Awards and it was voted the 15th most disruptive company in the world, among other prominent accolades.

The ultimate aim, though, is to create an integrated portal that would enable all parking providers to share real-time information with potential customers around parking availability, which requires a real cultural change in the industry. Only once this has happened can smart cities and autonomous vehicles become a reality, and parking can finally become a truly forgettable experience.

To find out more about AppyParking's vision for the future of parking, please visit www.appyparking.com

The rise of city car-sharing

Are we witnessing a cultural shift away from owning a car as mobility is increasingly viewed as a service just a tap away on a smartphone?

SHARING ECONOMY
TOM EDWARDS


Scott Barbour/Getty Images

Some 67 per cent of Zipcar members say they are less likely to purchase a car in the next few years because of the vehicle-rental service

Your car can sit outside your home for days doing nothing. Research from the RAC Foundation shows the average car spends about 80 per cent of the time parked at home, 16 per cent parked at work and it is only in use about 4 per cent of the time.

Is it any surprise many are looking at alternatives and see little benefit in car ownership?

In London, the transport authority says the reasons people chose not to own a car are cost, stress, car parking, congestion and good availability of public transport.

And research for University College London shows car use peaked at 50 per cent of all trips in 1990 in the capital and has now fallen to 37 per cent. It is predicted to fall further.

Car ownership for some in cities is no longer a freedom; it's an expensive hassle and local public policy is playing a part in that. In central London, there is already a £10 congestion charge. There could also be a £12.50 "toxic" pollution charge for cars built before 2005. And the cost of car parking can be £4.90 an hour in Westminster; that's if you can find a space.

Cities are changing. There are "public realm schemes" introduced to improve the environment for cycling and walking. The flipside of that is driving in some areas takes longer.

Take the Torrington Place area of Camden in London. Road space has been taken away from vehicles and given to pedestrians and cyclists. There are plans for key routes in the capital like Tottenham Court Road to be bus and bike only during the week. Oxford Street, a main shopping area, will also be pedestrianised.

And there has also been investment in segregated bike tracks to try and encourage modal shift away from cars. The latest figures from Transport for London show the number of car drivers entering the centre in rush hour fell from 137,000 in 2000 to 64,000 in 2014. The number of cyclists trebled from 12,000 to 36,000 over the same period.

Transport bosses say the shift away from private cars to public transport, walking and cycling is "a feat unprecedented in any major city".

These changes aren't welcomed by many drivers, especially the vocal black cab lobby, but this policy shift isn't just restricted to London.

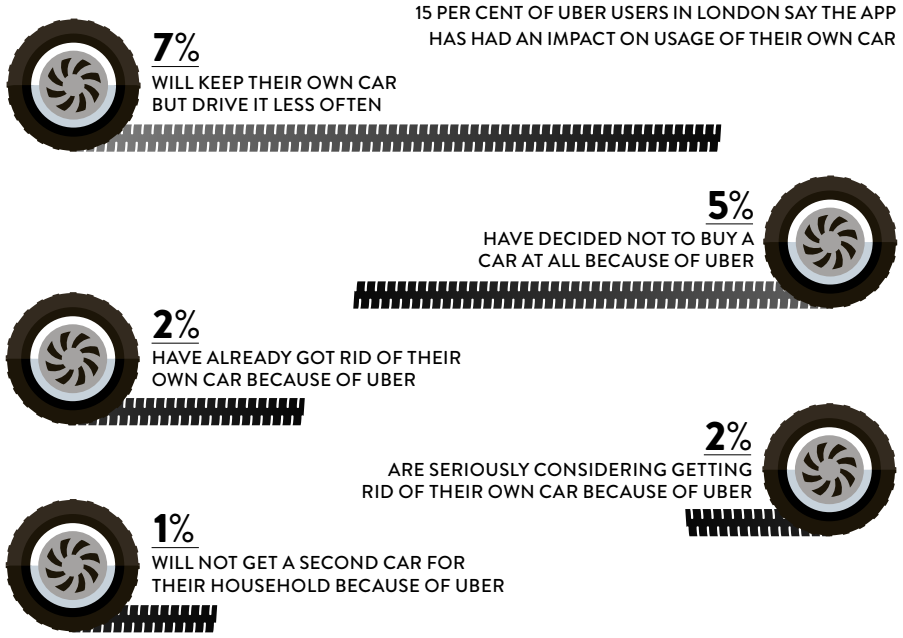
In Oslo cars will be banned from the centre by 2019 to reduce pollution. Large areas along the River Seine in Paris will be pedestrianised this summer as the city tries to clean up its air. In Dublin there are plans for key sections of the city centre to have no vehicles at all by 2017.

On top of public policy, you can add the new instant interactivity and practicality of the smartphone and ride-sharing and hailing apps. It's common to see someone tapping on a phone, standing on a street corner and either a black cab or a minicab pulls up.

You can use your smartphone to locate anything from black cabs, buses, hire bikes, car clubs and shared rides.

> The reasons people chose not to own a car are cost, stress, car parking, congestion and good availability of public transport

UBER'S IMPACT ON LONDON CAR USAGE
15 PER CENT OF UBER USERS IN LONDON SAY THE APP HAS HAD AN IMPACT ON USAGE OF THEIR OWN CAR



Source: Research Interactive 2016

> Our goal is a future where car-sharing outnumbers car ownership

If you have a postcode you can enter it into an app and it will plot the quickest way there using public transport.

In London, the minicab-hailing app Uber says it has two million users. It claims research shows 5 per cent of current or former users wouldn't buy a car because of the app. Black cabs also use apps like Gett, Kabee and Hailo.

Car clubs have also increased. Zipcar says it has 1,500 vehicles in the UK and it claims you can save £264 a month compared with owning a car. Nicolas Cole, president of Zipcar, has high ambitions. "Our goal is a future where car-sharing outnumbers car ownership," he says.

However, there are some concerns. City authorities recognise large numbers of car club vehicles and minicabs could increase congestion.

Referring to car clubs, Val Shawcross, the deputy mayor for transport in London, says: "I am a bit concerned that the business model might be set to change. Some are looking to park cars all over the place and leave them as massively available. That shift might be a step too far especially in inner London. We need to careful; are they reducing modal shift or increasing it?"

And there are warnings. Steve Gooding, director of the RAC Foundation, says cars that people own are still a vital way for them to get around.

He says continued investment in roads is crucial. "The car is the most common method of getting to work. Whether you believe cars help or hinder mobility and liveability, it makes sense to support investment in road infrastructure. Our paved surfaces are vital whether you get around on two wheels or four, on foot or on the bus, in car club vehicles or cabs," says Mr Gooding.

So will city planners change their design; will we continue to see a shift away from vehicles? Will planning policies encourage developments around transport hubs so people don't need cars?

In a number of inner London boroughs, such as Hackney, Camden and Tower Hamlets, some new developments are only given planning permission if they are car free. Residents aren't given parking permits for their own cars, but they can be given reduced rates for car clubs.

Zipcar's Mr Cole believes more cities will introduce these types of changes. "Urban planners are recognising again that streets should be designed for people and not vehicles, and we are already seeing many cities shifting towards better-managed urban growth, particularly in transport," he says.

Dr Rachel Aldred, senior lecturer in transport at the University of Westminster, says city planners should continue to make streets friendlier for people and cyclists.

"In London and many other cities across the world we see people, especially the young, turning away from the car. Cars are less and less crucial to people's identity, with car ownership and use levelling off or dropping," she says.

"This means, though, that politicians and planners must think radically, seize the moment, and reallocate space and investment to efficient and healthier modes – walking, cycling and public transport.

