

**Connected & Autonomous Vehicles are the future –  
the West Midlands is leading the way**



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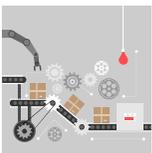
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# The CAV revolution is coming - the West Midlands will be at the heart of it

**Connected and Autonomous vehicles** are coming. Within 15 years, they could form the majority of cars on UK roads. The Government has set a target of driverless cars in normal use on UK roads by 2021. Our ambition is that the first fully driverless car journey will take place in the West Midlands to help someone take a safe and efficient trip. The first fully autonomous demand responsive transport service in the UK will launch in the West Midlands in time for the 2022 Commonwealth Games, connecting new development sites to transport hubs.

**The West Midlands is already playing a leading role at the heart of the UK CAV ecosystem**, developing and manufacturing the software, systems and parts within connected and autonomous vehicles.



**Thousands of new jobs** in the West Midlands and across the wider UK supply chain will be created to start scaling up this technology for export to global markets.



**We will demonstrate at scale as a UK showcase** how safety will be enhanced, congestion cut and air quality improved, as fewer people travel in single occupancy vehicles thanks to new autonomous first mile/last mile shared vehicles which will take people to/from their homes to/from transport hubs. These will be fully integrated with our rail, metro, bus and cycle services – this step-change in transport provision will drive a gradual reduction in single occupancy car use.



**The West Midlands will be a test-bed for globally significant and innovative solutions** that create a competitive and diverse transport services market, with multiple providers able to offer a range of “mobility packages” giving real choice to the public.

*“Connected and autonomous vehicles are the future. I want West Midlands manufacturing to be part of this future.” Andy Street*

# The West Midlands is the automotive capital of the UK and a global automotive centre

The West Midlands automotive cluster is by far the most developed in the UK. 1/3 of all cars produced in the UK each year are built in the West Midlands.

In addition to iconic brands such as Jaguar Land Rover, Geely and Aston Martin, the West Midlands is home to leading autonomous vehicle producers, Westfield and RDM.

The West Midlands automotive sector employs almost 50,000 people and its GVA is estimated at £5bn. More than 1/3 of the UK's GVA generated by the automotive manufacturing sector is generated in the West Midlands, far more than any other region. Approximately £1.5bn of automotive R&D investment was spent in the West Midlands in 2016, 40% of all UK automotive R&D.

We have 20 vehicle manufacturing sites and 35 automotive and off-highway OEM brands. The UK produces approximately 2.5m engines per year and more than 0.5m of them are built in the West Midlands at i54 (Jaguar Land Rover) and Hams Hall (BMW). The Midlands is the home of the two UK leading Connected and Autonomous SAE Level 4 POD Companies, Aurigo (owned by RDM) and Westfield.

The first purpose built factory for Electric Vehicles in the UK has been built in Coventry by Geely – a £320m facility to build new electric hybrid “London” taxis. An integrated automotive supply chain is supporting this development.



Jaguar Land Rover alone plans to invest more than £2bn in R&D in the UK in 2018 – its R&D function employs approximately 10,000 in the UK

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Jaguar Land Rover's Solihull site is the UK's largest car plant, producing 1,500 cars per day

# The West Midlands has a fantastic range of industry and academic R&D facilities

26 OEM Vehicle R&D Centres

8 Automotive Centres of Excellence

4 Low Carbon Centres of Excellence

The West Midlands region has world recognised R&D facilities within academia and industry. We lead the development of new automotive technologies that set the global standards. Three of the region's key R&D facilities are highlighted below.

**Horiba MIRA** is based near Nuneaton, and for 70 years has provided world-class automotive testing facilities. It was home to the world's first automotive wind tunnel, and pioneered the development of crash safety testing. It is the site of the Trusted Intelligent Connected Autonomous Vehicle consortium's new CAV testing facility - a purpose built realistic, safe environment for testing CAVs up to the limit of their operability.

