

# ams

july\*august 2018

automotive manufacturing solutions

## Moving targets

New plants, platforms and powertrains:  
PSA sets out its strategic push



### Global focus

South American plants welcome a steady recovery



### Technology

Industry 4.0 finds small but crucial gains in machine tooling



### Special report

Sub-system suppliers join in EV innovation wave



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# ABB Robots make all metal fabrication precious

## Golden production lines

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## Manufacturing the future



**J**ust before we went to print with this issue, I attended the FEAL Automotive conference in Lille, France. There was some focus on showcasing northern France's credentials as an important automotive manufacturing hub, with representatives from local government and industrial trade bodies. However, much of the content was concerned with the future of the automotive industry, and more specifically new mobility solutions (largely from the French automotive industry point of view).

Toyota France, Renault and Groupe PSA outlined grand plans for future mobility featuring multi-fuel and autonomous vehicles; all a far cry from the current transport solutions and, it seemed to me, some distance from current manufacturing and business models.

These are high volume producers of steel-bodied, ICE-powered vehicles that, as they all noted, are now transitioning through stages of developing and manufacturing various iterations of hybrid and BEVs. It made me realise the enormity of the task; given the scale and complexity of current manufacturing operations, integrating something new poses a big challenge, one which will only get bigger the more divergent the vehicle technologies become.

There will be a full review of the conference online and in the September-October print edition of AMS.

### Grouped together

Continuing the French theme, in this issue we have a close look at Groupe PSA, covering the vehicle-maker's PACE strategy, the acquisition of Opel and a report from its Portuguese LCV plant at Mangualde (the feature starts on p12). It's partially a success story for the French OEM, with the current management team credited with having turned



PSA has improved its fortunes but faces difficult decisions regarding its manufacturing footprint

around its fortunes in recent years. Much of this can be attributed to cutting costs, making the production and sales operations much more competitive, but there are difficult decisions ahead for PSA – not least how to best utilise the production capacity of the Opel and Vauxhall plants it gained from its acquisition of GM's European arm.

The vehicle-maker has to balance expectations that it will not compromise production at its French plants while also trying to restructure and integrate the loss-making Opel operation. There has been much speculation as to which plants might be closed, and no doubt some fierce lobbying on behalf of unions and government trade departments. Additional pressure also comes from poor sales in China, where it has been reported PSA will lease one of its underutilised plants to Nissan.

Elsewhere in the magazine, with the electrification of vehicles continuing to dominate manufacturing conversations, some major steel-makers believe they are well placed to deliver the materials to make this happen. We offer some insights into not just what steel types are being developed for the vehicle structures, but also how they play a very important part in the powertrain (p39).



EV powertrains benefit from steel development

Nick Holt, Editor

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# Globe at a glance

For all the latest automotive manufacturing news from around the world, go to:  
[www.automotivemanufacturingsolutions.com](http://www.automotivemanufacturingsolutions.com)

## Canada

- Toyota upgrades three assembly plants



## Sweden

- Volvo Cars increases XC40 capacity in Europe and China

## UK

- Magna opens aluminium casting facility

## US

- Changan Ford to make next-gen Explorer
- Ford appoints new chief information officer
- GM combines software and 3D printing
- Honda readies Indiana and Ohio plants for EV production
- Honda starts making Acura RDX in Ohio
- Hyundai builds new engine plant in Alabama
- Hyundai starts making new Santa Fe in Alabama
- Nissan's Canton plant turns 15
- Novelis builds new aluminium plant in Kentucky
- Subaru of Indiana starts making Ascent
- Volvo announces Charleston plant manager

## France

- Groupe PSA establishes digital factory
- Groupe PSA increases SUV capacity
- Mercedes prepares Hambach plant for EQ production
- Renault invests in EV production



## Brazil

- 200,000th engine produced at Nissan Resende







### Germany

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- BMW makes several production personnel changes
- Mercedes celebrates 1m milestone in heavy-duty engine production
- VW to suspend lines for WLTP update

### Czech Republic

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- Skoda opens competence centre

### Netherlands

- Constellium provides aluminium for Mercedes CLS

### Austria

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### Pakistan

- Renault builds new plant in Faisalabad

### India

- Suzuki passes 20m production mark

### Thailand

- Mitsubishi passes 5m production milestone

### South Africa

- Mahindra opens new assembly facility in Durban

### Russia

- Ford Sollers starts EcoSport production

### Hungary

- Audi starts producing new engine at Gyor plant
- Mercedes starts construction of 'Full-Flex Plant' in Kecskemét
- Mercedes starts making A-Class at Kecskemét plant

### Romania

- Ford spends €200m on Craiova plant

### Serbia

- ZF builds plant to make electric powertrain parts

### China

- BMW Brilliance boosts battery output in Shenyang
- FAW-VW to open three new plants
- GKN builds electric driveline plant
- Great Wall Motors constructs new plant
- Magna and BHAP establish door module facility

### Japan

- Mazda hits 50m production milestone
- Nissan to increase use of new steel grade
- Toyota builds fuel cell stack and tank production facilities



## North America

## Honda invests in Indiana and Ohio

**US** – The OEM is spending \$61.5m to ready its Indiana and Ohio plants for the production of electrified vehicles. This comes after the company outlined its goal of ensuring two-thirds of its total vehicle sales would be electrified by 2030.

At the same time as announcing the investment in the two plants, Honda revealed that production of its all-new 2019 Insight has begun at its Indiana plant, situated about an hour south-east of Indianapolis. The hybrid vehicle made its

global debut at the 2018 New York International Auto Show.

“The new Honda Insight exemplifies our growing investment in the production of electrified vehicles in America and our associates in Indiana are proud to play a key role in this initiative,” said Isao Matsuzaki, president of Honda Manufacturing of Indiana. “As the lead plant for Insight production globally, we are committed to delivering the quality and reliability that our customers expect.”



A new 19,200 sq.m building was built in Indiana for in-house assembly of the Insight's front-end module. The Honda Transmission Manufacturing of America plant in Russells Point, Ohio, received an investment of \$29m to make the twin electric motor unit for the Insight, while

its 1.5-litre Atkinson-cycle gasoline engine is produced at the company's engine plant in Anna, Ohio.

The Insight is now being assembled on the same production lines as the Civic and CR-V at the Indiana plant.

\* [www.honda.com](http://www.honda.com)

## Toyota invests in Canada plants

**Canada** – The Japanese OEM has said it will spend C\$1.4 billion (\$1.08 billion) to upgrade its three assembly plants in Woodstock and Cambridge, Ontario, in order to prepare for the production of new models based on the Toyota New Global Architecture (TNGA).

These include the all-new 2019 RAV4 and RAV4 hybrid. Furthermore, the company will invest C\$200m in research and development in Canada over the next ten years.

On completion of the plant investment project in late 2019, Toyota has said that Canada will

be the North American hub for production of the RAV4 and the company's hybrid vehicles.

“Toyota Motor Manufacturing Canada has always had a strong partnership with the Canadian government,” said Fred Volf, president of Toyota Motor Manufacturing Canada (TMMC).

TMMC's plants in Woodstock and Cambridge are currently able to produce over 500,000 vehicles per year. The investment is expected to support over 8,000 jobs in the region, and will create 450 new jobs as well as 1,000 new co-op placements.



Justin Trudeau, Canada's Prime Minister, praised the move by Toyota, and announced that the government would put aside C\$110m to help the OEM with the project.

The news marks the largest of several recent investments in Canada's automotive industry. In March 2017, Ford said it would

spend C\$500m to establish a research and engineering centre in Ottawa shortly after it had invested C\$700m in its manufacturing facilities across the country. In January 2017, Honda promised to spend C\$492m to modernise its Ontario manufacturing facilities.

\* [www.toyota.com](http://www.toyota.com)

## Asia

**China** – The new plants, which are being built in Qingdao, Tianjin and Foshan, will be operated as part of the joint venture between FAW Group and VW Group. They will house production of SUVs and electrified models, with the company suggesting both

## FAW-VW to open three new plants in China

segments will grow significantly over the next few years.

“Chinese consumers today are demonstrating strong demand for smart, sustainable electric vehicles as well as fun-to-drive, spacious SUVs,” said Herbert

Diess, chairman of the board of management and CEO of VW.

The production lines at these facilities are being designed with flexibility in mind, ensuring they can make both pure electric vehicles and those that include an internal combustion engine (ICE).

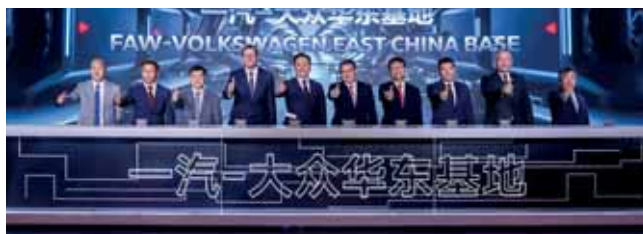
The Qingdao plant has started with the production of the new Bora, while the Foshan plant will make cars based on both the MQB and MEB platforms.

The news comes soon after

VW said it would launch 40 new energy vehicles in China by 2025. Local production will be a key part of this plan, and the OEM has said that it will spend €15 billion (\$17.37 billion) alongside its joint venture partners to in e-mobility, autonomous driving and new mobility projects.

VW recently announced that it would make pure electric vehicles in 16 different locations around the world.

\* [www.volkswagen.com](http://www.volkswagen.com)





## Europe

## Groupe PSA announces an increase in its SUV capacity

**France** – The OEM has said it will bolster the output of its SUVs due to growing demand for several different models.

It plans to start making the Peugeot 5008 at its plant in Sochaux once production in Rennes reaches full capacity. Following this, if capacity tops out in both plants in France, it will then start to assemble the Opel Grandland X in Eisenach, Germany.

“These vehicle allocations demonstrate that economic performance plays a key role in ensuring high capacity utilisation over the long term,” explained Yann Vincent, executive vice president, manufacturing and supply chain at Groupe PSA.

“Our agile production base, which has been broadened by the Opel acquisition, is enabling

us to meet growing customer demand for SUVs.”

The announcement was made soon after Groupe PSA recorded a sharp rise in revenue during 2017 as well as growth in its share of the European SUV market to 16.9% at the beginning of 2018.

In terms of the company’s total sales, SUVs accounted for 23% in 2017, with the Peugeot, Citroen, DS and Opel brands all seeing strong demand.

Amid uncertainty surrounding the impact of Brexit on the automotive industry, the future of several plants located in the

UK has come under question. However, Groupe PSA recently announced an investment in its Luton facility ahead of the launch of the Opel/Vauxhall Vivaro. It also outlined plans to expand its engine and electric motor output in Europe.

✱ [www.groupepsa.com](http://www.groupepsa.com)



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# A future European giant?

**W**hen Carlos Tavares arrived at PSA from Renault in 2014, he set about turning around the loss-making company. His plan, embodied under the strapline 'Back in the Race', aimed to restore PSA to profitability, cut costs and transform its product portfolio.

Overhauling the company's offering, notably adding SUVs and crossovers of varying sizes, has been key. The company is now rapidly building a presence in segments Peugeot and Citroën had been very slow to enter. Prior to Tavares' arrival, PSA's dire financial status had been boosted in 2013 with capital injections from both the French government and the Chinese company Dongfeng, each of whom took a 14% share. When Dongfeng became a shareholder, GM felt obliged to sell the 7% stake in PSA it had taken through a private share placement in 2012.

Despite the share sale, long-planned joint vehicle programmes in Europe were retained and, indeed, they have recently been launched. The first of these was the B-segment Citroën C3 Aircross/Opel Crossland X made at Opel Zaragoza, followed by the larger Peugeot 3008/Opel Grandland X made at PSA Sochaux (although production of the Grandland X will switch to Opel Eisenach from mid-2019 following agreement between PSA and the German unions).

## Geographically balanced

With the company returning to profitability, Groupe PSA launched a new strategy, 'Push to Pass'. The following core aims are to be fulfilled by 2021: maintenance of automotive operating margin at over 6%, growth of revenue by 25%;

and, having achieved a minimum of €700 (US\$817) saving per vehicle by 2018 at Peugeot, Citroën and DS, the company now wants to achieve an even higher ratio at Opel/Vauxhall - €1,100 saving per vehicle.

Progress with the new strategy was already clear in PSA's full-year 2017 results, which showed a rise from 6% to 7.3% in recurring operating profits, with revenue climbing to over €65 billion. Opel/Vauxhall was still loss-making in 2018, so the group's profit improvement is especially noteworthy. In Q1/2018, the company's revenue for the quarter was up just over 42% at €18.2 billion, versus just under €12.8 billion in Q1/2017; Opel/Vauxhall alone added just over €4.8 billion of revenue.

Groupe PSA's results for early 2018 continue to show a company in a rude state of health. It also has many challenges to address with the recently acquired Opel/Vauxhall operations. Its Q1/2018 results showed European sales volumes up 8.7% in the PCD (Peugeot Citroën DS) division, with Peugeot up 11.9%, Citroën up 4.4% and DS up 5.6%; and with a new range of SUVs/crossovers being launched, Peugeot and Citroën are reportedly the fastest growing brands in the top 10, with Peugeot claiming to be the number one SUV brand in Europe.

Comparing Q1/2018 with Q1/2017, PCD reported a 6.6% rise in volumes worldwide, but the whole company, including Opel/Vauxhall, could actually report a 44% volume rise as a result of the acquisitions. Moreover,

New models and increased market share: Ian Henry reports on PSA's improving fortunes under Carlos Tavares' leadership

Q1/2018 worldwide volumes were just over 1m, suggesting the tantalising prospect of reaching 4m units worldwide for the full year.

This impressive picture is increasingly global, with PCD claiming a rising European market share of 25.7%, and sales outside Europe growing by 16% year-on-year. Looking ahead, PSA is expecting a broadly stable picture in Europe during the rest of 2018 and modest rises elsewhere, e.g. China (+2%), Latin America (+4%) and Russia (+10%).

### A twin strategy

What is more, this growth is not just due to cars. For example, the company has a growing manufacturing footprint for vans, with production of the Expert and Jumpy models recently starting in Uruguay and Russia, while a joint venture in Uzbekistan is due to start production in 2019. Elsewhere, PSA is opening all-new factories in Malaysia and Namibia in the second half of 2018, and in Algeria during 2019. The Malaysian factory will become PSA's future manufacturing hub for the ASEAN region; firstly producing the Peugeot 3008, which will be followed by the Citroën C5 Aircross in 2019.