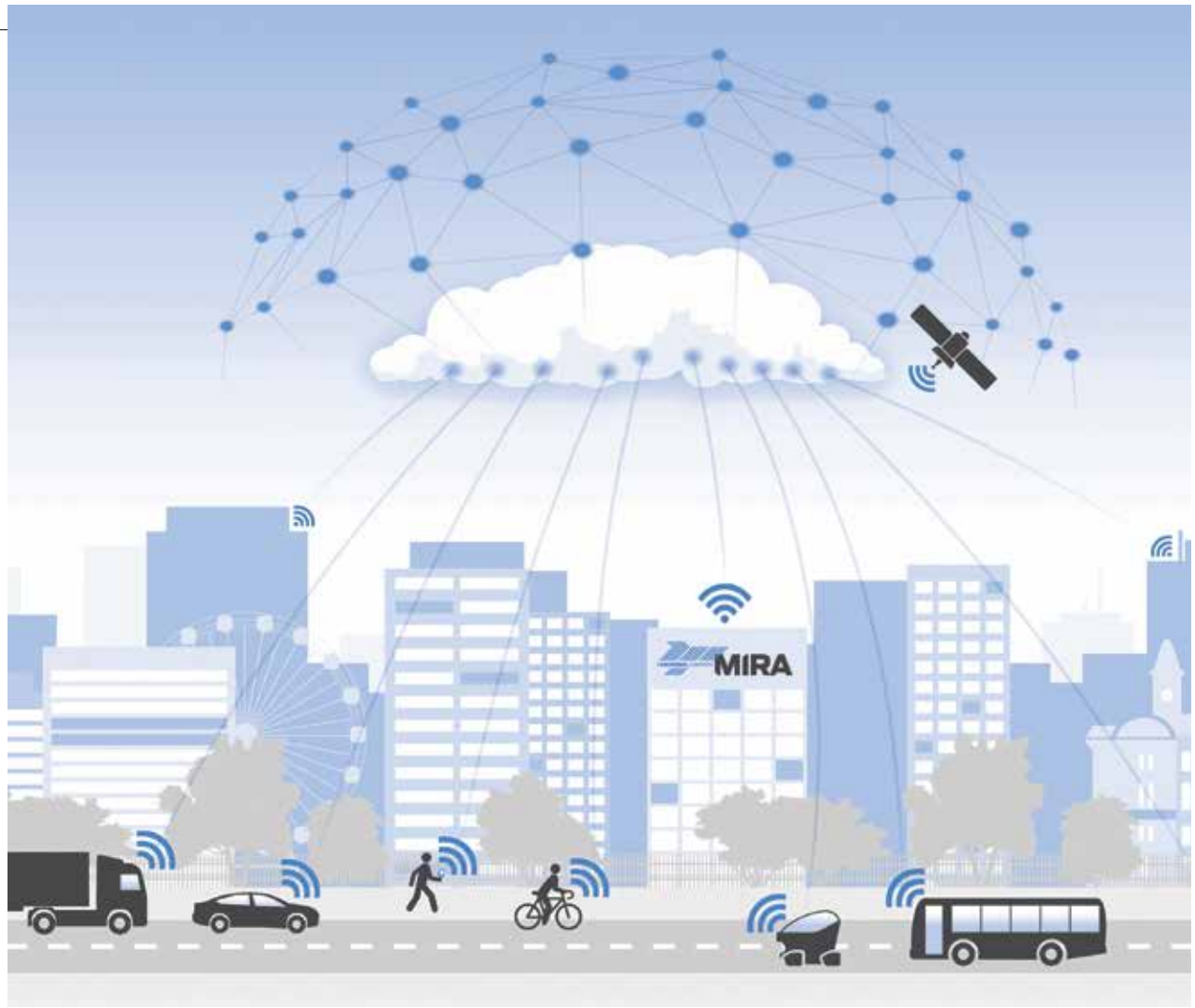
"Crucially, we need to design mass car use, based on that old model of individual car ownership, out of our cities, instead prioritising liveability and health. Otherwise the cultural pendulum could swing back as car trips speed up or petrol prices fall and we'll have missed the chance of a generation to change cities for good."

Urban areas are changing and it's being driven in part by public policy and the rise of sharing.

COMMERCIAL FEATURE

WHAT IS DRIVING THE DRIVERLESS CAR AGENDA IN THE UK?

The UK may be exiting the European Union, but it remains ideally positioned to lead the development of driverless cars



"In the world of personal mobility, change is in the air, or more precisely on the road. Not since the internal combustion engine got us off our horses at the end of the 19th century has the future of transport looked so different and the market opportunity so dynamic."

This bold statement, made by the chief executive of HORIBA MIRA George Gillespie, captures the mood of excitement within the automotive industry at present. As a pioneering global provider of engineering, research and test services to the sector, HORIBA MIRA is in the vanguard of developments and in Dr Gillespie's analysis, two global megatrends lie behind the way our relationship with the car is evolving and the industry along with it.

The first global megatrend has been ongoing for the last 25 years and revolves around continued efforts to reduce noxious gas emissions and carbon fuel consumption. This entails efficiency and environmental improvements to petrol and diesel engines, accompanied by increasing electrification, moving towards hybrids, battery-powered vehicles and alternative fuels.

Activity in this area has intensified of late, though, in response to the fallout from the so-called "dieselgate" scandal, involving misreporting of engine and emissions data by Volkswagen and other vehicle manufacturers. As a result, there has been a renewed focus from the regulatory authorities on emissions and fuel-economy performance and testing.

For the UK, this represents an important potential growth area, with the Automotive Council UK and government having identified the low-carbon powertrain – engines and transmissions – as a key differentiator going forward.

The second big megatrend is really about the car becoming a feature of our connected lifestyle and part of the internet of things – almost like a smartphone on wheels. In fact, the car is actually arriving pretty late to the party, with the automotive industry one of the last big markets to finally feel the force of the digital revolution. However, change is coming now and coming very quickly.

A lot of work at present is around technologies for vehicles that are increasingly intelligent – fitted with sensors such as cameras and radar – so they are increasingly aware of their surroundings and can take decisions on behalf of the driver on what to do, as well as optimise safety and efficiency. In addition, the cars are connected and it is this internet connectivity that enables them to become part of a 21st-century citizen's extended digital life.

Ultimately, the advances in connected and intelligent technologies lead us in the direction of autonomous vehicles or driverless cars as they are known. For the UK, these represent a major market opportunity and focus for investment.

According to figures from the Society of Motor Manufacturers and Traders, the overall economic and social benefit of connected and autonomous vehicles (CAVs) could be in the region of £51 billion a year by 2030. CAVs carry the potential to create an additional 320,000 jobs in the UK, and save more than 2,500 lives and prevent over 25,000 serious accidents.

In pursuing its market ambitions, the UK boasts a number of unique competitive advantages, says Dr Gillespie. "CAVs are going to happen, that is a reality and UK government recognises that. However, global competition is intense. Many nations around the world, including the US, China, Germany, South Korea and Japan, also see this as a once-in-a-100-years transformational opportunity and want to be part of it," he says.

"What the UK is looking to do is position itself as the leading location in Europe to test and deploy these technologies. In this country, we have an unrivalled ecosystem of resources to help customers develop their vehicles. In the whole of Europe, not only do we have four of the top five universities, but also its only megacity – London – and worst congestion, plus its only dedicated CAV test facility, right here in the Midlands, at HORIBA MIRA."

Developed at a cost of more than £10 million, the City Circuit at HORIBA MIRA in Nuneaton allows you to test CAVs in a safe environment, replicating road conditions and features found in a city, including controllable traffic lights, signs, multiple mobile communications permutations and urban canyon simulation.

Indeed, when the UK government announced funding earlier this year of £20 million for eight projects in enhanced communication between vehicles and roadside infrastructure or urban information systems, it did so at the HORIBA MIRA test centre.

