The Commercial Truth about Autonomy

By Richard Jinks, Oxa's Chief Commercial Officer

Analysts are busy running the numbers on the size of the autonomous vehicles market. The expectation is it will be north of $100bn globally by 2030. That number may be conservative as the number of applications is almost unlimited: From moving goods and people inside airports; monitoring assets in industrial sites; shuttling passengers around cities and much more. But determining the use cases is not the difficult part, the real challenge lies in deciding the deployment order.

All AV companies must consider the deployment readiness of their technology, market demand, regulatory requirements, and investment capacity. They should then test their go-to-market strategy against a chosen application, as investor pitch decks may not perfectly align with evolving markets. In truth, finding the perfect combination of technology, deployment arena, vehicle types, and delivery model has been challenging for everyone.

Oxa's focus has been on obvious areas of need and as a result we now concentrate on two specific market subsegments: industrial logistics and passenger shuttling. We also take an ecosystem approach, partnering with sector experts to ensure our solutions precisely meet market needs. We work with fleet operators and owners which gives us a route for massive scale adoption by 1000s of customers licensing our products.

This unashamedly commercial approach to autonomy is at odds with most AV innovators who are still running trial deployments. We find that it's only by working with paying customers that you can really understand how autonomy fits with real business workflows, and that helps you work through the product optimisations you need for real world deployment at scale. Customers are also best placed to advise where autonomy will make the biggest operational impact as they have far greater expertise in their sector than we do. That discipline allows us to learn which new product features and capabilities to prioritise. It's not one-way traffic though, our customers also learn. For example, they can define the skills they'll need to operate autonomy and work out the changes required to internal workflows. Importantly they can also hone their understanding of the transformative impact of autonomy and how they can best take advantage.

In addition to working with fleet operators and owners we partner with vehicle manufacturers (OEMs). They provide the foundation on which all autonomous hardware and software sits. These relationships provide us with multiple engineering and end-user insights that inform our technology roadmap. For instance, producing an autonomous luggage truck without manual controls for an airport operator today may not be smart. Vehicles tend to have multiple lives and not all companies are ready for autonomy so removing manual controls too soon may make vehicles harder to sell on later; the hybrid AV/manual fleet world will be with us for some years yet. Additionally, airport luggage loading bays are today designed for traditional trucks and trailers, requiring modifications for new vehicle types. These challenges can be overcome with the right planning, which is why we started collaborating with Bradshaw Electric Vehicles. With over 50 years of experience in vehicle manufacturing, Bradshaw possesses extensive knowledge and contacts in the industrial logistics sector. You can read more about Bradshaw further ahead.

Which Business Models will Win?

As always happens with advanced new technology, deployment challenges and poor choices are narrowing down the number of AV innovators with sustainable businesses. Apple's AV/EV project seems to have come to an end, while safety issues have caused delays for many robotaxi firms in the US, resulting in worker layoffs and investment pullbacks. However, despite these challenges, investment continues to pour in, including the upcoming launch of a new Tesla robotaxi in August despite the questionable economics of expensive low occupancy AVs. Why is this? It's because autonomy is a game-changing technology - safer, cleaner, better than what we have today. History has shown that when a technology offers such advantages, it gains traction and accelerates. We saw that with the Internet of Things (IoT) which was super-buzzy in the pre-AI era but it's now invisibly underpinning the digital transformation of industries and homes.

I'm also highly encouraged as vehicle manufacturers (OEMs) already run business models that will work really well for autonomy. Companies prioritise value-add features and outsource the rest, buying in chips, sensors, premium speaker systems, and tyres from tier 1 suppliers. With the advent of software-defined vehicles (SDVs) there are even more possibilities such as offering more advanced driving assistance packages. In fact, it is easy to envision full autonomy being offered in the same way in the near future.

This outsourced 'buy not build' model allows OEMs room for differentiation but it slashes development risks and offers them the best of everything in a highly competitive market. This approach does not undervalue the importance or complexity of AV technology; rather, it focuses on risk mitigation. Shareholders would likely question why an OEM would choose to build its own AV stack when it could be purchased more affordably from a specialist developer.