In Africa, PSA wants to position itself to take advantage of the continent's imminent and overdue industrialisation. It is following Renault into Morocco, with a vehicle plant to start production within a couple of years (engine production will begin there in 2018), making the replacements for the Peugeot 301 and Citroën C-Elysee which were made in Vigo, Spain in recent years. In addition, production in North Africa will include a pick-up truck for the local market based on a Chinese design.

PSA intends to produce almost its entire range – including future Opel/Vauxhall models – off just two core platforms, namely CMP (Compact Modular Platform) for models of the 208/C3/Corsa size and EMP2 (Efficient Modular Platform version 2) for almost everything else above CMP models. The new Opel/Vauxhall Corsa will be made on CMP, while large models, i.e. Astra and Insignia, will transition to EMP2 over the next couple of years.

The two core platforms will also incorporate electric powertrains, with PSA's future developments in this area channelled through a joint venture with Nidec. All core PSA models will be offered in electrified format, either plug-in hybrid or full battery electric, by 2025 if not before. By the middle of the next decade, PSA expects electrified vehicles to represent 15% of the market in Europe. This



PSA will hope for further improvement in China with the launch of two more SUVs

projection, made when the 2017 results were released, could be surpassed. The latest statistics from the European Automobile Manufacturers' Association (ACEA) show that demand for battery electric vehicles (BEVs) rose by 34.3% during the first quarter of 2018, and plug-in hybrid electric vehicle (PHEV) sales grew by 60.2%.

### China and Iran

After a period of strong growth China, PSA went into reverse in 2015 and 2016; but 2017 saw the beginnings of a rebound, with H2/2017 showing a 55% improvement in sales volumes over H1. Interestingly, full details on China are not included in the current financials, with PSA instead grouping Chinese sales with those for Asia as a whole. This may suggest that, while some improvements in the company's performance in China have been made, the figures are still not as good as PSA would like. Nonetheless, 2018 should see further improvement in China with the local manufacturing launch of two more SUVs - the DS7 Crossback and the long wheelbase C4 Aircross.

To oversee the Chinese turnaround, PSA moved its head of Brazil, Carlos Gomes, to China. This has already had some impact: PSA sales in China rose by 1.8% in Q1/2018, primarily due to improvements at Citroën which saw a 41% rise thanks to the launch of the new C5 Aircross. Elsewhere, by contrast, work remains to be done, especially launching new models that are currently making a mark in Europe. In Q1/2018 Peugeot volumes were down 14%, and DS sales – ahead of the Chinese launch of the DS7 (the model seen as the key to moving the brand upmarket in both China and Europe) – were down 60%.

As for Iran, PSA was one of the first western car companies (alongside Renault) to re-invest in the country when global investment sanctions were lifted in 2015. The company signed deals worth around €700m for production joint ventures in the hope of re-establishing itself as the leading manufacturer in the country. Quite what President Trump's decision to pull the US out of the 2015 deal means for companies like PSA is currently unclear. A PSA spokesman recently expressed the hope that the EU would protect the investments that PSA and others had already made, or planned to make, in the country.

The EU appears have to have taken an opposing view to that of US, proposing a Blocking Statute, which would forbid EU companies from complying with the extraterritorial effects on US sanctions and allowing them to sue the person/entity causing any loss for damages. On a broad level, the EU appears to want to keep Iran on its side and in return help the Iranian government to be able to receive oil revenues. For now, however, the situation remains fluid. \*

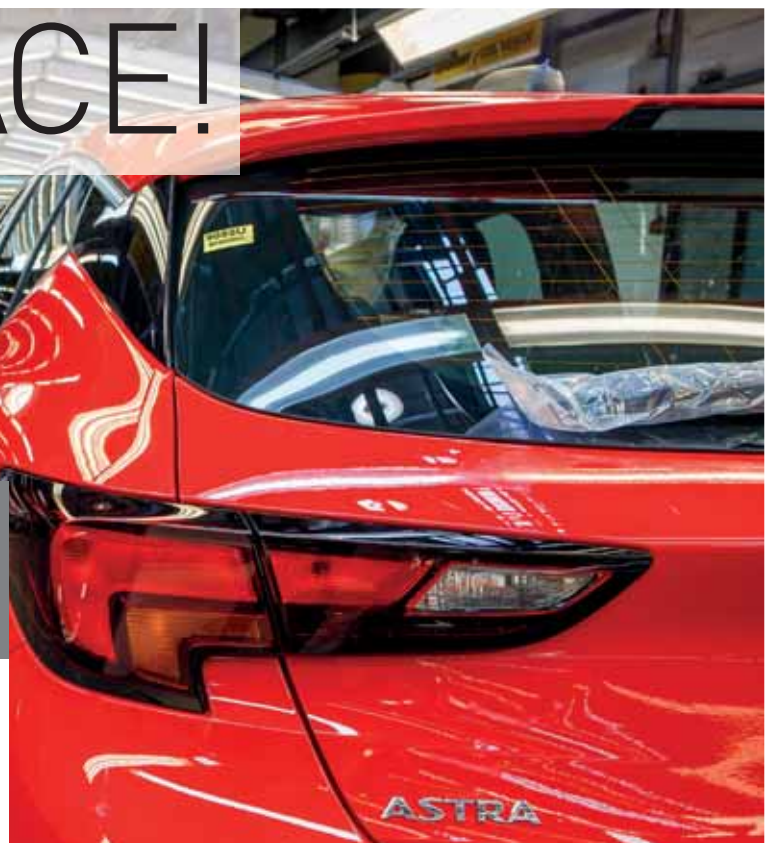
### New models boost growth

The impressive sales figures and potential for reaching 4m units in 2018 have been aided by a series of new model launches, of which the following are key:

- Peugeot 508 – which will likely form the basis of an imminent replacement for the current Opel/Vauxhall Insignia
- Citroën C5 Aircross – based on the Peugeot 5008 it will also likely form the basis of a new SUV for Opel/Vauxhall to be made at Russelsheim, from 2019
- DS7 Crossback – the new flagship in Europe and China for the DS brand
- And the new Citroën Berlingo/Peugeot Rifter, which will also be made as the Opel Combo, replacing the current Fiat-sourced model.



# Gaining PACE!



Groupe PSA's acquisition of GM's loss-making European operations raised a few eyebrows. Ian Henry looks at the plan to turn around the Opel/Vauxhall brands

**A**fter several months of due diligence, the deal was completed on August 1, 2017. Come early November, a new strategy, PACE!, was announced. Having been making a loss for almost 20 years, PSA wants Opel/Vauxhall to generate a 2% margin by 2020 and reach the 6% level that PSA sets as its own base requirement by 2026.

At the heart of the PACE! strategy will be driving down costs, increasing efficiency and the growth of revenues. PSA has emphasised that Opel/Vauxhall needs to cut its costs significantly to become competitive against both the rest of the PSA network and the market overall. In particular, PSA wants to see major reductions in what it sees as Opel/Vauxhall's overmanning and excess labour. A variety of voluntary separation programmes have been launched (including around 650 jobs being cut at Ellesmere Port, the UK lead plant for Astra production).

“PSA has emphasised how Opel/Vauxhall needs to cut its costs significantly to become competitive against both the rest of the PSA network and the market overall.”

However, there is now concern that the job cutbacks and redundancies in some areas have gone too far, and that the remaining Opel/Vauxhall workforce will end up having been de-skilled. Press reports in May suggested that several key engineers had left Opel, with many experienced people taking the generous redundancy packages on offer and then quickly getting new well-paid jobs at BMW, JLR and suppliers such as Continental who continue to grow and recruit.

This has led to the fear that Opel, which has been given specific technical responsibilities going forward for the Groupe PSA, could be left short of skills in key areas. As a result, in May, it was announced that Opel had stopped the voluntary separation or redundancy scheme, especially early retirement packages, which have proved popular.

## Working the unions

When the PACE! programme was announced, a brand new seven-seater SUV, based on the PSA EMP2 platform, was allocated to the Eisenach plant, while plans to switch production of the Mokka from Zaragoza to Eisenach were cancelled. The new PSA-based model was expected to go into production in late 2018, followed by a second SUV to be built at Russelsheim in 2019. However, in recent months, these programmes have been in doubt, with PSA facing intense difficulties in getting the German unions to

accept the need to cut costs and change ways of working at the factories.

For example, in April, the new Opel CEO, Michael Lohscheller (working closely with and under the direction of PSA's CEO Carlos Tavares) made it clear that investment in Germany was dependent on major cost-cutting exercises being seen through to completion.

Tavares himself has also gone on the record to tell the German unions that management would run the business, one way or another.

In late May of this year, however, PSA and the unions did manage to reach an agreement. A year later than planned, in mid-2019, production of the Grandland X will begin on a two-shift basis at Eisenach. Even so, 450 jobs will be cut at the plant.

By contrast, agreements have been reached with unions in Spain and the UK in particular – the Ellesmere Port agreement has included job losses, as noted above, moving to a single-shift operation and exiting from low-margin or loss-making, market share-driven sales.

More specifically, in late April 2018, it was reported that Vauxhall workers at Ellesmere Port had agreed a pay deal



with PSA. This provided the workforce with a one-off payment of £750 (\$995) and a 1.5% pay rise from January 2019 - the same as a deal reached earlier with the workforce at the Luton van plant. Len McCluskey, head of Unite, said the union remained focused on securing further investment for the UK factories, so there seems little doubt that accepting the deal is a core part of the union's strategy for retaining jobs in the UK.

In the short term, a reduction in output at Ellesmere Port to less than 100,000 units a year is about the best the factory and its workforce could expect, especially with a second under-utilised Astra plant in Poland also facing declining volumes. Long term, it seems unlikely that Astra volumes will ever again justify two factories, let alone the four that were used when Astras were also made in Bochum, Germany and Antwerp, Belgium as well as in the UK and Poland. When the Astra is replaced under PSA, it would seem likely that it will be made in one factory, although any short-term excess demand could well take place in an existing PSA factory. What this will mean for the future production allocations for the UK and Polish plants remains to be seen.

### New investment at Luton

The seemingly compliant approach of the UK unions has brought some success; at the beginning of April, PSA confirmed it would invest £100m in the Luton van plant and switch production from the Renault-based Vivaro to new vehicles based on the PSA Jumpy/Expert models currently made in France. From the second half of 2019, Luton will make a new Vivaro based on PSA technology, as well some Peugeot and Citroën models. Output at Luton is expected to reach 100,000 a year, around 30-35,000 above recent production levels; and the new models are expected to remain in production for two model cycles through to the early 2030s.

In the meantime, although labour agreements have been reached between PSA and the Opel unions in Spain at Zaragoza (where the new Corsa will be made), there is no sign of a similar accord between PSA and the unions in Germany. As noted above, PSA wants to launch new SUV crossovers at both German car plants (Russelsheim and Eisenach) but will not confirm these officially, nor commit further funds here until a German labour agreement is reached. By contrast, the labour agreement and flexibility in terms of working practices and factory operations at



PSA wants to launch new SUV crossovers at both the Russelsheim and Eisenach plants



Labour agreements have been reached between PSA and the Opel unions at Zaragoza

Ellesmere Port should help the factory in its bid to win production of the replacement for the next Astra or another model. A decision on this may not be made until 2020, although an earlier decision should not be ruled out.

### Tavares remains optimistic

Despite the problems PSA has with the German unions, Carlos Tavares remains optimistic that purchase of Opel/Vauxhall will ultimately be a success and that a European champion will emerge. It is important to re-emphasise the underlying logic here: the acquisition was made to transform Groupe PSA. Tavares believes that PSA needs to be much more than just a French company if it is to grow, especially in Germany and German-influenced markets. In May this year, Tavares claimed things are on track, although some analysts have questioned whether sustainable growth and profitable revenue will be quite as easy as cutting costs.

In recent years, Opel/Vauxhall sales have been dominated by unprofitable channels, especially short-term rentals but under PSA's direction, use of these channels is being reduced. This has led to a fall in sales volumes for Opel/Vauxhall segments, but at the same time, it has helped reduce the associated losses which had blighted Opel/Vauxhall under GM management.

The turnaround strategy at Opel/Vauxhall is being underpinned by a ruthless transformation of its business, cutting costs, simplifying the product offering (one example being that it will have just two steering wheel options on the Insignia as opposed to the previous 27 options), adopting common platforms and purchasing teams, sharing production facilities and a myriad of small-scale moves. Some of these may seem insignificant on their own, but are likely to have a major impact on the bottom line when aggregated together.

It is clear that progress is being made, with the May agreement over the future of Eisenach and its allocation of the Grandland X from 2019, as well as the fact that Opel is pleased to have secured unions agreement for a framework labour plan through to 2023. Time will tell if this is enough, or if other measures need to be taken to ensure Opel is a long-term success under PSA ownership. \*



# A little going a long way

Gareth Price visits a factory with a famous 2CV heritage and a secure LCV future

**E**arlier this year, Groupe PSA announced its plant in Mangualde, northern Portugal, would take on a third shift for its Peugeot Partner and Citroën Berlingo production lines.

The move was prompted by strong market demand for light commercial vehicles (LCVs). Around 53,600 were made in Mangualde during 2017, a rise of 7.8% from the previous 12 months and a significant contribution to the 476,500 group total – all of which added up to a record-breaking year for PSA's LCV production.

The original plan for Mangualde was to create the third shift at the end of 2018 but the changes have been brought forward and are already underway. "So, 2017 was the last full year of the current model, B9 – we launch the K9 this year. It wasn't expected that B9's last year would be its best year, beating our expectations," explains José Maria Castro Covelo, plant manager at Mangualde.

Initially, PSA's Vigo plant – some 280km north of Mangualde and over the border into Spain – was to operate the end-of-life production but it was subsequently decided to place that final output in Mangualde, so extra volumes arrived. The new version is currently in the pre-sale production period. According to Covelo, the first sales in France and Germany will take place in October, then it goes market by market through to January.

## Small-scale specialists

End-of-life runs were a specialty of Mangualde due to its compact scale and proximity to Vigo, the much larger sibling in the region with annual volumes in excess of 400,000 vehicles. The C4 Cactus line at Madrid makes up the third arm of Groupe PSA's Iberian Industrial Division. Mangualde's role in the group stretches back more than 50 years. It was the site of the last 2CV production in 1990. The association is marked by a specially-designed traffic

roundabout at the perimeter of the plant. Likewise, an adjacent roundabout is dedicated to the Citroën DS, known to the locals as *Boca de Sapo* (frog mouth). A stunning, full-scale granite sculpture commemorates the model that Mangualde produced from 1966 to 1975.