These projects are the first to receive monies from the £100-million Intelligent Mobility Fund, with HORIBA MIRA a member of the successful consortium behind the £5.6-million UK Connected Intelligent Transport Environment (UK CITE) bid to create the most advanced environment for CAV testing.

UK CITE involves equipping more than 40 miles of urban roads, dual carriageways and motorways with combinations of connected car technologies. The project will establish how this technology can improve journeys, reduce traffic congestion, and provide entertainment and safety services through better connectivity.

> What the UK is looking to do is position itself as the leading location in Europe to test and deploy these technologies

For society and the individual, this rapid and unstoppable revolution in personal mobility will ultimately change our relationship with the car, forever, says Dr Gillespie. "I do think the move towards autonomous models will loosen the emotional link between user and vehicle. Once you no longer have the direct driving pleasure and responsibility of touching and controlling the car, the bond is broken and the desire to own the vehicle will diminish. A move towards mobility as a service then becomes increasingly likely, with us seamlessly subscribing to these services," he concludes.

"The commercialisation of these systems is not without challenges, such as addressing regulatory and cyber security concerns. HORIBA MIRA is at the heart of delivering solutions to overcome many of the technical hurdles and I forecast that for domestic uses, such as the daily commute, the future will be driverless."

£51b
estimated overall economic and social benefit of CAVs by 2030

320k
potential jobs created in the UK

25k
serious accidents will be prevented

2.5k
lives saved

Source: Society of Motor Manufacturers and Traders

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Are drones set to take off in th

Despite issues still to be fully addressed around their safety and security, drones could be delivering goods t

DRONES

MIKE SCOTT

When Amazon announced in 2013 they were starting to test deliveries by drone, opinion was split between doubters who thought it was nothing more than a gimmick and those who thought that by now the skies would be full of unmanned aircraft delivering goods to homes and businesses.

As in so many areas of technology, perception has moved faster than reality. At the moment drones remain just a gimmick, says Tim Gammons, global smart mobility leader at engineering consultancy Arup. "But you only have to look at how previous gimmicks have developed, such as apps and mobile phones, to see they could become very widespread very soon," he says.

From a technology perspective, the capabilities of drones are improving day by day. Advancements in autonomous piloting, "sense and aware" technologies, and increased battery life mean delivery drones are now very much a potential for the future, says Trish Young, UK head of business consulting for retail, consumer goods, travel and hospitality at Cognizant.

"However, a lot of preparation is still needed before drone delivery in everyday supply chain and logistics becomes feasible," she says.

While there is huge interest in drones and there have been numerous technological advances in terms of enhancing airborne time, autonomous navigation and lowering operational costs, there are still barriers to wider commercial adoption.

"Given that most commercial drones currently are flown along the line of sight, or can only travel short distances and with light loads, they are only really suited to delivering smaller business-to-consumer packages at the moment," says Ms Young.

Amazon says it wants to offer a service that will be able to deliver any package that weighs less than 5lb (2.27kg) by drone, to anywhere that is within a ten-mile radius of its depots, within 30 minutes. A Deutsche Bank report says drone delivery would cost just $0.05 per delivery mile compared with $6 to $6.50 for a typical shoebox delivery via logistics groups such as UPS or FedEx.

There is an opportunity for the last-mile delivery of smaller goods and also for deliveries of a critical nature, such as vital components that need to be delivered fast, says Mr Gammons.

An area where the technology could quickly gain traction is healthcare and emergency response, including the delivery of medical emergency services. "One of the main issues for emergency response teams is getting life-saving equipment and treatment to the people who need it as quickly as possible," Ms Young points out. "As drones become more and more cost effective, the possibilities to reach those most in need are growing exponentially. Drones can deliver small packages to the incident area in densely populated and congested urban locations quickly and accurately."

Drones are already being used to deliver blood and vaccines to hospitals in Rwanda. Less constructively, if no less inventively, criminals have used drones to deliver drugs to prison inmates.

Despite some stumbling blocks, the market for unmanned aerial vehicles (UAVs), as drones are technically called, is projected to reach $5.59 billion by 2020. "Once the technology is developed further, drones could potentially speed up and reduce costs associated with traditional supply chains, deliver an additional source of data gathering and provide added convenience because they are not restricted to postcodes," Ms Young says.

But before drones will be able to sustain the volume and consistency of business-to-business services, more work needs to be done to increase their load-lifting capacity and journey endurance.

In the long run, retailers and companies in the fast-moving consumer goods (FMCG) sector will be heavy users of UAVs, Ms Young predicts. "In the retail and FMCG space, drones are fast becoming a viable platform for delivery of products to customers. Retailers such as Amazon and Walmart have already begun trialing drone projects after realising their potential role in the future of logistics."

There are even plans for drone ships. Rolls-Royce has recently published a white paper proposing autonomous, remote-controlled ships with no people at all on board, which it says would cut costs and provide more room for cargo.

But Ms Young cautions that for drones to really take off in transportation, a number of issues still need to be addressed in local markets such as airspace management, liability and privacy-related issues.

In addition, to make the optimistic expectations a reality, governments will have to relax some of the current restrictions, perhaps set up a register of companies allowed to operate drones, and organisations will need to prove they have a strategy in place that complies with legislation.

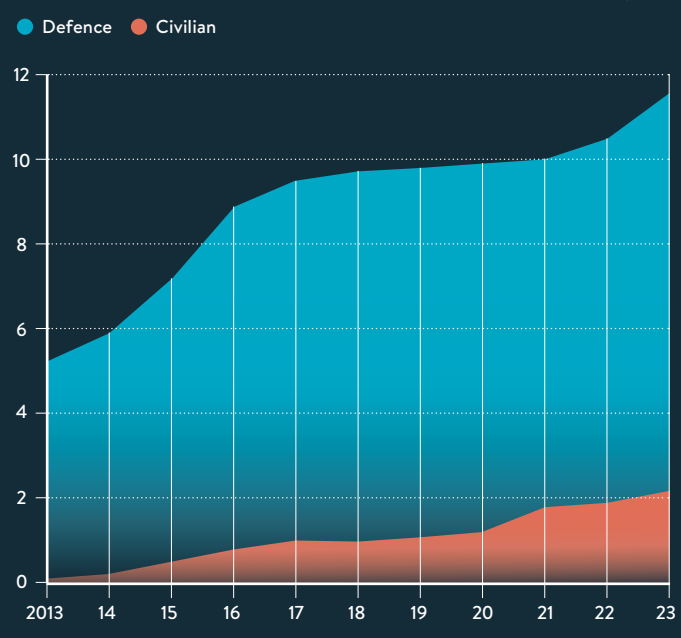
"We will need concrete legislation that outlines parameters of how they can be used. Only once an enabling policy framework is in place can the drone market fully develop," Ms Young says.

