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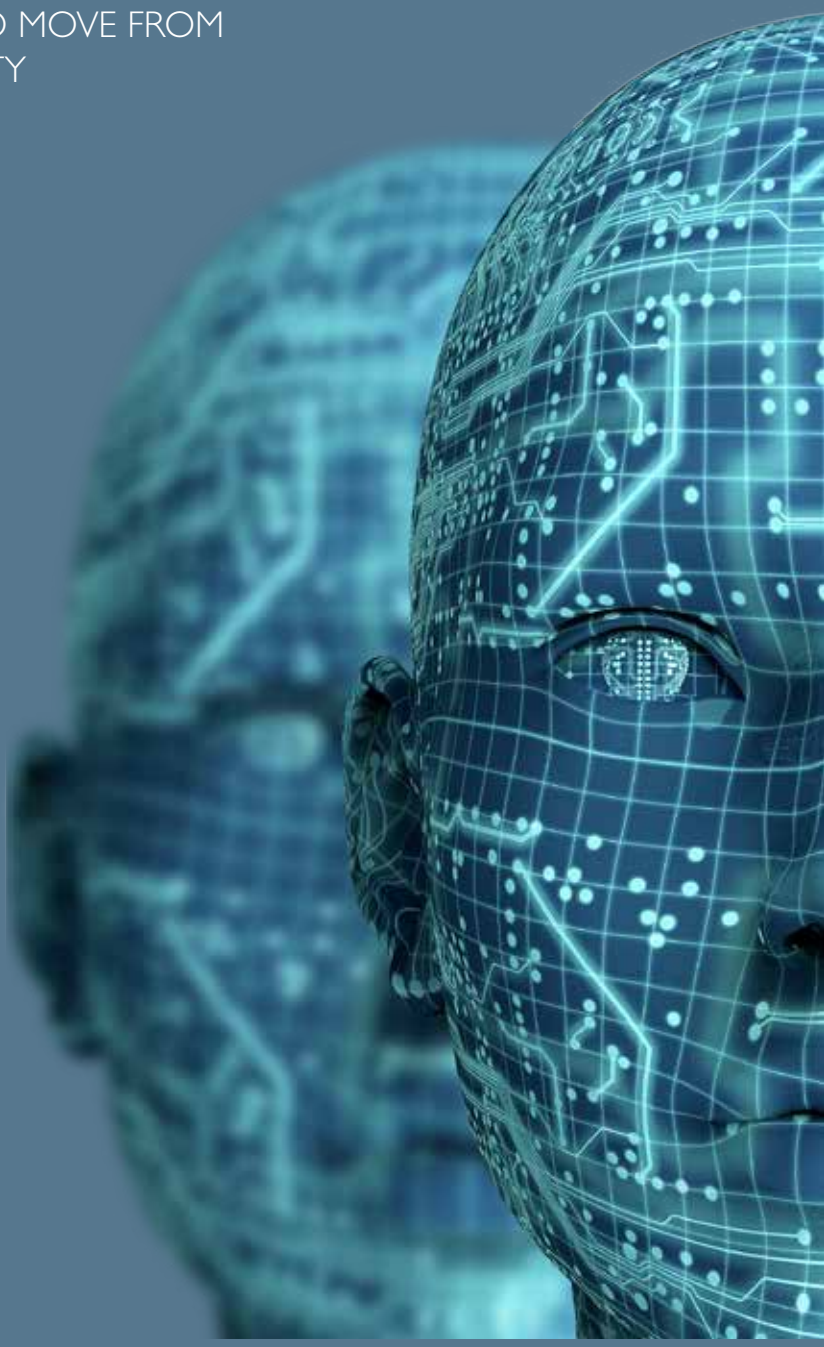
# Autonomous vehicles

## A FUTURE-PROOF APPROACH TO MOVE FROM TESTBED TO UBIQUITOUS REALITY



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# Autonomous vehicles

Safety is a key part of our autonomous future, and Roke's expert in autonomous systems, Dean Thomas, here explores the importance of technology and collaboration in building both robust communications infrastructure, and public trust.