Since the 1990s, however, LCVs have been the mainstay of the plant. The current models are underpinned by the EMP2 compact van platform and the growing volumes suggest a great success is being made of it. The switch to the new K9 model will see more self-sufficiency for the plant and further opportunity to play to its strengths. "For the current vehicle B9, we receive 50 modules more or less [from Vigo] but for K9 we are producing the rear doors for the first time," Covelo says. Beside the existing spot welding and MIG welding techniques, for the new body Mangualde is introducing laser welding, an unusual move for the numbers involved.



"PSA is producing vehicles nearer to our customers and building more smaller-scale plants. The model for each of those factories is often Mangualde." – **JOSÉ**

**MARIA CASTRO COVELO, GROUPE PSA**

"It's a laser technology that has been adapted to our volumes," Covelo explains. "Usually, for laser welding, you need a large, closed cabin. Such a cabin can cost €2-3m (\$2.3m-\$3.4m) but I am proud to say we are testing a solution that is not just innovative but which costs less than the usual solution."

As "the most compact factory in the group" Mangualde is



increasingly being seen as a useful incubator for techniques across the value chain and the welding initiative is just one example of which Covelo is proud.

“This is the DNA of Mangualde – we have made it, we made it at half the cost. An important characteristic of Mangualde is that it adapts,” he states.

The plant’s relationship with the broader company and the contribution it can boast has evolved significantly since the LCV era began. Covelo notes that, historically, it was quite difficult for Mangualde to refer to expertise elsewhere in group as appreciation of how to produce volumes of 12-15 cars an hour was not in abundance.

“Today the group has changed. Over the last four or five years, with the globalisation of PSA, we are producing vehicles nearer to our customers and we are building more and more smaller-scale factories. The model for each of those factories is often Mangualde,” Covelo proudly declares. “Mangualde has become a model for small volumes in the group and we get a lot of engagement from experts who come to learn, and also to improve our solutions.”

### Collaboration and transformation

The evolution of the plant is set to continue thanks to a joint initiative with government and academia in Portugal aimed at stepping up the factory’s adoption of Industry 4.0. Known as Mangualde 2020, the programme will bring in applications on automatic storage on press lines, machine-vision quality control, cobots and a full kitting system distributed through AGVs.

Describing the approach, Covelo says: “When we started to construct the Mangualde 2020 programme last year, we first tried to identify the industrial architecture we have in the factory. With logistics at two levels, unfinished arrangements on full kitting, we saw our opening move was to improve that industrial architecture.

“Another point was the move to K9, a new modern platform and, in the near future, to be able to answer demands on hybrid, electric and whatever comes.”

Covelo sees Mangualde 2020’s aim as being the significant transformation of the plant and he remains optimistic for a characteristically rapid process, based again on the strengths the plant has long shown.

It is often said that a little goes a long way. Entering this period of major transformations in infrastructure and technology, and in a lively LCV sector, the Mangualde team are confident of demonstrating just how useful a proving ground the plant can be for Groupe PSA as a whole. \*



Mangualde is set for further and rapid transformation

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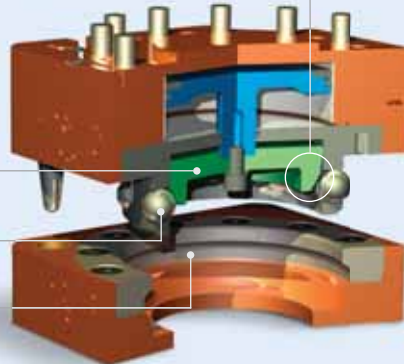
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# Collective thinking



Closer collaboration between product development and production teams could lead to significant improvements in vehicle manufacturing processes. Ford Otosan holds a unique position, as Michael Nash reports

**T**he scenery in Turkey is full of surprises. A quick car journey can lead to towering mountains, pristine beaches and lush forests, while historical ruins and ancient structures pepper the countryside. On the north-western side of the country, however, huge industrial factories sprawl for miles across the landscape, churning out everything from textiles to cars.

According to a recent Bloomberg article, Turkey's economy grew more than China's and India's during 2017. It suggests that the country has rapidly recovered after a slump caused by a failed military coup in July 2016, and points to continuous strong demand throughout 2018. Total vehicle production increased by 13% compared to 2016, 80% of which was exported. One of the companies that took advantage of this growth was Ford Otosan.

Its Gölcük and Yeniköy plants are situated in the Kocaeli region, two and a half hours south-east of Istanbul. With annual capacities of 315,000 and 110,000 units respectively, they are separated only by a small river that is maintained by the OEM and runs into the Sea of Marmara. From here, the company operates a private port that ships its Transit, Custom and Courier light commercial vehicles (LCVs) all over the world.

Gölcük is the only global production base for Transit Customs, but it also houses the production of the Tourneo Custom. The plant covers an area of 1,600,000 sq.m, and includes a tool-and-die centre, a pressing facility, a bodyshop, a paintshop and assembly area. Central maintenance, production planning and quality assurance departments are based in separate buildings.

The Yeniköy plant is much smaller. It is where the Transit Courier and Tourneo Courier are made and, according to Ford Otosan, it is the only plant in Turkey where "all activities aimed at creating a complete production

environment including construction, vehicle design from scratch, prototype manufacturing, and installation of production lines were carried out simultaneously." As a result, it was constructed over the course of just 16 months.

Although they are situated in a small and rather dated-looking town, both plants are surprisingly modern and well equipped. The Yeniköy plant opened in 2014, making it the first automotive plant established in Turkey in 13 years. In contrast, Gölcük opened in 2001, but has since benefitted from several large investments. In August 2017, for example, the company spent \$52m to expand its output by 12% and, since 2013, efficiency at the plant has increased by 23%.

AMS sat down with Cem Temel, head of the Gölcük and Yeniköy plants and assistant general manager for new projects at Ford Otosan, to discuss these improvements as well as plans for the future of LCV production in Turkey.

**Its quite unusual for one person to be head of two plants as well as a separate 'new projects' unit. Can you explain the benefits of this?**

I took over as plant manager at Gölcük in 2012 and then four years later was asked to head up Yeniköy. So, now I am in charge of both and have two plant managers reporting to me. I'm also in charge of a 'new project' office, which was set up in 2016. 55 white-collar workers provide data on how to manufacture new models and how much it will cost from a very early phase of a model, even before clay work is done.

They make evaluations of each part, give feedback to the product development team, and outline the specifications for the tools and facilities needed for the new programme. So the design, manufacturing and engineering all come under one umbrella, which gives us a considerable amount of flexibility and high information flow.

### Which of these responsibilities takes up most of your time on a daily basis?

I'd say 25% of my time is being spent on current production projects and issues, while 75% of the time I'm focused on future manufacturing technologies and products. These technologies and products are split in to two groups: the short-term, which covers the next one to two years, and the long-term, which covers the next three to six years.

### How do you prepare the plants for vehicles that may be introduced to your portfolio in the next three to six years?

The plants have a roadmap, which we have defined, and we start introducing production technologies and adopting certain principles as we follow the roadmap. We also carry out pilot manufacturing projects to verify whether or not it is practical to make new vehicles. These projects will often leverage innovative technologies to make sure the process is as efficient as possible, and this gives us a very good idea of how to adapt our plants to prepare for the future.

### Can you outline the primary method that Ford Otosan has used at its sites in Turkey to improve production efficiency?

The first is having a firm base in automation. We wanted to increase the number of robots we use, but cost was a big challenge. We were getting quotations from European and US companies which were very high, so we prepared a so-called 'grey model', in which we decided to only buy robots from European countries. And then, with our in-house engineering, we designed automation cells.

Between 2016 and 2018 we installed 150 TAR robots and we learnt how to program them, increasing our automation level in body construction from 60% to 92%.

### How much money did you save by programming the robots and designing the cells in-house?

We were able to reduce the cost of this kind of investment by up to 60%, which is huge. So now we have a principle in place to not invest in any more turnkey solutions. And the robots have also allowed us to increase efficiency and capacity by about 23% and 20% respectively between 2013 and 2018, which has saved us a lot of money.

### What impact has this growing level of automation had on the number of people working at Ford Otosan?

We have actually kept all our employees who were previously working on the manual lines. But as the level of automation on production lines increases, people will have different jobs and will need different talents.

We have a technical high school here with a training programme for all of our employees on the maintenance side. It includes a laboratory with a small production cell containing different tools, such as PLCs, sensors, software programmes and physical handling units. So the maintenance workers can get a really good idea of how increasing digitalisation in the factory will change their roles in the future.

### Do you think there will be any employees left working on the production lines in the next five to ten years?

In the future, these workers might be spending around 70% of their time on production and 30% of their time on low-level maintenance. Both sides should interact and work together. We have 6,000 people working here and we can't cut that number, it's not possible. So the method is to use lean manufacturing principles, working in parallel with robots.

### Are workers worried about losing their jobs to robots?

We have an incentive system whereby employees are paid if they identify improvements to production processes. They will receive 4% of the total saving or €800 (\$933), but the improvement must be physical not theoretical. The employee must make the change and show us how it works. Many of these suggestions lead to an increase to automation levels, but if it gives us efficiency gains then the workers will be rewarded.

"Between 2016 and 2018 we installed 150 TAR robots and we learnt how to program them, increasing our automation level in body construction from 60% to 92%."

**CEM TEMEL,  
FORD OTOSAN**



### What kind of challenges come with increased automation?

One of the major challenges is the growing amount of data coming from production lines, and finding out how to use it positively. A while ago we decided to create a common communication platform to connect each PLC from thousands of different robots and machines. With this, our 'big data' journey started, but it failed because we found that the amount of data we collected during each millisecond was so enormous.

So we started another phase of engineering and lowered the data requirements. We contracted local Turkish firms to help us and then we put together a team from Ford Otosan made up of the workers on maintenance and workers in IT. It took two years to define the system internally, and it is still a work in process.

### What uses do you think this common platform will have?

We are now beginning to analyse the data that we are getting from all the machines, and have started some pilot projects using the data for predictive maintenance. These pilots have been going on for the past two years, but honestly, the technology isn't ready yet. We're testing the software here in our Gölcük paintshop and body construction along the actual production lines. If we see a big benefit we will decide to bring it in, but we haven't had satisfactory gains yet.

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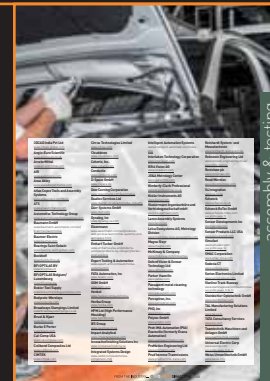
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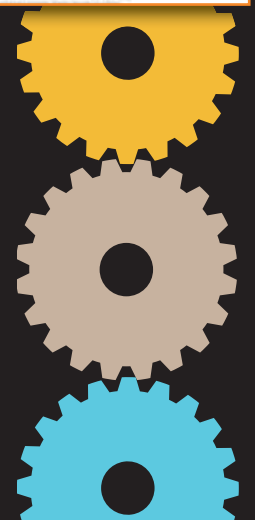
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### Aside from predictive maintenance, can you use data from other areas of manufacturing to improve your plants?

Quality checks come in many different forms – weld data, paint raw materials, sheet metal quality and so on. These are often kept in excel spreadsheets or other people-orientated systems. We are preparing a digital vehicle identification number (VIN) platform for all quality data. If one of our operators enters a VIN, they will get all the quality data for each vehicle. It's a huge project.

### Is it so big because of the amount of data you need to put on the platform?

Yes, because each vehicle is different from the other. We're starting to put cameras in some production areas that the vehicle passes through. These are linked to a system that has a checklist for all the features that the vehicle should have, such as a painted bumper and a large electrical mirror. The system is trained to identify what is what, and if the features are all there, the vehicle can pass to the next stage. All of this type of data will be stored.

### What does the term digitalisation mean to you?

Digitalisation it is not a new concept in the industry, but it will be for Ford Otosan. Here's a confession: our production lines still use paper. We're going to use digital screens instead, starting with a pilot project in December 2018. Each vehicle will be defined on tablets, and the operators will verify which part is going where on the screen. He or she can then also confirm the quality of each process with a signature.

### Do you see any benefit in adopting more advanced digital tools in the manufacturing process, such as virtual reality?

Today, we have a computer screen on which product development sends data to be evaluated by the engineering team. But the engineers can't see the real production environment, so we are currently scanning our entire plant with a high-resolution camera. Once we've done this, our engineers will be able to do everything in this digital plant, making sure it all works before spending money on pilot projects or implementation.

The second stage will be to integrate component data to the digital plant, which we will be doing in February 2019. Then the third will be designing manufacturing facilities and testing production technologies in 3D. Once we have all this, we can make changes to both the plant and the vehicle to make sure that the production processes are as efficient as possible.

### Are there any trends in the industry that could play a key role shaping Ford Otosan's future?

From the product point of view, the entire industry is talking about electrification. There's no doubt that it will come. Autonomous driving technology is also a hot topic and will probably first be introduced with large commercial vehicles that are operating on fixed routes. There will also be more personalised features in vehicles, which means high complexity from a manufacturing point of view. Many different parts will need to be fitted correctly to the vehicle. Lastly, customer satisfaction and quality is and will continue to be very important, so traceability is crucial.

### How could vehicle electrification change plant layouts?

Nobody really knows what the share of electrified vehicles will be, but I think the ratio of them could go up to around 30% during the next few years, while 70% of vehicles will still only have internal combustion engines. One thing is clear: the demand for batteries will rise dramatically, and these will need to be assembled in the plants before being married to the vehicles, not shipped from somewhere else. This will have a big impact on plant layouts, but we are prepared for it already as Ford previously announced that all models will include electrification in some form, including the Transit. The underbody of vehicles will also be made differently to account for the heavy and bulky batteries.

### Will autonomous driving have a similar impact?

We don't yet have much involvement regarding the autonomous driving trend at the moment, but it will have a big impact on the way that electronics and software is built in to the vehicles. There will also be more severe quality checks during the manufacturing process, because these systems are safety critical and therefore must be completely robust.



