Automotive World MAGAZINE

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Coronavirus: Impact on the auto industry

COVID-19: Investing through the crisis | **COVID-19:** What can automakers learn from China? | **Gordon Murray Design** talks Motiv | Why **Magna** tests EV tech in ice and snow | **Henrik Fisker's** ambitions for the Ocean | What went wrong at **StreetScooter?** and **Starsky Robotics** |

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Editor's note

Not even a war or a financial crash has had an impact on the automotive industry as devastating as the novel coronavirus (COVID-19) pandemic. A few production and assembly lines may have resumed operations in China after lengthy stoppages, but in most of the rest of the world, car and truck production has come grinding to a halt.

For now, production is anticipated to be suspended for a number of weeks. Each week is costly, in terms of production, sales, jobs and of course, cash. The longer the production stoppages last, the more serious the liquidity issue becomes, especially with manufacturers taking fire on all sides, including a collapse in oil prices, stock market volatility, imminent recession in most major markets, and a long-anticipated cyclical downturn in the truck industry. Expect to hear and see plenty of synonyms of the word 'catastrophic'.

With automakers focusing on liquidity management, tough decisions will need to be made about future investments. At recent results presentations, automakers were keen to emphasise significant long-term R&D investments, on the basis that, as BMW Group CEO Oliver Zipse put it, "there will also be a time after coronavirus".

The shape in which automakers and their suppliers emerge from the pandemic will ultimately decide the fate of the areas of future mobility they have been working on. COVID-19 has brought an abrupt stop to shared mobility–in the short-term, at least–but there's a sense that the other elements of CASE, namely connectivity, automation and electrification will emerge stronger from the pandemic. Indeed, anyone developing autonomous last-mile delivery vehicles, or an affordable electric vehicle based on an easily adaptable platform, could find themselves facing an open goal.

Martin Kahl

Editor-in-Chief, Automotive World

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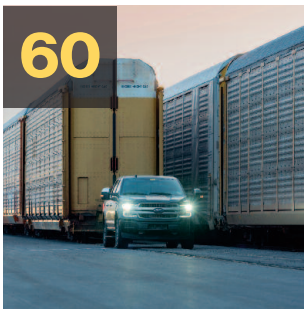


How is the auto industry responding to the coronavirus?

Megan Lampinen explores the immediate impact of the coronavirus on the world's automakers

As the novel coronavirus (COVID-19) pandemic grinds global supply chains to a halt, automakers are scrambling into crisis management mode. Tasks forces around the world have been hastily assembled to map out strategies to mitigate the impact of the global pandemic, both on workforces and businesses around the world. The initial impact on production and sales, as well as the imminent backlash of a recession, promises long-lasting implications for the world's automakers.

Production

Manufacturing operations were one of the first business areas to take the hit. China led the way but took aggressive steps to halt the spread. At the time of writing, 90% of China's automakers have resumed production. Europe was hit next. Here, most automakers started with small steps to counter its spread, like social distancing strategies, revised break patterns, deep cleaning of plants and equipment and heighted sanitary measures. However, more aggressive measures soon followed.

Over the past few weeks, all major European automakers confirmed production halts, with an average closure of about two weeks. There is no guarantee that plants will resume at this time; it's rather that the plans will be re-examined then. "In the short-term, shutdowns reflect the three most pressing concerns for car-makers–the safety of their workers, though many have been noticeably slow in responding on this front, collapsing demand as no one is going out and buying cars, and substantial disruption to the supply chain, though this may start to ease as the number of new cases in China slows and production there resumes," stated Christian Stadler, Professor of Strategic Leadership at Warwick Business School and automotive industry expert. As of 20 March, IHS estimates that the European shutdowns will cull 880,000 units from initial production plans.

With vehicle production suspended, automakers are offering manufacturing expertise to produce clear plastic face protectors...

North and South America look to be following a similar pattern. The United Auto Workers, Ford, General Motors and Fiat Chrysler (FCA) formed a COVID-19 Task Force in the US to implement enhanced protections for manufacturing and warehouse employees. A similar Task Force was formed in Canada among the Big Three and local union Unifor. Both unions were vocal in their calls for plant closures, and announcements on this front have been steadily building up. In the US alone, the initial plant closures would shave around 336,000 vehicles from earlier plans.

Taken as a whole, the degree of disruption to the industry is unprecedented. “We haven’t seen this sort of widespread closure before, even during the economic downturn in the 2000s,” Pedro Pacheco, Gartner’s Automotive Research Director, told *Automotive World*. The financial impact for workers and companies alike is causing concern.

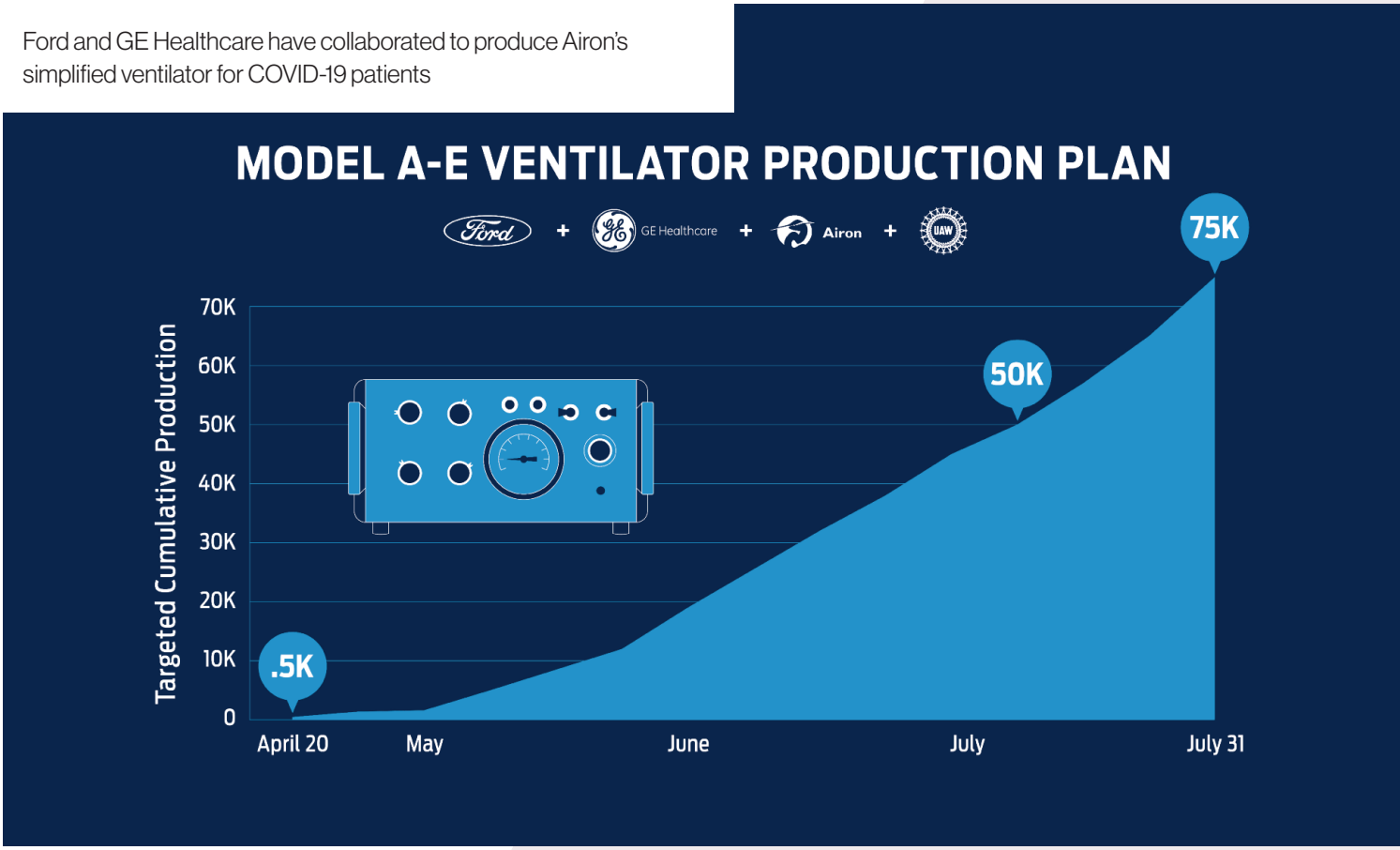
“The impact that these factory closures will have on the car manufacturing industry will depend on the support available from government and will therefore vary from country to country,” observed Stadler.

...and surgical face masks

From cars to ventilators?

With car production halted at many locations, some automakers are using their manufacturing facilities to produce high-demand medical equipment like masks and ventilators. In China, BYD is currently rolling out five million masks a day. In the US, President Trump invoked the Defense Production Act, directing private firms to make critical goods in response to a national emergency. General Motors was one of the first to confirm its participation.

Ford and GE Healthcare have collaborated to produce Airon's simplified ventilator for COVID-19 patients



Specifically, it is helping Ventec to increase production of its respiratory care products.

"The automotive industry is using its fantastic capabilities in terms of development and manufacturing to really help squash this threat," noted Pacheco. "Much of the technology its players possess can be shared and channelled to help fight the pandemic." These products are admittedly outside of the automakers' usual remit, but they are decidedly less complex than a modern vehicle, and Pacheco believes this will not pose a too considerable obstacle. "A company with the knowledge and capabilities of mechanical engineering and software can quickly jump on this," he added.

Sales and retail

Not surprisingly, new car sales are on the decline. China's sales dived nearly 80% year-on-year in February at the height of the crisis. With many cities around the world in lockdown, consumers cannot get out to dealerships. As a result, sales volumes across the industry in the first quarter were hit hard, mostly due to the impact from China. The world's largest automaker, Volkswagen Group, saw sales contract 15% in the first quarter.

Even as China recovers, volumes in Europe and the Americas are poised to nosedive. S&P Global Ratings is predicting a nearly 15% drop in global light vehicle sales to less than 80 million units in 2020, compared to 90.3 million in 2019. "We expect this decline will be particularly severe in the second quarter of the year, only gradually recovering thereafter provided that restrictive measures are effective in slowing contagion," commented S&P Global Ratings Credit Analyst, Vittoria Ferraris. For Europe and the US, the sales decline is expected in the 15-20% range. For China, the full-year drop could be around 8%-10%.

Dealers are on the front line. BMW recently confirmed that almost all of its dealers in Europe are now closed. Volkswagen management indicated there might be some form of support forthcoming to those that have to close because of the virus. The National Automobile Dealers Association (NADA) is concerned that government restrictions on business operation or movement of people might prevent

At Spartanburg, BMW's largest factory, production was suspended for at least two weeks in April 2020

vehicle repair, maintenance and sales facilities from operating. It has been urging for them to be classified as essential operations in light of the repair and warranty work they carry out.

Interestingly, some markets have reported a spike in cheap used car sales. "People are veering away from public transport in order to better isolate themselves, but they also want to support elderly relatives even more than before," commented Rod Joseph, Director of UK used car website DesperateSeller. "Suddenly, getting a cheap runabout with a good reputation for reliability...makes a lot of sense. It looks like budget cars could be the motoring equivalent of hand wash and dealers will certainly welcome the increase in demand."

Future tech investment

Despite the near-term challenges, investments in future technology and new models continues to flow. On the same day it announced plans to halt North American production, FCA announced it had secured a €300m (US$323m) loan for R&D projects around electrification. In the same vein, BMW announced plans to invest €30bn on future-oriented technologies just as it confirmed a production halt across Europe and South Africa.

As BMW Group Chief Executive pragmatically observed: "Coronavirus is here now, but there will also be a time after coronavirus." When that time comes, companies need to be ready.

In the meantime, nobody wants to be seen taking their foot off the accelerator. Both VW and BMW said they would sticking to Europe's fleet wide standards for CO2 this year. "We do not expect that we will have to divert from our fleet targets," VW Group Chief Executive Herbert Diess told media.

In fact, clean mobility could become even more important after the health concerns around the pandemic abate. "I can see increased impetus on clean driving and electric vehicles (EVs) emerging out of this," predicted Andrew Bergbaum, Managing Director at AlixPartners. "The reduction in NOx and CO2 around the world has not gone unnoticed." China reported noticeable declines in smog levels after factories halted during the outbreak. In Italy, satellite imagery has shown reduced levels of air pollution while the citizens remain on lockdown.

"Science has proven that when you reduce transport use with fossil fuel engines, you have a significant beneficial impact on air quality," continued Bergbaum. "If nothing else, I can sense that the local and city organisations will take up the mantle to drive more aggressive requirement for EVs."

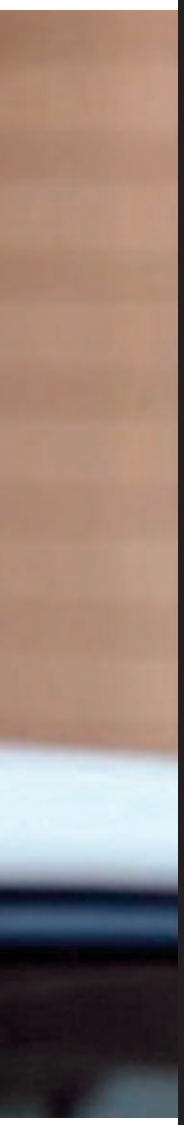
> "No one can estimate how severe this will be, or for how long it will last
>
> *Frank Witter, VW Group*

Will the automotive industry ever be the same?

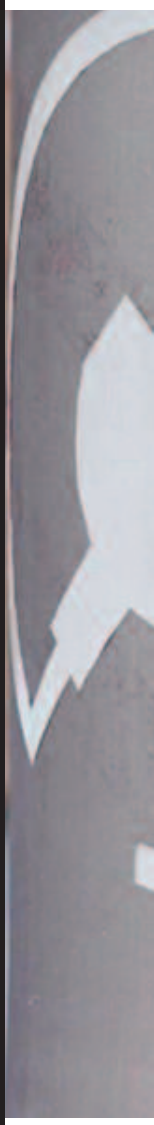
Making long-term predictions for the industry is tricky at the best of times, and the current uncertainties do not help. "Likely scenarios in terms of sales trajectories and production volumes are hard to predict," observed Pacheco. "My gut feeling is that it will be very hard to recover. On the one hand, you have the personal health impact, and on the other the economic backlash that will come even after the pandemic is solved. Compensating for these negative effects will be extremely hard."

As Stadler pointed out: "Another long-term concern for the automotive industry is the fact that most people expect this coronavirus pandemic to be followed by a recession. This industry tends to be more severely affected by downturns."

The automakers themselves are dialling back recent forecasts. "At the moment, it is impossible to share a reliable forecast," VW Group Chief Financial Officer Frank Witter told media. "No one can estimate how severe this will be, or for how long it will last."



Investing through the crisis: automakers remain focused on future mobility



The crisis is only now kicking off in Europe and North America, but automakers are busy preparing for business after COVID-19. By Megan Lampinen

A strange mix of headlines have emerged over the past 72 hours. Alongside the news that most of European vehicle production is grinding to a halt due to the impact of the coronavirus, there have been announcements of fresh automaker R&D investments and new financing to support future vehicle technology developments.

FCA issued one of each on 18 March. 'FCA suspends production in North America in response to COVID-19 emergency' was quickly followed by 'FCA-EIB: €300 million loan for R&D projects'. Apparently most of this loan is going to prepare plants for plug-in hybrids and electric vehicles (EVs). Similarly, BMW issued the release 'BMW Group plans over €30bn on future-oriented

technologies up to 2025' on the same day it announced plans to halt European and South African production. Its compatriot Volkswagen Group confirmed a European-wide production halt while in the same breath asserting that it was starting with the second phase of its TRANSFORM 2025+ strategy, "marking the beginning of a new era for the brand."

Why is the world's largest automaker kicking off an EV offensive while the lights are essentially going off across Europe? It may sound incongruous, but there is solid logic behind this and the other fresh investment news.