An alternative model, especially in the initial stages, is for OEMs to collaborate with specialist AV outfitters who handle the autonomy integration instead of the OEM having to invest in a new factory production line process. This is in line with how the industry works already with the likes of Ford Pro and specialist custom companies refitting standard vehicles for specific use cases or applying performance upgrades. This can also be done on a large scale for AVs.

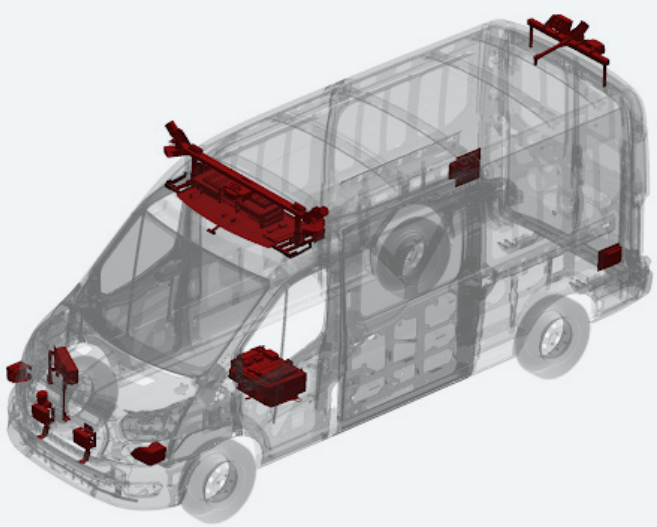
OEMs, driven by Oxa

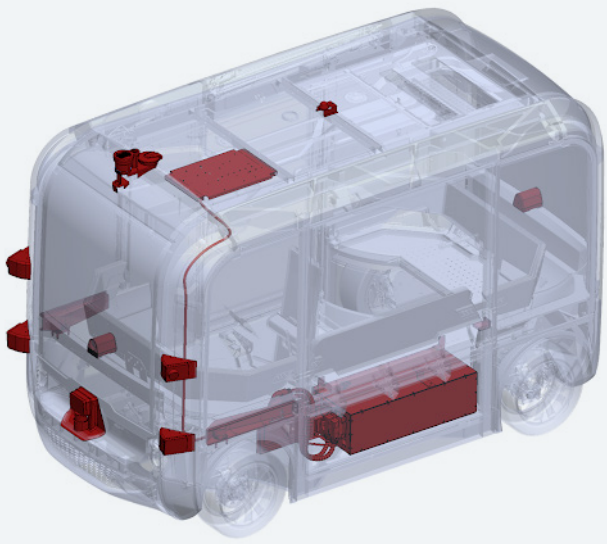
Principles of deployment models

Model	Vehicle sourcing and supply	Homologation and warranty	Vehicle modifications and upfitting
OEM line fit	Direct sourcing and supplied by OEM	'Driven by Oxa' OEM SKU approved by OEM Warrantied by OEM Homologated and certified	OEM end of line fit OEM modification centres OEM specialist pre-delivery inspection
OEM approved upfitter	Direct and indirect supply	'Driven by Oxa' OEM SKU approved by OEM Warrantied by OEM via upfitter Homologated and certified	OEM approved upfitters
OEM approved kit	Indirect supply	'Driven by Oxa' OEM SKU approved by OEM Warrantied by OEM via upfitter	Oxa upfitter network End user fleet install

Oxa Reference Autonomy Designs (RADs)

Oxa Reference Autonomy Designs (compute + sensing) enable a vehicle to run Oxa's software and operate autonomously. A 'buy not build' business model enables fast integration of autonomy for OEMs.