Ford Otosan has reduced the amount of money it spends on robots by designing the software for them in-house

### What are your thoughts on multi-material vehicle designs and how could they change the manufacturing process?

If we are still considering electric vehicles, then weight needs to be reduced because of the heavy batteries. There will be boron composites, which are currently under development, while aluminium usage will also increase. We do use boron and aluminium today, but the ratio will climb. There will likely be a trade-off between weight, cost of the material and then efficiency of using it in production.

### What will the greatest improvement to vehicle manufacturing be in the next ten years?

There will be a stronger relationship between product development and manufacturing. They currently have very different priorities, but they also want to achieve the same goals. There must be flexibility, and as they learn, they will understand each other and work effectively together. Also, they can both leverage the digital plant. Engineering will look at it to see what design parameters they have, and the manufacturing team will give them pointers on what is possible. This kind of relationship probably won't surface until 2025 or beyond, but when it happens it will make me very happy. \*

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# A slow return to growth



**B**razil is by far the biggest market in South America and a decade ago the country had been drawing in investment far and wide from manufacturers looking to tap into growth that saw vehicle sales top 3.8m in 2012. Then came the crash, and in 2016 the market slumped all the way back to 2.05m. Last year growth returned. It was nothing spectacular, but vehicle sales rose 9.2% to 2.24m (of which 1.86m were cars). However, production rose 25% to 2.7m on the back of a boom in exports, according to figures from the local manufacturers' association Anfavea.

This year the sales growth has been more impressive. Totals were up 20% in the first four months, with April growing a whopping 38% – the biggest surge this decade, according to sales tracker Bestsellingcarsblog.com.

The main players are sounding more optimistic again. Fiat Chrysler Automobiles, which last year lost its long-standing number-one position to General Motors after its share slumped, believes the market will grow 10% this year to 2.4m. In the long term, FCA believes Brazil will expand to 3m by 2022 and is confident the company will once again be making a 10-12% profit margin in the wider Latin America region, executives told investors at an event on June 1 this

## Top six South American countries by light vehicle sales, Q1 2018

	Country	Units	+/- 2017
1	Brazil	527,700	+15%
2	Argentina	265,000	+19%
3	Chile	97,300	+15%
4	Colombia	54,400	-3.3%
5	Peru	39,000	-7.4%
6	Ecuador	31,900	+66%

Source: JATO

Vehicle-makers in South America are seeing signs of recovery, boosted by growing exports, reports Nick Gibbs

year. In 2017, Brazil was FCA's third biggest revenue earner after North America and Italy.

Meanwhile, GM's leapfrog into the lead helped it turn around a loss in South America and make a profit in 2017, according to company figures, helped by a 14% increase in sales for Chevrolet across the region. In Brazil last year, GM had an 18% share thanks in part to the Chevrolet Onix. Built at its plant in Gravataí, Rio Grande do Sul, the Onix remains Brazil's best-selling car by far, beating the Hyundai HB20 and Ford Ka into second and third places respectively in the first four months of this year.

The previous downturn had been brutal for the region. In 2013, the industry employed 135,343 working directly building vehicles – the highest ever. That dropped to 109,530 by 2016, according to Anfavea, and was barely any better last year at 109,910. Savage job cuts were the order of the day at companies like VW, which announced in 2016 that it was slashing 7,000 jobs across South America – 5,000 in Brazil and 2,000 in Argentina.

Revenue from cars sold in 2016 fell to \$41.3 billion, down more than half from a peak of \$87.3 billion that was reached back in 2013. Investment by auto parts-makers also fell from \$2.4 billion in 2011 to just \$452m in 2016, with several car makers putting their developments on hold. For example, in 2016, Honda spent \$1 billion constructing new plant in Itirapina – a municipality in the state of São Paulo. It has capacity to build 120,000 cars, but the plant was idled on completion. →

**Cautious plans for growth**

Now, however, there are signs of life again as companies cautiously plan for growth. Honda announced in April that it will pull the sheets off the production lines at Itirapina next year to start building cars there, beginning with the Fit B-segment hatchback. But the announcement came with caution, as the OEM revealed that it would stop car production at its Sumare plant, also in São Paulo state, and migrate models over to Itirapina. The Sumare plant will switch to engines and other components. In an interview with *Globo* newspaper,

Honda Latin America chief Issao Mizoguchi said the growth wasn't strong enough to support two factories.

Meanwhile Daimler has opened a new production line for Mercedes-branded light- and heavy-duty trucks at its plant in São Bernardo do Campo in São Paulo state. The plant is the company's largest for commercial vehicles outside Germany and the new line is 15% more efficient thanks to increased automation and supply chain improvements. It also opened a new proving ground for Mercedes commercial vehicles in Iracemapolis, São Paulo state. In fact, 46% of all Brazilian-made vehicles were manufactured in São Paulo state last year, and it is home to 27 automotive plants, including for Ford, GM, Honda, Hyundai, Daimler, Scania, Toyota and Volkswagen.

The newly lean VW is also investing in Brazil. In November last year it announced it would spend 7 billion *reais* (\$1.9 billion) to bring 20 new models to Brazil by 2020, starting with a new small sedan, named Virtus, based on the group's MQB platform. The OEM promised it would return to profitability in South America in 2020, something it's not achieving now. "Over the next few years, we will be doing everything in our power to take Volkswagen back to the lead in the largest South American automobile market," said Juergen Stackmann, VW board member for sales. In the first four months of this year, VW had overtaken FCA to take the

number two spot behind GM.

VW spent €660m (\$767m) modernising its Anchieta plant, just south of São Paulo, for the production of the Virtus and the new Polo hatchback. In April came news that it would start producing its first SUV in Brazil, the small T-Cross, at its São Jose dos Pinhais plant in Curitiba, Parana state. The T-Cross goes on sale in the first half of 2018 to rival Renault's Kwid, which was localised at its plant, also in Curitiba, and successfully launched in July last year.

Meanwhile, on the parts side, Spanish pressed metal specialist Gestamp opened its seventh plant in Brazil last year, in Betim, Minas Gerais state, to serve FCA by supplying parts for the Fiat Palio and Siena. The company said the €24.9m plant would employ 82 people by the end of 2017.

Gestamp president Francisco Riberas was bullish about the country last year in an interview with *AMS*, stating that Gestamp's strategy was to keep its nerve in the downturn. "Some of the competitors are now finished. We kept what we have and we have taken the most important orders for the future. What we need now is for the market to recover," he said, adding that he was confident that would happen. "To get to 3.5m [a year] is logical for a nation of 200m. It's just a matter of reducing interest rates," claimed Riberas.

**2012 peak was a 'one-off'**

However, Brazil won't hit the highs of 2012 in the medium or even long-term future, analyst firm LMC Auto predicts. It backs FCA boss Sergio Marchionne's view that the market will hit 2.4m this year, before making a gradual climb to 2.7m in 2020 and 2.9 million by 2023. By 2030 it predicts a total of 3.5m, but that's it. "We don't see Brazil reaching the peak from 2012 again," Augusto Amorim, senior manager, Americas vehicle sales forecasts, tells *AMS*.

There are good reasons for this prediction. One is that 2012's peak was fueled by debt. "Back in 2012, there were tax incentives for several industries. Consumers bought cars, but also appliances and furniture. Debt skyrocketed," Amorim says. "The government is still trying to adjust its fiscal deficit, so we don't expect it to offer more incentives to the auto industry."

Another reason could be that those who bought cars in 2012 are keeping them. "A 2012 used model isn't that old and can offer more features than a new, entry-level car," Amorim says. Brazil is a price-sensitive market and the already high

**Top six automakers by sales share – Brazil 2017**

	Carmaker	Market share
1	General Motors	18%
2	FCA	17%
3	Volkswagen	12%
4	Renault Nissan	11%
5	Ford	9.5%
6	Toyota	8.5%

Source: Anfavea



Daimler has opened a new production line for Mercedes-branded light and heavy duty trucks at its plant in São Bernardo do Campo





Like other premium carmakers in Brazil, BMW is struggling, with its factory in Araquari operating at just 50% capacity

prices are getting higher. In Brazil an average of 30% of the purchase price is tax, compared to 17% for the UK and 6.8% in the US, according to figures from Anfavea. In 2014, tougher legislation killed some of the older, cheaper vehicles.

### RIP Inovar Auto

The premium market is in the doldrums. Last year it stood at around 45,000, down from 60,000 at its peak. That wouldn't be such a problem if the government's Inovar Auto policy, designed to encourage local manufacturing, hadn't persuaded Europe's premium automakers to set up plants in Brazil. But they did and those with expensive localised manufacturing are feeling the pain. That includes Jaguar Land Rover, which in 2014 started construction at Itatiaia, Rio de Janeiro state, at a cost of 750m reais, aiming for an annual capacity of 24,000. Production started in 2016 with the Land Rover Discovery Sport and Range Rover Evoque SUVs, but last year the firm sold just 7,759 vehicles in Brazil, of which fewer than 5,000 came from the Itatiaia plant.

Audi reduced its investment by building cars at VW's Curitiba plant, and recently installed a new line in the bodyshop there for its A3 sedan and Q3 SUV production, despite disappointing sales.

However, BMW is feeling similar pain to JLR. In 2014, the German marque built a factory in Araquari, Santa Catarina state. According to Helder Boavida, president and CEO of BMW Group Brazil, it is now operating at just 50% capacity, and the carmaker's sales in Brazil fell last year to 11,758. The plant was built in response to Inovar Auto, which penalised imports with high taxes, but now BMW is frustrated by the lack of a follow-up industrial policy after Inovar Auto ended last year and wasn't renewed, largely because Brazil lost a dispute at the World Trade Organisation over high import duties and other discrepancies that breached its membership rules. "We need clear policy to have predictability to define our future plans," Boavida recently told Bloomberg.

Inovar Auto's replacement, Rota 2030, is meant to offer incentives based on the vehicles' energy efficiency rather than local production, but has been delayed. "Rumour has it that the lack of incentives is one of the main issues delaying the announcement of Rota 2030 – companies want incentives, the government refuses to give them," LMC's Amorim said.

### Exports lead the charge

The production jump last year was partially due to a 46% increase in exports to 784,718, giving hope that they could grow to beat 2005's record of almost 900,000. Exports had slumped in the downturn but not with the same force as local sales, and manufacturers can now be hopeful of another path to reducing excess capacity. The president of Anfavea, Antonio Megale, in his introduction to its 2017 review, credited the government's new trade agreements, citing as an example the one concluded with Colombia in December. He also said that Brazil's safer, more high-tech vehicles were a better fit with more advanced markets.

Sales to local markets are increasing. In Chile, for example, a country with no automotive industry of its own, the market share of cars imported from Brazil jumped from 1.2% in 2014 to 8.8% in 2017, Megale said. Exports to Argentina stood at 534,970, with Brazil by far the largest source of vehicles for its neighbour in 2017 at 83% of all its imports. Argentina's sales figure for all vehicles in 884,000 was up 23% on the year before. To give some indication of size, that was above Thailand and below Turkey.

Brazil's import figure eclipsed Argentina's production figure of 473,408, of which 139,967 were exported the other way to Brazil. Vehicle production in the country flatlined in 2017 compared to 2016, and both numbers were a long way off the record of 828,771 in 2011. Investment is maturing, however. This year Mercedes X-class pickups began rolling

off the Renault production lines in Cordoba, while Groupe PSA is in the middle of modernising its plant in El Palomar for the production of new vehicles in 2019. Late last year, meanwhile, VW announced investments of about €560m to optimise processes at its plant in Pacheco, as well as prepare the facility for production of a new SUV, which is due to start rolling off the lines in 2020. \*

### Top-selling cars in Brazil, January-April 2018

	Country	Units	+/- 2017
1	Chevrolet Onix	58,390	+8%
2	Hyundai HB20	33,618	+4%
3	Ford Ka	32,790	+19%
4	Chevrolet Prisma	23,017	+30%
5	VW Polo	23,538	new
6	VW Gol	21,705	+1%
7	Fiat Strada	21,461	+39%
8	Renault Kwid	20,303	new
9	Toyota Corolla	19,413	+8%
10	Fiat Argo	17,818	new

Source: Bestsellingcarsblog.com



The Chevrolet Onix was Brazil's best-selling car in the first four months of this year

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# Jack of all trades

Inönü is a small, sleepy town in north-west Turkey. The nearest city, Eskisehir, is a 40-minute drive away and is populated by young students who attend its two universities. Aside from an array of dilapidated houses and ancient-looking coffee shops, Inönü is home to a large Ford Otosan plant that opened back in 1982.

But this isn't any old factory in the middle of nowhere. It houses an unusual production portfolio, churning out trucks and tractors as well as 9.0-litre and 12.7-litre, six-cylinder engines for heavy commercial vehicles (HCVs), and 2.2-litre, four-cylinder Duratorq engines for Transit light commercial vehicles (LCV). It is also Ford of Europe's only production centre for rear axles of the Transit models, and will soon feature in-house transmission manufacturing.

"[Producing HCVs and LCVs] in the same plant increases efficiency, and we can leverage the combined know-how and experience. We also benefit from flexible, low volume HCV production and a more automated, higher volume for LCVs." – **AYSAN HOSVER**, FORD OTOSAN INÖNÜ

Speaking to AMS, plant manager Aysan Hosver outlines the advantages of making these components and vehicles under one roof. "Although they are used on different types of vehicles, the components of the engines have similar manufacturing processes," he explains. "Having both in the

same plant increases efficiency, and we can leverage the combined know-how and experience. We also benefit from flexible, low volume HCV production and a more automated, higher volume for LCVs. Machines and lines are designed in such a way that they backup each other in case of any breakdowns."

The HCVs and rear axles are made in one area of the plant, while the engines are made in another. The four-cylinder and six-cylinder engine production is separated due to them being different sizes and having different cycle times – around 225 four-cylinder engines are made at Inönü every day, while just 45 six-cylinder engines are produced.

However, both the nine-litre and 12.7-litre six-cylinder engines are made on the same line."

As well as benefitting from the unusual production mix, the plant at Inönü is strategic in terms of location. "We're a couple of hours away from

our capital, Ankara, just one hour from Bursa, and two hours from Istanbul," Hosver continues. "We don't have the high costs involved in being in these locations, but can easily transfer things to and from them. Also, Eskisehir is a source for educated engineers and workforce, as →

Ford Otosan's Inönü plant houses an unusual production mix, and is taking on more projects. Michael Nash investigates



2.2-litre four-cylinder diesel Duratorq engines are produced for Transit models at Inönü

well as an important base for joint projects with the universities. When you put this all together, Inönü is a very wise place to make investments, which is why we are spending more and expanding.”