The University of Warwick is home to both the new **National Automotive Innovation Centre (NAIC)** (which opened in the summer of 2018) and the **Advanced Propulsion Centre (APC)**. The NAIC will develop technologies to reduce dependency on fossil fuels - £150m is being invested in the NAIC by Jaguar Land Rover, WMG and the University. The APC is a joint venture between the Government and the automotive industry focussed on making the UK a centre of excellence for low carbon propulsion technology.

The **UK Battery Industrialisation Centre (UKBIC)** will open in Coventry in 2020. It will develop the processes to transition the UK to become a world leader in the design, development and manufacture of batteries for vehicle electrification. It addresses the joined-up electrification agenda developed by the Automotive Council and the Advanced Propulsion Centre and will be a key enabler to full scale, high volume battery manufacturing (gigafactory) and high volume electric vehicle production.



The West Midlands is home to **Meridian**, a Government initiative to develop a co-ordinated nation platform of CAV testing infrastructure

# The West Midlands is the leading CAV testing and trialling region in the UK

## The West Midlands is leading real-world, open road CAV testing – working beyond the test track

### Midlands Future Mobility

A network of over 50 miles of roads in Coventry, Birmingham and Solihull will form this world-class, “real-world” UK testbed for developing next generation CAVs following £31m of investment by Government and the private sector.

Covering the most diverse range of roads, junctions and traffic measures in the world, it will also include the University of Warwick campus – a mini city in itself.

5G ready and with smart monitoring systems, vehicles will be connected via high-speed, high-capacity wireless infrastructure across the whole route, ensuring no loss of signal.

**UK Connected Intelligent Transport Environment (UK CITE)** is a project creating the world’s first fully connected infrastructure - trials are being held on public roads throughout 2018. Critical infrastructure has been installed on urban roads around Coventry and road-side units are installed on the M40 and M42. These provide the technical platform for real-time data exchange between vehicles and traffic control equipment. £7m has been invested overall by a consortium led by Visteon and Jaguar Land Rover and also includes Vodafone, Siemens, Huawei, Horiba Mira, WMG, Highways England, Coventry University, Coventry City Council and Transport for West Midlands.

**The UK Autodrive project** has been running for almost 3 years and is due to end in October 2018. The trial will culminate in a series of urban demonstrations on selected public roads and footpaths in the host cities of Milton Keynes and Coventry. UK Autodrive has investigated important aspects of automated driving – including safety and cyber-security, legal and insurance issues, public acceptance for connected and autonomous vehicles and the potential business models for turning automated driving systems into a widespread reality. The consortium includes Jaguar Land Rover, RDM, Horiba Mira and Coventry City Council with Transport for West Midlands.