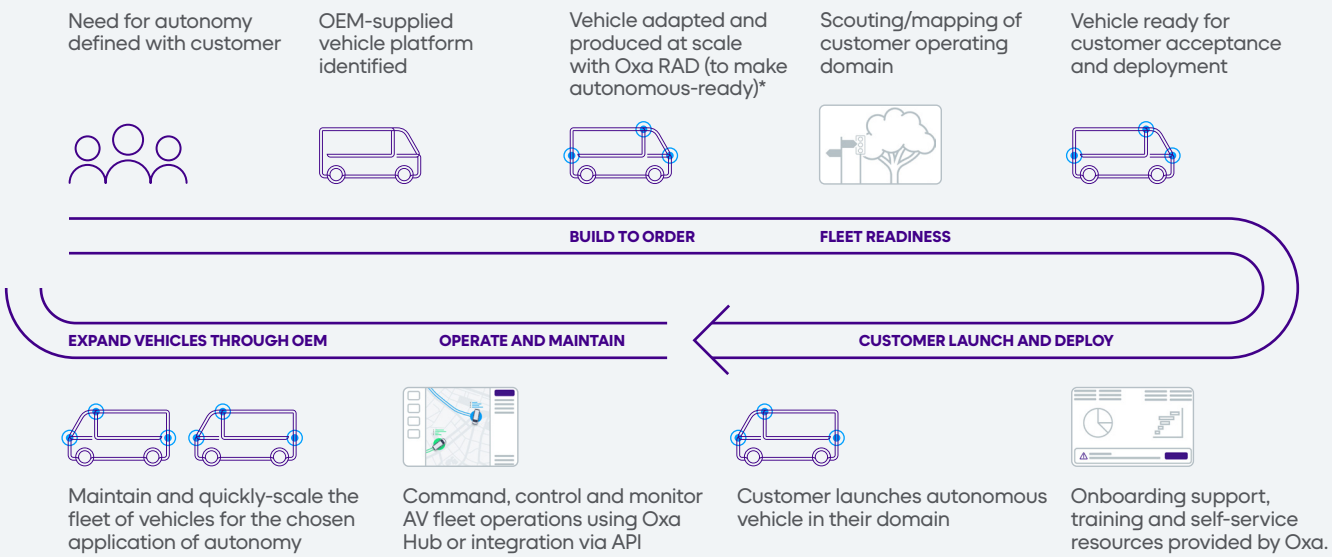


A Company Doing it Right

We work with many industry players and our engagement model varies depending on whether we are providing self-driving software, the software plus a compute/sensor hardware system, or all of that already fitted onto a vehicle. A great example of the latter is our engagement with Bradshaw Electric Vehicles. In this case, Bradshaw, as the vehicle manufacturer, would work with the ultimate customer and outsource the autonomy provision to Oxa.

As mentioned earlier, Bradshaw has been manufacturing vehicles since the 1970s. It creates high volume and custom electric vehicles for sectors including aviation (airports), materials handling and manufacturing. Oxa will provide Bradshaw with Reference Autonomy Designs (RADs), including specific sensor and compute components, and Oxa Driver software. This gives Bradshaw the ability to produce autonomous vehicles off the line 'driven by Oxa'. The customer is the big winner with this model as they're able to integrate autonomy highly cost-effectively as Oxa amortises R&D costs across multiple vehicle OEMs. The customer also benefits from pan-sector learnings as Oxa technology is deployed horizontally across markets and multiple applications.

Autonomous Vehicle Deployment at Scale with an OEM



*mechanical redundancy added with Oxa vehicle engineering support, if required

Key Benefits

1. Oxa can provide a full autonomy system design including software and hardware components - along with mechanical redundancy for steering, braking and traction.
2. OEMs can reduce time to market, mitigate risk and cut R&D and BoMs cost, and scale vehicle sales faster.
3. Oxa can deliver remote support throughout a vehicle type's lifecycle, including managing over-the-air updates.
4. Flexibility for either OEMs or end users to license Oxa's autonomy software.

"The skeleton key that will unlock connected and automated mobility (CAM) at scale is a truly collaborative ecosystem with cutting edge science innovators and traditional transport companies, insurers, governments, operators and local authorities all working towards a single goal. That goal is a sensible, wide-scale deployment of self-driving vehicles to create a better, safer, transport ecosystem for everyone.

Zenzic was formed to accelerate CAM cohesion in the UK, elevating what companies can achieve on the domestic and global stages. The UK has always been at the forefront of innovation; from Sir Isaac Newton to Sir Tim Burners-Lee. Today, a fresh wave of visionaries are creating exciting new technology that will reshape the world positively over time. Zenzic is proud to be part of that movement."

Mark Cracknell
Programme Director, Zenzic

ZENZIC

CASE STUDY: **Bradshaw Electric Vehicles**

A prime example of a company that has implemented the outsourcing business model to incorporate autonomous capabilities. Specialising in manufacturing high-volume and custom vehicles for various sectors such as aviation, waste collection, and manufacturing, they focus on understanding their customers' challenges rather than simply offering autonomy as a solution.