#### In-house expertise

The plant churned out around 6,000 HCVs in 2017, and Hosver hopes to achieve a 50% increase during 2018, with a target of 9,500 units set. “Currently we have stabilised at about 35 trucks per day, but we plan to go up to 45-ish by the year end,” he explains. “We have a really aggressive plan to go to 16,000 and 18,000 in a couple of years’ time. We are also increasing sales of our engines and rear axles for LCVs, mainly thanks to strong demand from the export market which increased by 50% between 2016 and 2017. In addition to that, spare part demand is climbing and is becoming a huge part of our business here.”

#### Change in the body and paint shops

One example of testing robots and using in-house expertise is currently taking place in the bodyshop. It was established in 2017 and is therefore modern compared to some of the other areas of the plant, but work is still on-going, and parts of the bodyshop still house several inactive robots. “What we are doing here is programming them for welding operations,” explains Mehmet Ercan, Ford Otosan Inönü plant area senior manager. “After our shutdown period in August, the robots will be working and we station the human workers that are currently carrying out manual welds in other areas of the plant.”

The idea of programming robots in-house is not unique to the Inönü plant, but is also taking place at Ford Otosan’s Gölcük and Yeniköy plants, in which the Transit, Custom and Courier LCVs are made. By using this strategy, the company has managed to reduce investment costs in robots by around 60% (see p18).

Robots used in the new paintshop at Inönü, which like the bodyshop was established in 2017, are also being programmed in order to keep costs down. “We designed the entire paintshop in-house,” Ercan adds. “Due to the small production numbers, we haven’t introduced robot applications on the sealing process yet, but in the near future we probably will. However, the paint line is fully automatic. We have three paintshops in Turkey as Ford Otosan and this is the most automated one, with roughly 63% of processes

“We designed the entire paintshop in-house. Due to the small production numbers, we haven’t introduced robot applications on the sealing process yet, but in the near future we probably will. However, the paint line is fully automatic.” – **MEHMET ERCAN, FORD OTOSAN INÖNÜ**

Ford Otosan exported \$4.9 billion worth of vehicles in 2017, shipping a record 297,396 units to 89 countries. This accounted for 72% of Turkey’s total CV exports and 69% of Ford’s CV sales in the whole of Europe.

In order to meet rising demand and hit output targets, companies often outsource engineering or manufacturing, but that’s not the plan for Ford Otosan. On the contrary, Hosver is eager to outline the company’s strategy of maximising in-house production. “When you get a solution from a supplier it is introduced and then forgotten about,” he says. “But when we design and engineer something in-house, we integrate it, start using it for production, and then we keep revisiting it to see if we can make improvements. This gives us a great advantage in terms of costs over our competitors, and allows us to make consistent progress with our facilities.”

The strategy is extremely important in the HCV segment, he continues, as production numbers are far smaller than in the passenger vehicle segment. Therefore, paying for costly outsourced production work has a significant and continuous impact on profit margins.

As well as upping in-house capability, Hosver reveals that the company is investing in pilot projects to test the use of robots in certain production processes. “We are starting to use robots in some areas of production and doing case-by-case studies to see if it makes sense,” he says.

completed by robots.”

Engineers at the plant are not only developing sophisticated software for robots, but have also drummed up ideas that have helped to increase production in other, less glamorous ways. At one point during HCV production, for example, the chassis needs to be flipped and rotated in order to go back down along a production line to be married to the cab. The company therefore integrated a unique belt mechanism that cradles and slowly rotates the



A truck chassis is flipped and rotated before it sits back down on a production line and is married to the cab



giant chassis – an idea that was concocted and then quickly introduced in 2017.

Change is also taking place in the powertrain production area, with more robots being tested for certain processes. Yavuz Demir, powertrain manufacturing engineering senior manager at Inönü, highlights the introduction of two new projects, both of which are having a notable impact.

“The product development team have been looking at ways of reducing the weight of certain components in order to make the trucks more fuel efficient,” he states. “They have come up with a new design for the differential carrier in the centre section of the rear axle, so during the shutdown period this August, we will modify the carrier machining and other components in the centre section to carry out the new design.”

After this, the powertrain team at Inönü will be preparing for the production of a new transmission. The company currently outsources its transmissions from ZF and Eaton, but, according to Demir, the plan “is to localise the product, so we will integrate a new assembly line soon. We will probably make the same number of transmissions as engines here, at 15,000 per year.”

Along with increasing efficiency, Hosver believes the use of in-house expertise can help Ford Otosan to better meet the varying demands of its customers. “There’s more of a push for tailormade production because the customer wants different wheel sizes and different suspension systems, for example,” he observes. “So this makes the production process very complex, but by using our own tailormade automated processes we can manage the demands accordingly.”

### Linking to the future

Lean manufacturing is another key phrase at Inönü. Although he thinks the plant has come a long way in recent years, Hosver is confident that many processes can be streamlined to improve efficiency even further. In some cases, he adds, certain process could become entirely redundant: “We are looking to make year-over-year efficiency improvements. To do that, we need to be getting rid of all non-value-add processes. We can use our experience for this up to a certain level, but after that we need automation and smart digitalisation to guide us.”

Connecting numerous systems is a notoriously difficult challenge in car manufacturing. This is because most plants use robots and other tools sourced from a variety of different companies. However, as Ford Otosan has been using its in-house programming strategy, Hosver thinks it has a head start. “We’ve started making sure that our machines are all linked and talking to each other as well as the maintenance system,” he notes. “The next step will be to link the production system to customers, as customer demand could have a big impact on our manufacturing processes and applications.”

He refers to the trend of autonomous driving. Like many experts in the industry, Hosver believes that the HCV segment could become the first to adopt higher levels of autonomous driving technology. This is due to the fact that the routes these vehicles take are fixed and don’t often change, making it easier for computers to guide the trucks safely to their destination.

“The drivers also have to operate the vehicles for very long periods of time,” he continues. “If we can leverage autonomous driving technology in the trucks then we can minimise the possibility of driver distraction, vastly enhancing safety while also improving driver comfort. It also allows the trucks to be driven even longer, which is important because every time they stop the companies that are using them are losing money.”

As autonomous driving technology trickles into the truck segment, Hosver thinks that plants like Inönü will need to adapt, both in terms of layout and processes. More sensors will be added to the vehicles, which means production lines and component storage areas will change. And if these sensors start to drastically reduce the amount of road-traffic collisions, then more lightweight materials could be used in order to maximise fuel efficiency.

“If we really look into the future of autonomous driving then we may not even have a cab at all,” Hosver muses. “The implications that this would have on our plant is huge, but we’re already thinking of how we might best adjust to these kind of big changes, so we will be fully prepared when the time comes.”



Ford Otosan makes around 15,000 trucks and tractors per year at its Inönü plant

This vision may be some 20 years away from coming to fruition, according to Greg Roger, policy analyst at the Eno Center for Transportation – a non-profit, independent think tank based in Washington, DC. “I think the technology to support autonomous long-haul trucking technology will approach maturity in the next five to ten years,” he commented in a recent PwC report. “However, we’re still ten to 20 years off from having fully driverless trucks from being a common sight on the roads. I think the fear of displacing human workers and the general public’s initial safety concerns will keep drivers in the trucks for at least another decade, maybe two, beyond that.”

As for the near future, Hosver describes several factors that will have a big impact on Inönü. “We have an increasing demand and so we are planning an increasing supply, expanding our production,” he emphasised. “Inönü is an area that Otosan will be willing to invest in, so our aim in the future is to expand our current business but also add additional businesses, not necessarily in truck, axle and engine assembly.” \*

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**DIGITISATION**

**31** Working towards the greater efficiency of Industry 4.0

**PLASTIC PROBLEMS**

**34** Machining polymer-based materials

**M**ajor machine tool OEMs are upping their game when it comes to digitalisation. “Industry 4.0 (I4.0) is not just a gimmick, as some would have you believe, but a cornerstone of advanced manufacturing,” states Matthias Meyer, managing director in charge of Heller’s subsidiary in Redditch, UK. “It allows the last few percent of productivity to be extracted from an already efficient process, and results in considerably more benefits in the case of less well optimised manufacturing environments.”

Some 75% of Heller Group’s business comes from the automotive industry, and the company has adopted the name Heller4Industry for the suite of related modules it offers. Within the portfolio, Heller4Performance, includes workpiece-specific analysis for the optimisation of a process and extraction of real-time data over the internet, plus evaluation and graphical display in the Cloud. In practice, the module could, for example, map tool paths and



Steed Webzell scrutinises the technologies currently available to assist those wanting to digitise their machining processes

# Heading for the clouds

workpiece tolerances in parts of a cycle where tool wear is expected. That section of the sequence would be simulated on the machine without cutting metal, so the paths actually traversed by the tool could be recorded and compared with the workpiece design. The ability of the machine to produce the part to the required accuracy could then be determined.

## Fewer sensors, more data

Another module, Heller4Services, focuses on the transparency of digital manufacturing and maintenance. The module forms the basis for evaluating machine data and statistics, which in turn can help to reduce downtime.

This raises the question of the need for additional sensors in the machine. Heller says it is minimising their inclusion, as each additional sensor poses a potential risk of failure and compromising machine availability. The company says its approach to improving production processes is based on the possibilities for extracting and evaluating more data from existing sensors and making better use of it through additional computing power in the control, and Siemens’ Sinumerik-Edge technology.

Sinumerik-Edge, designed to improve production processes, is claimed to have new developments in four interrelated areas: the amount of high-frequency data that can be collected during machining; the architecture to process terabytes of that data in minutes; the semantic data model that defines how the information relates to the

actual machining process; and the applications available for analysis, optimisation and feeding back meaningful results to the control.

Makino is another machine tool OEM with its own solution for I4.0 strategies. Its ProNetConneX is an interface that connects, collects and analyses machine data. The system is intended to provide manufacturers with a built-in, instant on-ramp to the IoT, with secure connectivity to software management systems via the MTConnect standard.

With support for fog-level computing over local networks, and Cloud accessibility, this interface is claimed to enable

“Industry 4.0 (I4.0) is not just a gimmick, as some would have you believe, but a cornerstone of advanced manufacturing.”

– **MATTHIAS MEYER, HELLER**

customised and secure transmission of machine information across connected devices on the factory floor. The system can be integrated into Makino’s machine controls to enable full MTConnect v1.3-compliant data collection. Additional machine sensors can be installed and added to ProNetConneX, thus expanding real-time manufacturing data collection capabilities based on customer requirements. →

### Creating a connected factory

At Mazak, recent focus has been on iSmart - a factory-based concept that utilises the company's I4.0 infrastructure to help machine users make the step up from automated cell manufacturing to a completely connected I4.0 'factory of the future'.

Mazak's iSmart Factory is centred on three key pillars, namely the company's proprietary Smooth Technology, the new SmartBox, which is said to provide fast data analysis with increased security, and the MTConnect standard communications protocol. All elements combine to facilitate the real-time sharing of manufacturing data between the production floor and offices.

Smooth Technology, incorporating CNC and 'Smooth Process Support' factory management software, sits at the heart of Mazak's I4.0 infrastructure, from where it connects entire machine shops and provides real-time monitoring and analysis capability. Newly introduced programs include 'Smooth Spindle Analytics' software, which provides instant spindle vibration reporting and analysis.

Data processing is made possible by Mazak's SmartBox, which, utilising Cisco's fog-computing concept, effectively extends Cloud computing closer to where the data is produced.

This enables sensitive data to be analysed and acted upon securely, with only selected data sent to the Cloud for historical analysis and long-term storage. The company says the SmartBox can interface with any machine featuring an MTConnect adaptor and older legacy machines can also be connected to SmartBox with the addition of its new SensorBox.

Richard Smith, European group managing director

"Ultimately, Industry 4.0 is only going to become an ever-more critical element of modern manufacturing."  
 – RICHARD SMITH, YAMAZAKI MAZAK

at Yamazaki Mazak, says: "We can demonstrate that the connected factory of the future is here today. Ultimately, I4.0 is only going to become an ever-more critical element of modern manufacturing and Mazak is determined to ensure its customers embrace the opportunity and realise the full potential of their manufacturing capabilities."

### Constant status monitoring project

DMG Mori says it recently equipped one of its DMC 80 FD duoBLOCK machining centres with more than 60 sensors that transmitted digitised information on components to the Cloud for the purposes of data collection, storage and



analysis. Constant status monitoring within the machine was the ultimate objective. Putting the theory to the test, a major supplier of bearings to

the automotive industry, Schaeffler, is working out how to convert the data into practical machining knowledge (the aforementioned DMG Mori DMC 80 FD duoBLOCK pilot machine is in operation at the site). Schaeffler considers the opportunities to be highly diverse, ranging from improved management of the machining process, with greater focus on tool wear, for example, to lower energy and/or coolant consumption.

Likewise, on the basis of empirically determined 'behaviour patterns', the transferred status data can be used to make qualified predictions about potential damage to the spindle.

"With this project, we want to demonstrate that Industry 4.0 is not an abstract, remote vision but that it can make a contribution to added-value today," says Martin Schreiber, president of the production machinery business unit at Schaeffler Technologies.

The DMG Mori machine at Schaeffler is equipped with sensors that can record the measurement values for pressure, vibration or force. Most are integrated in motion components such as bearings and linear guidance systems. Valuable data generated at these points is not only saved in the machine itself but also, in pre-analysed form, in the Cloud. Communication with central servers takes place via a secured gateway, which aims to protect against hackers. The condition of individual components can be viewed at any time, either using the operating terminal on the machine or via an Internet-connected device, such as a tablet.

Only when they are linked together can valuable information be derived from large pools of data, which can then contribute towards ensuring manufacturing processes are organised more efficiently. In order to clearly categorise



Schaeffler is working with DMG Mori to develop constant status monitoring in its machining operations



## A meeting of minds

At the EMO exhibition in Hanover towards the end of last year, Siemens demonstrated the various connection and installation options of its MindSphere open Cloud-based IoT operating system for applications in the machine tool sector. In fact, Siemens managed to connect over 240 different machine tools from over 140 manufacturers across the whole exhibition site using its 'Manage MyMachines' app on MindSphere.