## AUTONOMOUS VEHICLES

The world of automotive transport is undergoing a revolution. Over the last few years we've seen multiple headlines and hype about the emergence of the autonomous or driverless car. Far from being a futuristic vision, there's no doubt the technology that is now at our disposal has the potential to completely transform the automotive industry.

A number of big brands made early inroads into the development of autonomous vehicles, including Google, Tesla and also Uber, whose "driverless cars" were tested in California in 2016. Where these companies lead, others are set to follow. Jeff Klei, president of Continental AG's North American region, predicts that as many as 54 million autonomous vehicles will be on the road by 2035.

Several European countries including the UK, France, Belgium and Italy have also started to plan the integration of driverless cars into their transport systems.

The publication of a classification system for autonomous vehicles in 2014 by SAE International, an automotive standardisation body, served to bring a regulatory framework to this burgeoning sector. It sets out six levels of automation for on-road vehicles, ranging from zero to five (fully automated), with the aim of defining what automated driving actually is and guiding manufacturers and others in the design and testing of such vehicles.

Truly driverless cars, those at level five, are not currently permitted on public roads without a driver sitting behind the wheel, ready to take over at a moment's notice. Yet while predictions vary over when we'll see level five driverless cars on our roads, it's clear that we need to prepare for the day when they are.

The much-touted benefits of vehicles that are capable of sensing the environment and navigating without human assistance have been written about at length. Supporters and enthusiasts of the technology cite the potentially dramatic reduction in traffic accidents, plus the environmental benefits of driving in an optimal way to save fuel.

There's also the personal benefit of taking our hands off the steering wheel and making better use of our travel time by reading a book, talking to friends, working on the move or simply catching up on some lost sleep.

But before we get carried away with the hype, let's take stock of what ubiquitous autonomous driving actually means.

The challenges go far beyond the car itself or even a handful of cars in every town or city. It means a burgeoning global ecosystem of connected vehicles, people and transport infrastructure, and making that a reality means overcoming a whole new set of challenges.

## CREATING A FUTURE-PROOF INFRASTRUCTURE

Today's road systems were built with human drivers in mind. It's an entirely unstructured environment. Yet self-driving cars require accurate road maps, live traffic updates from other vehicles, and reliable data from the entire infrastructure, including traffic lights, speed limits and lane closures.