### Major CAV trials occurring in the West Midlands:



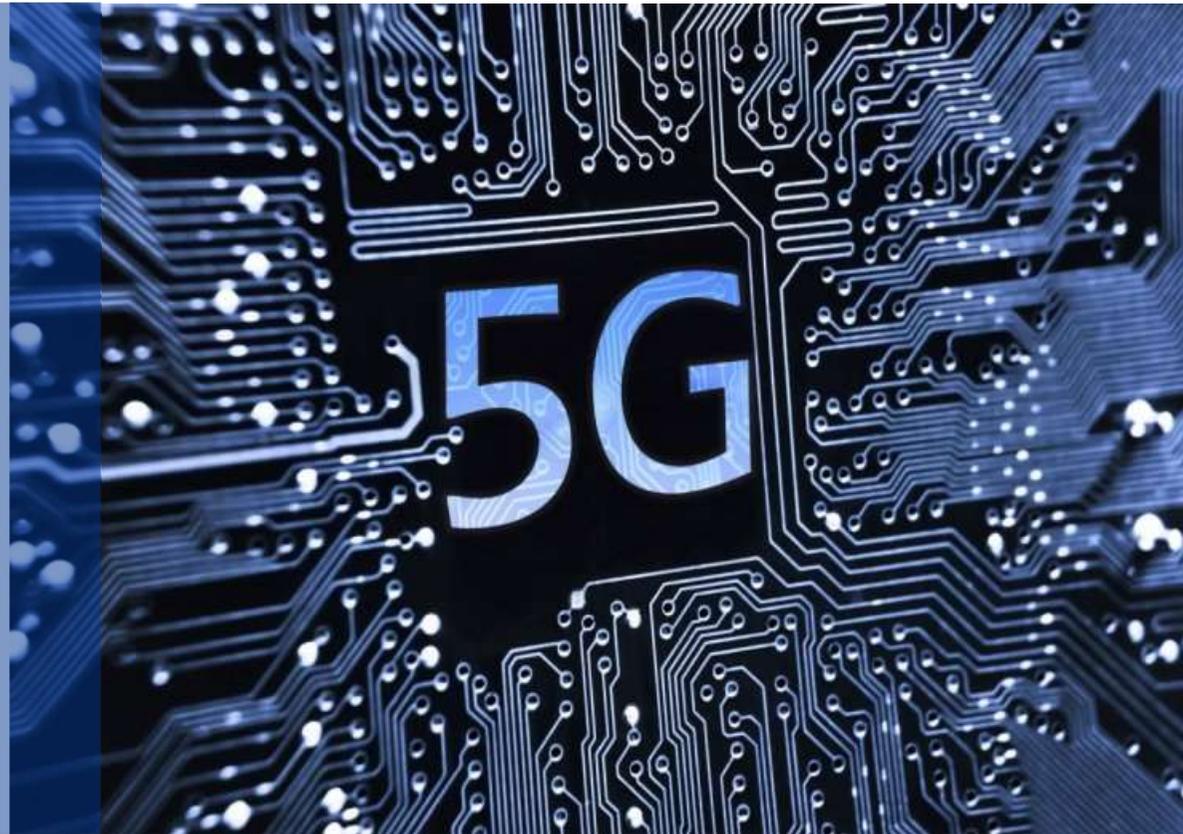
## Case study | The West Midlands 5G Testbed

The Government has chosen the West Midlands to become home to the UK's first multi-city 5G testbed

The £50m initial investment behind the Urban Connected Communities Project, supported by the Department for Culture, Media and Sport and matched by the WMCA will develop a large-scale, 5G pilot across the West Midlands. The public sector is investing in 5G to make it happen faster.

It is a 3 year project that will combine public and private money to accelerate the development of 5G across the region with hubs in Birmingham, Coventry and Wolverhampton. We will be the first region in the UK to develop new 5G applications and services at scale, and will position the West Midlands as a global leader in 5G. The promise of 5G is the end of “Not Spots” and full, fast and ubiquitous mobile broadband across the region.

WMCA was selected by Government as the best place for this. Our initial focus will be on the health, construction and mobility. We will drive economic growth and benefit people's lives through these new digital technologies and digitally transformed public services. For CAV the technology will build of the 5G R&D testbed we have as part of Midlands Future Mobility to ensure rapid deployment at scale.



*“This announcement is game-changing for the West Midlands economy. This will be the backbone of our future economy and society.” Andy Street*

## Case study | We are a global centre for the development of Autonomous Pods

RDM and Westfield are building a global reputation in manufacturing innovative autonomous vehicles

Following the success of trials, Aurigo (the autonomous vehicle division of RDM Group), based in Coventry, has been awarded £3.2m by Innovate UK to develop an autonomous shuttle service. The funding is being used to build and trial six 10-15 seater self-driving shuttles to operate on a guided busway in Cambridge. Aurigo will design and manufacture larger versions of its four passenger self-driving pods to suit the location and customer needs. The manufacturing of these pods will take place in Coventry. Aurigo has opened offices in Houston, Ottawa and Adelaide as it looks to expand into overseas markets.