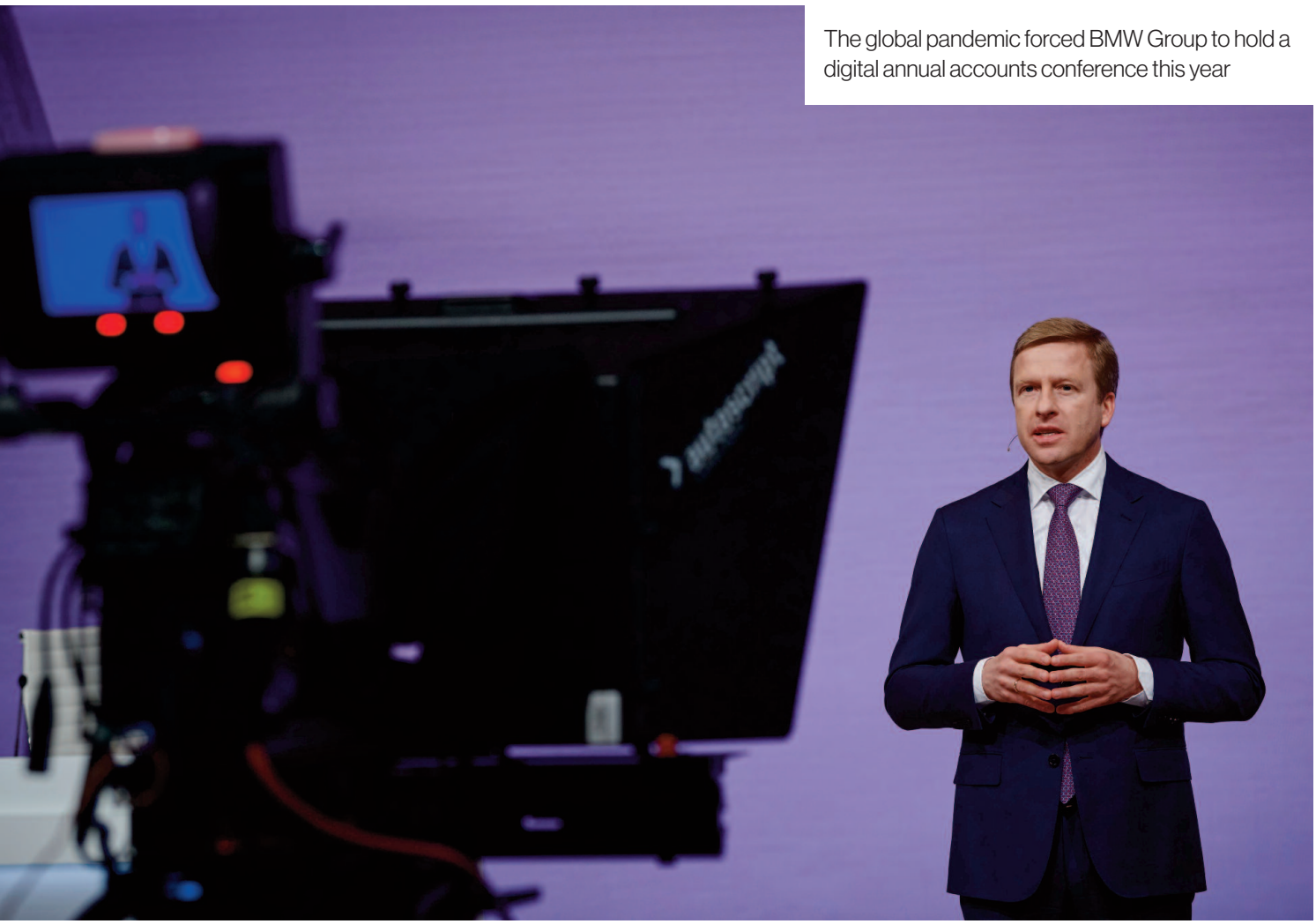
"If you look at the recent announcements, there has been some bad news across almost the entire automaker portfolio," observed Sean O'Flynn, Managing Director, Automotive and Industrial Goods, at AlixPartners. "But the wheel keeps turning. Companies are aware that, at some stage, they will emerge from this crisis. While there is a public and social requirement to shut down sites, there is still demand coming down the pipeline. Part of the challenge is to figure out how to ramp up activity again after such a shut down. We have seen that come through in the announcements about future spending."

This need to prepare for an eventual recovery was recently highlighted by Oliver Dixon, a Senior Advisor at Roland Berger. In a comment piece for *Automotive World*, Dixon wrote: "Of one thing we can be certain: the coronavirus pandemic will, in time, come to an end. How bad that end will be, no one can say, but at least some part of the industry's focus needs to be fixed upon the post-pandemic period."

> "One thing is certain: coronavirus is here now, but there will also be a time after coronavirus
>
> *Oliver Zipse, BMW Group*

Focus on future mobility

Volkswagen Group Chief Executive Herbert Diess was keen to take a future focus in talks with media at the recent press event, where he told them: "We believe that the crisis can be overcome as it was in China, and then we may expect market recovery. Exactly how long that takes is a big unknown in Europe but we will have no delays in our electrification plan." At the moment, the Group is standing by its launch schedule for upcoming EV models.



The global pandemic forced BMW Group to hold a digital annual accounts conference this year

Comments from BMW Group Chief Executive Oliver Zipse show the German luxury brand is very much preparing for market recovery even while the downturn is just getting started. "We take our responsibility seriously, both when it comes to ensuring the protection and health of our employees and to achieving the best possible balance in terms of profitability. One thing is certain: coronavirus is here now, but there will also be a time after coronavirus. The approach we are taking clearly reflects the BMW Group's ability to react quickly and flexibly."

Part of preparing for an eventual recovery involves keeping workers as active as possible. While distance working and digital meetings are the new standard, they are not always possible. Volkswagen is taking what it calls 'a parallel approach', which aims to boost the number of individuals working from home while recognising some will still need to meet face to face. This applies particularly to software engineers working on the new I.D.3. These employees continue to meet in person to finalise the software in this pivotal new EV. "The software completion rate requires complex engineering; many people need to collaborate to drive this forward," said Diess. As a concession, it has reduced the number of face to face meetings for engineers. "This is important for the post corona time, so we can drive up production again."

And resuming production after a complete and prolonged halt is no easy feat. The global industry traditionally takes a summer break, during which time plants stop rolling out vehicles. Even during these closures, though, some form of activity usually continues, such as plant maintenance. "Starting again after a complete closure is like re-establishing the entire supply chain," explained Andrew Bergbaum, Managing Director at AlixPartners. "It takes time and

Volkswagen says the current crisis will not impact the launch schedule for the new I.D.3

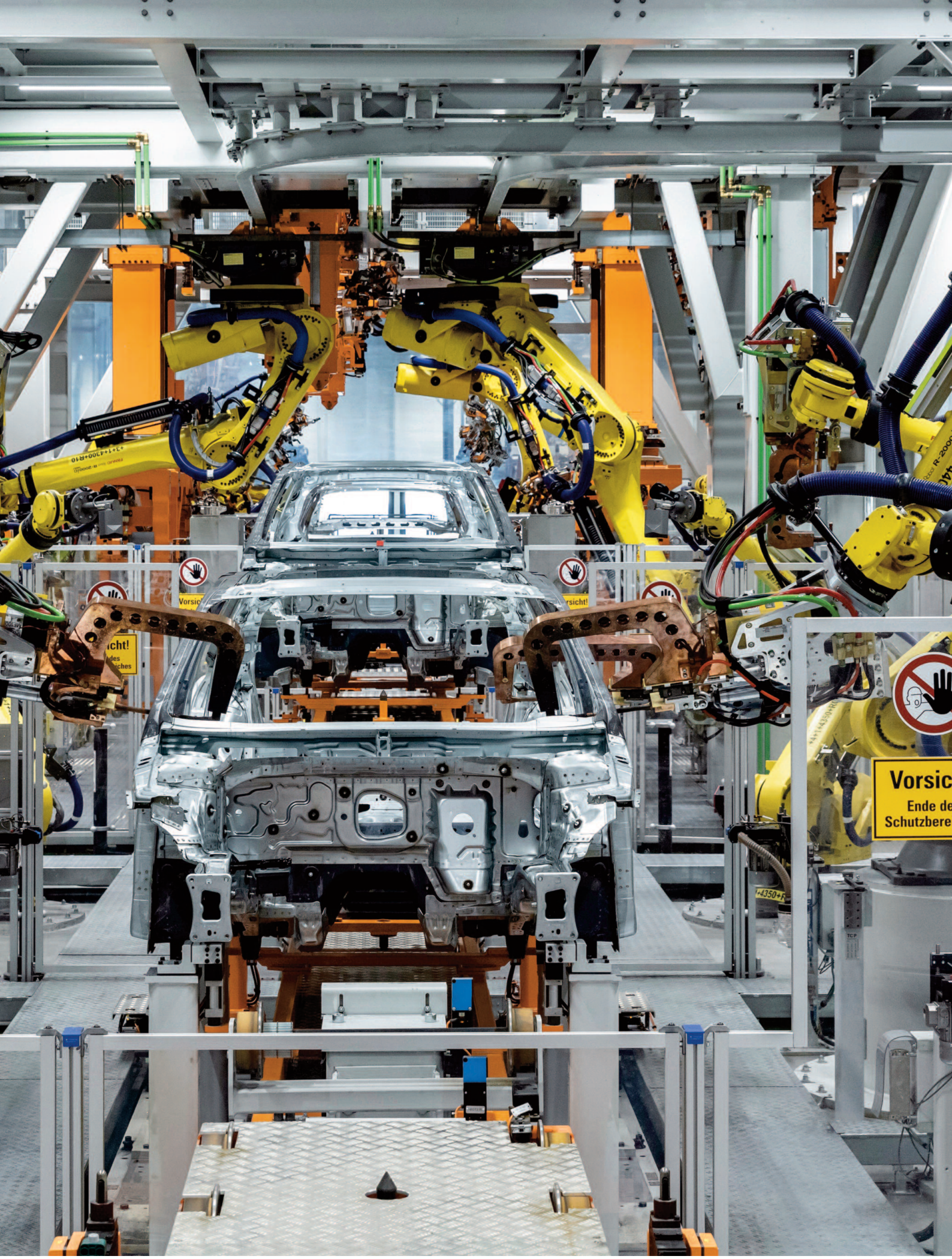
> We believe that the crisis can be overcome as it was in China, and then we may expect market recovery
>
> *Herbert Diess, VW Group*

incredible coordination and diligence to make it happen. You need to get all things flowing, everything from raw materials through to assembly, production and then to the OEMs."

For executives like Diess, maintaining a state of readiness is not an option– it's a necessity in what will prove an increasingly challenging market for everyone. "The European economy won't be cured by everyone staying at home," Volkswagen's Chief Executive told media.

As China gets back to normal, automakers will hope for a repeat in Europe and US

As coronavirus puts markets on lockdown, China enters the final phases of the COVID-19 outbreak. Is its trajectory a sign of things to come? By Xavier Boucherat and Megan Lampinen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With the novel coronavirus (COVID-19) pandemic causing widespread disruption, industry watchers are working to determine the effect on automotive markets. They might do worse than look to China: four months on from the first reported cases, officials from the country's national health commission reported that between 18 and 19 March, there were no new domestic cases of infection. Contrast this with February, which on some days saw the number of cases rise by thousands, and it would appear that measures employed by the government and companies have successfully gained a grip on the situation.

There can be little doubt that China's automotive industry has suffered, and that similarly difficult times lie ahead for other markets. Sales of new vehicles in China fell 79% in February, by which time the country had moved to enforce severe restrictions on movement and business operation. Most dealerships were closed throughout the month, and those that remained open saw little if any business. Cui Dongshu, Secretary General of the China Passenger Car Association, said, "There was barely anybody at car dealers in the first week of February as most people stayed at home. Very few dealerships opened, and they had very little traffic."

> "The lesson is clear: the quicker you stop, the quicker you start again. Italy is furthest ahead where COVID-19 is concerned, and they were not affected until they were placed on lockdown

But as Europe and the US move to enforce their own lockdowns and restrictions, in China, manufacturers are beginning to come back online. Volvo announced its operations in the country were now nearly back to normal. Elsewhere, the Honda Dongfeng joint venture re-opened its factory in Wuhan, the epicentre

of the virus, and capital of Hubei province, a major automotive manufacturing hub in China which accounts for around 10% of the country's total capacity. Dongfeng has restarted some operations elsewhere in Hubei. Many other manufacturers in the region, including the SAIC-GM factory, are still waiting to restart, but these early re-openings will offer the industry some hope.

Keep it clean

The questions is, can Europe and the US look to China for lessons on how best to survive? "The lesson is clear: the quicker you stop, the quicker you start again," said Andrew Bergbaum, Managing Director at AlixPartners. "Italy is furthest ahead where COVID-19 is concerned, and they were not affected until they were placed on lockdown. We will see similar

"The effect of the shutdown on top line demand will play through the supply chain" - Sean O'Flynn, AlixPartners

> The industry will have to move cautiously in bringing full capacity back online, taking account of both their ability to resource the labour needed and whether demand has returned

> Working from home should be promoted as much as possible. This is hard for factory workers, but there are still companies which will not allow office employees to work from home. This is very difficult to justify

deep reductions, but what China shows is that it can come back relatively quickly." The March sales drop, he says, is already looking less severe than what has been seen in February.

In this case, 'stopping' also mean following best practice in a pandemic. On a purely practical level, said Pedro Pacheco, Senior Research Director at Gartner, companies must make sure sufficient hygiene protocols are in place, including regular disinfection and cleaning, employee checks, on-site protective wear and distancing. In addition, companies must minimise their operations. "Realistic assessments are needed of which processes are absolutely critical and which are not are critical," he says. "Working from home should be promoted as much as possible. This is hard for factory workers, but there are still companies which will not allow office employees to work

from home. This is very difficult to justify."

Factory shutdowns have rapidly become the norm across Europe and the US, with global manufacturers agreeing that the health of their companies–and the quick resumption of business as usual–will depend on measures much like those that have been seen in Wuhan and throughout China. Speaking at a recent conference, BMW Chief Executive Oliver Zipse, acknowledged that China had now seen out the crisis, and that lessons learnt there should be applied elsewhere.

"We are global manufacturer," he said, "and we can draw our own conclusions based on what we see in China. Basic behaviours are now being implemented in Europe and the US, and social separation is also needed very quickly. Teams must be kept at a distance, and the number of workers must be reduced." On the one hand, he said, remote working must be pursued where possible, and on the other, correct etiquette and behaviour must be enforced where meetings are unavoidable.

A serious matter

However, questions remain on whether governments have the means or political will to emulate China in responding to COVID-19. Despite repeated advice from the World Health Organization (WHO) as early as January, some governments have proven reluctant to take extreme measures. The UK is a case in point: mixed messages from government and a lack of enforcement in the weeks leading up to lockdown mean that even as cases soared, mass public gatherings were still taking place in the country. The WHO estimates the incubation period for COVID-19 could be as long as 14 days, meaning a exponential jump in cases could be on the horizon.

Meanwhile, President Trump has claimed the US could return to business as normal within weeks, despite the virus only beginning to take hold in the country and with deaths set to jump in the coming weeks. Multiple comments on COVID-19 by Trump have been countered by Dr Anthony Fauci, the Head of the US National Institute of Allergy and Infectious Diseases, who has been advising the president. Elsewhere, in Brazil, President Bolsonaro has called the crisis a 'media trick'.

Full picture still coming

Speaking in a digital media conference, Herbert Diess, VW Group Chief Executive, agreed that a focus on containment had proven effective in China, but stressed that production and logistics chains had been maintained where possible to support the economy: "As soon as the health care system could deal with the crisis, they shifted their focus to restarting the economy, and moved back to production." Diess expects special measures to be taken in the country that could improve demand and return to the economy to its former state. "Crisis management has been very successful, and we have hopes for a satisfactory ramp-up for our businesses there."

However, Sean O'Flynn, Managing Director at AlixPartners, suggests that the full impact of the China shutdown has not yet run its course, with the country yet to return to full capacity and both manufacturers and suppliers anticipating a few more months of reduced operations. "The effect of the shutdown on top line demand will play through the supply chain," he said. "The industry will have to move cautiously in bringing full capacity back online, taking account of both their ability to resource the labour needed and whether demand has returned." China's post-pandemic months could therefore prove an essential case study for those now entering peak COVID-19.

From ICE to EV: next-gen vehicle propulsion tested to the extreme

Magna's latest technology demonstrator shows that next-generation EVs will travel further, faster and safer than ever before. By Freddie Holmes

Early four-wheel drive (4WD) systems had a fairly simple remit: improve a vehicle's ability to move forward when the going gets tough. The expression 'going forward' was taken very literally.

Engineers were focused on improving longitudinal dynamics, which in simple terms meant sending power to all four wheels to help vehicles climb steep inclines. Tier 1 supplier Magna has been developing such systems for the last 60 years or so, and in the early days found that improved grip came at the loss of efficiency. Lateral dynamics was also completely out of the picture at this stage, and the industry eventually turned its attention toward all-wheel drive (AWD) technology.

These systems allow torque to be sent to individual wheels where necessary and have become particularly advanced in recent years.

Today, AWD systems are supported by advanced software that has been honed not only on racetracks and public roads, but also the frozen lakes of Northern Sweden.

Torque vectoring technology constantly shifts precise levels of torque to each wheel so that the vehicle remains stable even at high speeds on almost zero-friction surfaces. Modern systems also enable all torque to be split between the front or rear axle in isolation, which naturally improves energy efficiency. In a conventional vehicle, this equates to reduced fuel consumption. Fast forward to 2020, and Magna is leveraging its expertise for the next-generation of battery electric vehicles (BEVs).

Over the last decade, Magna's Powertrain division has made great strides with several prototype BEV architectures. Revealed in 2018, its first technology demonstrator, the e1,

> "With cars being sold on a global scale, they need to work in these conditions as well as in other conditions

The e4 technology demonstrator not only offers improved cornering compared to the standard I-PACE; it also has 120km greater range

was based on a Tesla Model S with an extra motor on the rear axle. Its latest offering, the e4, is based on the Jaguar I-PACE. "The e1 has been phased out and replaced with a more modern technology," explained Anton Mayer, Senior Vice President of Engineering at Magna International. "This vehicle was extremely important for us to understand the first steps of electrification," he added.

Mayer spoke to *Automotive World* on the shores of Lake Kakel, one of Sweden's deepest frozen lakes, where the latest e4 technology demonstrator was undergoing optimisation. One of the main talking points of the original Tesla-based prototype was the inclusion of three electric motors, but Magna's engineers now believe this might be surplus to requirements for most applications. With automakers looking not only for performance and efficiency gains but also reduced costs, a front and rear motor should be the perfect blend.

The e4 uses the standard battery in the I-PACE production vehicle, but utilises Magna's highly integrated PSM (permanent magnet synchronous) eDrive Systems (EDS) on both the front and rear axle. The unit on the front is equipped with a mechanical differential, while the unit on the rear has a twin-clutch torque vectoring system. The gearbox, torque vectoring clutches, electric motors, inverters, inverter software and vehicle control strategy have all been developed in-house by Magna. The e4's active disconnect system can already be found in models like the BMW M5 today, and on a BEV platform can increase electric driving range by limiting power to only one axle.

The results so far have been impressive. Tests have shown that the e4 technology demonstrator not only offers improved

> “Our customers expect best in class efficiency, driving dynamics and safety, and we have achieved that perfectly

cornering compared to the standard I-PACE, but it can also be optimised to provide up to 25% greater energy efficiency. One test showed how the I-PACE can accelerate up to 75kph (46mph) around a circle of sheet ice without losing control, and without altering the steering angle. The driver simply needs to hold on to the wheel and let Magna’s torque vectoring technology modulate the power being sent to each wheel. When the vehicle does lose grip, it enters a manageable power slide that can be maintained with fingertip precision–even with a complete novice at the wheel.