MATURITY LEVEL OF COMMERCIAL DRONES USED IN DIFFERENT SECTORS

STAGE: Early Middle Late

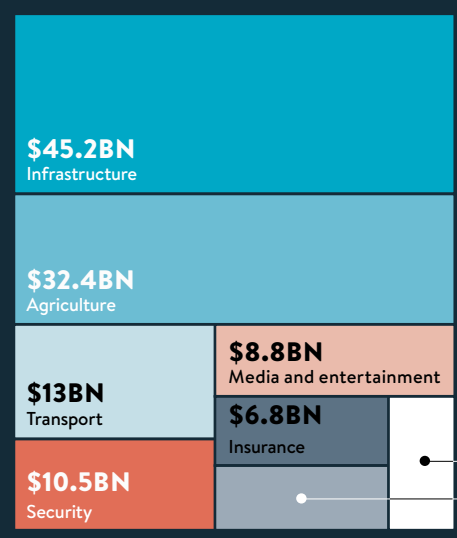
Source: Oppenl

GLOBAL AERIAL DRONE MARKET AND FORECASTS ($BN)



Source: Teal Group/BI Intelligence

ESTIMATED VALUE OF GLOBAL DRONE-POWERED SOLUTIONS IN 2015



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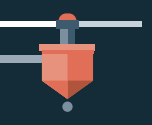

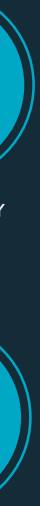

heimer & Co 2016

$127.3BN
TOTAL

$4.3BN
Mining

$6.3BN
elecommunications

Source: PwC 2016

LEISURE AND COMMERCIAL USAGE FOR SMALL REMOTELY PILOTED AIRCRAFT (RPA) IN THE UK

	Commercial	Leisure
01 RISKS	Collisions with other airborne or stationary objects and risk of injury to people on the ground	Collisions with other airborne or stationary objects and risk of injury to people on the ground
02 PERMISSION	Permission from the Civil Aviation Authority (CAA) is required for commercial flights. Permission can be withdrawn in cases of misuse	Permission from the Civil Aviation Authority not required for short flights away from people/ property/congested areas
03 FLYING RESTRICTIONS*	RPA system pilots can now apply to the CAA for permission to fly over congested areas and people. Flights are prohibited near restricted areas	No flights above 400 feet, closer than 50 metres to people/building or near restricted areas such as airports
04 PILOT QUALIFICATION	Pilot's ability is assessed as part of the CAA granting a permission to fly	None
05 DATA PROTECTION	UK Data Protection Act 1998 applies to commercial RPA use	UK Data Protection Act 1998 does not apply to data purely for personal or household use
06 LIABILITY INSURANCE	EU regulations require all commercial RPA pilots to purchase third-party liability insurance	None required

*under Air Navigation Order 2009

Source: European Union Committee/House of Lords 2015

COST BREAKDOWN OF REMOTELY PILOTED AIRCRAFTS IN THE UK

Category (weight)	Price (estimated)	Quantity (UK)
Few hundred grammes	• £100 (leisure use) • £10,000 (specialised)	Tens of thousands
<2kg	£100-£900	Thousands
3-7kg	£500-£4,000	360 commercial units
8-20kg	£4,000-£20,000	150 commercial units
21-50kg	£40,000-£100,000	2 commercial units
51-150kg	Up to £300,000	3 commercial units
>150kg	More than £500,000	None

Source: European Union Committee/House of Lords 2015

The UK already has guidelines around the use of drones. The Civil Aviation Authority's Drone Code requires drones to be flown in direct visual line of sight of the pilot; away from congested areas, aircrafts and airports; at least 50m from people, vehicles and structures; and under 400ft.

In the United States, drones can be used to inspect crops and infrastructure such as bridges, for aerial photography and for search and rescue purposes, but the US has placed restrictions on their use for deliveries.

The US Federal Aviation Administration has stipulated that the drone and its payload must weigh less than 55lb combined (about 25kg), that it must be within sight of its pilot, and each drone must have its own pilot, while those flying drones must pass a test every two years.

In the UK, the Civil Aviation Authority says deliveries must weigh no more than 20kg. So while companies such as Amazon and DHL say the technology is ready to be rolled out on a commercial scale, comprehensive restrictions imposed by regulators are putting a brake on the sector's development and frustrating companies that want to try something new.

But there are good reasons for this caution on the part of the authorities. Most obviously, it is still not clear how drones will interact with the world around them, who is responsible if there is an accident and how users can ensure the devices are safe.

One of the biggest issues is cyber security because drones need a wireless connection to an operations centre, making them vulnerable to attack by hackers. The answer to this is to implement encryption technology, but it is difficult to do this well, says Cesar Cerrudo, chief technology officer of cyber security consultancy IOActive.

"Drones rely a lot on GPS technology, and it has been proven that you can jam the signal and cause interference so drones don't know where they are," he says. "Another risk is that an attacker takes over your operations centre and then he will have control over all your drones. The best approach is to make sure your operations are strongly encrypted, not just on paper, but when your plans are implemented."

But Mr Cerrudo questions the extent to which this will happen because it requires investment and time that many companies are not prepared to commit. Nor does he think that, just because drones have emerged at a time of growing awareness of cyber threats, the industry will deal with the issue any better than other sectors.

"Tech companies have been investing in cyber security since the late-1990s, but experience tells us that every time there is a new technology, it has all the same problems that the old technologies did," he says.

Nonetheless, sooner or later drones look like being the next disruptive technology within the supply chain and logistics, and companies would do well to start investigating strategies now to see if drones would lift their business model.

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DRONE REGULATIONS BY COUNTRY

	Possibility of commercial flights	Licence required to fly	Possibility to perform beyond visual line of sight (BVLOS)	Licence required for BVLOS flights	Insurance required for commercial flights	Training required for pilots to obtain licences
UNITED KINGDOM	Yes	Yes	Yes	Yes	Yes	Yes
CHINA	Yes	Yes	Yes	No	Yes	Yes
GERMANY	Yes	Yes	No	No	Yes	Yes
FRANCE	Yes	Yes	No	No	No	Yes
AUSTRALIA	Yes	Yes	No	No	Yes	Yes
BRAZIL	Yes	Yes	Yes	No	No	No
UNITED STATES	Yes	Yes	No	No	No	No
JAPAN	Yes	No	No	No	No	No
RUSSIA	No	No	No	No	No	Yes
ARGENTINA	No	No	No	No	No	No

Source: PwC 2016

COMMERCIAL FEATURE

COMBATTING THE TRANSPORT HACKERS

Connected vehicles, packed full of cutting-edge technology, are now a must-have, but can present a golden opportunity for cyber hackers. Learn how a British company is helping secure vehicles globally against bleeding-edge threats

Over the last five years we have seen an explosion in the use of connected devices and services across the transport sector.

The development of in-vehicle apps is one example; everyone is used to apps on their smartphones and now expect to have access to the same apps when they're in their car.

They expect to be able to stream media over the internet, from music to games and films for passengers. We're also starting to see increased adoption of features such as smartphone-based vehicle unlocking.

Last year, NCC Group's Transport Cyber Security Practice demonstrated how a connected car's infotainment system can be wirelessly attacked via its DAB radio. Depending on the configuration of the vehicle platform, this can result in access to other connected "cyber-physical" systems that electronically control braking, steering or acceleration functions. This clearly shows the importance of cyber security and how it can directly affect the safety of vehicle occupants and other road users.

There are many areas driving developments in the automotive sector, including the insurance industry, which uses telematics data for premiums, and breakdown companies using location information to pinpoint where vehicles are.

We're even seeing the concept of just-in-time parts-ordering emerge, where a connected car can alert a local dealership if a particular component is wearing out and the dealership can ensure it has one in stock before contacting the customer.

But cars are not the only form of transport using connected technologies. Aviation has seen significant advances, to the extent where passengers can watch content mid-flight using their own devices rather than via the traditional seat-back screen.

And passengers even have the ability to make phone calls, and send texts and e-mails through mobile devices while in the air. Such connectivity opens up the possibility of online ordering, so customers can make in-flight purchases of duty-free products and pick them up at their destination, meaning airlines can offer a wider range and don't need to have items stored on the aeroplane.

Trains have similar infotainment systems to those seen on planes, including wi-fi access. They also have additional connectivity for the European Rail Transport Management System, which controls signalling and manages the location of trains throughout Europe.

Yet with this growing use of connected technology comes the threat of attack, either from cyber criminals or those intent on causing disruption. Much of this applies to all modes of transport.

GPS, for instance, provides both location data upon which autonomous vehicles rely for safe driving, and accurate date and time information used to manage timetables and schedules. New concepts such as truck-platooning, where trucks drive close together to conserve fuel, also rely heavily on GPS, so anyone tampering with information could cause chaos and even deaths.