Westfield Technology Group is the other UK leading autonomous vehicle provider. The Westfield POD is the UK's first fully autonomous vehicle for first mile – last mile transportation. The POD has been developed in conjunction with Heathrow Airport, and the original system has now completed over 5 million kilometres in a live commercial environment serving Terminal 5. Westfield have delivered the UK's first Commercial CAV POD contract with Sejong Special Governing City (SSGC) in South Korea and recently signed an MOU with Emirates Group to autonomise the movement of goods, personnel and passengers “airside” at airports. Westfield have also signed an MOU with Ordnance Survey, one of the world's leading providers of 3D high definition mapping capability, enabling Westfield to have access to the latest mapping technologies to assist in the development of its connected and autonomous systems.

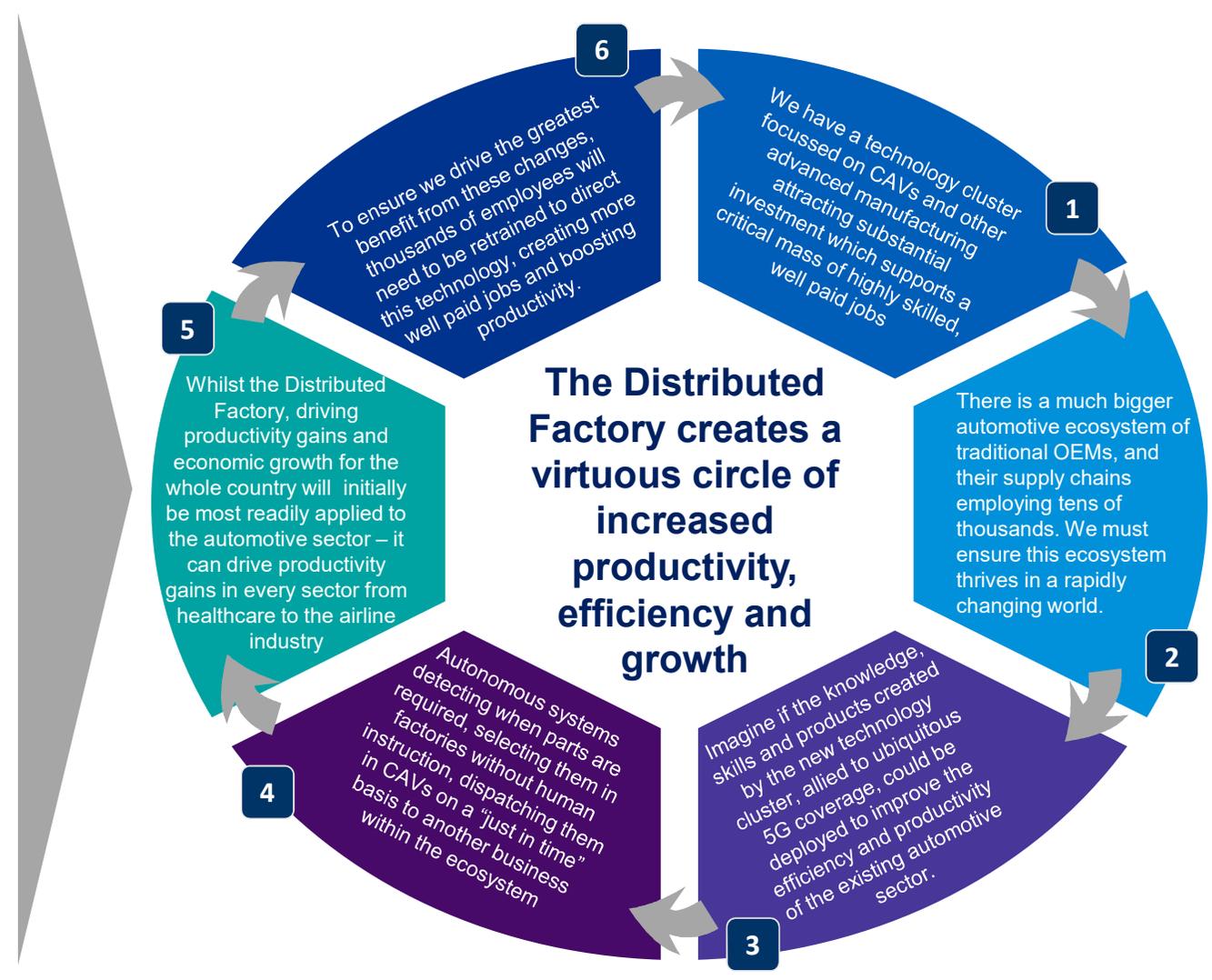
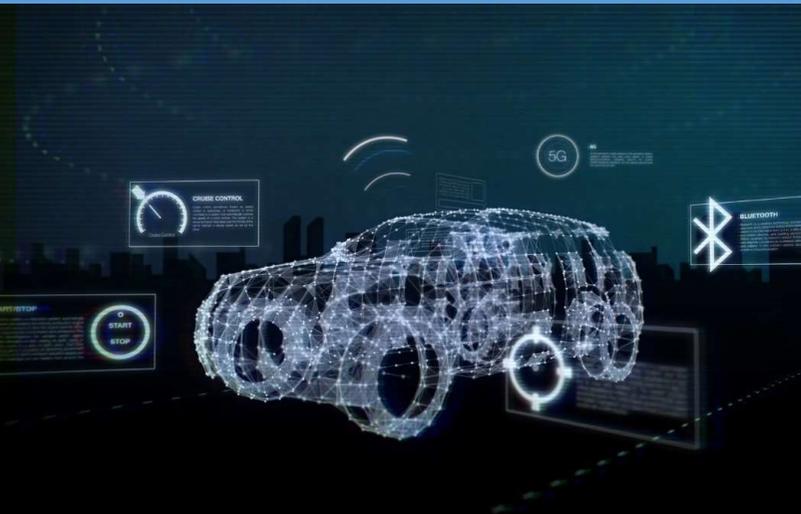
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*“The West Midlands is the Centre of Excellence for CAV development in the UK.”* Julian Turner, CEO, Westfield Technology Group