It may seem all for show, but the idea is that if the system can keep the vehicle stable in the most challenging conditions in the world, everyday driving will be significantly safer. “If we want to have a reliable, dynamic and safe car, this is important. And with cars being sold on a global scale, they need to work in these conditions as well as in other conditions,” explained Mayer.

Because Magna develops both the hardware and software behind these systems, it has been able to perform a complete ‘system optimisation’ of the vehicle. That means looking at elements outside of the drivetrain. Greater battery density can be achieved by decreasing the level of cobalt content, adding improved electrolytes, and optimising the battery management system. Further gains can be found by introducing low rolling resistance tyres, extra lightweighting, greater

aerodynamics and a 'predictive operating strategy' that utilises connectivity to plan for the road ahead. During one test run between Vienna and Venice last year, engineers found that the vehicle's usable range had increased from 470km (292 miles) to 590km.

Initial tests on the ice have also proven positive. "We have great lateral dynamics, very high torque and throttle response, and even the ability to boost torque for short periods which enables us to improve lateral dynamics even more than usual," said Mayer. "Our customers expect best in class efficiency, driving dynamics and safety, and we have achieved that perfectly with the e4."

The e4 architecture is due to enter series applications in 2025, but will not necessarily end up in the I-PACE. Jaguar's fully electric SUV was chosen simply because it met the needs of Magna's development team, and several other models were considered for the technology demonstrator. Because the architecture uses what Magna describes as technology 'building blocks', the system is highly scalable across a range of different applications.

The primary consideration for Magna is whether a flexible working relationship can be had with the automaker in question. "We have to work hand-in-hand

Alongside the e4 is the e2 prototype, which can be configured as an ICE, mild hybrid or PHEV via a tablet

with the automakers," said Mayer. "In this case we decided it would be JLR, but in the past we have also worked with BMW, for example. Every year it should be a new customer for us as there are different expectations to meet."

Partnering up to produce a technology demonstrator also makes financial sense, as it provides an existing platform to work with. "If we were to develop our own, €20m (US$22m) would not be enough," quipped Mayer. "The solution should be scalable in terms of driving dynamics, cost and efficiency. If we are able to optimise everything in the right manner, everything can be perfect."

Some automakers prefer to perform drivetrain system optimisation themselves, but many offload that task to Magna. The best results tend to come when given free rein on a project, advised Mayer: "Some OEMs see this area as their own real estate, but for us it is always exciting if we can support functionality at a high-level and show our full competencies."

Testing will continue as the e4 architecture approaches series production, but the supplier is already working on its next variant. This could be a hybrid, plug-in hybrid or full EV solution, advised Mayer.

INTERVIEW

Henrik Fisker, Chairman and Chief Executive, Fisker Inc

Megan Lampinen talks to Henrik Fisker about his plans to position his new company as one of the mobility leaders of the future


FISKER

Henrik Fisker is determined to play a pivotal role in shaping the mobility of the future. Driven by a passion for eco-friendly but stylish vehicles, he founded Fisker Automotive and launched the groundbreaking Fisker Karma extended-range plug-in hybrid in 2011. While the company went on to suffer serious supply chain troubles and eventually fell into new ownership, its founder walked away in 2013, retaining the Fisker brand. After several quiet years, the former BMW and Aston Martin designer is back on the scene with a new company, Fisker Inc, and a potential game changer in the form of the Fisker Ocean.

The Ocean should enter production in late 2021, with the first high-volume deliveries expected in 2022. This new electric SUV ticks all the right boxes in terms of green credentials. Not only does it promise zero-emission driving and a range of 250-300 miles (400-482km), but it is also billed as the most sustainable vehicle yet. The Ocean may also be one of the most affordable zero-emission luxury SUVs on the market, with a starting price of US$37,499 in the US. For buyers not interested in making that sort of commitment, a flexible lease will be offered from US$379/month. As Fisker explained in a recent *Automotive World* interview, this is all about setting a new standard and providing a flagship to drive positive global change.

Henrik Fisker is back on the scene with a new company, Fisker Inc. and an all-new car, the Fisker Ocean

Billed as the most sustainable vehicle yet, the Fisker Ocean promises zero-emission driving and a range of up to 300 miles (482km)

Fisker has been rebranding itself as a 'mobility and technology company'. How does the Ocean fit in with that new market positioning?

The Ocean is an exciting, yet very functional and practical vehicle that can offer a unique mobility experience across a variety of scenarios: driving the kids to school, going to the beach with surfboards or picking up stuff at the DIY store. Some may simply enjoy opening up the entire vehicle in California model for a free-flowing cruise. We want to bring in a new generation of young drivers, who prioritise experiences like I've just mentioned, but don't want the commitment and high costs of owning and maintaining a car, or having to sign up for a binding three-year lease.

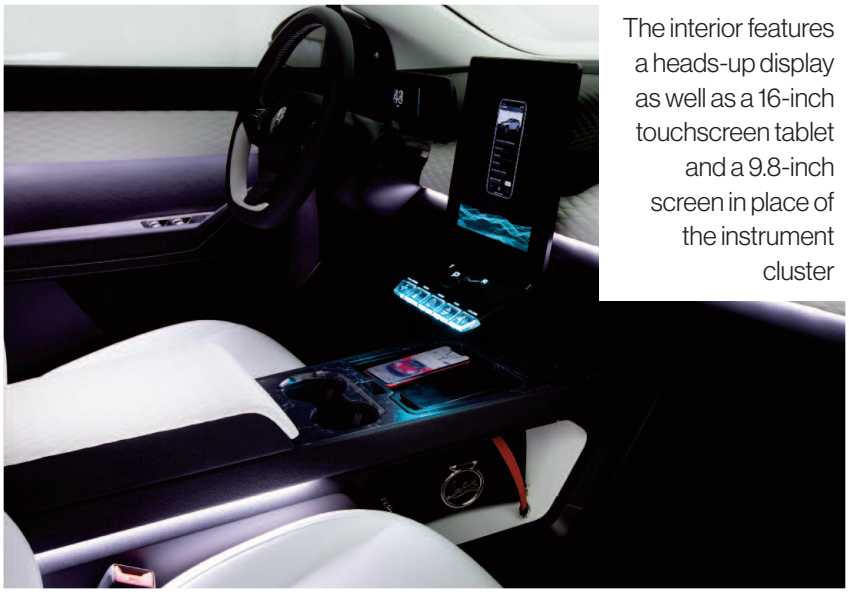
Lease management and many other functions are done through the Flexee mobile app platform. What role does this play in the overall customer experience?

The idea is that from the moment a consumer considers the vehicle, looks through options, schedules test drives, selects a vehicle, buys affordable insurance plans and services the vehicle to the time they return it to Fisker, the entire experience is based on the mobile app. This allows us to create direct, meaningful communication with customers, which benefits both the user and the company. We are positioned to stay ahead of the emerging consumer trends that look at automotive in a different way from previous generations.

What brands do you see as direct competitors?

Our competitors range from app-based mobility companies and ride-hailing services to any premium SUV or crossover in our price class, most of which

The Fisker Ocean should enter production in late 2021



The interior features a heads-up display as well as a 16-inch touchscreen tablet and a 9.8-inch screen in place of the instrument cluster

are still gasoline vehicles with a few EVs to come, although those electric SUVs are mostly more expensive. The cheaper electric vehicles usually lack the emotionally-compelling design touches and unique experiences that the Fisker brand is delivering.

Who is the target buyer for the Ocean?

As I mentioned, we want to bring in a new generation of young drivers who prioritise experiences but may not want the commitment and high costs of running a car or a binding three-year lease. The consumer trends are pointing to people who value carefree fun and emotional experiences, yet functional mobility that's elevated through outstanding and powerful design. Most importantly, they share our passion for a cleaner world for all, as well as pride in being able to drive the world's most sustainable vehicle.

Eco-conscious materials have been used throughout the vehicle

While much of the industry is looking at tailpipe emissions, Fisker is going beyond that to address sustainability. How does the company define a truly sustainable vehicle?

For us, it is about getting started, and setting things in motion: not just talking about it. We have implemented recycled materials all over the interior, we have added an extremely large solar roof and are constantly looking at ways to improve every part of our vehicles with some of the most eco-conscious materials and processes in existence today. Unlike others across the industry, it's not just a concept. The Ocean already features some of the most eco-conscious materials possible from carpets made of recycled fishing nets pulled from the ocean, vegan interior, eco-suede made of recycled t-shirts and plastic bottles to rubber surfaces made of recycled tyre. And all while ensuring that luxurious quality is delivered for passengers.

Can you take this any further?

This is a long journey of ever-more improvements. We have to, and are, taking the lead, and bringing our suppliers with us. We have to constantly innovate. We even want to deliver our Flexee lease vehicles by driving them to our customers through zero-emission means, instead of putting them on a diesel trailer truck. Our goal is to keep improving every aspect of the development, manufacturing, supply chain and customer interaction to make our entire process as sustainable as possible.

When it comes to brand awareness and marketing, are you building on Karma heritage?

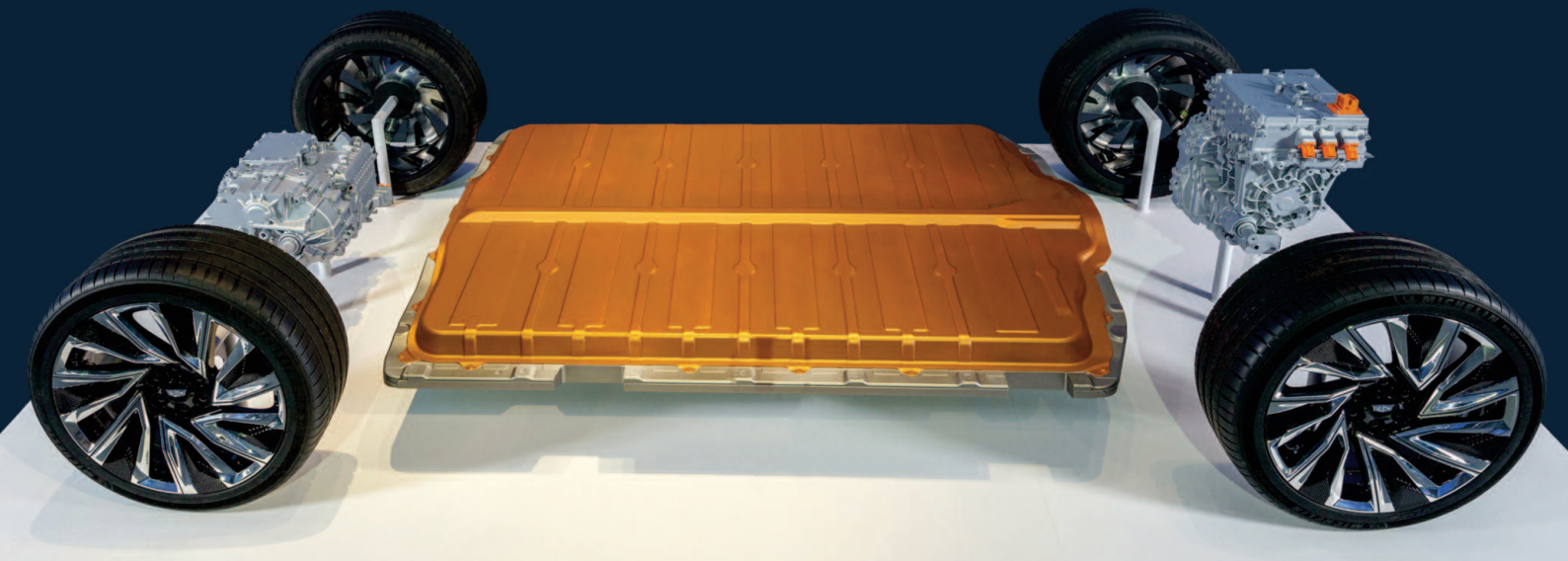
The Fisker Karma showed that the Fisker brand can make beautiful, emotionally-desirable, innovative and sustainable vehicles. We are proud of our heritage: we were the first to use reclaimed wood, offer a vegan interior and integrate a complete full length solar roof, even when not many people cared about being eco-conscious in the automotive industry. We took early risks and helped pave the way– remember, the Fisker Karma came out more than a year before Tesla's Model S. We are building on that heritage: we still have a lot of great Karma owners, who are our brand ambassadors and ultimately we will make a true successor to the Fisker Karma too.

In what way does the Ocean mark a fresh start?

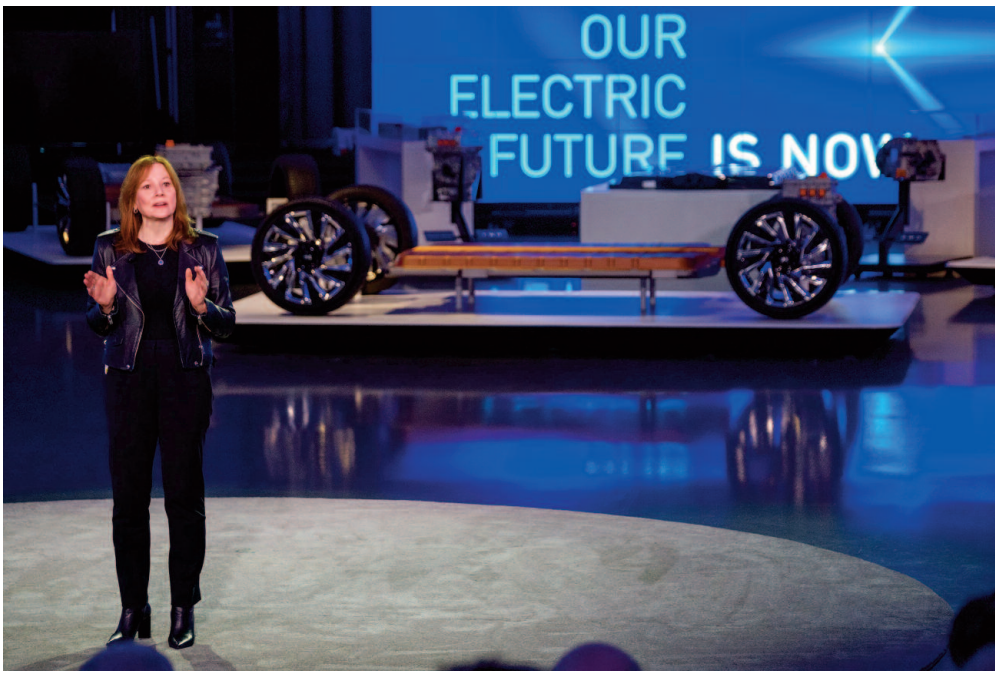
For now, the Fisker Ocean marks a new era and a new line of vehicles, where we are proving that great design, luxurious touches and experiences and sustainability do not have to be out of reach. People can make a difference now, while enjoying the differentiated design touches that have characterised the Fisker brand and have won fans from all across the world. We are planning many different vehicle types and different price categories–and there is more to come.

GM's EV offensive: from good intentions to key revenue stream

Megan Lampinen takes a closer look at GM's updated roadmap for electrification



General Motors has been talking about its vision of a zero-emission future for years now, frequently declaring its intention to 'go electric'. A couple years ago it put forward a target of 20 electric vehicle (EV) models by 2023. While the market has seen little development on these model plans since then, the automaker has more than made up for its silence with a massive new EV commitment and roadmap unveiled at the GM EV Day in Warren, Michigan. "We want to put everyone in an EV, and we have what it takes to do it," Chief Executive Mary Barra told media and investors at the event.



GM Chairman and CEO Mary Barra addresses the gathering in the Design Dome on the GM Tech Center campus in Warren

The plan

The company has pledged a fresh infusion of US$20bn for electric and autonomous vehicle programmes over the coming five years. However, the focus of the recent presentation was primarily on electrification and the news that it has developed promising new battery technology that slashes costs and improves performance. The latest generation of its electric propulsion system, known as BEV3, introduces the Ultium battery system based on a new chemistry for lithium-ion cells.

One of the big advantages of Ultium is the reduced amount of cobalt–70% compared to most of today's NMC (nickel, manganese and cobalt) cells. Not only is cobalt very expensive, but it is frequently mined in inhumane conditions. Ultium uses an NMCA (with the 'A' standing for aluminium) chemistry, which was developed in collaboration with battery expert LG Chem. In the long run, GM aims to eliminate cobalt entirely, along with nickel, from its batteries and continues to work on new chemistries with LG Chem.

"GM has done some very cool engineering with its new battery design," observed Sam Abuelsamid, Principal Analyst at Navigant Research. This new low cobalt chemistry is key to cutting costs and ramping up volumes. "With so much new cell production capacity coming on line in the next couple of years, reducing cobalt content or locking in supplies will be crucial for any manufacturer that wants to hit its EV volume targets," he pointed out.

Abuelsamid also highlighted changes in the cell format itself, noting how the cells are longer and narrower than in the past: "The electrode coating lines have also been made wider which allows for faster cycle

GM unveiled its new modular platform and battery system, Ultium, at an event on 4 March

times and lower cost. The pouch material is folded around the electrode stack and sealed on three sides rather than having two layers sealed around all four sides. This leaves a flat surface along one edge of the cell that sits against the thermal layer to conduct heat away more efficiently."

The cells are just one aspect of the innovation at work; the pack design itself also features notable advances on the competition. While others rely on a single battery management system (BMS) for the whole pack, here, each module has an integrated BMS. "This can be programmed with information about the cell chemistry contained in the module so the BMS can manage the output," explained Abuelsamid. "This allows modules with different chemistries to be mixed in a single pack. In the future when a pack needs servicing a module can be replaced with one that may contain cells with a newer chemistry and the BMS can still balance the output to the other modules. This means the manufacturer won't have to stock service parts with older cell chemistries for years after a vehicle is out of production." GM also explained how the integrated BMS will allow it to cut the amount of wiring in the pack by 80%.