Cyber attacks are a growing concern. Organised criminal gangs are expected to be the first to target vehicles as a means of making money through ransomware attacks or stealing financial data. Another major concern is the storage of payment card details and personally identifiable information on such devices.

Intellectual property is at risk too. Some of these vehicle systems contain sensitive algorithms, which manufacturers have spent millions of pounds on developing, and these could be the target of an industrial espionage attack.

For manufacturers, the problem is that many embedded devices were originally developed as standalone units, with no intention of them one day being connected to other devices or networks, so they often do not employ the same security practices as a connected system would have. With the rising demand for external connectivity of vehicles, these older embedded systems are being exposed as weak links from a cyber-security perspective.

The solution to this is two-fold. It takes a long time to build a new vehicle platform so manufacturers need to understand how to add connected functionality within existing legacy systems securely. But for next-generation platforms, makers need to design in security at the outset and think about how this needs to be applied at each stage of the product's life.

This secure development life cycle goes all the way from design, development and implementation through to ensuring you have an incident-response plan in place. If your system does get attacked, or someone talks at a hacker conference about a vulnerability they have found without disclosing it to you first, an incident-response plan will help you to manage the information flow to customers.

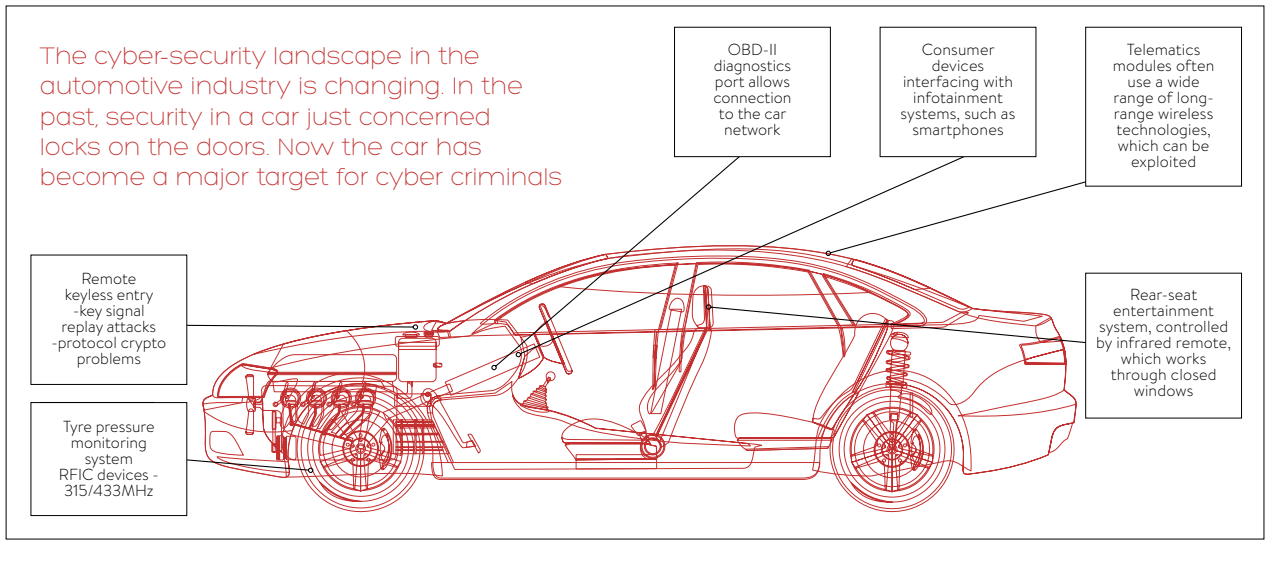
From a preventative perspective, at NCC Group we also use security assurance concepts, such as threat modelling, where you can look at all the different entry points from the perspective of a hacker and understand what you would potentially be able to achieve by attacking these points.

RIGHT
Andy Davis
NCC Group

NCC Group has a dedicated Transport Cyber Security Practice that regularly provides assurance to clients in this sector across the globe. The practice focuses on five main areas: automotive, maritime, aviation, rail and space. The potential for commercial space flights in the years ahead, along with the growing use of satellite technology means there is already demand for cyber security in this area.

The message to manufacturers and developers is clear. It's never a cost-effective or efficient approach to add a security solution as a bolt-on to a finished product. Such measures need to be designed in from day one, helping manufacturers create products that can better withstand cyber attacks, and to give customers peace of mind when using connected devices, regardless of the mode of transport they are using.

For more information about how NCC Group can help your business please visit www.nccgroup.trust



When your car becomes a command centre...

Connected technology is changing the way we use cars. Here are five of the biggest innovations

CONNECTED CARS
EMMA WOOLLACOTT

The auto industry is in the early stages of a revolution that could change the way drivers interact with each other and with the world.

Key to this is the internet of things, an emerging set of technologies whereby computing devices, vehicles, buildings and other items are given sensors and activators, and the ability to transfer data over a network.

And with the advent of super-fast 5G, with a theoretical download speed of 10 gigabits per second and near-zero latency, these objects, including cars, can gather huge amounts of data and share them in real time.

01 ENTERTAINMENT

While in-car entertainment features have been appearing in cars for quite a while now, they've tended to come via a smartphone, using, say, Android Auto or Apple CarPlay.

But as connectivity moves to the car itself and 5G is rolled out, these systems will be integrated directly into the vehicle. New streaming services will appear offering online games, movies and more.

Options will be synced with home entertainment systems, allowing passengers to, for example, pick up a Netflix movie where they left off. It will even be possible for the car to act as a wi-fi hotspot, enabling its occupants to take advantage of the car's high-speed connectivity to stream content on their own devices.

According to Juniper Research, in-car infotainment systems will be worth $600 million over the next four years.

Meanwhile, no new technology development is complete these days without a focus on advertising and shopping, and both Visa and MasterCard are working with car manufacturers to bring electronic payments to smart vehicles. Location-based advertising will allow retailers to offer drivers special offers as they approach.

02 HOME INTEGRATION

With the huge increase in connectivity offered by 5G and other technologies, automation is expected to take over the home. Already, companies such as NEST offer smart thermostats, smoke detectors and the like that can issue alerts and be controlled using the householder's smartphone.

All these capabilities and more are being extended to connected cars. In the future, for example, your car could be programmed to call ahead when you're a mile or so from home, triggering the heating to come on and the oven to warm up.

Systems such as the Control4 App or AT&T Digital Life, currently smartphone apps, but a sign of what's to come, allow a driver to simply touch "away" to close the garage door, turn off the lights, arm the security system and switch the thermostat to energy-saving mode.

In the longer term, even more household devices will be connected and thus accessible from the car. Drivers will be able to check the contents of their fridge, for example, to decide whether to stop at a shop on the way home. If they do, they could choose to share the fridge data with local stores to receive special offers on the products they need.

03 USAGE-BASED INSURANCE

Fully autonomous cars are likely to prove a headache for the insurance industry, thanks to questions over liability. In the meantime, however, connected cars will allow firms to offer far more personalised quotes.

Already, telematics or black box technology collects driving data, such as speed, distance and time of day, which is then fed back to the insurer to help calculate premiums. In future, this information and more could be transmitted in real time, giving a completely accurate picture of driver behaviour.

With premiums based on real-life activity, such policies could prove popular, as many drivers could see their premiums fall. Indeed, consultancy PTOLEMUS estimates that by the end of the decade, nearly 100 million vehicles will be insured with telematics polices, rising to nearly 50 per cent of the world's vehicles by 2030.

Meanwhile, when accidents do occur, it will become far easier to work out who is at fault. Insurance companies will be able to establish the precise movements of each car, combining behavioural data, such as hard braking and accelerating, with real-time contextual data, including road conditions and the weather, and even video from onboard cameras.

04 VEHICLE MANAGEMENT

Fleet operators are particularly interested in connected car applications that promise to reduce running costs and streamline maintenance, and high-speed connectivity means vehicles can be tracked and their performance monitored in real time.