# Our CAV cluster and 5G network will pioneer “Industry 4.0” in the automotive sector

The West Midlands automotive sector has a large and complex factory eco-system - the supply chain is a broad mix of Tier2/3 suppliers, feeding Tier 1 suppliers and OEMs. The West Midlands logistics network caters for both the resident manufacturing sector, but also acts as the major UK freight consolidation and distribution hub. It is hugely important to our economy, and we have a long-term vision to ensure it continues to thrive.

The UK’s CAV and advanced manufacturing technology cluster based the West Midlands will pioneer “Industry 4.0” in the automotive sector leveraging off the development of world-leading 5G infrastructure to create an integrated Distributed Factory across the West Midlands, where factories will make decentralised decisions and co-operate with each other without human intervention.



# The Distributed Factory – from component to customer powered by automation & 5G

08:00 10:00 12:00 14:00 16:00 18:00 20:00 22:00 24:00 02:00 04:00 06:00 08:00

'Distributed Factory' model: after-sales support model

24 Hour Timeline 

**WORKED EXAMPLE:** At 8am, the OEM factory's automated systems inform its LIDAR sensors supply chain of its requirements for the next 24 hours



**Tier 3 factory**  
Processes raw materials into basic components needed for autonomous vehicle LIDAR sensors

**Tier 1 factory**  
Takes the LIDAR Sensor component from the Tier 2 factory and incorporates into the full LIDAR system pack

**OEM factory**  
OEM installs LIDAR system pack into the vehicle, performs final checks and verification / certification that the system is working

**Customer**  
Car ownership models have changed – many customers now order a vehicle on demand from a fleet manager when they need it

**Maintenance**  
Nature of after-sales support based on new skillset as maintenance changes from traditional bodywork repairs to systems, technology and safety updates. The skills and training is directly integrated with the manufacturing supply-chain, ensuring on-going safety certification

**Tier 2 factory**  
Takes the basic components from the Tier 3 factory and uses in the manufacture of a LIDAR sensor. Component delivered to Tier 1 factory