The combination of all these advances should slash the cell cost down below US$100/kWh. Just how far this drops is anyone's guess, but Barra is optimistic. "This is only the beginning," she said. "Because the team will continuously work to improve chemistries and development processes, costs will drop even lower as the programme moves forward." Range is also impressive, with Ultium promising up to 400 miles (644km) on a full charge. In comparison, the latest Chevrolet Bolt offers a top range of 259 miles.

Revenue sources

Eventually, these batteries will make their way into all GM brands, as Chevrolet, Cadillac, GMC and Buick will be launching new EVs. And they will be profitable in their first generation. That's a big claim: electrification is expensive and profits have proven elusive so far.

GM is confident that with the battery cost savings and its manufacturing expertise, the gamble will pay off. Notably, with Ultium the company is capitalising on an opportunity to insource more of its battery costs and effectively take back some of the economics previously outsourced. "It is a very strategic move," Doug Parks, GM's Global Product Development and Purchasing Chief, told analysts. "We have the expertise. We made a lot of electric motors over a long period of time. Vertically integrating gives us a huge competitive advantage."

GM expects to sell more than 1 million EVs a year by the middle of the decade

Parks also pointed to the close collaboration on cell technology with LG Chem, which allows for rapid development advances and greater oversight of the supply chain: "If you outsource things like axles on trucks, you never know the true value chain. With electrification, we will know that. We are partnering with the chemistry and manufacture of the cell itself, but the packs and the vehicle are something we hold as a potential future revenue stream."

Barra also spoke of new sources of revenue down the line, specifically in the form of technology licensing and tapping the shared mobility segment: "By vertically integrating the manufacturing of our own battery cells and drive units, we can reach beyond our fleets and licence the technology to others. We also see opportunity to sell EVs to ride-share providers."

The potential

The outlook for global EV sales is promising, and while forecasts differ in the details they all agree on the direction of the market: solidly upward. ABI Research expects that by 2029, EVs could account for 16.3% of the market, up from 1.3% in 2018.

"GM's EV announcement is another sign that the auto industry knows the future of transportation is electric," Sandra Roling, Head of EV100 at The Climate Group, told *Automotive World*. "More and more major companies are committing to switch their fleets to EV by 2030, and our research shows a lack of supply is their top barrier. GM risks losing its largest customers to other automakers unless it rapidly scales up production of EVs."

The automaker showed off 12 upcoming electric models at EV Day, and some will make their public debut in the coming months, starting with the Cadillac Lyriq in April and the Hummer pick-up in May. Market launch is at least 18 months away, but as Abuelsamid noted, there should be a quick succession of new vehicles after that. "If the lower cost batteries and propulsion allow GM to price aggressively, it may start to see some significant volumes of EV sales," he added.

Barra has said she aims to sell 1 million EVs a year by 2025. However, the industry is not about to classify GM as an all-out EV manufacturer just yet. Roling points out that the company still needs to "stop blocking federal fuel efficiency standards" and "put its full weight" behind the inevitable shift to electric propulsion.

Production suspended: what it means to stop a vehicle assembly line

Car and truck factories are falling silent all around the world. But what does it mean to suspend production—and how easily can assembly be restarted? By Martin Kahl

Car and truck production has ground to a halt around the world. Apart from in China, where factories have resumed production after a lengthy suspension in February caused by the novel coronavirus (COVID-19), automakers have stopped almost all assembly lines, with most suspensions expected to last two weeks at the very least.

As the automotive industry grapples with the big picture implications of this unprecedented industry-wide shutdown, plant managers face the uncertainty of how long the suspension will last, what impact it will have on the global automotive supply chain, and how to restart once the pandemic is over.

Factories have been forced to close for a number of reasons, from falling demand and supply chain disruption to factory worker welfare. In some cases, national responses to the coronavirus outbreak have prevented workers and management commuting across national borders. And at a time when white collar workers were being told to work from home, factory workers could hardly be expected to clock in and work in a factory during a pandemic. Nonetheless, these unscheduled stoppages hide much greater challenges.

There's no on-off switch in a car factory

Vehicle assembly plants rarely run all year round; lines stop over Christmas and in the summer for planned downtime, with holiday periods used for maintenance and machinery

upgrades. However, such stoppages and the accompanying work are scheduled well in advance, and carefully coordinated with all stages of the supply chain, finished vehicle logistics and retail.

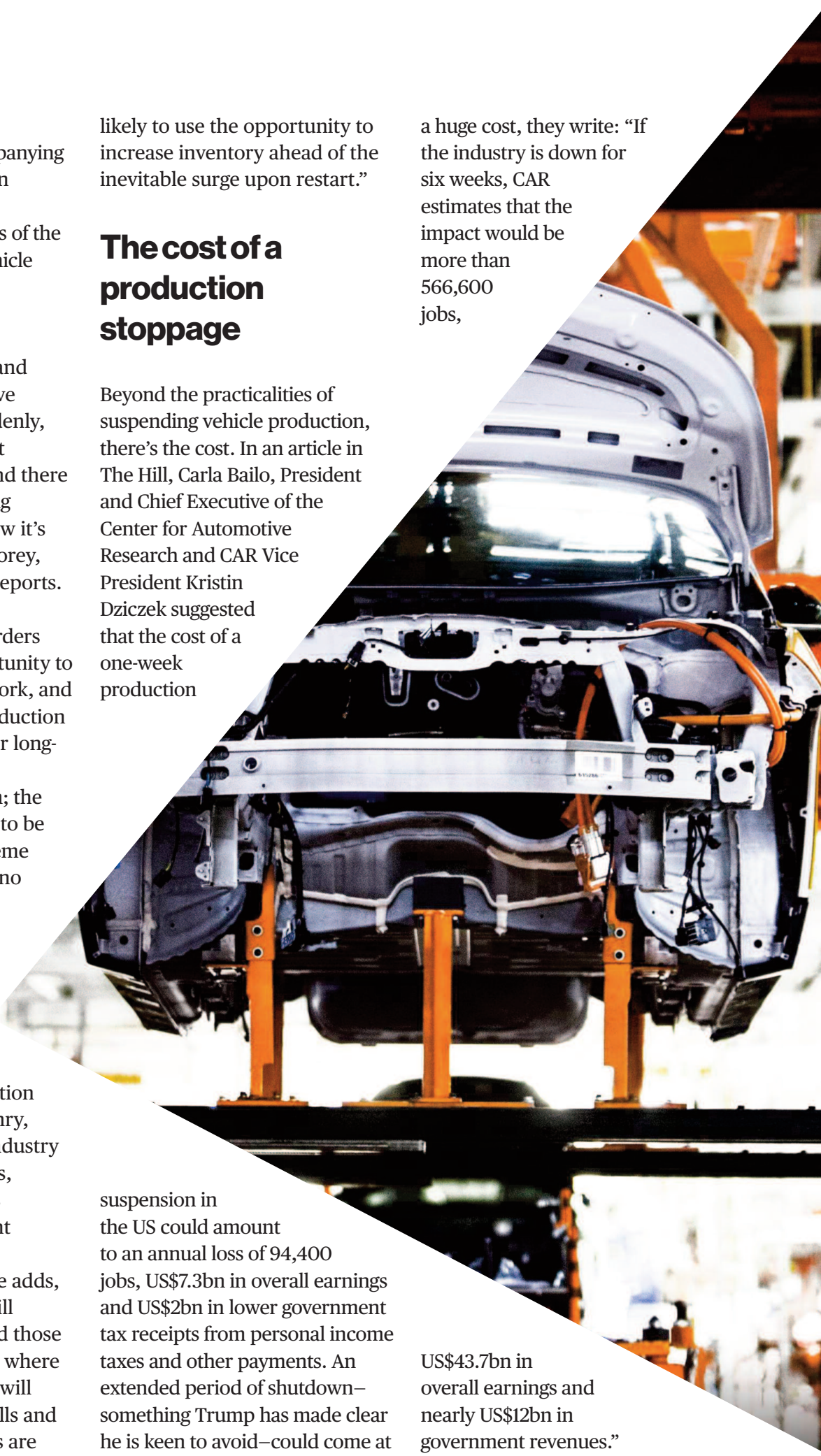
All factories have crisis management protocols, and although the closures have happened relatively suddenly, "we are still talking about controlled shutdowns, and there will be standard operating procedures (SOPs) for how it's done," notes Jonathan Storey, Director of Automotive Reports.

However, stay-at-home orders have ruled out the opportunity to carry out maintenance work, and few existing SOPs for production suspension are written for long-term company-wide and industry-wide suspension; the current situation is likely to be much more than an extreme summer shutdown, with no end in sight.

"Most car factories focus on assembly operations, with not much more manufacturing than stamping and some injection moulding," notes Ian Henry, Director of automotive industry consultancy AutoAnalysis, "making it a perhaps less arduous task than it might otherwise be to restart production." However, he adds, "Hydraulic equipment will require maintenance, and those areas of the supply chain where extreme heat is involved will struggle, such as steel mills and foundries. Steel suppliers are likely to use the opportunity to increase inventory ahead of the inevitable surge upon restart."

The cost of a production stoppage

Beyond the practicalities of suspending vehicle production, there's the cost. In an article in The Hill, Carla Bailo, President and Chief Executive of the Center for Automotive Research and CAR Vice President Kristin Dziczek suggested that the cost of a one-week production suspension in the US could amount to an annual loss of 94,400 jobs, US$7.3bn in overall earnings and US$2bn in lower government tax receipts from personal income taxes and other payments. An extended period of shutdown–something Trump has made clear he is keen to avoid–could come at a huge cost, they write: "If the industry is down for six weeks, CAR estimates that the impact would be more than 566,600 jobs, US$43.7bn in overall earnings and nearly US$12bn in government revenues."



From Motor City to Medical City?

Keen to keep factories up and running, automakers have been exploring alternative production, notably medical equipment such as masks, ventilators, even hand sanitiser to assist in the fight against the coronavirus. Automakers–reportedly baffled by Trump's suggestion that he had approved them to begin production of ventilators and other urgently needed medical equipment–are nonetheless prepared to step up to the challenge. GM has begun exploring the feasibility of building ventilators for Ventec Life Systems Inc. at one of its components factories. The automaker has reportedly secured supply lines for almost all of the parts required for ventilator production from its existing supply base, as it prepares 'Project V' ventilator production in Indiana. Images have been seen of a ventilator design that uses Ford vehicle parts; and FCA has begun face mask production, aiming to supply 1 million masks a month for distribution across North America, "in addition to the support we are giving to increase the production of ventilators," noted FCA Chief Executive Mike Manley.

How deeply involved the automakers can become in the production of medical equipment remains to be seen. Most car factories are poorly suited at best for the production of carefully regulated sterile medical equipment, although automakers certainly have the scale and engineering capabilities to produce parts for such equipment.

> "If the industry is down for six weeks, CAR estimates that the impact would be more than 566,600 jobs, US$43.7bn in overall earnings and nearly US$12bn in government revenues


C1
C2

There may be trouble ahead

For vehicle production to resume, everything needs to be in its right place, requiring sufficient inventory of parts and materials. With thousands of parts in a car, a missed delivery of one small component could be the deciding factor. “This goes right to the heart of production in a just-in-time world,” notes Andrew Bergbaum, a Managing Director at AlixPartners, emphasising that suspending production is about more than just stopping the line. “Automakers need to decide how much stock to hold in order to start up again. And if a delivery is already on the water en route from a distant supplier, it will arrive whether the automaker wants it or not–and that supplier will expect to be paid.”

Among the challenges facing the industry will be the threat to smaller suppliers integral to the supply chain. Indeed, perhaps the biggest risk is small suppliers going under and not being able to resume operations. There is also no guarantee that all links in the supply chain can restart at the same time with sufficient stock and quality. “A lengthy global shutdown will of course be far more disruptive than a routine two-week summer break,” adds Storey.

Many suppliers may need assistance to ramp up production at the automakers’ desired speed, and even to remain solvent over a lengthy shutdown, note CAR’s Bailo and

> “The automotive industry is nothing if not resilient, but restarting will require cash and liquidity. Automotive companies know how to do this, but it will need careful management

Dziczek. “The supply chain depends on small businesses that an extended shutdown could wipe out entirely. Roughly 75 percent of automotive supplier establishments employ fewer than 100 workers, and these firms—like all small businesses in the United States—are going to need help with liquidity to stay afloat.”

Survival of the fittest

Carefully managing cash and liquidity will be crucial, says Sean O’Flynn, a Managing Director at AlixPartners, and companies should access any emergency packages and assistance offered. Companies must do anything and everything to ensure their survival, emphasises Bergbaum, to avoid allowing insolvencies that could have been prevented.

Add to this the fact that suppliers produce parts for numerous manufacturers, each with different demands, stretching supplier capacity and prolonging supply chain disruption even after production resumes. Furthermore, many of those suppliers are not dedicated to the automotive industry.

“The further along the supply chain you look, the deeper you get into primary materials,” says O’Flynn. “Tier 2 and 3 companies likely supply other industries as well as automotive. That supplier may not be in a shutdown, but it no longer has its automotive customers, meaning its factory is running with the same operating costs but a reduced cash flow.” In the short term, gaps in demand might be plugged by increasing volumes to other sectors; aluminium sheet metal suppliers, for example, are likely to switch production from automotive sheet to drinks can sheet in the short term, the VP of a leading metal beverage packaging company told this publication. This is far from a long-term business strategy, however.

Where necessary, automakers will find alternative suppliers, but many supply chains are highly sensitive. The fact that FCA was preparing weeks ago for supply chain disruption and production stoppages in Europe as a result of production suspension in China underlines the sensitivity of global supply chains. JIT supply lines require careful coordination between all parts of the supply chain; should any link in the chain fall victim to a crisis such as this one, it can have a serious knock-on effect.

Nothing if not resilient

Ford, GM and FCA “are currently well-stocked with inventory and as more of the country moves to follow shelter-in-place orders, vehicle sales will inevitably be softer,” notes Jessica Caldwell, Edmunds’ Executive Director of Insights. “The greater challenge is that once the country gets past the worst of the pandemic, automakers will need to be prepared to get back online quickly to capitalise on the wave of deferred consumer demand.”

To be able to do so, notes Bergbaum, all parts of the supply chain will need to be operational when the pandemic is over. “The automotive industry is nothing if not resilient,” he says, “but restarting will require cash and liquidity. Automotive companies know how to do this, but it will need careful management.”

No signs of slowing in Ford's push for autonomous vehicle leadership

With the 2021 launch deadline nearing, John Rich, Chief Operations Officer, Ford AV LLC, speaks to Megan Lampinen about the company's AV journey

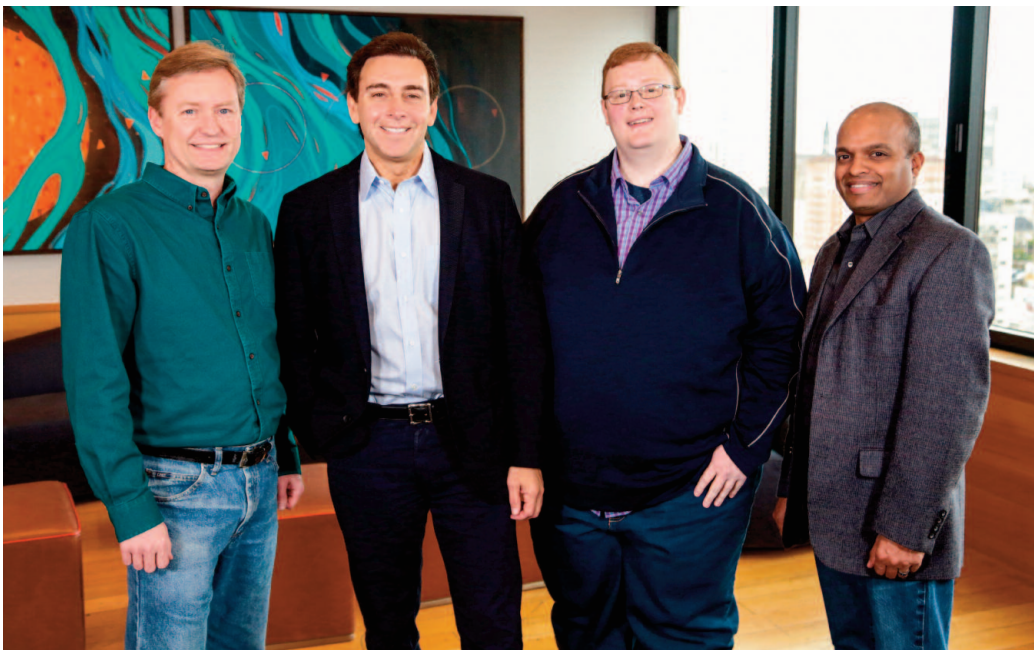

Ford
ARGO

One of the industry's oldest vehicle manufacturers was also one of the first to stake its claim in the race to autonomous driving, and Ford has kept its foot on the accelerator ever since. From its first DARPA entry in 2005 to the launch of Ford Autonomous Vehicles (AV) LLC in 2018, developments have been rolling out at breakneck pace. And they are all leading up to the anticipated launch of its first SAE Level 4 autonomous vehicle (AV) in 2021.

Building expertise

Ford kicked off its AV research efforts in 2004, and the following year it entered the DARPA Grand Challenge with a self-driving F-250 pick-up. At this time, the military were spearheading AV developments, and Ford was the first on-road vehicle manufacturer to participate in the US competition, funded by the Defense Advanced Research Projects Agency (DARPA). Its pick-up made it to the finals, but was disqualified when it intentionally drove outside of the course boundaries to avoid hitting a photographer. The performance was promising enough to secure Ford a US$1m grant from DARPA to return for the 2007 Urban Challenge.