"The overwhelming willingness of machine tool manufacturers at EMO to connect their machines to MindSphere shows the potential that the sector sees in cloud-based digitalisation solutions," says Wolfgang Heuring, CEO of the Siemens Motion Control Business Unit.

Digitalising machine tool operations by connecting to MindSphere allows machine manufacturers and operators to analyse and use large volumes of machine data, thus helping improve machine efficiency and productivity. The open access of the operating system is particularly important, such as the use of open interfaces (APIs) to produce OEM and customer specific apps, as well as open standards for connectivity, like OPC UA.

the measured data, each component manufactured on the machine receives its own ID. All data generated during milling or in the subsequent machining processes can subsequently be assigned to a specific component. It is hoped that by comparing the data for individual components it will be possible to quickly recognise deviations, correct them, and in turn continuously optimise the manufacturing process.

Ronny Hüttner, who is responsible for the introduction of new technologies at Schaeffler's Höchststadt plant, sees the machine as an opportunity: "With this project we are taking a clear step towards the digital value-added chain," he says. "The decisive question will ultimately be, how significantly can we increase productivity in practice?"

The answer will soon be known as the machine is already being used by Schaeffler in the volume production of precision bearings. Machine condition is transparent at any time, helping production processes become more efficient and easier to plan.

### Removing the guesswork

Avoiding machine downtime makes a big difference to efficiency. Evaluating the data from the DMG Mori machine and its 60 sensors, it is possible to accurately schedule a machine bearing replacement, avoiding a breakdown situation.

"Recording load data, particularly for the main spindle, allows potential overloads to be made transparent," says Hüttner. "The combination of data recorded by force sensors on the spindle bearings, and by speed sensors on the feed screw, allows us to calculate the remaining useful life of the bearings. We can choose when to carry out the necessary replacements based on the selected level of capacity utilisation."

"Setting and inspecting the precise machine loads used to be a very complex task," adds the machine's operator Gezim Feta. "However, I can select the correct spindle operating mode and monitor the loads whenever needed via the control panel. If a load limit is exceeded, I receive an active warning and can therefore respond immediately. This also covers vibration on the machine components. Moreover, I can check for temperature fluctuations and view the effect



on forces using the operating panel."

Benjamin Wirth, quality manager, is also impressed with the potential of the machine. "The machine allows all process and quality data for manufactured parts to be traced," he says. "In the future, data analysts will even make it possible to predict quality results. In other words, machine operators should be able to proactively influence the manufacturing process."

The final word goes to Oliver Jung, COO at the Höchststadt plant: "We want to optimise existing processes digitally, to create new service-oriented processes and consistently promote the digital interaction of people and IT systems. The clearly defined goal is the permanent optimisation of production and the supply chain." \*



Over 60 sensors are fitted to the DMG Mori machine at Schaeffler's Höchststadt plant



control problems in producing thousands of plastic components.

“For us, the development of LFV has transformed our turn-milling operations, so we can now confidently operate the Citizen machine from the start, rather than having to continually interrupt the cycle to clear troublesome ‘birds nesting’ of plastic swarf,” explains managing director Jonathan Newis.

Newis describes LFV as being especially effective during the drilling of deep holes. “We have totally eliminated any clogging of the drill flutes,” he states. “Previously we often had to set the machine with two or even three drills due to swarf problems, but we can now go straight to depth with a single tool and the flutes are completely clean.”

PTP supplies major automotive manufacturers with plastic components in bulk quantities. In addition to PTFE, the plastics-based materials passing through the machine shop are wide ranging, including acetyl, Delrin, nylon, PVC, polypropylene, polyethylene, Nylatron, PEEK, graphite-filled PTFE and other high-performance materials, such as variants of glass-reinforced plastics. Batch sizes range between 500 and 10,000.

# The problem with plastic

With automotive manufacturers looking at ever increasing levels of plastic-based materials content, Steed Webzell examines the challenges for machine shops

**R**ecent research suggests that by 2020 the average car will incorporate 350kg of plastic-based materials. As a result, the need for efficient and economic machining methods for plastics has never been greater; and therein lies a challenge.

The lack of rigidity is the principal difficulty when machining any polymer-based material. All cutting tools rely on the rigid nature of the component being machined, which is why the inherent properties of metals can be leveraged with such good results. In contrast, plastic parts tend to ‘bend’ or ‘flex’ away from the cutting tool during machining, usually deflecting back after the cutter has passed, which makes it hard to achieve the specified dimensions and tolerances.

In a typical car, plastic parts might include bushings, caps, guides, nozzles, spacers and supports, for example, often made from materials such as acetyl, acrylic, Delrin, nylon and polycarbonate, many of which present swarf control issues during machining.

## Low frequency solution

Among the companies familiar with the demands of machining plastics is Plastic Turned Parts (PTP), based near Hertford, UK. PTP was the first company in the UK to install a Citizen CNC sliding-head turn-mill centre incorporating patented Low Frequency Vibration (LFV) machining technology. As a result, PTP has been able to eliminate swarf

“We have the skills to respond to the demanding nature of some of these materials,” says Newis. On machining polyethylene, he describes the material as “being a nightmare” due to swarf wrapping around the tools and often melting on drills. “However, with LFV it readily chips so we can even run unattended for several hours,” he adds.

The patented LFV process is different to conventional ultrasonic vibration machining; it is fully programmable and activated through a G-code, enabling on-demand application anywhere in the cutting cycle. Importantly, the servo axes of the machine drive system are ‘oscillated’ in the direction of tool feed in phases that involve tens of microns, which are synchronised with spindle rotation.

Part of the tool path includes ‘air cutting’, which interrupts the cut that breaks the swarf into smaller lengths or pieces. This process also reduces the onset of built-up edge on the tool tip, which is often a cause of premature failure.

It’s possible to program the LFV to tailor the ideal length of swarf through P1 and P2 codes that set the frequency of oscillation. This is a very important benefit as ultra-small chips of plastic would simply build up and clog the machine.”

PTP tends to run the machine spindle at 4000rpm with feed rates of 0.03mm/rev (P1) or 0.05mm/rev (P2). P1 is used for general swarf breaking and P2 for small diameter turning and drilling.



### Machining composites

A little further west, in Oxfordshire, Witney-based Shape Machining says its most recent gains in composites machining have come as a result of software investment. This is why the company is now leveraging the benefits of Vericut CNC machining verification and simulation software from CGTech

Shape Machining was founded by former Formula One chief designer Peter McCool to provide carbon-fibre composite machined tooling and parts to both the motorsport and automotive industries. Vericut software enables Shape's five-axis programmers and machine operators to verify their toolpaths for clash and collision avoidance.

"Our programmers have adapted quickly and incorporated the running of Vericut into our standard operating procedures," says McCool. "Each time we grow, we need to change and adapt. Introducing Vericut is part of our push to constantly improve."

NC programs are now written and verified before jobs are loaded on to each machine. This strategy gives Shape the ability to extend significantly the available machining hours in a day, and makes possible the planned introduction of late and night shifts.

Of course, composites such as CFRP and GFRP have a rule book all of their own when it comes to machining. An interesting observation here is that machining these materials is usually a dry operation. However, machining composites poses many challenges to production engineers:

not least the tendency for delamination and split fibres, despite low speed and feed rates. Moreover, cutters are under intense stress as composite fibres can cause rapid wear, resulting in frequent tool changes. To counteract these issues, tools made from PCD or cutters with diamond-like coatings are generally required.

The dry machining of CFRP also raises a number of questions with regard to health and safety. The fine dust released during cutting is a particular cause for concern. To avoid endangering employees, firms must install ventilation and filter systems, which are not cheap.

### Lubricants for composites machining

One company working on this problem is Lubricant manufacturer Rhenus Lub, which says it is performing tests on newly developed coolants assisted by the Research and Transfer Centre at the University of Applied Sciences in Zwickau.

Tools and workpieces are inspected for wear and machining quality during suitability tests carried out in a production environment. The first fully developed coolants are Rhenus XY 190 FC and XT 46 FC.

Due to concern about the potential for coolant to penetrate the material, interactions between the coolant and CFRP were studied in a series of tests carried out under worst-case conditions. The results were positive: the short residence time of the coolant during machining did not change the properties of the CFRP, and there were no signs of the coolant penetrating the material. \*

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# From paper labels to smart materials

From the Internet of Things to Industry 4.0, manufacturing is changing. Paper labels no longer fit process complexities; what is required is optimal flexibility and quality assurance



**F**or 40 years, paper has been a trusted flag in manufacturing, providing sequential work instructions for operators. This simple visual cue has been the core of a process that balances production and creates more efficient just-in-time inventory. It may then be a surprise to many who work in the industry to find out that the static, paper-based, or kanban systems, which have been at the core of material flow management for decades, are also the number-one cause of factory inefficiency today.

So, with technology and customisation trends expanding how do factories keep up? Despite the need to change, it's easy to see why other systems have been unsuccessful in replacing traditional paper: it is simple, reliable, visual and familiar to the workforce.

However, it is also highly inflexible. Once the paper label is placed onto a container and launched into the process,

its instructions or trajectory cannot be changed without significant human resources or costly manual work-arounds. Neither can it be tracked or communicate with robots or machines on the line. A next-generation system ideally needs all these attributes while still retaining the simplicity and reliability of paper.

## Enter the IIoT and smart materials

The Industrial Internet of Things (IIoT) has been a key driver to bring new interactive technologies to existing processes like material flow management. This demand for technology to make material 'smart' has resulted in an innovative combination of e-Paper, RF communication and simple business logic called ProVIEW.

In most factories, the scheduling team meets in the mornings to determine the demand for the day and create the jobs and output for the day. The schedule is committed

## Common issues that are being solved today using the ProVIEW system

### Issue: Rescheduling/reassigning routes for work in process (WIP)

When bottlenecks occur, it is prohibitively expensive for racks to be tracked down and new labels applied – or operators compensate by ignoring the instructions on the label to bypass issues. The result is chaos on the factory floor.

**Resolution:** Using existing systems to know what machines and operators are available and instantly use this information to send a message to the View tags to create optimised routing for each rack or smart container.

### Issue: Updating build instructions for WIP

Updating build instructions, especially during the production process, is difficult. For instance, if tooling is serviced or updated at any given station, an extra QA step must be added to qualify the new tool.

**Resolution:** Build instructions are easily changed in real time with the ProVIEW system to accommodate for quality or process changes. The view tags are equipped with buttons to provide a means for the operator to indicate that the QA has been done and is automatically notated to the system.



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to hundreds of paper labels with instructions upon them and manually affixed to the racks of materials for the day. But what if something goes wrong? Will you make the schedule for the day?

Instead, a wirelessly updated, e-paper 'View' tag can be placed on containers routing through the manufacturing process. Unlike paper, the location-aware tags change instructions along the route to tell operators what to do with them next and where to go if there are bottlenecks or other issues. These 'smart materials' also become immediately traceable in real time.

"ProVIEW's Pick Application reduced our average pick times from 47.5 to 29.2 seconds and our accuracy on quantity and sequence was dramatically better with the visual instructions right at the point of picking. Most impressive for us is the ease of use of the system. New workers could jump in and be effective immediately because of the easy visual cues and instructions.

"Setting up a new picking cell when we reconfigured lines used to take more than a week. Using the wireless tags and simple software, last month we did a changeover in two hours using just the line operators (no IT team needed). Based on this success, we've added the replenishment application and are looking at full container management as well."

– **PLANT MANAGER**  
TIER ONE AUTOMOTIVE SUPPLIER

E-paper directly replaces the paper, fitting seamlessly into existing process with minimal to no training required for operators. This system is the first of its kind to provide paperless, wireless and interactive material flow management along with end-to-end process visibility.

Every rack, item and container on the factory floor is tracked by its location, state and condition – which can be dynamically changed at any time to accommodate a work flow change. Repurposing some material for another part of the line or staging it to balance flow? No problem. Machine is down and material needs to be re-routed to optimise output? ProVIEW can take care of that.

\* See how Daimler Trucks and others are using ProVIEW to optimize their Material Flow Management processes at [www.omni-id.com/AMS](http://www.omni-id.com/AMS)



**Issue: Out-of-sequence container or rack delivery**

Parts are often hard to distinguish from one another – if installed in the wrong sequence it can destroy the value of an entire batch. This could result in a costly write-off of the entire WIP.

**Resolution:** Each view tag ensures that its rack or container is associated to a specific work process. If it arrives out of order, it automatically signals the operator with a message indicating that they should not use the materials as they have arrived out of order.

**Issue: Reconfiguring pick areas**

Setting up to enable optimal picking when a new job is put to the floor can take a week or two depending on the installation of shelves, racks, configuring or even coding the picking software to match the setup. With changes happening more and more often, this wasted time is becoming significant in the overall efficiency.

**Resolution:** Wireless view tags make it easy to swap out parts or reset a pick area. View tags can be quickly mounted where they are needed with simple Velcro tape or snap-in brackets. What took a week can literally take an hour, making multiple changeovers possible for competitive advantage.

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# Making a strong case

In 2017, global sales of battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) reached 1.3m units, according to Frédéric Painchault, head of global automotive marketing at steelmaker ArcelorMittal. “This represents a low share of total vehicles sales – less than 2%,” he explains. “However, the market is growing quickly – by over 57% compared with 2016. Global automakers are reportedly planning to launch approximately 340 BEV and PHEV models over the next three years. This means sales should reach almost 5m units in 2020.”

And that’s just the start. Basjan Berkhout, marketing manager for automotive at Tata Steel Europe, adds: “Tata Steel expects electric vehicles (EVs) to make up 90% of vehicle sales [in the European Union (EU)] by 2050.”

“Our scenario for 2030 is that each type of vehicle – PHEV, BEV and ICE – will account for one-third of sales. Within 15 to 20 years, non-ICE vehicles should dominate the market.”  
– **FRÉDÉRIC PAINCHAULT, ARCELORMITTAL**

Environmental legislation is the primary motive for the automotive industry’s move towards electric powertrains. The EU, for example, has mandated that new cars can emit no more than 130g of CO<sub>2</sub> per kilometre travelled. This target will be lowered to 95g per kilometre in 2021, phased in from 2020, and is likely to get even more stringent in 2030.

The level of take-up of electric drivetrains varies from

With the push for powertrain electrification gaining strength, producers of high-strength steel are preparing themselves to capitalise, reports James Bakewell

region to region. Berkhout says the single biggest influence remains the Chinese market, where the government has set mandatory EV production quotas for OEMs operating there to reduce tailpipe emissions.