By partnering with Oxa, they access the latest Oxa Driver software and a Reference Autonomy Design (RAD) that addresses sensor and computing requirements. This collaboration allows Bradshaw to expedite the integration of autonomy features more effectively than if they were to develop them independently, leveraging Oxa's ability to distribute research and development expenses across multiple projects. Ultimately, the customer benefits from the functionality of autonomy without needing to understand the intricacies of the autonomous system.

Bradshaw was founded in the 1960s as a plant hire company, but by 1976, they were importing electric vehicles from the United States. Progressing from imports, Bradshaw delved into crafting their own designs, offering off-the-shelf and bespoke vehicles for various sectors like logistics, waste management, and hospitality. Today, they provide all-electric, zero-emission light road vehicles for urban delivery and waste collection. While catering to industrial markets, Bradshaw consistently explores cutting-edge technologies.

For instance, the use of AC-powered technology to enable precise tuning, high efficiency, and effective energy management of their vehicles whilst simultaneously offering reduced maintenance operating costs due to fewer components.

The company continues to work with cutting-edge technology, currently in the development of autonomous vehicles to meet the latest customer requirements.

According to Managing Director Drew Bradshaw, the incorporation of autonomy into their vehicles is not solely for human elimination but rather to optimise the entire system and allow for continuous evolution. Therefore, implementing AC-powered technology in their electric vehicles enables Bradshaw Electric Vehicles to achieve this goal efficiently.

Furthermore, the relationship with Oxa highlights the importance of collaboration and outsourcing in driving industry innovation. By leveraging external expertise and resources, companies can bring new technologies to market faster and more effectively. This not only benefits the company itself but also contributes to the advancement of the industry as a whole.

BRADSHAW
ELECTRIC • VEHICLES

With AV design model thinking maturing we're now focusing on scaling deployments. Alongside industrial AV applications we're assessing with Bradshaw, we're making solid progress in autonomous passenger shuttles. Shuttles are quickly gaining traction with cities looking to improve services and reduce traffic. An excellent example is the work we're doing with Beep, our US shuttle operations partner, and their client the Jacksonville Transportation Authority (JTA). The JTA is focusing on city regeneration and how vibrantly-branded shuttles can boost downtown areas.

JTA CEO Nat Ford said recently: "A change is coming to public transportation in our country, and that change is starting here in Jacksonville, Florida. Ten years from now we'll see people hopping on and off autonomous vehicles, and it'll be pretty commonplace. I think we could look back and be very proud of what we're doing today."

Beep shuttle in Jacksonville, Florida, running Oxa Driver software. It's one of 7 US passenger services, driven by Oxa, due to launch in 2024 across multiple cities.

Bringing Regeneration to Cities:

Jacksonville Transportation Authority, Florida, has started a major investment program in autonomous transportation as part of an Ultimate Urban Circulator Project. The JTA's vision is to bring about "a vibrant, revitalized and better-connected Downtown Jacksonville". The city is just one of many deploying AV shuttles driven by Oxa, with our US fleet operations partner Beep - to brand and enhance urban areas.

The Jacksonville shuttles are part of an AV program licensed by the US National Highway Traffic Safety Administration (NHTSA).

The first deployment has seen Oxa powered vehicles serving the Florida State College at Jacksonville (FSCJ) which is also building an AV skills programme into its academic curriculum - gearing up students for AV-inspired careers.

Oxa believes AV shuttles will quickly become a potent new way for cities to brand themselves, with unique designs and on-board functionality. The cost of deployment is also a fraction of heavier infrastructure-dependent systems such as trams which can cost $80 million per mile.

The JTA scheme, serving the Florida State College at Jacksonville, runs Oxa Driver software on custom shuttles procured by Beep. Oxa and Beep are now partnering on six more schemes across multiple US cities. In the UK we are working with Belfast Harbour and vehicle partner eVersum to deploy AV shuttles in the harbour area.

The provision of electric automated shuttles is fast becoming a new market subsegment of note but passenger-carrying will likely be superseded by industrial autonomy due to the breadth of industrial applications; a global fleet of millions of vehicles from tugs to wagons, pick-ups to vans, forklift trucks are all ripe for an autonomy upgrade.