This was the start of a game-changing journey which took another major step forward in 2017 through a US$1bn investment in Argo AI. As its name suggests, Argo AI is an expert in artificial intelligence (AI), a key component in self-driving capability. "About three years ago we became much more serious about AI and realised just how hard the AI challenge was," explains John Rich, Chief Operations Officer at Ford AV LLC.



It was under former CEO Mark Fields that Ford announced its investment in Argo AI

The team developing Ford's virtual driver system was combined with Argo's robotics talent pool. The relationship was more than just a technical partnership but something short of an outright acquisition. "We had to build out Argo AI very methodically and aggressively, and we had to build out credibility," notes Rich. It was a billion-dollar gamble on a small Pittsburgh start-up, but Ford was willing to take its chances. As Rich elaborates: "We realised that there was likely to be more than one successful AV company, but not many more than one. It's not a winner-takes-all game, but at the same time it is not something that proliferates easy. It's hard. It requires hefty investment."

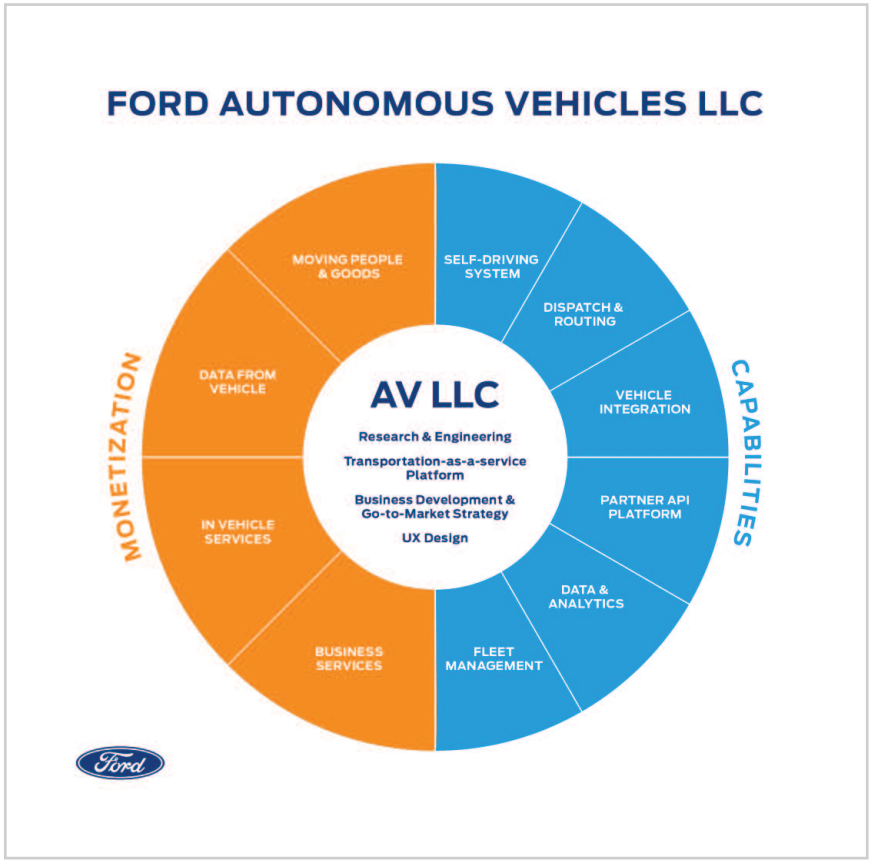
To date, the Argo collaboration has gone well, and in fact, Rich describes it as "extremely successful". It has clearly come a long way in a short time: "We started with two guys, zero lines of code and zero cars. Over the last

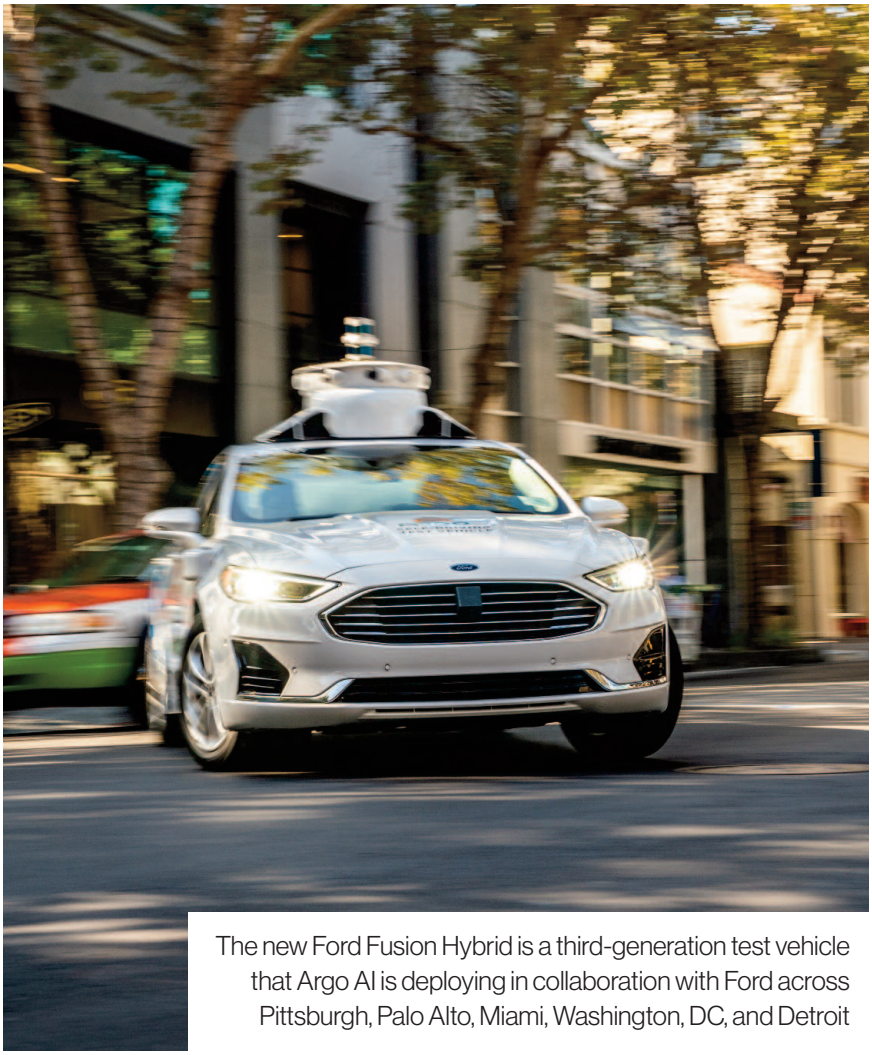
three years, Argo has expanded into almost a 500-person team." Ford teams are working to integrate developments at Argo into their AVs, but it is not the only automaker collaborating with the AI specialist. Volkswagen Group made a US$2.6bn investment in the company last year, as part of a broader alliance with Ford spanning electric vehicles and AVs. "We realised that Argo had to be a platform, and it had to be bigger than Ford," he adds.

Not long after the Argo AI investment, Ford's AV efforts made another significant advance with the formation of a dedicated organisation. In July 2018, it announced the establishment of Ford Autonomous Vehicles LLC, which spans all aspects of its self-driving vehicle business operations: systems integration, AV research and advanced engineering, AV transportation-as-a-service network development, user experience, business strategy and business development teams. This is the organisation that holds Ford's ownership stake in AI, and is where Rich is based today.

Preparing for launch

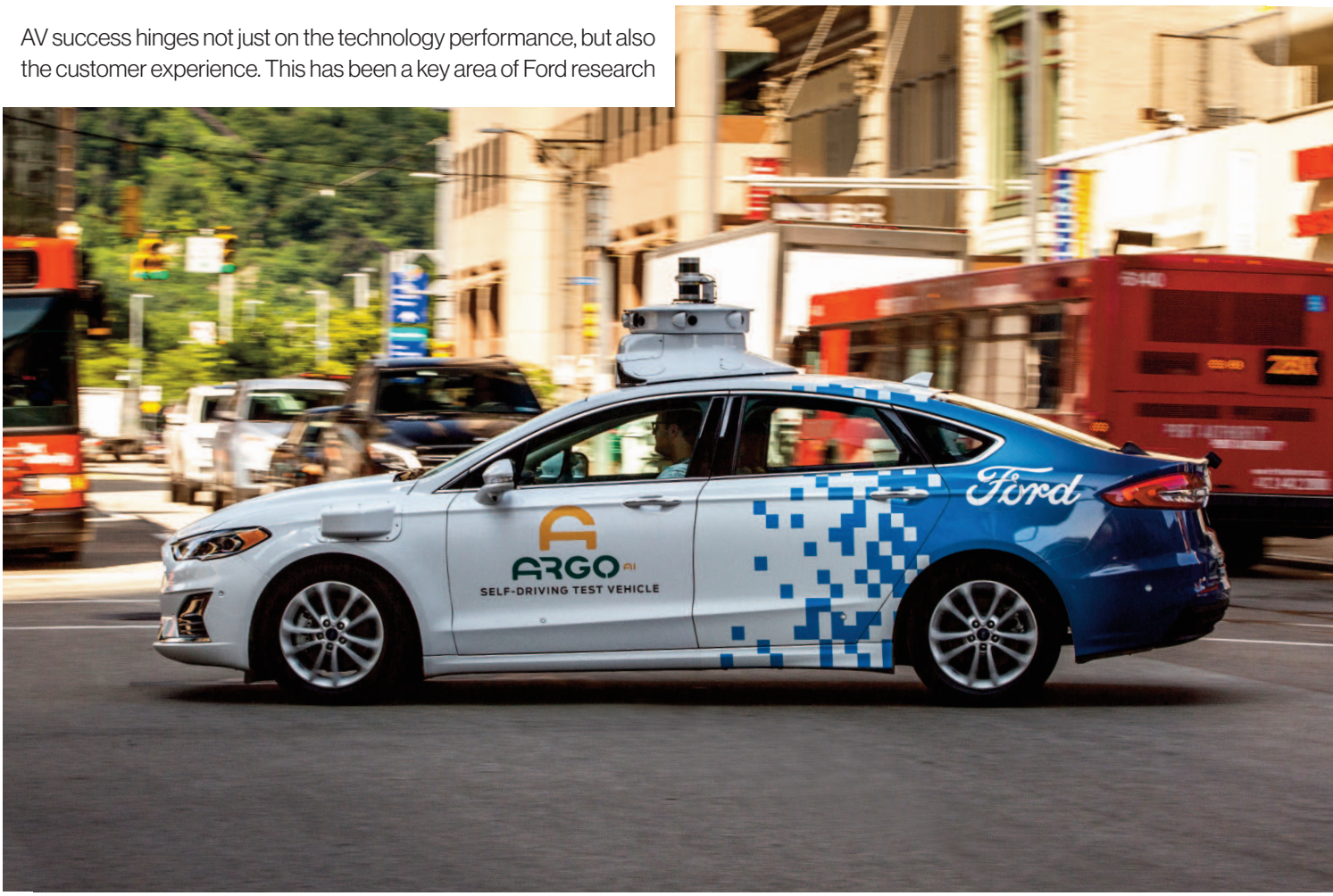
Argo AI makes a pivotal contribution to Ford's AV development, but so too do other companies. The automaker is investing in and working with a handful of additional technology specialists, including Velodyne, SAIPS, Nirenberg Neuroscience LLC and Civil





The new Ford Fusion Hybrid is a third-generation test vehicle that Argo AI is deploying in collaboration with Ford across Pittsburgh, Palo Alto, Miami, Washington, DC, and Detroit

AV success hinges not just on the technology performance, but also the customer experience. This has been a key area of Ford research



Maps. "AVs will not happen at scale until the technical problems are solved," says Rich. "At the same time, the regulators also have to be on board. We have to do this in collaboration with the regulators in order to solve meaningful problems in cities. And society has to be accepting. You cannot force this down anyone's throats. When these three things come together, then scale will really happen."

So far, the US Department of Transportation and the National Highway Traffic Safety Administration (NHTSA) have taken a non-regulatory approach to automation with recommended guidelines and voluntary standards. While this has some safety groups concerned, Rich believes the industry will see further developments around testing and standards down the line: "We will see standards emerge and evolve over the years. At the moment it is voluntary but meaningful. Technology forums and reasonable standards are essential. We need communication to establish those and to ensure system robustness. We are prioritising transparency with our partners in the form of both municipalities and consumers."

Ford has intentionally been cultivating relationships with the initial launch cities for its upcoming commercial AV business: Miami, Florida; Washington DC; and Austin, Texas. It has also been testing AVs in Detroit, Pittsburgh and Palo Alto, but no plans have been announced to run the AV business in these cities. Operating its fleet in a number of different cities has been vitally important, as each has unique characteristics and challenges. "I didn't realise how distinct driving patterns were city to city in the US," he observes.

Regulations also vary by location, by state and by city. "We have met with various reactions and willingness to embrace the technology," notes Rich. "We have deliberately picked cities interested in solving transport problems. They are open minded and embrace this approach, and are determined to realise a step improvement in safety for their constituents."

When Ford's first AVs arrive next year, they will be used in commercial fleets, with a focus on moving both people and goods. The schemes will be geofenced, but that regional coverage will grow over time. "We will tackle a massive chunk of a city–not just a few blocks or a tourist centre or a business area," says Rich. "It is a meaningful business and living area of a city, and larger than most people realise. It will expand gradually."

Business model implications

Automated driving promises tremendous safety benefits, but it could also facilitate new approaches to mobility and disrupt traditional concepts around car ownership. If an AV can be summoned to the front door at the touch of a button, will that see private ownership replaced by fleets of shared vehicles? Rich is not worried. In fact, he sees this as an opportunity to access new segments

"Ford's strengths today are our trucks, vans and SUVs," he says. "The initial phase of our AV work targets urban centres, where ride-hailing is already starting to replace some ownership. This is not a traditionally strong market for us. In fact, it will be additive." Even if shared mobility schemes take off, and most expectations are that they will expand dramatically over the 2020s, the jump in vehicle miles travelled (VMT) could prove a bonus for the automaker: "If asset utilisation is high, vehicles will wear out more quickly and need to be replaced more frequently. We will also see VMT stay more consistent through economic cycles. It will result in a different, more stabilised model."

> We have deliberately picked cities interested in solving transport problems. They are open minded and embrace this approach
>
> *John Rich, Ford AV*

Most notably, Ford does not aim to become the new Uber or Lyft. “We intend to work with sources of demand,” Rich clarifies. “We will provide capacity to them. We are a disruptive technology, but to a driver, not a network company.”

For now, Ford is busy readying its purpose-built AV for next year’s launch. Initially, a safety driver will need to be on hand, but that is not economically viable in the long-term. After all, one of the main attractions of AVs in commercial settings is cutting out the expense of the driver. “We will not scale until we are without a safety driver,” says Rich. “The economics don’t make sense.”

But how safe is safe enough? Rich concedes that incidents are inevitable, even with AVs. While one of the top priorities for this year is to increase the fleet’s time without disengagements, he cautions that focussing too much on this metric could be self-defeating: “We don’t want to have the safety driver thinking that disengagements look bad. We would never want that to be a disincentive for a takeover. It is important that we avoid metrics that drive the wrong parameters.”

As for the long-standing trolley problem and other ethical considerations around AVs, Rich suggests these are non-issues. Instead, he and his team focus on avoiding unresolvable situations in the first place. “Humans do not really make a choice in this sort of situation,” he suggests. “Our goal is to avoid unresolvable situations and dramatically bring down accidents and carnage on the road. The central question is how fast you can operate safely. This will improve over time as sensing, compute and infrastructure improves.”

Demise of Starsky Robotics a 'setback for the industry'

What does the collapse of the promising teleoperation start-up mean for remote driver control? Freddie Holmes investigates

To the surprise of many industry observers, Starsky Robotics–the plucky US start-up looking to introduce remote operation of heavy-duty trucks–abruptly came to a halt in February.

Reports first circulated that virtually all employees had been laid off, and within just a few days it was confirmed that the company had gone bust.

Most of its past employees have since taken up positions with Cruise Automation, as well as Uber, Waymo and Apple's Special Projects Group. Others have moved into AI start-ups such as Farmwise, which works in the agriculture sector, and Scale AI, which works with everything from drones and robotics, to self-driving cars and retail.

Founded in 2016, the company envisioned fleets of big rigs being driven across the country without a driver behind the wheel. Instead, an operator in a Starsky operations centre would sit comfortably in front of a live-stream, ready to intervene where required. This would include the tricky roads at either end of the journey, with the truck left to drive itself on the highway. The approach drew the ire of many within the industry, but the company held strong and came close to achieving profitability.

"I believe that this model is not yet viable," observed Susan Beardslee, Principal Analyst, Freight Transportation & Logistics at ABI Research, and for various reasons: the need for extensive simulation miles; physical testing on restricted and approved roads; the need to build a highly integrated factory-fit system; a lack of federal regulation to support such technology on public roads; new commercial vehicle insurance policies, and of course social

acceptance challenges. “The leadership at Starsky Robotics was trying to address the issue of driver shortages and retention, along with quality of life for long-haul. However, the solution was not ready for execution.”

Teleoperation 101

Paul Schlegel, former Senior Vice President at Starsky Robotics, is confident that despite the fallout, teleoperation remains a viable option for the truck industry to improve safety and efficiency. It could also help to tackle the growing driver shortage. Speaking to *Automotive World*, he explained that the collapse of the start-up ultimately came down to funding. While the business model and underlying technology was sound, an issue with one investor during an initially promising round of funding caused a ‘domino effect’ of investor withdrawals. Resources dried up shortly after.