With China being the largest profit market for most OEMs, the risk of ignoring this is far too great. Another pressure is improving air quality targets in cities. The tightening of tailpipe emissions in the EU has also now been brought into sharper focus following the fallout from the

recent diesel scandal and the pending shift later this year to the new WLTP emissions test.

Painchault adds: “Uncertainty on Corporate Average Fuel Economy [CAFE] regulations in the US may mean that growth in the NAFTA region is not as

high. In Europe and China, ArcelorMittal is forecasting that the combined number of BEV and PHEV sales will exceed internal combustion engine [ICE] sales by around 2025. Most of the growth will come from PHEVs.

“Our scenario for 2030 is that each type of vehicle – PHEV, BEV and ICE – will account for one-third of sales. Within 15 to 20 years, non-ICE vehicles should dominate the market.”



### Gaining a place in the electric future

The steel industry is typically bullish about its place in the electric future. For instance, in a recent report, Tata Steel said increasing demand for ultra-low emission vehicles (ULEV) will drive growth in steel supply to the automotive industry by 4.2m tonnes in Europe alone.

In recent years, innovation, not to mention profits, in the automotive materials industry have been driven primarily by the need for lighter and/or stronger products that allow carmakers to reduce the mass of their ICE vehicles, thereby lowering their fuel consumption and carbon dioxide emissions. Lightweight materials have been key in early EVs too, such as BMW's i3 or Tesla's Model S (carbon fibre-reinforced plastic (CFRP) and aluminium, respectively).

With ICE vehicles, consumers are used to being able to drive several hundreds of kilometres before they have to refuel. To achieve a comparable range from a single charge of a BEV, a very large, expensive and heavy battery has had to be used,



“Reducing mass has a limited impact on extending range. For example, a 100kg reduction in mass only increases range by between six and 11 kilometres.” – **JEAN-LUC THIRION, ARCELORMITTAL**

meaning that carmakers have had to cut weight elsewhere in the vehicle. Will this always be the case?

“Yes, it is likely that electric vehicles have more incentive to lightweight than ICE vehicles,” states president of automotive at NanoSteel, Craig Parsons. “A battery always has a finite amount of power storage and therefore range, and reducing weight equals a direct increase in total vehicle range, which is the largest design hurdle faced by EVs. Batteries are very heavy and every pound saved in the vehicle will either make more room for a longer life battery, and/or a less powerful battery for the vehicle to travel a given distance.”

Jonas Adolfsson, business development manager, automotive, at SSAB, concurs. He says that regardless of the powertrain employed, the physics involved in a vehicle's movement remain the same. The resisting forces to motion are acceleration, rolling resistance, gradient and wind resistance. All but the latter are strongly influenced

by the weight of the vehicle. “Batteries have much worse energy density [Watt-hours per kilogramme] compared with gasoline or diesel powerplants, so I would say that lightweighting would be even more important,” he adds.

Jean-Luc Thirion, head of global research and development for automotive at ArcelorMittal, has a different opinion: “Reducing mass has a limited impact on extending range. For example, a 100kg reduction in mass only increases range by between 6-11 kilometres. To extend range it is much easier and less expensive to add more batteries. The impact of weight saving on top speed and acceleration is also negligible. A 100kg mass saving increases top speed by less than one kilometre per hour and reduces acceleration time by less than half a second.”

Berkhout agrees: “All vehicles should be as light and cost-effective as possible, but with current technology, hybrid and full electric-powered vehicles are 20-30% heavier. A lighter vehicle will extend the range a hybrid or full electric vehicle can achieve, but at higher costs. Will a vehicle manufacturer pay significantly more for the additional lightweighting for only a small increase in range?”

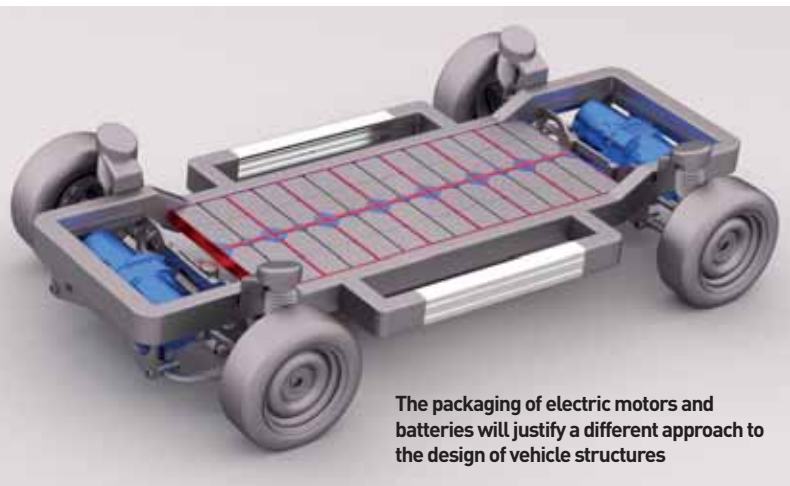
He uses the latest VW Golf as an example. The hatchback is available in petrol, diesel, hybrid and full electric variants, with the petrol kerb weight at 1,206kg, the diesel at 1,301kg, and the hybrid and electric at 1,615kg. The electric variant has a range of 300km. If 10kg of weight was cut from the body-in-white (BIW), it would only amount to a 0.62% weight saving, which would increase the range of the vehicle by just 10km.

Energy recuperation technologies already exist in BEVs, which help to extend their range. Furthermore, future developments in infrastructure must also be considered. A BEV may be charged overnight at its driver's home, could trickle charge wirelessly during a commute, and then automatically charge while parked at the workplace. In this scenario, a heavy and expensive battery pack capable of storing enough energy for a 300km journey without the need for recharging is redundant.

### Component packaging and vehicle structures

Should all of this be proved correct, then the steel industry has an ideal opportunity to re-assert its dominance in the automotive materials market. The electrification of drivetrains could create a host of new applications for strong and formable steels in the body structure of these vehicles.

Berkhout hypothesises that if the ICE is no longer packaged at the front of the vehicle together with the radiators, and the position of the front wheels is not dictated by the engine position, then the length of the front-end can be reduced. If the front-end is shorter, the length of crash structure is shorter, but it must absorb the same amount of energy in a frontal impact. This could require the use of a larger section of front rail, made from a higher grade of steel, and the surrounding BIW structure holding the front



The packaging of electric motors and batteries will justify a different approach to the design of vehicle structures



rail will also have to manage higher loads.

He continues: “With the battery packs mounted under the floor, the side impact load will also need to be managed differently. Today, in ICE vehicles, we have a sill or rocker reinforcements supported by the seat cross-members; these support the B-Pillar during impact. If the battery is positioned in the vehicle where the seat cross-members usually are, then the battery tray must be able to withstand side impact load. The Opel Ampere battery unit weighs over 400kg, and 70kg of this is structural battery tray. This also leads to changes to the rocker panels for supporting the battery tray and absorbing more load.”

Head of the application technology department at ThyssenKrupp, Lutz Keßler, agrees that the battery tray is an ideal place to target with high-strength steels. “The battery is the heart of an electric car and the most sensitive and expensive component, accounting for 30-50% of total vehicle costs. So, it’s all the more important to develop solutions to protect the battery that do not drive the costs for EVs even higher,” he states.

Jean-Luc Thirion adds: “Some products for hot stamping available today, such as [ArcelorMittal’s] Usibor 2000, can now reach a tensile strength of 2000MPa. Two decades ago, the maximum strength was only 340MPa, so this is a spectacular increase. Martensitic grades for roll forming and ArcelorMittal’s Fortiform range – the third generation of cold-stamped advanced high-strength steels [AHSS] – also have very high strengths. These steels allow vehicle designers to protect the cockpit and battery pack in an optimal way.”

Indeed, Tata predicts that European demand for advanced steels for the structure of these vehicles will increase by approximately 2.6m tonnes by 2050 as manufacturers look to save weight in cost-effective ways.

### Electrical steels for motors

Another key growth area for steel will be in the powertrains used in ULEVs, including electric motors and battery cells. Expected by Tata to account for a 1.6m-tonne increase in European demand for steel by 2050, these components will use greater levels of electrical and plated steels, respectively.



Electrical steel is an essential material in the construction of electric motors

whereas cylindrical cells are packaged within a nickel-coated ‘can’ and are likely to be the most common, especially in the immediate future, as they offer cheap energy storage, are reliable, relatively easy to manufacture and possess good mechanical stability. These are a good candidate when it comes to the use of electrical steels.

Steel producers predict that aluminium and CFRP will have a relatively low impact in these vehicles for several reasons. Firstly, they will remain prohibitively expensive. Secondly, they argue that steel demonstrates better mechanical properties – that it is stiffer than aluminium, has a much higher fatigue strength and is easier to form, join and paint over other materials.

“Despite the excellent property profile that steel offers, competition between materials will remain challenging,” says Keßler. “So, steel manufacturers must also continuously seek new and better solutions. At ThyssenKrupp, for example, we are working to close the gap between hot and cold forming by highlighting opportunities for cold forming offered by new ultra-high-strength dual-phase steels in the 1200 class. We have also recently developed a technology that – for ultra-high-strength steels in particular – eliminates spring-

“Despite the excellent property profile that steel offers, competition between materials will remain challenging. So, steel manufacturers must also continuously seek new and better solutions.” – **LUTZ KEßLER, THYSSENKRUPP**

Electrical steel is an essential material in the construction of electric motors, and the grades of electrical steel used can alter the performance of these machines. Tata believes this will become extremely important to carmakers as they look to differentiate their powertrains from those of their competitors. Higher performing electrical steels can improve the efficiency of motors, it says, which will help to either extend the range or increase the dynamic performance of the car.

Meanwhile, lithium-ion batteries – the energy storage solution currently favoured by most carmakers – are manufactured in three different battery cell formats: cylindrical, prismatic, and pouch. Prismatic and pouch formats are generally packaged in a non-ferrous casing,

back in the press plant, reduces material usage and ensures greater process reliability.”

Finally, it can be argued that aluminium and CFRP are less sustainable than steel when looking at the full lifecycle, which could be a major future driver in automotive. “Life-cycle assessment (LCA) looks at total emissions generated during the three stages of a vehicle’s life: production, drive phase and recycling,” says ArcelorMittal’s Thirion. Studies show that aluminium emits four-to-five times more greenhouse gases than steel over the full life cycle of a vehicle.”

Unsurprisingly, Berkhout reveals that Tata Steel is actively lobbying the relevant EU government organisations to introduce LCA for measuring vehicle emissions. \*

# Get your electric motor running

Mike Farish reports on the development and manufacturing of a promising innovation

**T**he rise of electric vehicles (EVs) and the need for new, efficient powertrain technologies has provided smaller companies with an opportunity to establish themselves as major players – particularly as component or sub-system suppliers – if they can offer genuinely innovative technology. One such company that feels it fits that bill is Equipmake, based in Hethel, a few miles outside Norwich, UK.

According to managing director and owner Ian Foley, the company offers a highly efficient and compact electric motor utilising a configuration in which the magnets are arranged radially, like the spokes in a wheel (described as a ‘spoke motor’). He concedes that the configuration is not completely new, but where the company feels it is breaking new ground is in its work to ‘productionise’ the design to make it capable of economical high-volume manufacture.

Equipmake is not a recent start-up. It has been operating for some 20 years, since Foley decided to set up for himself after gaining initial experience in the F1 world, including a spell with near-neighbour Lotus. The foundations for its current activities were laid in 2007 with the development of an electrical flywheel that featured in the kinetic energy recovery system (KERS) used by the Williams F1 team in the 2009 season. “That flywheel was effectively a high-speed electric motor and we learned a lot from it,” says Foley.

## Developed for volume production

The company’s initial product of this type, the APM120, was developed in response to an enquiry from a specific customer and was produced in low numbers, so a volume manufacturing capability was not required. Nevertheless, the performance of the device was good enough to gain wider interest and in 2016 the first prototype of a derivative device, the APM200, appeared. Foley says the aim was to take the performance benefits of the initial device “but to design it in a way that made it capable of being manufactured in volume.” The basic performance figures of the motor are that it weighs around 40kg, can run at 10,000rpm and has peak power/torque of 220kW/450Nm.

Foley notes that the crucial difference between the two devices, apart from general manufacturability, was improved in-operation cooling in the newer

version. “We don’t lay claim to inventing the spoke motor,” he says, adding that “there were manufacturability and cooling problems with existing designs and we have solved those” in the form of a water cooling system. “We pump water into the middle of the rotor and it is then routed in channels around the outside of the rotor and the back out,” Foley describes.

A key enabling feature of the motors is “a rotating water seal” and another important design factor is that the motor has a hub made from aluminium – a highly thermally conductive material. So, those two factors have been combined in a way that is mutually reinforcing. “We have put water channels in the hub to conduct away heat very effectively,” he explains. This means that the operating temperature of the motors can be kept to around 100°C – well below the melting point of aluminium.

Other benefits of using aluminium include its relatively light weight compared with steel as well as the fact that it is “easily machinable”. It also allows for the use of the cheapest grade of magnetic material – neodymium iron boron – in the motor. Nevertheless, Foley states, “they are still rare earth magnets.” However, as he explains, when magnets

are required to operate at much higher temperatures their material composition



The use of aluminium means the rotor hub is forged, rather than subject to time-consuming and expensive machining that would be required by the use of a non-magnetic steel





Equipmake's Ian Foley gained experience in F1 helping to develop the kinetic energy recovery system (KERS)

needs to be augmented with a further rare earth additive called dysprosium, which can significantly add to their cost.