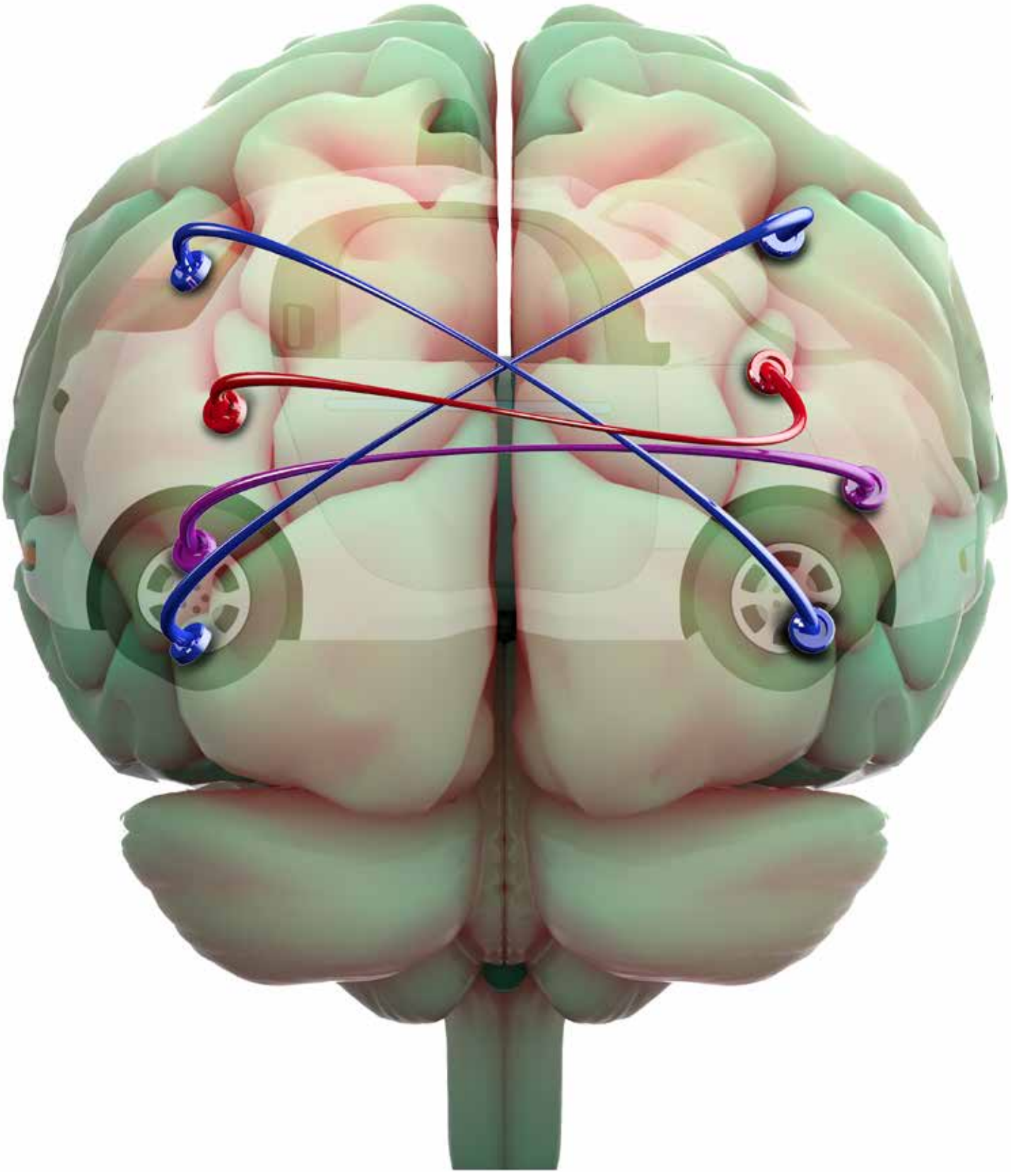
Completely re-thinking the existing infrastructure becomes essential to making autonomous cars a safe and effective reality. But that's only the tip of the iceberg; all this data will rely on GPS and advanced communications systems to operate effectively.

It's a highly complex infrastructure with many technology interdependencies. And it doesn't stop there.

Many consider the infrastructure to be the final hurdle for making autonomous cars a reality, but what happens if (or when) this infrastructure fails? As we become more and more reliant on technology in our vehicles, highly resilient fall-back options are also vital.

We all know what it feels like to lose a GPS signal at a critical moment when you are trying to reach a new destination. Autonomous vehicles such as unmanned aerial vehicles (UAV) or driverless cars can have the same issue, but with much wider repercussions than being late to a business meeting or missing a flight.

“Autonomy is the future”



# Autonomous vehicles

Roke is at the forefront of developing new infrastructure technologies for autonomous vehicles and has created the world's first unmanned aerial vehicle that is capable of landing autonomously on a moving ship using vision technology.

Roke's Autoland technology, funded and developed in collaboration with the Defence Science and Technology Laboratory (Dstl), uses cameras and modelling to enable a UAV to self-land without the need for human assistance or additional infrastructure.