A 33-year veteran of the truck industry–primarily as a driver but also on the operations side at big names in the logistics business–Schlegel was not exactly sold on the idea when first approached to come on board with Starsky. “When I first got the call, I laughed,” he said. “But there were a few strong elements that made me believe in what Starsky was doing over its competitors. We weren’t trying to do everything at once, we were limiting the variables.”

Initially, Starsky began tentatively testing on short, repeatable roads with safety drivers behind the wheel. Eventually, it reached a point where the truck had no human presence inside the cab for an entire journey. Its maiden ‘driverless’ voyage took place in Florida in June 2019, where one truck drove nearly ten miles (6km) with just the support of a remote teleoperator.

The process of performing a test run at Starsky was fairly simple. First, the safety driver would perform a check of all systems and equipment prior to it ever leaving the yard, and would manually start the vehicle as normal. Aside from the Florida pilot in June, that safety driver would then remain in the vehicle from start to finish. With all systems go, the teleoperator–or ‘teleop’–would take control of the vehicle from a seat in front of several 55-inch TV monitors, which displayed feeds from

Starsky ceased operations in February 2020

numerous cameras mounted on the vehicle. It was widely reported that teleops had a better view of the road than when sitting in the cabin of the truck itself.

It became apparent during testing that teleoperation was particularly beneficial when travelling from the warehouse and onto the highway. “Teleoperations perform very well in any situations under 35mph (56kph); anything over 35 mph is where autonomous drive technology does very well,” explained Schlegel. The long-term view was to teleoperate trucks up to the highway–navigating all the tricky traffic, narrow roads or complicated junctions–and then leave the truck to rely on its on-board sensors and artificial intelligence (AI). Repeated test runs on set routes would allow the truck to essentially learn its route and better recognise any potential hazards.

As the truck approached the exit of a highway, the teleop would take back control and navigate the back roads to the industrial park or distribution centre. While not common practice among Starsky’s teleops, some had even garnered a reputation for backing trucks up into the dock more accurately than a conventional driver.

> “We weren’t trying to replace the driver. We were trying to change the role of the driver

Driver shortage

The nature of such a job would have lasting implications on the truck industry from an employment perspective. “As someone with a background in the industry, driver shortage is a real problem. It’s about turnover: drivers enter and leave the truck industry at such a fast pace,” Schlegel explained. “If trucking operated similar to other industries and the turnover wasn’t in excess of 100%, there would not be the driver shortage that the industry has right now.”

Even drivers that do stay in the industry change jobs every six months or so, he added. In fact, the issue is becoming so severe that young drivers entering the truck industry barely make it a full year before moving on–some estimates put driver turnover for millennials to be in excess of 300% during a six-month period. “All of this related strongly to what we were doing at Starsky,” said Schlegel. “We weren’t trying to replace the driver. We were trying to change the role of the driver.”

Ignoring the lure of a high-tech industry such as autonomous trucking, Starsky believed the role of a teleop would appeal to drivers from a practical perspective. Rather than spending days away from their families, sleeping in the cab and becoming increasingly fatigued, drivers would have a set ‘office’ to work from, and could go back to their home after each shift. It would flip the conventional working day on its head. Starsky envisioned creating hubs around the country that would perform a similar role to air traffic control centres, with teams of teleops handling multiple trucks during a single shift where necessary.

"I really bought into that idea," said Schlegel. The selling point for fleets, he explained, was quite simple: "coast to coast, it could be cheaper than rail. It would also remove the cost of hiring local drivers to run transfer hubs in the conventional 'AI-based' autonomous truck model. With local drivers at each end of the journey, you would need to pay salaries, so any productivity gains would be eaten up in local costs of delivering that load."

"A loss for the industry"

Prior to the eventual collapse of the business, Starsky was almost ready to begin manufacturing its hardware and was set to grow its fleet to 25 trucks. It had secured additional test lanes in Texas, and the general expectation among the team was that Starsky would commence full operations within a year, working directly with freight brokers and other customers within the logistics space.

"In my opinion, we were close to delivering an operational model that would at least break even, if not make some money, within the next 12 months," said Schlegel. "I truly believe that losing Starsky's approach toward autonomous vehicles with remote drivers is a setback for the industry."

A common issue raised around the subject of teleoperation is the fact that a driver remains in the loop. This goes against the notion of tackling human error, which is commonly attributed to the majority of road collisions today. In his experience, heavy trucks are able to navigate the busy environment around a warehouse with a higher degree of safety than a truck that relies on sensing and AI. That may change over time, he admits, but for now he sees teleoperation as an invaluable asset for any fleet looking to introduce autonomy.

"Having that extra resource allows the vehicle to stop or pull over if it needs to," he explained. Teleoperation might also prove preferable to systems that enable 'conditional autonomy' that shares control of the vehicle with the driver depending on the situation. "The minute you create a tool that is so good that the driver feels they don't need to pay attention, you're asking for trouble. The last thing I want drivers to do is to rely on self-driving behind the wheel if it is not fool proof," affirmed Schlegel.

What now for teleoperation?

While funding issues may have led to Starsky Robotics' demise, others are still looking at this area with interest. Israel-based start-up Ottopia is investigating remote operation of heavy trucks in shipping ports, warehouses and factories, for example. Its in-vehicle teleoperation module is a 'plug and play' solution that it says can get fleets up and running within days.

Volvo, too, has an eye on how remote operation might benefit the industry. "For autonomous hauling applications, we intend to use teleoperation as a back-up solution developed to be safe for specific use cases," noted Sasko Cuklev, Director Autonomous Solutions at Volvo Trucks.

However, some have concerns around the viability of the technology due to its reliance on connectivity. "In public areas using public cellular networks, remote operators could serve as fallback for autonomous systems, or steer the truck in areas where autonomy is not yet available, such as between a highway off-ramp and the depot," said Bernd Heid, a Senior Partner at McKinsey and head of the consultancy's commercial vehicle activities. "The main challenge for this use-case, however, is reliability and latency of the public cellular network, which would need to be virtually guaranteed at sufficient bandwidth to allow uninterrupted control. With the current state of technology, this is far from being the case, and it is unlikely that a telecommunications operator would guarantee full coverage."

It is clear that while teleoperation has proven a tricky sell—not least to investors—it has the potential to revolutionise certain areas of the truck industry. If it can attract and retain new 'drivers' and improve road safety at the same time, it is a win-win for fleet operators; the question is, will anyone step into the void left by Starsky Robotics?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If electric delivery is so hot, what went wrong with StreetScooter?

Megan Lampinen explores the reasons behind Deutsche Post DHL Group's decision to walk away from StreetScooter production

Deutsche Post DHL Group (DPDHL), the largest logistics and delivery services provider in the world, became the poster child for green logistics with its electric StreetScooter models. When the market was unable to offer the type of zero emission delivery vehicle it required, DPDHL decided to build its own, and brought in StreetScooter to help design a vehicle that met the specific requirements of its deliveries. DPDHL later acquired ownership of the start-up, built up a fleet of more than 11,000 electric vans and sold many others on to third parties.

But now, six years on, it is walking away. In February 2020, StreetScooter Chief Executive Joerg Sommer stepped down, reportedly over a difference of opinion over the future direction of the company. In March, DHL announced that it would end vehicle production later this year. It has also scrapped talks to find a buyer.

At the same time, the outlook for electric delivery has never been brighter. E-commerce is booming while urban centres are cracking down on vehicle emissions–a winning combination for the electric van if ever there was one. So what made StreetScooter no longer viable?

Segment potential vs profitability struggles

"The issue is not the demand for electric mobility–this remains strong, particularly in urban environments for the use cases

The first prototype of the StreetScooter was unveiled in 2012

around goods delivery and people transit," said James Hodgson, Smart Mobility Principal Analyst at global tech advisory ABI Research.

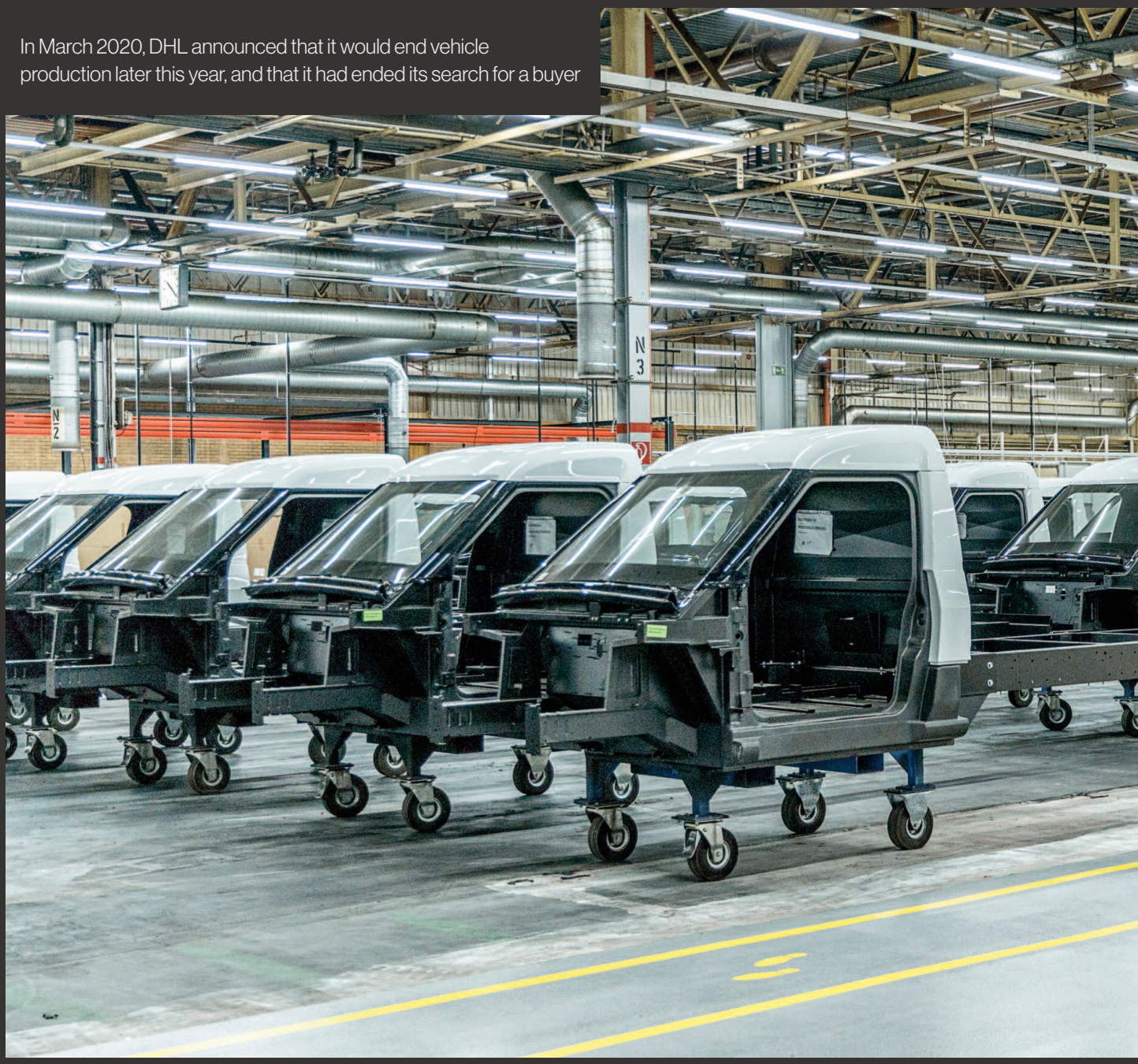
Others agree. Frost & Sullivan (F&S) estimates that logistics vehicles account for 30-40% of the traffic on the road in the average western city. Cleaning up emissions in this one segment could have a big impact. "Congestion is worsening while online deliveries and e-commerce are booming," observed Shwetha Surender, F&S Industry Principal in New Mobility. "Against this background, last mile delivery services that shift towards greener, more sustainable mobility like electric propulsion will be big winners in the eyes of the government. It will also prove a win for the fleet operators themselves, as cities introduce limited access areas like congestion and low-emission zones. New regulations like these will positively impact demand for last mile electric transport."

Demand may be poised to accelerate, but profitability remains an uphill struggle. "The problem is the near impossibility of making a profit when manufacturing cars," Hodgson told *Automotive World*. "Established, century-old automakers only make small margins on most of their models, and the profitability problem is further worsened by the level of investment that electric vehicles (EVs), in particular, require."

The profit challenge for EV makers was also flagged by Axel Schmidt, Automotive Global Lead at Accenture. "For the time being, nobody is making profit on EVs, either on passenger cars or commercial vehicles. This is new technology and the players are still in the ramp-up phase." Schmidt believes that profits will be possible as volumes scale and processes across the value chain become more automated, but that will take time.

At the same time, DPDHL never set out to become a leading vehicle manufacturer. "In terms of electrifying its own fleet, it has achieved this objective," said Hodgson. "The question going forward was whether or not the business of manufacturing and selling EVs could ever become profitable." At one point it had considered partnering with Chinese automaker Chery, combining StreetScooter's engineering with Chery's manufacturing scope. The deal has since fallen through, with no explanation, but DPDHL has made it clear this is no longer on the table. "As soon as this deal collapsed, DPDHL faced a choice between continuing as a logistics company with its newly electrified fleet, or trying to navigate a partial transformation into a vehicle manufacturer," added Hodgson. "This decision was only ever going to go one way."

In March 2020, DHL announced that it would end vehicle production later this year, and that it had ended its search for a buyer



Model offering

DHL's motivation to build its own vehicles in the first place stemmed from the lack of product on the market that met its needs—and it was not alone. "Fleets are having challenges around sourcing electric delivery vehicles," observed Rob Massoudi, Head of Digital Transformation for ABB Ability. "There are only a handful of OEMs that are doing that right now—it is mostly start-up companies building those vehicles. Some players, like Tesla, have decided to focus on the heavy-duty segment, but the medium-duty delivery vehicles are in limited production right now."

With StreetScooter production on the way out, what does that mean for demand? "The market has changed quite dramatically since 2014 when DPDHL made the decision to buy StreetScooter," said Schmidt. "There was little choice on the market, and at that time the decision was well founded." He believes the segment has been attracting more players, and volumes will ramp up over time.

Surender expressed a similar view: "The market has changed significantly in just the past few years, and the number of automakers offering zero-

emission vehicles in this segment has risen. There will be models for logistics players to chose from."

Play to your strengths

While DHL's move to bring EV manufacturing in-house with StreetScooter ultimately may not have panned out, it was not the first delivery company to look into designing its own vehicles. UPS generally sends out its designs to automakers and coachbuilders, which then respond with quotes for what it would take to build them. Automakers would generally become involved in higher volume orders, with coachbuilders specialising in lower volume work. But few, if any, fleets are showing interest in bringing this sort of expertise in-house. "I don't believe this can be successful, as it requires different skills," cautioned Schmidt. "I'm a fan of extending the value chain in general, but it's a pretty long way to go from operating a vehicle to building and designing one."

It is the scope of this challenge that makes Surender think that moving away from vehicle production was a wise move for DPDHL: "It is not easy to convert yourself into a vehicle manufacturer. Over the last 50 years, Tesla has arguably been the only new successful automaker. There have been many that have died on the field." She suggests it is all about companies playing to their strengths: "Manufacturing is a completely different ballgame for DPDHL. If that's not your capability, that's fine. Just contract with an OEM and focus on your strength, which is the logistics network."

Hodgson sees a stark warning to others in the company's struggles. "This saga ultimately demonstrates the value of specialisation versus aggressive in-housing," he said. "Ownership of transformative technologies, such as electrification or autonomous driving, can help a fleet operator to accelerate their innovation ahead of competitors. However, even fully specialised vendors in the areas of electrification and autonomous driving are still struggling to find a path to profitability. The tale of DPDHL/StreetScooter should serve as a cautionary tale to fleet operators when considering investment in transformative technologies."

Could electrification change North America's love affair with the pick-up?

Recent announcements would suggest the pick-up space will soon go all-electric. But with nothing on the road, it's all just noise for now. By Freddie Holmes


BUILT FORD TOUGH

Early examples of mass-produced electric vehicles (EVs) were impractical, expensive and ugly. This may not have changed significantly to date–the ticket price for any EV is far higher than a comparable internal combustion engine (ICE) alternative, and styling is often to an acquired taste–but driving range, charging time and driving dynamics have all made exponential improvements.