Research commissioned by the SMMT last year suggests Autonomous Vehicles (AVs) can deliver annual economic benefits as high as £66 billion to the UK by 2040, with an estimated 342,000 additional jobs created in the economy, of which 12,250 would be in automotive manufacturing. The technology is also expected to save around 3,900 lives and prevent 60,000 serious accidents between now and 2040.

Looking deeper, AVs have the potential to deliver safer and less stressful journeys for passengers and more efficient movement of goods and logistics for businesses across many sectors, including haulage, manufacturing, agriculture, mining and construction. The technology can also offer people with restricted mobility, and those unable to drive, the freedom to travel more easily, all while improving traffic efficiency and, when deployed in substantial numbers, improving the environment.

However, none of these benefits can be realised without AVs achieving critical mass in deployment. To scale up, four critical challenges must be overcome:

1. The technology must be refined and matured to ensure it is safe, operational and resilient across wider operational design domains.

2. The public must be properly informed and have their views considered to build acceptance along the journey, from trials to early rollout and, ultimately, scale expansion.

3. Business models must be created to ensure commercial adoption is economically viable, especially for businesses commissioning and deploying the technology.

4. Most importantly, a full fit-for-purpose regulatory framework must be in place to ensure the rollout and scaling of AVs is done safely and responsibly. To this end, ensuring the successful passage of the Automated Vehicles Bill through the UK Parliament is a crucial first step.

Overcoming these challenges will ensure the UK becomes an attractive and competitive location of choice for AV technology to scale, bringing with it significant benefits for the economy, society and the environment.

Mike Hawes
Chief Executive, Society of Motor Manufacturers and Traders (SMMT)

SMMT
DRIVING THE
MOTOR INDUSTRY

Feeling the Heat

As part of the industrial logistic realm, there is a growing demand for asset monitoring. One highly ripe opportunity is in solar power as rapid sector growth is giving rise to significant challenges where automation will be vital.

According to Solar Power Europe, the world's total generating capacity for solar-generated electricity in 2022 was 1 Terawatt. But that's tiny when you look at the same group's prediction for 2030 by when they expect 1 Terawatt of new solar energy to be deployed every single year. But what has solar got to do with self-driving vehicles? The answer is the land and number of panels needed to capture the sun's rays.

A gigawatt solar farm requires 3-5 million solar collectors and may occupy 8 to 30 square kilometres of land. They are classed as critical infrastructure as a 1GW farm may be supplying electricity to 1 million homes. Such facilities cannot be allowed to fail and must be inspected and maintained 24/7 by human crews driving around looking for problems such as fire threats or dirty arrays - constant safety and efficiency issues. But using humans for these routine tasks is laborious, inefficient, risky and expensive: Enter AVs.

AVs are now being considered as a highly cost-effective and sustainable alternative to using human inspectors. Using a combination of cameras and heat spot detection the vehicles would patrol solar sites, and potentially also perform minor maintenance such as panel cleaning. What works for solar farms is also translatable into other industrial environments such as nuclear plants, refineries, chemical plants and wind farms. The vehicles can perform numerous tasks including security work; inspecting fences and intruder alerts, and go into environments where it's dangerous for humans to be.

The Path to Value

The pace of autonomy is picking up and scaling up. We're seeing commercial deployments in cities and plenty of later stage experimentation in industrial use cases. Oxa is working closely with a broad range of expert partners and no-one is denying the challenges but confidence is accelerating. For example, we've just become the UK's first commercial exporter of AV software into a host vehicle we didn't make or source. Even more excitingly, that deployment is in the US - reversing the usual one-way traffic for the most advanced technology.

With pace picking up, there's still time for vehicle OEMs, fleet operators and any business with transportation in its value chain to act on autonomy. That includes working out a sensible path from early adoption of autonomy with humans involved, to full autonomy as trust is built and regulations allow. Autonomy will not be a one and done process change for any company but more of an evolution. That will also include working out the operational hand-off at various points with existing systems and making considered decisions about how to redeploy displaced staff to add new value.

Key for us is working very closely with our partners and customers to validate use cases and deliver a sensible transition to autonomy - shaping operational goals together. We want to create a new generation of winners ready to deploy autonomy at scale ahead of the competitor curve.

Full 'From Here to AV Eternity' report coming soon...
Follow Oxa on LinkedIn for updates.