Navigation tools can optimise routings based on real-time traffic and weather information, recommending an optimal speed based on traffic and roadway conditions. They can even find empty parking spaces.

Connected cars will monitor fuel consumption and prompt you to stop at the next service station or the one after, if the real-time information that the vehicle is receiving shows there's a lower price to be had within range.

Broadband connectivity means software updates can be carried out remotely in super-fast time, and detailed data on vehicle performance allows maintenance and repairs to be scheduled automatically when needed.

Meanwhile, the ability to monitor vehicle location in real time is expected to provide a boost for car-sharing schemes. Customers will be able to check instantly whether a vehicle will be available and may start to see cars as a service, rather than as something to own.

05 AUTONOMOUS DRIVING

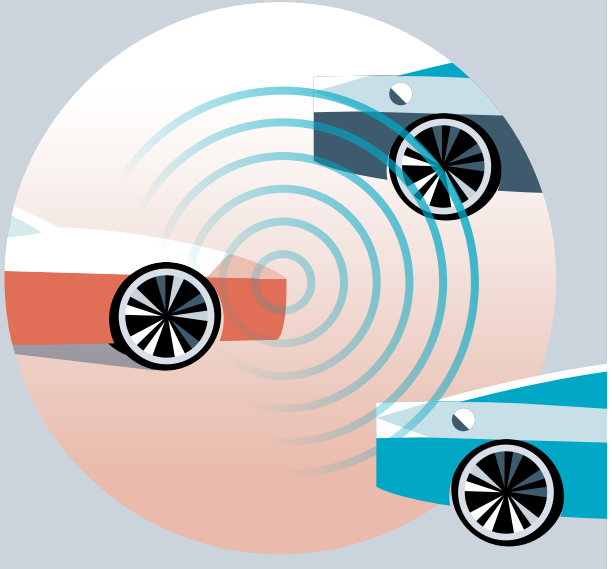
Fully autonomous vehicles have been hitting the headlines for some time, but are some way from commercialisation.

However, many manufacturers are already including autonomous parking and help with navigation at low speeds.

Safety features, too, are making their appearance, from automatic emergency calls in the case of accidents to danger warning systems that alert drivers to hazards, especially in the driver's blind spot. Meanwhile, collision protection systems can automatically slow the car or take control of the steering to prevent accidents.

Fully autonomous vehicles, though, are a taller order. They rely on totally accurate, real-time transmission of vast amounts of data, for a start. And although Tesla vehicles have logged around 130 million miles of autonomous driving so far, a fatal crash earlier this year has caused alarm. There are major challenges in terms of regulation and legal issues, such as liability in the case of accidents.

Despite this, PwC expects fully autonomous long-range driving at motorway speeds to start appearing between 2020 and 2025. However, fully autonomous city driving, where speeds are more variable and obstacles more frequent, is likely to be a lot further down the road.



How big data is

The collision of big data and the internet of things, with a network

TRAFFIC MANAGEMENT

JIM McCLELLAND

It is said the British love to queue. However, that tolerant attitude to standing in line does not extend to sitting in traffic – everybody hates a jam. For city planners, dwellers and commuters the world over, congestion is the enemy.

According to the *INRIX 2015 Traffic Scorecard*, while the United States had the worst congestion on average, it was a UK city that topped the world list for metropolitan areas. In London last year, it was estimated that drivers wasted an average of 101 hours, or more than four days, in gridlock. This figure marked the first time a metro area had surpassed the 100-hours threshold, making the capital a record-breaker of the wrong kind.

> The emerging science of predictive analytics has already seen numerous successful urban transport applications

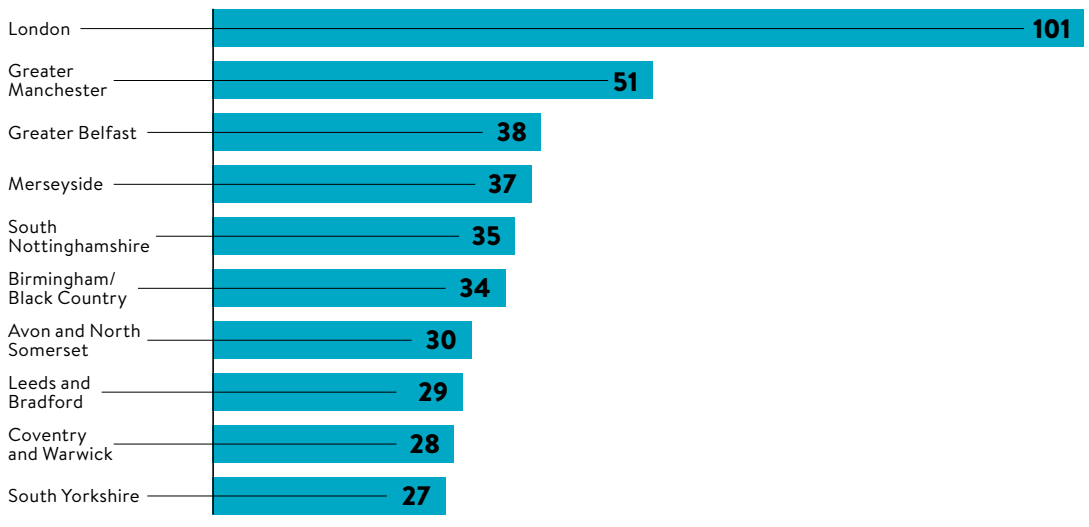
Congestion is bad for business. An earlier INRIX study conducted in 2014 with the Centre for Economics and Business Research forecast the cost to the UK economy would be a staggering £307 billion between 2013 and 2030.

And congestion is also harmful to urban resilience, impacting negatively on both environmental and social sustainability, in terms of emissions and global warming, plus air quality and public health. As for the liveability of a modern city, congestion is effectively part of the urban transport user experience (UX).

Calculating levels of UX satisfaction at any given time means solving a complex equation with a range of key variables and factors: total number of transport assets (such as road and rail capacity, plus parking spaces), users (vehicles, pedestrians), incidents (roadworks, accidents, floods and breakdowns), plus expectations (anticipated journey times and passenger comfort). To do the maths requires one essential – data.

TOP 10 MOST CONGESTED REGIONS IN THE UK

BY HOURS WASTED ANNUALLY PER DRIVER



Source: INRIX 2015

now busting city traffic jams

of connected cars and sensors, means traffic management is getting smarter


Tim Graham/ Getty Images

Driven by one trillion sensors becoming active throughout our environment by 2025, it is boom time for big data and the internet of things. Figures from Gartner estimate 6.4 billion connected things now in use worldwide, up 30 per cent on last year and rising at a remarkable rate of 5.5 million new additions a day.

Total things will hit 20.8 billion by 2020, of which a quarter of a billion will be connected vehicles.

This growing availability of data sources within our cities means analytics offer potential to open up a whole new era of smart transport, explains Hussein Dia, associate professor at Swinburne University of Technology, Melbourne, Australia.

"The fusion of urban data from increasingly complex networks of sensors allows for new ways to 'sense the city' and enhance transport capability and resilience. Predictive analytics provide a unified approach for extracting useful urban mobility information from networked infrastructure, connected vehicles and smartphones, for real-time estimation of traffic patterns, and deployment of management strategies," Dr Dia says.

However, it is only early days. He adds: "While decision-makers and city leaders are recognising the role of data analytics in 'sweating of assets' and providing innovative solutions to meet demand, deployment at a global scale is still in its infancy."

Dr Dia's cautious optimism is echoed by Mark Wedlock, associate director of smart mobility and intelligent transport systems at Arup. "Predictive analytics on its own is not the solution to rising congestion," he says. "However, what it does enable is a transition from reactive to proactive traffic management regimes.