Parts delivered between Tier 1-3 factories within the Distributed Factory Network via small, autonomous inter-factory pods supported by a high capacity 5G network

Completed vehicles delivered to dealership via autonomous car carrier

Final LIDAR system loaded onto autonomous trucks which transport the LIDAR systems to the OEM site

**Dealership**  
Dealership sends finished autonomous vehicle to customer's home / place of work

Dealership manages after-sales support including repairs and maintenance – the vehicle drives itself to the dealer when automated appointments are sent

# The Distributed Factory will transform supply chains and productivity in every sector

OEM factory computer system recognises that a full LIDAR system is required for 1,000 autonomous vehicles. It transmits an automated notification to the Tier 1 supplier factory to order these systems. This order flows through the supply chain without the need for human intervention.



1

Initial suppliers

2

Tier 3 suppliers

Tier 2 suppliers

Tier 1 suppliers

3

OEM factory

A CAV pod transfers basic materials from the Tier 3 to the Tier 2 factory. Then the Tier 2 factory transfers the LIDAR components to the Tier 1 factory. A CAV lorry then delivers the finished LIDAR systems from the Tier 1 factory to the OEM

We can drive the cross-sector adoption of the Distributed Factory model leading to productivity gains in other industries

## Health Sector



- Medicines / samples in hospital wards ordered via automated computer system
- Small, autonomous pods deliver packages from nurse stations in wards to testing laboratories

## Airline industry

- Autonomous vehicles are widely used "airside"
- Passengers are transferred from planes to terminals using autonomous vehicles instructed autonomously to meet planes



## Exporting the Distributed Factory concept

### Selling services overseas



- The Distributed Factory model is taken from West Midlands' automotive industry by West Midlands' businesses and applied internationally across multiple sectors in numerous regions, driving international investment and subsequent economic growth

# We will use CAVs to drive a better, less congested and cleaner transport system



Through intelligent systems and integrated policy CAVs will be key to the West Midlands leading the way in reducing individual car ownership, reducing congestion, shortening journey times and improving air quality.

New demand responsive transport business models will be created, and link seamlessly to the public transport system to give the public a reliable, safe and value for money alternative to private car ownership.



We will ensure that the arrival of HS2 in 2026 will be matched by the ability of the local transport system to transport those travellers in a seamless, flexible and efficient way to their final destination, using shared mobility services wherever possible.

The Second Devolution Deal commits TfWM & the Government to developing the West Midlands as the UK's leading centre for deployment of Mobility as a Service (MaaS), providing new integrated easy payment and guided travel across all modes.



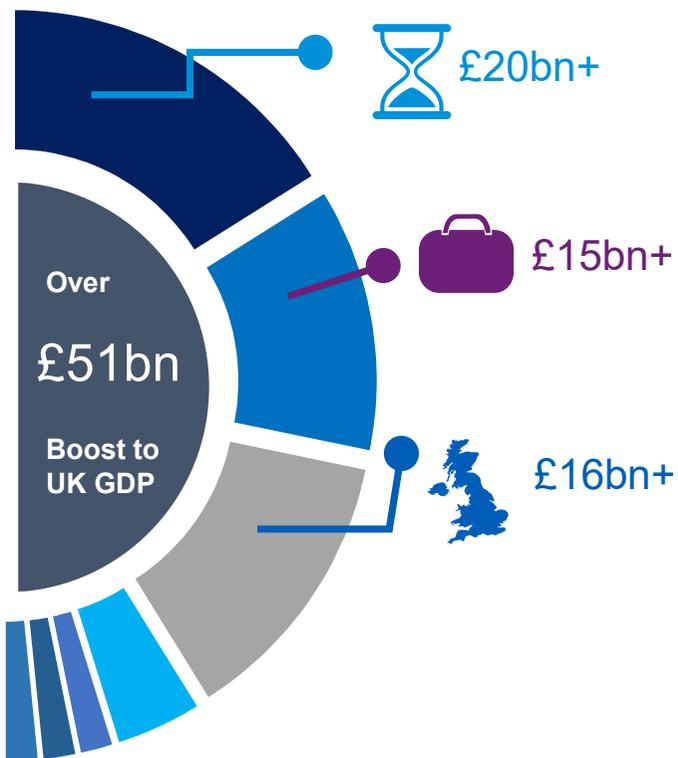
TfWM's role is not to mandate how the region's transport system evolves – but to ensure it is resilient, has the necessary regulatory safeguards and standards for data protection and privacy in place, and meets the region's goal of using CAV technologies to improve the transport network for everyone in the West Midlands