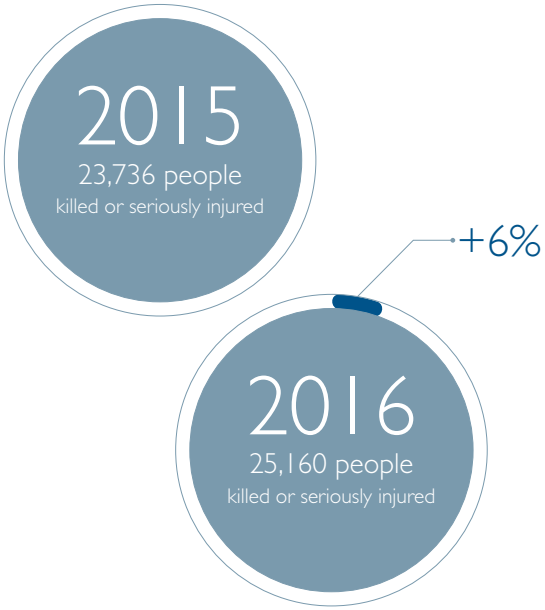
Other UAV landing systems rely on a signal from beacons on the ship to identify the landing site or easy-to-jam GPS, but Autoland intelligently identifies obstacles on the ship's superstructure to land safely.

Ensuring the infrastructure – and any backup system - works for the driverless car will only be possible if all those involved in providing the UK's infrastructure collaborate now to plan the future. By working together, stakeholders including highways agencies, law enforcement agencies, insurance companies and engineers can drive the development and application of new technologies, standards and frameworks.

Having faith in the technologies that support driverless infrastructure will be critical for achieving public trust and acceptance.

## BREAKING DOWN BARRIERS TO BUILD TRUST

The number of cars on the road is increasing in line with the number of road accidents.




*According to UK Government figures, 25,160 people were killed or seriously injured in the year ending September 2016, up by six per cent from the previous year.*

One of the benefits frequently cited about autonomous cars is the power to reduce accident rates. Through their ability to work in complete unison with other vehicles and detect other cars, they can take appropriate actions such as applying the brakes, activating acceleration or taking control of the steering if there is a position of danger.

But there's a fundamental barrier standing in our way. And that's the disconnect between personal and public accountability. It's widely accepted that driving a car comes with a certain amount of risk, but this risk is personal. The driver learns to drive, buys a car, obtains insurance and makes conscious decisions about risks on the road and how to navigate them. This is not the case when a passenger steps into an autonomous car.

To overcome this challenge we must look to other industries where risk is calculated on our behalf and measures are put in place that make us safe.

For example, in air travel we readily rely on safety systems that will not only protect us, but identify the cause of an

accident if it occurs. Aircraft have black box recorders for a very good reason and a similar technology has already been tested in cars. It could prove an important solution for eliminating the risk of personal responsibility and increasing the acceptance of driverless vehicles.

Roke has developed the world's first viable 3D 'black box' technology for vehicles, the Integrated Visual Navigation Sensor (IVNS), using just a single dashboard camera. Fitted to an autonomous Toyota Prius, Roke has demonstrated how data captured via vision processing technology could be used to provide a precise, 3D reconstruction following a road incident. The technology has the potential to offer insurers, drivers and manufacturers (in the case of autonomous vehicles) with independent evidence of what happened. This will not only lead to safer vehicles but also help to build public trust in driverless vehicles.

It's clear that autonomous vehicles will dramatically change the landscape of the automotive industry and the technology has the potential to bring widespread benefits.

But for this potential to become a reality we need to make sure that the infrastructure is ready. Roke is working with Highways England and UK research laboratory TRL to inform this process. The solution is likely to be a roadmap for the roll-out of autonomy with "connected corridors", indicating the start of the autonomous journey - making sure we consider the implications and consequences of what happens when this infrastructure fails.

This is just one example of how widespread collaboration across industries and the standardisation of systems and technologies can create a safe, controlled driving environment that builds trust with the public and makes the autonomous future a reality.