"As the amount of data about current and future travel demands increases in the connected world, so the possibility of better analytics increases. In order to have real benefit, though, predictive analytics for transport as a whole is required."

Alongside need for scale and a more systemic application that would support better modal shift, requirement for real-time inputs is also critical, says Tim Barber, vice president for software solutions, Europe, the Middle East and Africa, at global technology company Pitney Bowes.

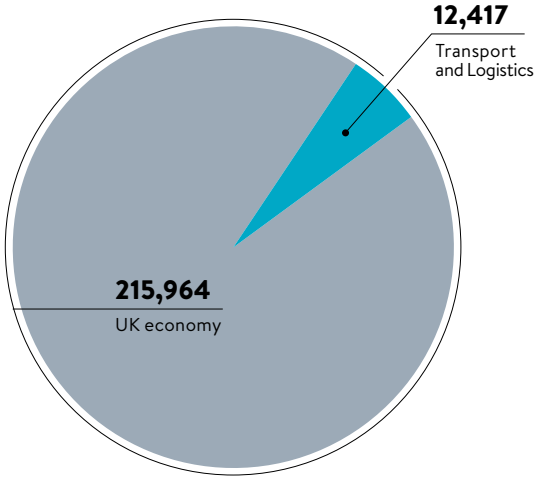
"Collecting reams of data isn't enough. You have to be able to validate, link and access data in real time to extract meaningful, accurate insight, and predict trends and patterns. Data decays at 2 per cent per month, so the real-time element is crucial," he says.

Caveats aside, the emerging science of predictive analytics has already seen numerous successful urban transport applications.

In the US, use of the world's largest community-based traffic and navigation app Google Waze helped tackle the scourge of double parking in Boston, Massachusetts. Whereas, in the Irish Republic, IBM has been using big data with the City of Dublin to identify and solve root causes of traffic congestion in its public bus network.

THE VALUE OF DATA EQUITY BY INDUSTRY

2012-17 CUMULATIVE ECONOMIC BENEFITS BY INDUSTRY OR DATA EQUITY, £M (2011 PRICES)



Source: Cebr analysis

CASE STUDY: CITY OF MORENO VALLEY

As one of California's fastest emerging cities, Moreno Valley has witnessed spectacular population growth since incorporation in 1984, with total numbers up fourfold to more than 200,000.

Given that its rise over the last three decades has spanned two global recessions, the growth spurt has not been without its challenges. As a result, the City of Moreno Valley found itself keen to address a basket of civic and development issues to make the most of in-house capabilities coming under significant budget pressure.

Prime mover behind the quest for innovative solutions was the Moreno Valley Police Department, desperate for technological support to back up and boost its shrinking staff numbers. With public safety therefore a priority, it made sense to pursue a community-wide camera system and video platform, but with additional data blend and analytics capabilities, plus strong interoperability to enable partnering.

The municipality adopted Hitachi Visualisation, working with public and private entities to build an effective and accessible video and data ecosystem, combining edge-capture devices and cloud-based software.

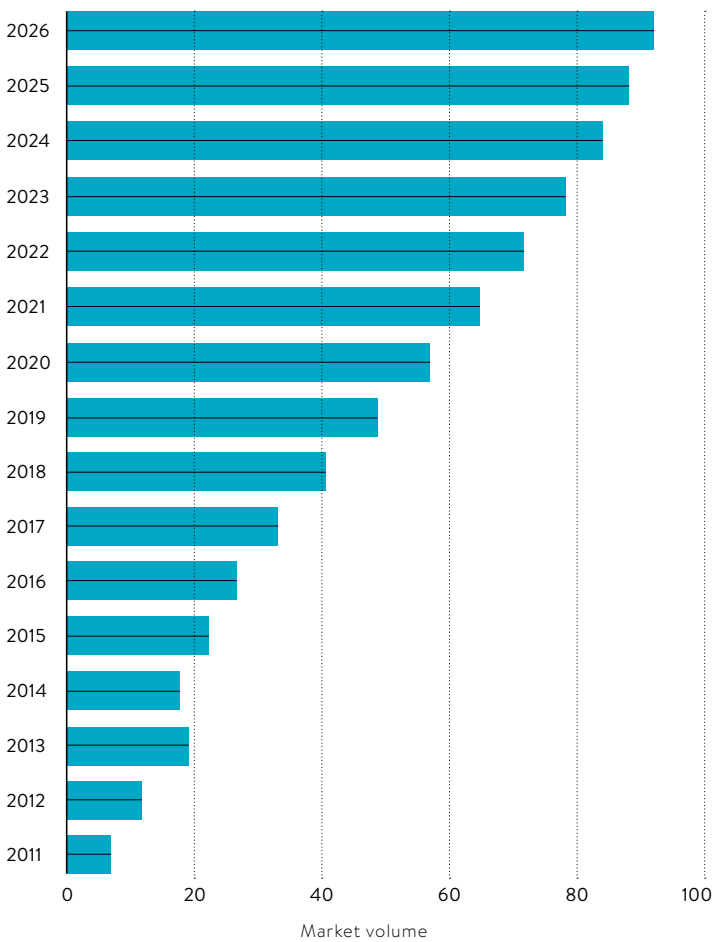
Devices include high-definition video cameras with analytics, plus intelligent gateways for external sensor data, third-party video integration and live streaming. The unique software is ideal for capitalising on rapid response and actionable data intelligence in the event of emergency or crisis.

The resulting integrated video and data resources are displayed, along with any real-time alerts and live feeds, on an intuitive, map-based screen. A software-as-a-service or SaaS model also enables turn-key deployment and easy integration.

A ten-month implementation period saw 212 cameras mounted initially throughout the city, rising to 275 active now. With real-time monitoring, signal-timing adjustment and priority-routing capabilities, the benefits to transportation management have proved significant, says city traffic engineer Eric Lewis.

"From special events, such as the air show and July 4 parade, to what's happening in construction work zones, we are moving traffic in the ways it demands. We have central-control software for both traffic management and emergency vehicle pre-emption. Now we can see exactly what's happening, what resources to deploy and make any changes on the fly," he says.

BIG DATA MARKET SIZE REVENUE FORECAST WORLDWIDE FROM 2011 TO 2026 ($BN)



Source: Wikibon

Using an array of sources – timetables, inductive-loop traffic detectors, rain gauges and CCTV cameras, plus GPS updates every 20 seconds for each of the city's 1,000 buses – a digital map of Dublin gets overlaid with real-time positions of services using stream computing and geospatial data.

Focusing on benefits to intelligent systems and networks, it is easy to lose sight, however, of the urban UX. Here, for example, predictive analytics can be vital in facilitating emergency response, both for general road users and key services.

As project director at Mott MacDonald, Martin Perks, explains: "Data analytics has a great role to play in helping professionals inform drivers interactively and reduce the risk of accidents, plus support management of incidents when they do occur. Opportunities are far greater for the traffic management community than the individual motorist at the moment, but the community is working hard to improve journey-time reliability."

This opening-up of the data to the private user, with widescale interoperability, is the real direction of travel. Mr Perks concludes: "Accessibility to the individual of analysed metadata against the backdrop of live traffic information is where the future is headed."

Flying high in Europe despite

Europe's aero industries have been working collaboratively to tackle the environmental impact of aviation with to fly solo cloud the skyscape?

ECO-AVIATION AND BREXIT
PAUL SILLERS

Airbus Group/P. Pigeyre

Airbus says its a350-1000 aircraft, powered by Rolls-Royce Trent XWB engines, burns 25 per cent less fuel than its nearest competitor

"I was alone, isolated, lost in the midst of the immense sea, and I did not see anything on the horizon." No, not Brexit punditry, but the words of intrepid French aviator Louis Bleriot upon landing his aircraft in Dover on July 25, 1909, following a foggy 37-minute flight from Calais.