We have already begun piloting Mobility as a Service with one MaaS operator, and **our ultimate aim is a competitive system of MaaS operators underpinned by a strong public infrastructure providing a range of flexible transport services to the public**

# The prize is significant – CAVs represent a £50-100bn opportunity for the UK economy

*We can seize this opportunity in the West Midlands by investing now to boost our productivity*



Value of consumers' time freed up during travel through to 2030

Value of more efficient journeys contributing to greater productivity and labour flexibility

Value to UK industry as a result of:

- ↑ Cost efficiencies in travel and freight industry
- ↑ New digital revenue streams
- ↑ Service industry revenue
- ↑ City infrastructure efficiency, etc.

Investment focused on improving the productivity of the West Midlands automotive industry has the potential to generate substantial benefits to the UK economy. Indicative analysis using a national economic model suggests that for £1 of productivity gained within the West Midlands automotive industry, up to £2.20 in GDP is likely to be generated for the UK economy through efficiencies gained within the supply chain.



If investments in our skills and infrastructure enable us to realise our Distributed Factory vision and improve the productivity of the West Midlands automotive sector so that its GVA increases by £500m, the national economy could receive up to a £1.1bn increase in GDP in the long run.

# What support do we need to achieve this vision – what are the consequences of failure?



Huge changes are about to hit the global automotive sector. Some global OEMs and their supply chains may not exist as we recognise them in 10 years' time.

The UK has failed to invest in its automotive sector in previous eras and the consequences have been devastating for industry and for jobs in this region.

The West Midlands is the historic home of the UK automotive sector – it is our passion.

The West Midlands is at the heart of the coming automotive revolution and with continued investment can continue to be a major part of our future.

The skills required to exploit and service CAVs are very different to the traditional skills we have across the region's automotive sector. We need help to equip our workforce with the skills required to build successful careers in this new world.

In order to drive the development of CAVs across the region, the West Midlands must continue to be prioritised in relation to 5G investment, both from a DCMS perspective, and from a Highways England perspective. The West Midlands must be the first fully connected region in the UK. The Government's investment in the 5G Urban Connected Communities testbed must just be the start.

The provision of incentives to encourage early adoption and engagement from a West Midlands population which recognises the West Midlands as both the home of the automotive sector and the future of CAV development.

The West Midlands needs a special CAV economic zone with high levels of regulatory flexibility including trialling proposed legal changes to accommodate CAVs and accelerate their development.

We need support to enable us to develop and showcase of the 'Distributed Factory' concept – this can include incorporating a programme of engagement of Tier 2 and Tier 3 supply chain parties and the development of pilot areas to demonstrate the technology.

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**Midlands Future Mobility**  
[www.midlandsfuturemobility.co.uk](http://www.midlandsfuturemobility.co.uk)

## Our Ambitions for CAVs in the West Midlands

We are the UK Centre of Excellence for Connected and Autonomous Vehicles, the installation of 5G networks and the development of Industry 4.0. We will be a global centre for testbeds, pilots and trials of these new technologies.

We will demonstrate an operational connected and autonomous vehicle in time for the 2022 Commonwealth Games, showcasing to the world our leadership in this area.

We will reduce congestion and improve air quality through the development of innovative and attractive automated ridesharing services that form a seamless part of a vibrant public transport system underpinned by a simple single payment platform.

We will pioneer the Distributed Factory concept in the West Midlands driving substantial productivity gains in our economy and equipping our workforce with the skills they need to thrive in this new world.