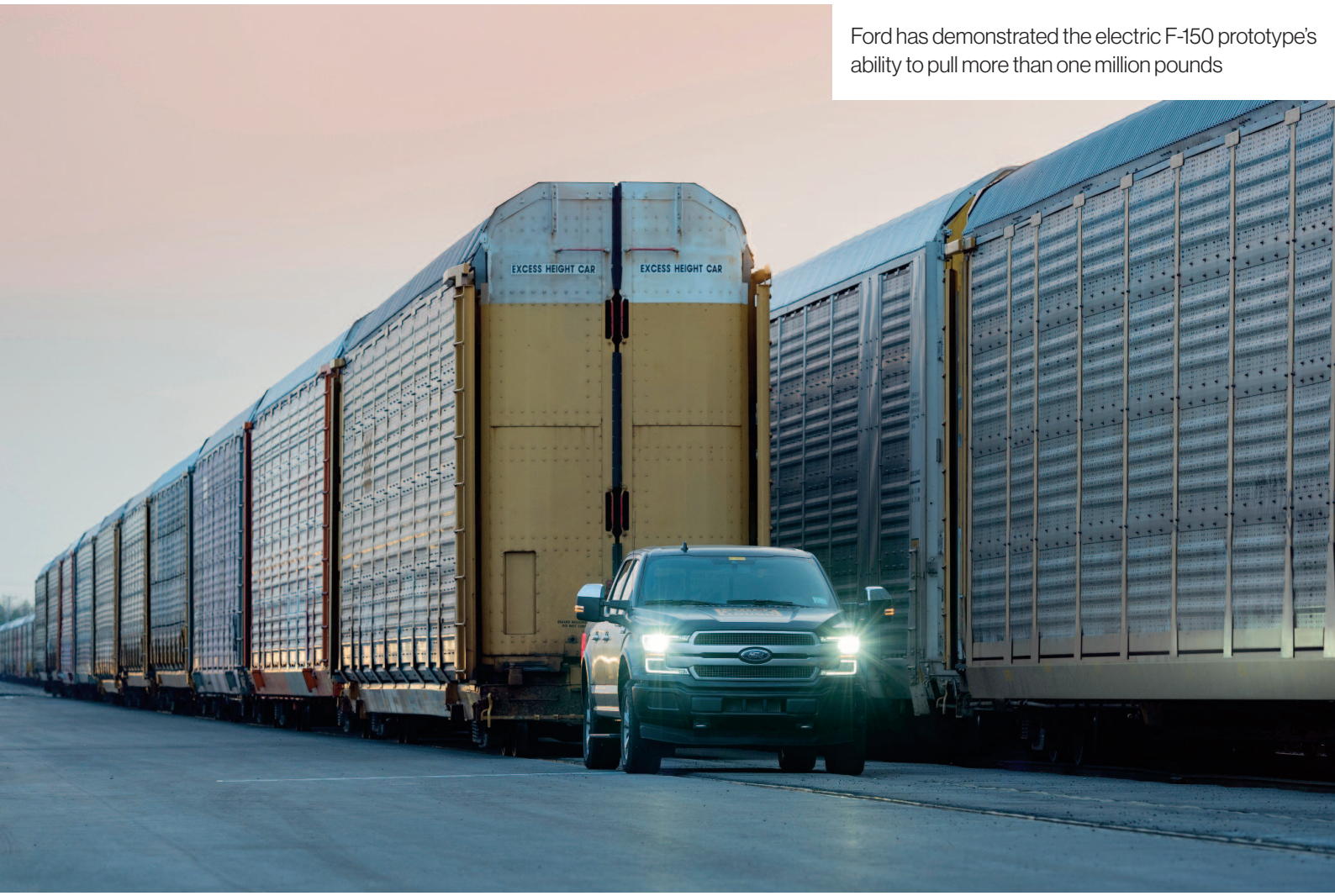
Anything from a compact or sedan to a full-size SUV can now be found with a battery electric powertrain, but there remains one segment that is yet to launch without an ICE: the pick-up. Recent headlines would suggest that competition is heating up in this area, with several manufacturers all touting a fully electric offering in the works.

But is North America's most popular vehicle segment ready to ditch the ICE, or is it all hype?

Status symbol

Compared to smaller, entry-level vehicles, pick-ups have cult status to boast. They are big, powerful and luxurious, have significant storage space and are adept in off-road conditions. For many across the continent, they are the perfect utility vehicle. It makes sense that battery electric variants are being considered, as automakers would be able to leverage historically high demand and benefit from higher margins compared to other vehicle segments.

"Recent history in the US car market–and indeed in most countries–shows that an increasing number of people prefer pick-ups and SUVs to sedans. It's partly a prestige thing, but also the power and adaptability of these vehicles," said Ana Nicholls, Director of Industry Operations at the



Ford has demonstrated the electric F-150 prototype's ability to pull more than one million pounds

Tesla generated headlines with the eventful unveiling of its Cybertruck, but other automakers were already lining up their electric pick-up launches

Economist Intelligence Unit. "An electric pick-up will definitely be more than a gimmick, as long as all these factors are in place."

With a high proportion of used vehicles imported into Mexico, demand for new pick-ups has been low; smaller models such as the Chevrolet Aveo and Nissan Versa tend to lead Mexico's new car market. In the US and Canada, it is a different story: the Ford F-150 has been America's best selling vehicle for the last 38 years, and the best selling truck for the last 42 years. The F-150 also remains the best selling car in all segments in Canada. "The F-Series is the crown jewel of our company," noted Joseph Hinrichs, President of Automotive at Ford Motor Company in February. During the fourth quarter of 2019, US sales of the pick-up totalled 233,952 units.

During the 2019 NAIAS in Detroit, it was announced that the F-150 would be going electric. Swapping out the ICE with a battery electric powertrain is a seismic shift, but could bring significant rewards. "In the US, the pick-up is an everyday car," noted Massimo Galli, Chief Executive of electric vehicle consultancy EVE. "As such, an electric pick-up makes sense, and I would not be surprised to see it take the market share of ICE pick-ups."

Consumers could be forgiven for believing the electric F-150 was nearing production following a battle for bragging rights between Ford and Tesla. Both manufacturers went head-to-head with staged performance tests to indicate the pulling power of the prototype electric F-150 and Cybertruck respectively. Hitched up to a train of rail cars, Ford demonstrated the vehicle's ability to pull more than one million pounds (453,600kg), while Tesla ran its own tug-of-war against a gasoline F-150. Importantly, neither manufacturer has a production-ready vehicle on offer, nor a specific timeline for launch.

"We wanted to showcase the benefits of instant torque from an electric motor," Linda Zhang, Chief Engineer, F-150, told *Automotive World*. "When combined with lightweight aluminium alloy, an all-electric F-150 has the potential to provide new levels of power and

In February 2020, GM confirmed plans to introduce the GMC Hummer EV

performance to help customers improve productivity, similar to what EcoBoost has done for truck customers."

Details on the latest Ford prototype are thin, and the company remains relatively tight-lipped. "It is too early to get into specifics," explained Zhang. "The all-electric Ford F-150 will give Ford Truck customers a new choice with the power, efficiency and capability they expect from 'Built Ford Tough'. We are excited and feel there is tremendous opportunity." Various outlets have suggested a launch date of 2021, but Zhang advised that while the hybrid F-150 is due in 2020, the all-electric variant will be out "in a few years."

Ford and Tesla are not the only manufacturers targeting electric pick-ups. Bollinger showed the B2—self-proclaimed as 'the world's most capable pick-up

The Bollinger B2 boasts a 0-60mph time of 4.5 seconds

Nikola revealed the Badger in February 2020

truck'—in September 2019; GMC teased the electric Hummer in January 2020, which is set for an official reveal in May. In February 2020, Nikola revealed the Badger and Rivian has ramped up marketing activities for the R1T in recent months. The only reveal that matters—the customer showroom—is yet to be confirmed, but Nikola says the Badger will be available from September 2020.

With developments in their early stages, it remains unclear as to how those working prototypes may materialise, and how they might impact North America's new vehicle market.

Pulling power

Almost all players in this space have understandably placed an emphasis on towing capability. For high-riding vehicles that weigh more than two tonnes, it is curious to see acceleration figures also being touted.

The Cybertruck concept reportedly boasts 1,000 pound-feet (lb-ft) of torque and a 0-60mph time of 2.9 seconds, for example, and even the utilitarian Bollinger B2 can reportedly complete that sprint in 4.5 seconds. The upcoming Hummer—which has never been regarded as a performance vehicle—is said to hit 0-60mph in three seconds with its new battery powertrain. Such figures could be made possible due to the high levels of instant torque provided by an electric motor. But in the real world, is that level of performance surplus to demands for most pick-up owners?

"We will need to evaluate further upon launch, but for now the Hummer, Tesla and Rivian are all claiming more than 800lb-ft," noted Susan Beardslee, Principal Analyst, Freight Transportation & Logistics at ABI Research. If that kind of figure makes it to production, battery electric variants "should provide a steep challenge to traditional ICE trucks," she added.

"The increased torque of electric motors makes an electric truck desirable when hauling a heavy load a short distance," explained Karl Brauer, Executive Publisher for Autotrader and Kelley Blue Book. "However, using the torque of an electric motor rapidly depletes the battery pack, which means an electric truck needs to either have a predictable route that fits within the battery pack's range or a

large enough battery pack to absorb the inevitable drop in range when hauling a heavy load." A full-size electric truck engineered for the consumer market would need "about twice the range of an electric car, or at least 400 miles, to remain viable for genuine truck demands," he suggested.

stations," explained Nicholls. "More importantly, though, recharging times could be long, which will make that 600-mile range all the more necessary."

Brauer pointed out that while the larger size and weight of a full-size pick-up might easily accommodate a larger battery pack, the added weight of those batteries to an already heavy vehicle will mean energy efficiency remains an issue. The Bollinger B2 has a stated curb weight of 5,000lb (2,268kg), for example, and Rivian's R1T weighs in at a hefty 5,886lb. All of that weight will do little to help extend electric driving range. "There's likely a point of diminishing return on battery pack size and weight, and the makers of electric trucks will hopefully know where that point is," Brauer mused.

> "There hasn't been a production EV truck yet, and that puts the pressure on multiple automakers to be first

Interestingly, Nikola says that its battery electric 'Badger' pick-up will be available with a hydrogen fuel cell range extender, which could provide a peak range of around 600 miles. It is an admirable figure, but the combination of those powertrains may do little to alleviate infrastructure concerns. "If the publicity is correct, the Nikola Badger does seem to offer the range and power that buyers want, as long as its producer sorts out the problem with locating hydrogen refuelling

The complete package?

The primary challenge for automakers will be to provide a complete package that meets–or exceeds–the expectations of existing pick-up owners. An electric pick-up must also be enticing enough to attract new drivers to the segment. However, the anticipated price-hike that comes with an electric powertrain could mean that consumers are even more sensitive to any difference in quality, performance or usability. These vehicles will have to bring something extra to the table: social status.

"I believe that prospective buyers may be willing to compromise on a new brand such as Rivian or Nikola if it meets price, reliability and use case requirements. Social media may also play a role," said Beardslee. "That said, many truck buyers are loyal to a particular brand, so GM and Ford may have an existing advantage, especially for work trucks."

There is no doubt that the segment will need to go electric at some stage–20mpg is efficient for a gasoline truck today–but it is unclear whether the product is ready. Flashy reveals will spark interest, but series production is the announcement that matters. "The growing demand around trucks and SUVs in today's market adds to the interest in EV versions

Rivian has ramped up marketing activities for the R1T in recent months

of these popular models," concluded Brauer. "There's definitely a component of hype, simply because there hasn't been a production EV truck yet, and that puts the pressure on multiple automakers to be first."

According to independent production trackers, the Tesla Cybertruck has already garnered more than 500,000 reservations. A pre-order deposit is just US$100, compared to the initial US$1,000 deposit for the Model 3. "It is not much to go by, but if you have to make a forecast, it is good to have that information at least," noted EVE consultancy's Galli. It is unclear exactly where the model will be produced. In July 2019, Rivian shared images of pre-production manufacturing of R1T components from its Illinois factory, with a reported annual capacity of 250,000 units.

From pre-orders to series production

Production of the Bollinger B2 is slated to commence in Q2 2020, with customer deliveries from 2021. The company is still on the hunt for a local assembly facility in Michigan. Workhorse Group subsidiary Lordstown Motors has teased the 'Endurance' electric pick-up, although official details are sparse. The company will operate out of its Lordstown, Ohio plant, which was acquired from General Motors last year. UAW filings indicate that the electric Ford F-150 will be produced at its Dearborn Truck plant, while the GMC electric Hummer will be produced at the Detroit-Hamtramck assembly facility.

Nikola will reveal its manufacturing partner for the Badger in September 2020, and currently has heavy-duty truck operations in Arizona. It is worth noting that in September 2019, the start-up secured a US$250m investment from CNH Industrial. Exor, the holding group that owns CNH Industrial, also owns a 29% stake in FCA and owns 42% of voting rights in the automaker. It would not be surprising to see FCA named as the manufacturing partner–the automaker already produces pick-ups via the Ram brand and could leverage Nikola's EV platform in a clear win-win.

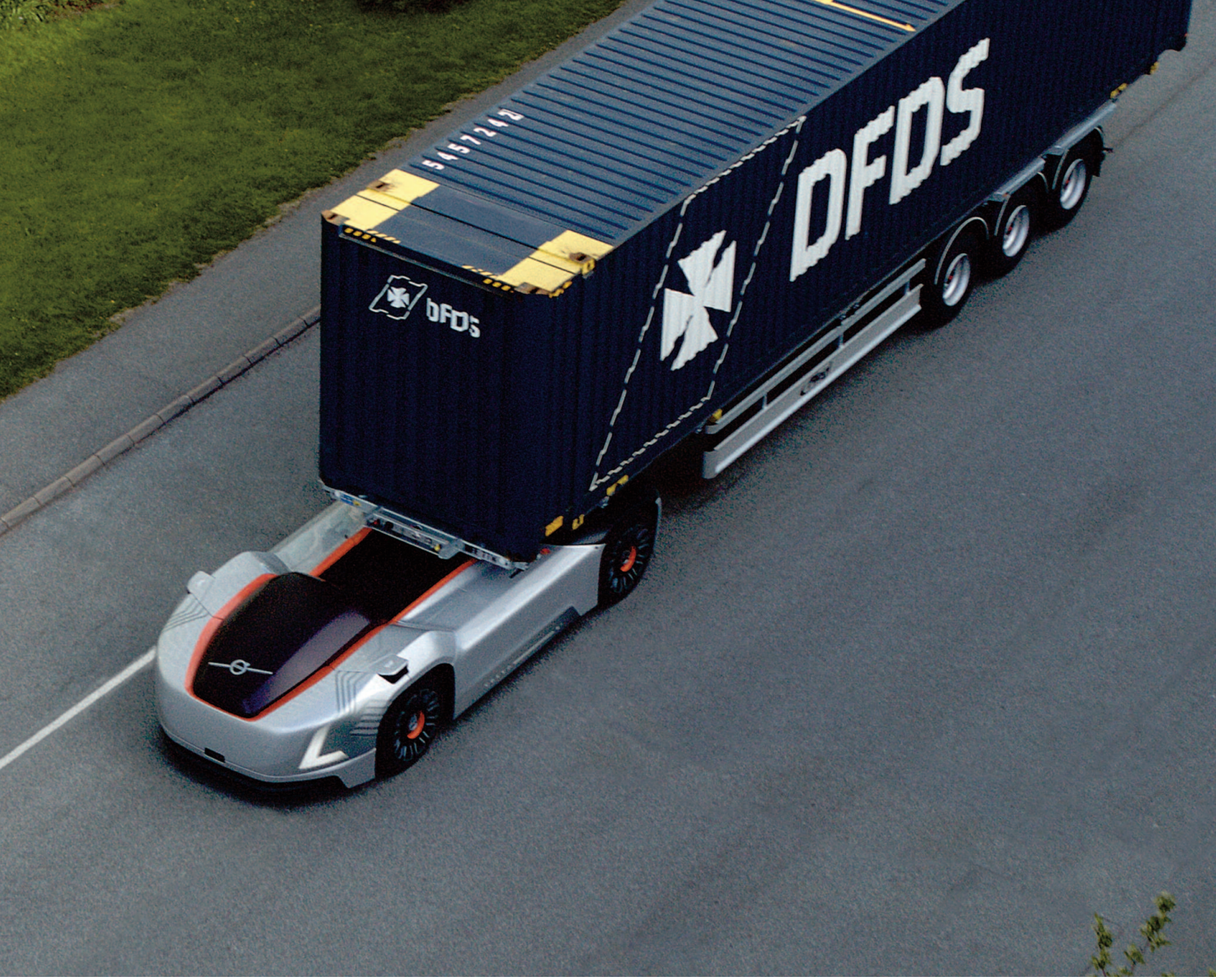
How are commercial vehicle suppliers preparing for autonomous driving?

Portfolios are being revamped, software expertise is being brought in and competitors are partnering up. By Freddie Holmes

It is well known that suppliers play a significant role in the development of any new vehicle. Automakers may get the plaudits for consumer-facing solutions, but much of the heavy lifting will have been carried out by a global network of Tier 1 systems integrators and their downstream suppliers.

The consensus is that around two-thirds of any new vehicle consists of parts provided by third parties today, and the truck market is no different. In fact, autonomous driving has meant that manufacturers are leaning on their Tier 1s more than ever.

"Just as we are doing today with our existing products and solutions, we will also work with



partners and suppliers within the autonomous area," Sasko Cuklev, Director Autonomous Solutions at Volvo Trucks, told *Automotive World*. While some elements of the autonomous truck will be developed in-house, he said, "other parts might be developed by partners and suppliers."

The move to commercialise autonomous commercial vehicles (CVs) brings new challenges to the supply chain. Many Tier 1s in this area will already have established operations in driverless car technology, but CVs are significantly bigger, heavier and harder to manoeuvre. They also have different operational domains, not only on the road but also at the warehouse where goods are loaded and unloaded. Most suppliers have taken steps to boost their in-house expertise, either organically or through investments and acquisitions. They are also joining forces to accelerate progress in challenging new areas.

In September 2019, Bosch invested in Chinese autonomous truck start-up Trunk, for example, which is developing both hardware and software to support autonomous logistics operations between ports and depots. A survey led by the German supplier in 2018 found that a quarter of respondents would have more confidence in the capability of an autonomous truck than a human driver.

In 2018, WABCO revealed that it had been working with several industry stakeholders to form Autonomous Driving Open Platform Technology (ADOPT), which will allow 'qualified partners' to leverage its braking, steering, stability control, driveline and suspension control systems. The supplier

was acquired by ZF last year through a US$7bn deal. Continental has worked with CV braking and steering specialist Knorr-Bremse on platooning trials, although news that Daimler would stop testing the partially autonomous technology last year has left question marks over its future.

ZF goes all in

As a systems integrator, ZF has its hand in a wide range of technologies related to autonomous CVs, from heavy trucks to driverless people movers. The latest iteration of its Class 8 Innovation Truck has highlighted the supplier's advances in autonomous depot operations in particular. But what attracts a supplier to this area of research?