The significance of this? It was the first time the English Channel had been crossed by an aeroplane and, beyond ticking a box in the evolutionary timeline of European aviation, Bleriot's pioneering achievement signified a catalytic moment, a genesis of aerial connectivity between the UK and mainland Europe.

That airborne linkage has morphed into the prime conduit for intra-European trade and tourism. "The UK is geographically very well placed, with only 11 per cent of European airspace, but 25 per cent of its traffic and with some 80 per cent of transatlantic traffic using our airspace to access Europe," says Dave Curtis, head of future air traffic management and policy at NATS, the UK's main air traffic control provider.

He points out: "We are Europe's transatlantic gateway and we need to build on that to consolidate our position as one of the leading global economic hubs." Moreover, a study published in April by the International Air Transport Association corroborates that European air connectivity supports 11.7 million European jobs and $860 billion of European GDP.

Not only is it a key protagonist in Europe's airspace infrastructure, the UK also plays a dominant role in European aeronautical design, innovation, research and manufacturing. Since joining the European Union, or the European Economic Community as it was in 1973, the UK's aviation expertise and aero-industrial resources have become deeply intertwined with their continental counterparts.

Initially, this was through the design, development, construction and service-entry of the Anglo-French supersonic airliner Concorde and subsequently through deeper integration with mainland Europe's aviation ecosystem, particularly via the Airbus Consortium; the UK arm builds the wings for every Airbus airliner.

As air transport infrastructure and manufacturing have flourished through European collaborations, burgeoning passenger traffic, which is set to double by the early-2030s, continues to raise concerns about aviation's environmental impact.

In unison with its European colleagues, the UK has been working to address aircraft noise and emissions as it tackles fuel efficiency and capacity concerns, using smarter air traffic control innovations and by introducing greener aircraft. And it's an effort supported by the airlines that strive to facilitate capacity growth while upgrading to environmentally friendly planes.

> We are Europe's transatlantic gateway and we need to build on that to consolidate our position as one of the leading global economic hubs

A case in point is the recent $4.4-billion order by Virgin Atlantic for 12 Airbus A350-1000 aircraft. "Sustainable growth and meeting our carbon targets is incredibly important to us and the aircraft's environmental credentials were a genuine factor in our selection," according to the airline's president Sir Richard Branson.

The planes, powered by Rolls-Royce Trent XWB engines, are designed to be 30 per cent more fuel and carbon efficient than the ones they replace, while reducing the airline's noise footprint at airports by more than half.

Underpinning European aviation's quest for greener aeronautics is a €4-billion public-private partnership called Clean Sky, funded jointly by the European Commission and Europe's main aerospace entities. Airbus and Rolls-Royce are major players in this collaboration, which focuses on developing ecological technologies for tomorrow's aircraft, and enabling deeper aero-industry engagement between the UK and Europe.

Airbus is involved in multiple Clean Sky projects, including a new focus on advanced engine and aircraft configurations to explore and validate the integration of fuel-efficient propulsion concepts for next-generation short and medium-range aircraft, as well as new ways to integrate aircraft cabins, systems and structures to bring weight reductions which translate into fuel savings.

"By taking part in the EU's Clean Sky initiative, we will not only reinforce Europe's industrial leadership and future competiveness, we will also help enhance the sustainability and efficiency of commercial aviation," says Axel Krein, head of research and technology at Airbus.

> An unanticipated wall of fog between the UK and Europe has suddenly obscured the flight plan

Rolls-Royce, meanwhile, is engaged in developing and testing the next generations of engine technologies, such as Advance, which will reach market in five years, reducing emissions by 20 per cent, and UltraFan, scheduled for service-entry in the mid-2020s with 25 per cent less emissions. Increasingly, the company is looking to use additive layer manufacturing (3D printing) to achieve what it says is a "30 per cent like for like reduction in manufacturing lead time".

Significantly, the UK has 69 organisations in the Clean Sky ecosystem with participation in 145 technology programmes. But as with Bleriot's Channel crossing, an unanticipated wall of fog between the UK and Europe has suddenly obscured the flight plan, following the outcome of the EU referendum. Could Brexit affect the UK's continuing involvement in Europe's collaborative efforts for a greener skyscape?

"At Farnborough [International Airshow], Clean Sky was an active exhibitor, bringing some 20 innovative pieces of hardware representing different technology platforms, including engines, wings, systems and eco-design within our research programme," says Eric Dautriat, executive director of Clean Sky.

Accentuating the UK's contribution, he continues: "We celebrated, in particular, the participation of the University of Nottingham, which has been an important player from the beginning and has recently won several large-scale research topics."

With regard to the UK's future relationship in EU aerospace programmes, green and otherwise, Mr Dautriat declares: "EU law continues to apply to the full to the UK and in the UK, until it is no longer a member." For the moment, at least, as far as European collaboration on creating eco-friendly solutions for air travel goes, it seems it's business as usual.

MEASURES TO REDUCE CO_2 EMISSIONS FROM AVIATION

For every 10kg weight reduction, about **4 tonnes** of CO_2 can be avoided in one year

USER-PREFERRED ROUTES

Initiatives have been taken where the airline can select the most efficient route based on aircraft and weather conditions

User-preferred routes can save more than **30 tonnes** of CO_2 on a single transpacific flight

WINGTIP DEVICES
can reduce CO_2 emissions by up to **6%**

The weight of a teabag on an aeroplane is equivalent to using **1kg** of CO_2

Source: International Air Transport Association

Brexit vote

much success, but will the UK's decision

CASE STUDY: NOTTINGHAM UNIVERSITY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A new approach to runways is paying ecological dividends. Reducing noise and fuel-burn as planes taxi from the terminal gate to the runway threshold are major environmental objectives at airports.

Aircraft usually use thrust from their jet engines to push themselves along the taxiways in readiness for departure – a wasteful, noisy process, especially when planes get stuck in a queue for take-off. Multiply that unwanted environmental impact by more than 100,000 global daily flights and the scale of the challenge becomes all too apparent.

One of the UK's leading aeronautical research centres, the University of Nottingham, has developed a solution in partnership with Germany's DLR (national aeronautics and space research centre), and France's Safran Landing Systems and Adetel Group.

Working together with Clean Sky funding on a programme called the Green Taxiing Demonstrator, designed for medium-sized airliners such as the Airbus A320, their solution is to integrate an electric motor into the aircraft's landing gear, enabling taxiing without reliance on the aircraft's engines.

A logical concept, but implementation requires elaborate technologies, after all the A320 weighs 78 tonnes. The benefits? Less fuel-burn means less carbon and nitrous oxide emissions, and quieter airports too. On a two-hour flight, fuel consumption could be reduced by 5 per cent, less engine use would reduce maintenance costs and expensive carbon brakes would no longer be required.

Now the tricky part: the system requires revolutionary new motor technology to move that kind of weight, but Nottingham University and its collaborators have come up with a peak torque density electrical motor, reaching values of 42Nm/kg and 184kNm/m^3 – in plain English it's a paradigm shift in electrical motor science.

Developed to technology readiness level 5 – industry jargon meaning prototype testing has been completed under realistic conditions, meeting environmental targets – Safran is now evaluating production options with a view to implementation into aircraft in the near future.

Nottingham University exhibited the Green Taxiing system at Farnborough Airshow and simultaneously announced it had secured £9.5 million of Clean Sky funding to develop further breakthrough aerospace technologies for leading European manufacturers designing the next generation of aircraft.

And Brexit? "There is a continued, strong appetite from industry and Europe for us to remain strongly engaged after Brexit. At present, nothing has changed," says Professor Hervé Morvan, director of the University of Nottingham's Institute for Aerospace Technology. "We encourage industry and academia globally to continue to see Nottingham as a collaborator of choice because of our strong research, training pedigree and innovation capabilities in aerospace."

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