"We estimate that autonomous driving will initially become established in the CV sector," Torsten Gollewski, ZF's Executive Vice President Autonomous Mobility Systems told *Automotive World*. "Our business units are therefore already prepared for this development. However, we do not think of autonomous driving in silos but 'horizontally' through the company across all areas and divisions."

ZF is "continually developing" its technological expertise in autonomous CVs, Gollewski advised, and the company continues to make significant R&D investments in both hardware and software. To date, the company has built up a strong footing in vehicle perception hardware including radar, camera and LiDAR. Its Full-Range Radar, for example, can perceive the height of objects and captures several thousand measuring points per cycle to create a 3D image of the vehicle's local environment. ZF is currently the leading supplier of camera-only perception systems in the market.

"We are also developing our automotive grade central computers–the ZF ProAI product family–which are suitable for all areas of automated driving," added Gollweski. The 'AI-capable' high-end model, the ZF ProAI RoboThink, can process up to

ZF's Innovation Truck uses sensors for remote bay parking

Knorr-Bremse will work with Dongfeng on AV technology for CVs in China

600 trillion computing operations (teraOPS) per-second.

Building out an expertise in software is also vital for suppliers if autonomous CVs are to be commercialised. “Going forward, software will have one of the largest impacts on automotive system development and will be one of the key differentiating factors when it comes to realising higher levels of automated driving functionality,” affirmed Gollewski. ZF has also readied itself for so-called ‘people mover’ shuttles, and currently provides the electric drive, steering and braking systems as well as the ProAI central computer and sensors for the fully electric e.GO Mover.

Steering and braking

Braking and steering are key considerations for any vehicle, but are perhaps the most important mechanical processes for a heavy-duty truck–which when fully loaded can weigh up to 80,000lbs (36t). Ensuring it can safely manoeuvre all that weight is critical to the success of an autonomous big rig.

In March, Knorr-Bremse expanded the scope of its APAC-based joint venture with Chinese manufacturer Dongfeng. The initial partnership, which has been in place since 2015, first focussed on conventional air brake products for the Chinese market but has now been expanded to include steering systems. A greater level of investment will also be funnelled toward autonomous driving-ready technologies. According to Knorr-Bremse Executive Board Member Peter Laier, this will position the company as a “systems supplier” of advanced driver assistance systems (ADAS) and highly automated driving (HAD) systems for CVs in China.

Steering supplier Nexteer is currently laying the groundwork to take a share of the CV market. Steering is one of the core elements to controlling a vehicle, but it requires a more advanced electronic system to safely and efficiently handle the extra load of a heavy-duty CV. As the number one supplier of rack-assisted electronic power steering (EPS) technology in

North America, Nexteer intends to bring that expertise into the CV space.

"We see our EPS technology as a springboard into higher-load vehicles in the CV market as we move forward," explained Chief Technical Officer Robin Milavec. "The Class 8 market is certainly something we have our eye on. Many of the features we offer with today's EPS are the very ones that will provide additional benefits to the CV market."

Nexteer currently offers a Magnetic Torque Overlay (MTO) system for passenger cars and Class 6-8 CVs. It essentially reduces the effort required to steer a vehicle–useful for heavy trucks–but will also support basic levels of automation in a truck, bus or people mover. "The technology allows us to add torque overlay commands to the hydraulic steering assist to provide much of the autonomous and ADAS functions that our full EPS systems support today," Milavec explained. "MTO could certainly find an application in autonomous CVs, especially when considering how high those steering loads are."

Nexteer is also working on autonomous shuttles, which serve as more compact alternatives to a city bus or airport transfer vehicle. These 'people movers' operate at lower speeds, controlled routes and typically present a lower hurdle for those looking to introduce vehicle automation. As part of the 2020 Michigan Mobility Challenge, Nexteer is working with Continental to develop a 15-passenger vehicle that will shuttle people around the North American International Auto Show in June. At the time of writing, the Detroit Auto Show is scheduled to go ahead as planned amid coronavirus disruption. "We see plenty of scope in last-mile goods delivery vehicles that might deliver pizza or groceries," noted Milavec. "We are using the same autonomous steering systems that are developed for autonomous cars in both of those applications."

Other suppliers

Chip suppliers may play the biggest role in facilitating the autonomous driving features

NXP has worked closely with DAF Trucks on platooning in Europe

In 2019, Volvo Group and Nvidia established a partnership to develop artificial intelligence for autonomous trucks. Pictured: Vera, Volvo's cab-less autonomous tractor

found in an autonomous vehicle. Companies such as NXP have supplied the semiconductors that support autonomous cars for the better part of a decade now, and the Dutch company has seen rising demand in the CV space.

"As the market leader in automotive chips worldwide, it is a good development for NXP," Maurice Geraets, Vice President, Innovation and Managing Director of NXP Netherlands told *Automotive World*. "We expect that the value of chips to automakers and Tier 1s in this area will definitely increase, as those software developments are enabled by our chipsets. The trend towards ADAS and highly automated driving will have an enormous positive impact on our business opportunities."

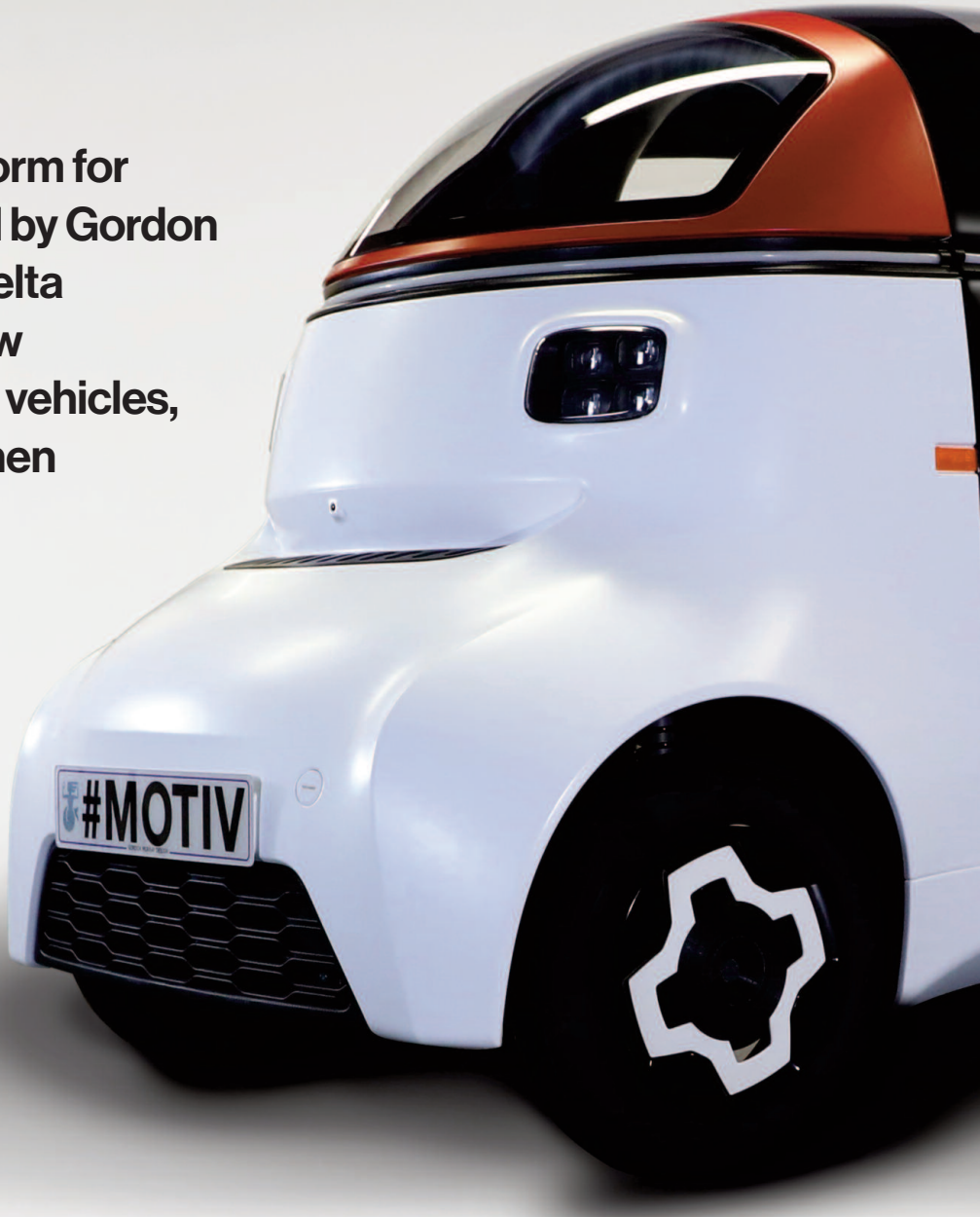
Historically, the truck market has followed the passenger car market in terms of automation, but technologies such as platooning mean that ADAS chips are perhaps even more important in a truck than a car in some cases. "We've seen many extra initiatives in recent years on platooning, and keeping those vehicles a few metres apart whilst travelling at highway speeds requires increasingly advanced chipsets," explained Geraets.

Trailer suppliers such as Schmitz Cargobull and Kögel have made advances to support autonomous trucks to some degree, but these technologies are more concerned with rollover prevention, improved braking and reduced aerodynamic drag. Such features will of course be crucial, but not exclusive, to any autonomous truck. As for the cabin, it is unclear exactly how interiors and seating suppliers may be impacted. Some concepts illustrate a future where long-haul trucks have no cab at all, while others suggest that drivers will be able to sleep on the move in a separate compartment.

At this stage, CV suppliers that are investing in automation are primarily focussed on developing algorithms that support partially automated functions such as self-parking and hands-free highway driving; reducing the cost of perception sensors such as LiDAR; and commercialising advanced steering and braking systems that can control such exceptionally heavy vehicles.

Motiv: is this the platform of the future?

A purpose-built platform for autonomy developed by Gordon Murray Design and Delta Motorsport sets a new benchmark for urban vehicles, writes Megan Lampinen



Vehicle design is evolving along with the wider mobility ecosystem. As manufacturers become mobility providers, as internal combustion engines make way for batteries and as AI systems take over driving responsibility, the traditional approach to vehicle design is being turned on its head. New demands on mobility could set a new standard in platform engineering, and Motiv could lead the way.

Motiv is a brand new all-electric single-seater pod developed for easy integration with any type of autonomous technology. The platform has been put forward by a consortium of UK partners–Gordon Murray Design (GMD), Delta Motorsport and itMoves–and was recently unveiled at the MOVE 2020 show in London. As a convenient and affordable development test bed for autonomous systems, Motiv could revolutionise urban mobility. "The consortium is not interested in the autonomous software stack or sensor suite," clarifies Mike Brown, Advanced Product and Business Strategy Director at GMD. "We want to provide a vehicle that is agnostic–anyone can come in and use it."

The vehicle

A compact, nimble structure will be useful in navigating the crowded cities of the future, and that's exactly what Motiv offers. "Space in cities is at a premium, and it should not be wasted on empty seats," points out Jose Paris, Director at itMoves, an advanced mobility and innovation specialist. This company is credited with the vision behind Motiv, including the vehicle concept, strategy usability and visual image.

Its ultra-lightweight quadricycle vehicle platform–think Renault Twizy or G-Wiz (REVAi)–measures 1,628mm high, 2,537mm long and 1,310mm wide and weighs less than 450kg (excluding batteries). Quadricycles are also less complex to build than cars, making this ideal for new players keen to get to market with new mobility offerings. The platform is designed to be flexible, and target applications ranging from personal transportation to commercial delivery.

Motiv a new all-electric single-seater pod developed for easy integration with any type of autonomous technology

"We saw a clear opportunity to look at something in this space which meets the lightweight L7 quadricycle homologation requirements, and yet is safe," says Brown. Notably, Motiv is the first quadricycle to incorporate passenger car safety levels, and the platform conforms to European passenger car (M1) crash safety standards.

"The best way to make any vehicle commercially viable and cost-effective, while delivering first-class efficiency is to make it as light as it can be while retaining the highest levels of safety," asserts Professor Gordon Murray, Chairman of Gordon Murray Group. That's made possible thanks to the high-strength properties of GMD's iStream Superlight technology. This keeps weight to a minimum, with ultra-lightweight high-strength extruded aluminium in the chassis, composite panels and door, and aluminium suspension.

"There's nothing else in this space from a homologation perspective that can deliver the attribute performance that we can with this product, and the iStream is the real enabler," Brown tells *Automotive World*. "We are lightweight, safe and comfortable with good range performance. We have not had to compromise."

Such a lightweight structure allows for a smaller battery without impacting vehicle range. Power comes from a 20kW electric motor and a 17.3kWh liquid-cooled battery pack, which offers a range of up to 100km. Top speed is just 40mph, but that should be sufficient within the urban and suburban locations at which it is targeted.

Delta Motorsport is responsible for Motiv's power, motors and control systems, including an innovative drive-by wire dedicated vehicle control architecture. This operates the steering, propulsion and braking.

"The control systems integrated into the platform prove that electrified vehicles need not be heavy and cumbersome, but can be lithe, lightweight and energy saving," observes Nick Carpenter, Engineering Director at Delta Motorsport.

Next steps

The UK consortium behind Motiv is now on the lookout for development partners. "That may be an autonomous driving software provider or a Mobility as a Service (MaaS) operator interested in a real-world pilot programme," Brown suggests. "Many of these self-driving projects are running through pilots, and that's the obvious next step for us. Beyond that it depends on uptake and legislation to a certain extent."

GMD and its partners can support these trials with a small number of vehicles, though in

the long term they would be looking to license the vehicle out to someone else interested in building it. Mass production is targeted for some time in the next two to five years. It is too early to delve into pricing details at the moment, but Brown insists that the vehicle will be 'highly competitive' in the long term. It conforms to European and US norms at the moment, but Brown is optimistic it will eventually become a global vehicle.

> We have deliberately tried to be a little provocative, alittle different to anything else today

Something different

While Motiv tackles many or the mobility challenges faced by cities, it is intended to operate among other mobility modalities. "This is designed to be one piece of the puzzle," says Brown. "It is very much targeting that last mile aspect and plays within a wider mobility ecosystem."

Plenty of other developers are also working on the autonomous last mile angle. For instance, Navya's self-driving shuttles are currently transporting riders around urban centres in France and the US, while driverless pods from AECOM are ferrying shoppers around UK retail outlets and Local Motors' Olli is kicking off a four-month stint at Turin's ITC-ILO campus. These are all low-speed, self-driving applications, but for multiple passengers. Motiv is doing something different.

"The bulk of last mile transport as well as commuting is done by people travelling or driving by themselves," notes Brown. "The pod we have shown is single use and provides private space for someone that may not want to use multi-occupant shuttles." A recent survey from Transport for London found that the rate of single occupancy within traditional cars and vans in London is on average greater than 60%. European occupancy rates average 1.1–1.2 people per vehicle.

In general, the partners want to stand out in a crowded marketplace. "Much of what we have tried to do is pretty unique," he adds. "We have deliberately tried to be a little provocative, a little different to anything else today. We think we can deliver something special."

COMMENT:

Automakers' long-term health will be affected by their post-pandemic strategies

Deep in a crisis caused by coronavirus and worsened by stock market turbulence, the auto industry must begin now to prepare for business in the post-pandemic period, writes Oliver Dixon

With the COVID-19 death toll having passed 4,600 worldwide, including over 1,000 people in Italy alone, it may seem rather trite to focus upon the automotive industry. The eventual toll of the novel coronavirus pandemic is impossible to gauge. That said, it now obviously a very real problem, and one that is hurting the global automotive industry. However, of one thing we can be certain: the coronavirus pandemic will, in time, come to an end. How bad that end will be, no one can say, but at least some part of the industry's focus needs to be fixed upon the post-pandemic period.

The fact that a number of automotive stocks have seen around 25% wiped off their value over the past six weeks would normally have us sitting bolt upright.

Moreover, a 30% fall in oil prices would usually lead the news cycle but, with current events, the decision on the part of Saudi Arabia to begin a price war has become rather lost down the page.

But for truck manufacturers–especially in North America–the oil price shock represents a worry that comes on top of a concern. Coronavirus will impact economic growth–and even the most casual look at current bond yields points to the markets pricing in a significant recession in North America–and this will impact freight demand.

Furthermore, as we have seen in previous cycles, a low oil price counterintuitively impacts demand for new trucks; there is a reduction in the operational advantage of a newer, more fuel-efficient truck when oil is pricing below average and so the attractiveness of investing in new vehicles diminishes accordingly.

Truck manufacturers–already bracing for a cyclical downturn–could, therefore, be faced with not just one but two significant demand restraints, and the impact of either would be significant. Combine both, and the significance increases exponentially, not just for the truck maker but for the entire truck supply chain.

Rothschild's assertion, that one should "buy when there is blood

in the streets, even if the blood is your own" serves us well here. While we can assert that the current period will come to an end–viruses go away and oil prices stabilise–we can also say with some certainty that what follows will not be a continuation of that which went before. Life in the 21st century is just not like that. Some organisations will emerge intact; some, sadly, will not.

Those organisations that do avoid the cull will, ultimately, be those that are not just financially but strategically brave. They are the organisations which will have taken tough and at times seemingly counterintuitive decisions. They will not so much have bought but acted while there was blood in the streets–even their own. Managing the present is a clear and present challenge, but positioning to manage the future is a clear and present imperative.

> "Coronavirus will impact economic growth, and this will impact freight demand. Furthermore, a low oil price counterintuitively impacts demand for new trucks

Once again, how the current coronavirus crisis ends no-one knows, and we can only hope that it ends as well as possible. But end it will, and the future will need to be addressed. Crucially, the time to address that future is not then, but now.

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