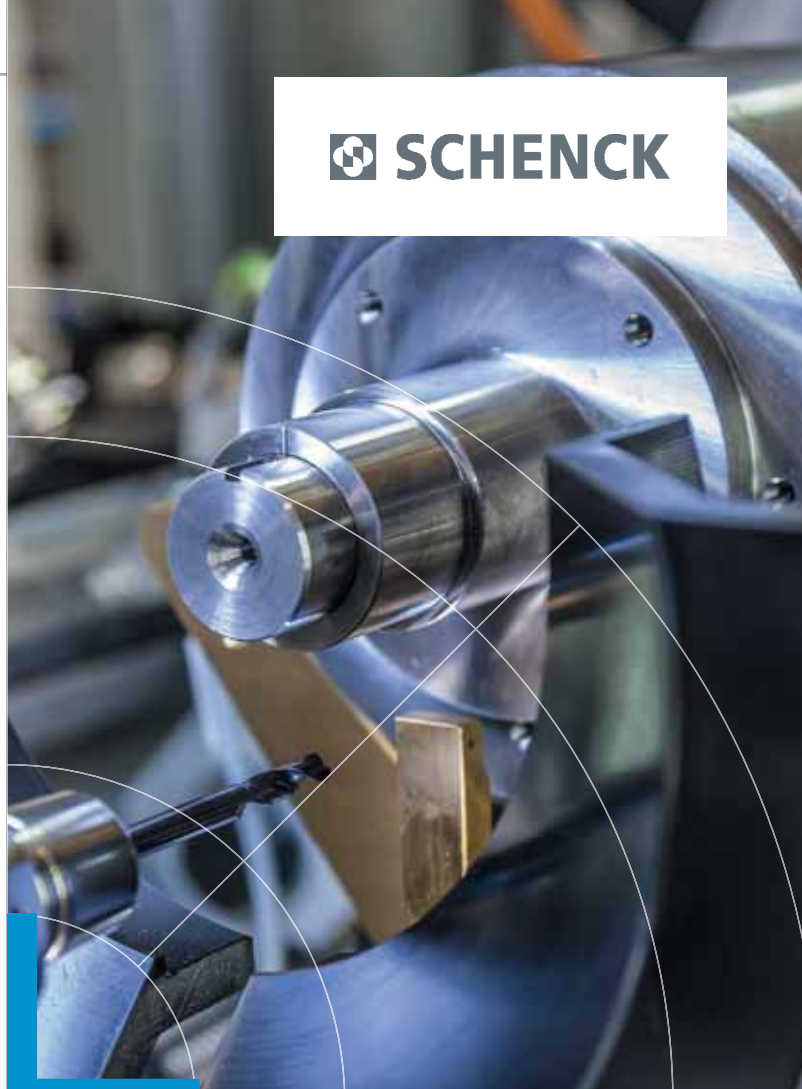
### Virtuous circle design strategy

Foley also confirms this approach is now patented. Without giving too much away, he adds that at least one aspect of the patent concerns the “detail design of the rotor” so that it provides sufficient strength to withstand the forces generated by high-speed rotation “even though it is easy to make.”

The use of aluminium means the rotor hub is forged, rather than subject to time-consuming and expensive machining that would be required by the use of the conventional alternative of a non-magnetic steel. As such, costs, material selection, low operating temperature and ease-of-manufacture are all achieved through an overall design strategy in which they reinforce rather than compromise each other. “It is a kind of virtuous circle,” Foley suggests.

The company has also developed some manufacturing processes to help with volume production. One example is a new way of winding the coils for the motors. Foley says the methodology has not been given intellectual property protection, but will instead be kept an “in-house secret.” This is coupled with a pragmatic willingness to buy off-the-shelf componentry where it makes sense. “We were keen to make use of existing manufacturing technology where possible,” he confirms.

Most electric motors already on the market use a radial flux design “so that, for things like a segmented stator, we can go to existing suppliers and get ones that are very low cost and very high quality.” Everything, he stresses, “is to our design” but wherever possible established, low-cost manufacturing techniques are involved. For instance, “the stator laminations are stamped.”



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The end result is a motor that is claimed by Equipmake to be “50% of the size and 80% of the mass” compared to more conventional counterparts. The proviso, Foley explains, is because direct comparison between different electric motors is complicated by the need to take account of whether continuous or full-load performance is involved.

The importance of this, Foley argues, is that in order to meet the combined targets for performance and compactness that automotive electric motors must achieve, there really is no feasible alternative to the use of permanent magnets. “We have carried out comparisons of our motor and non-magnet counterparts, such as induction or switched reluctance motors, and whenever we have done so those other motors have ended up about twice the size of ours for the same performance,” he states.

Even though such motors may avoid the costs of permanent magnets, Foley says the Equipmake device’s use of the cheapest grades of magnetic material makes that a much less influential factor than it might be otherwise. “The magnets in our device only account for about 15% of the final bill-of-materials by cost, so that is the maximum amount you could save for a device that would be twice the size,” he explains.



Equipmake employs a team of skilled engineers to support design, development and production of its electric motors

This has all been achieved through a concentrated focus on the use of internal resources. Foley says that, though the company employs just 22 people, most of them are graduate-level engineers and between them they provide all the technical knowledge necessary to develop the motors. “We’ve got people skilled in mechanical design, power electronics, controls and electrical design,” he states. As a result, “all the development has been carried out in-house.

But that development has not been carried out in isolation from real requirements, and Foley also confirms that Equipmake has been working with two OEMs in real applications intended for on-the-road passenger vehicles, albeit ‘supercar’, use. The identity of one of them remains strictly confidential and Foley cannot provide any information about them at all. The other, though, is Ariel Motor Company, based in Crewkerne, Somerset, UK. That company has chosen the APM200 as the main power source for a projected hybrid electric supercar, provisionally known as the Hipercar, first unveiled last year and due for formal launch next year with full production starting in 2020. In

addition, Equipmake has been working with an Argentine bus-maker to develop a powertrain utilising two APM200 units for that type of much larger but more sedate vehicle. All three projects, in fact, are due to go into full production round about the same time.

By then, of course, Foley and his team at Hethel will have completed their current efforts to turn the existing prototype production methods into ones capable of supporting much higher volume outputs. He envisages that will require a doubling of the current number of employees and the construction of a production facility housing a mix of CNC machining, assembly stations and final testing. In consequence, the hunt is on right now for premises that could house manufacturing operations on the necessary scale. Foley says something in the order of 20,000 sq.ft will be required, and confirms that the intention is to remain within the local area.

### Localised supply chain

Interestingly, Foley adds that, in a slight break with the company’s usual in-house practice, it has turned to an external consultancy service to help plan the projected new manufacturing facility in order to leverage specialist input in areas such as machine layout and process flow. The necessary supply chain, though, is already established and in some cases close at hand. “The suppliers we are using now will be the ones involved in volume supply,” Foley confirms, adding that the supplier for castings is very nearby in Bury St Edmunds, while forgings are produced in the UK’s main automotive city of Birmingham. Meanwhile, the stamping supplier is identified only as “one of the largest in Europe.”

Those three categories of component are probably the ones most crucial to achieving the company’s manufacturability targets. In more detail, Foley indicates that castings are used for the motor and gearbox housings, the rotor is forged in two halves and then machined, while the laminations for the stator and rotor are stamped.

Within the last couple of months, for instance, the company has taken delivery of its first cast housings, replacing the units machined from solid that have been used previously. The immediate aim, therefore, is to assemble a small number of motors using components, such as the housings and forged rotors, that will be used in volume devices, and then carry out appropriate validation testing.

“We are already building a durability test rig,” Foley confirms, adding that perhaps as many as 40 units may be required before the end of this year to support the full testing programme, which will also include test routines for shock and vibration, salt spray resistance and thermal cycling. Operations are expected to stretch well into next year.

The longer term target, though, is to ramp up manufacturing operations. This will enable the production of around “a thousand units a year” by 2020. But that figure is only likely to meet projected demand from the first three customers previously mentioned. When considering the rising demand in vehicle electrification across the world, and given what Foley describes as the wider interest the APM200 is attracting, he is confident the company will need to be meeting production targets several times greater within a few further years. \*



Sponsored by FOBA

# Fixture-free marking

At IMTS 2018, FOBA will showcase an innovation in direct-part laser marking that removes the need to hold components in a fixed position

**A**s Dr. Faycal Benayad-Cherif, business manager for software and vision at FOBA explains: “Today, in 95% of the laser-marking applications, automotive components must accurately be fixed to guarantee a proper alignment of the laser mark to the part.”

With FOBA’s innovative laser-marking solution, Mosaic, parts can sit in any orientation or position within the marking field. The new patent-pending software feature is a powerful advancement in vision-based laser marking. It speeds up device handling and laser-marking processes while drastically reducing overhead costs. The technology brings products up to market over a shorter cycle time while significantly reducing cost of development and engineering.

## Product integrity, reliability and traceability

Direct-part laser marking is being deployed for a wide range of applications in the automotive industry. Most components must be marked with traceability contents such as data matrix codes, serial numbers and other marks, e.g. decorative elements or illustrative symbols on backlit plastic panels for day-night visibility.

OEMs depend on marking systems to ensure the safe functionality and traceability of parts and products throughout their entire lifecycle. The marking procedure must be seamlessly integrated into the production process and ensure highly efficient, reliable and error-free marking.

FOBA laser marking systems, mainly based on fibre and UV-laser technology, offer advantages for an economic and reliable production process. FOBA uses imaging technology that covers pre- and post-mark verification as well as automated mark alignment. The integrated camera prevents marking errors, which is economically significant as parts get marked at the end of the production cycle, where errors can prove particularly expensive.

Dr. Benayad-Cherif answers the most important questions about FOBA’s innovative vision-based technology for fixture-less laser marking.

## How can FOBA’s laser-marking innovation best be described?

FOBA uses a concept based on through-the-lens vision combined with the tiling of images. The exceptional image simulates a straight-down view from inside the laser with an imaging field as large as the laser marking area. The straight-down view is critical as it eliminates the perspective



inaccuracies of external cameras. Within a second, the part, presented in the fixture-less mode of operation, is imaged, laser-aligned and laser-marked with precision.

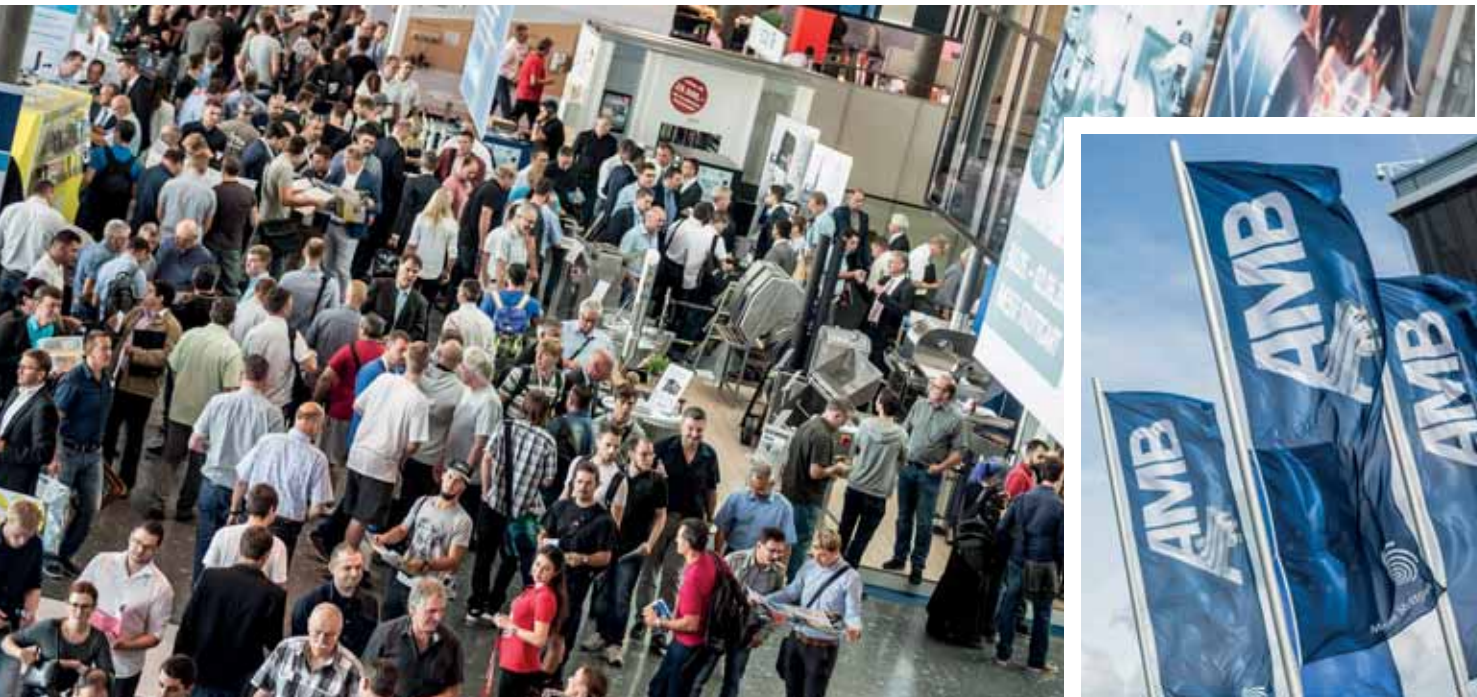
For automotive, the benefits are significant cost savings in the design, manufacturing and maintenance of industrial fixtures. It also offers faster and more consistent production throughput as parts can be marked accurately regardless of their placement under the laser. The ability to run mixed parts on the same conveyor and a reduction of additional hardware for re-orienting and repositioning parts also saves costs. Other advantages include faster reconfiguration of conveyor lines, a reduction or even elimination of fixtures completely and a lower maintenance schedule.

## What makes the new feature innovative?

FOBA’s mark alignment feature, with its integrated camera, solves various marking issues common to the market. To guarantee properly marked parts, the industry has, to date, relied on custom fixtures or custom vision systems designed to compensate for part placement inaccuracies. Fixtures are notorious for being expensive, due to the extensive design engineering time and maintenance required, and they typically work for one part only.

Common imaging solutions work well but still rely on some sort of low accuracy fixtures. Other approaches resort to an external camera pointing at an angle toward the laser-marking area to eliminate the motion. Even though fast, this approach introduces optical distortions and significant mark inaccuracies that can limit its use and flexibility, particularly when parts are not flat.

\* [www.fobalaser.com](http://www.fobalaser.com)



# Follow the digital way

**W**ith sales markets and machining utilisation showing healthy growth in Europe, investment in digitalisation is seen as an important factor to maximise efficiencies. As such, exhibition organisers have added a special show to the 19th edition of AMB, which runs from September 18-22 in Stuttgart. “With the new Paul Horn Hall (Hall 10), the special AMB show, entitled ‘Digital Way’ and the related Congress, we have created ideal conditions to make AMB 2018 even larger and better,” says Ulrich Kromer von Baerle, CEO of Messe Stuttgart.

Indeed, an additional 15,000 sq.m of space has been made available in the new Paul Horn Hall, with this year’s exhibition providing a total of 120,000 sq.m for 1,500 exhibitors to present their latest developments in equipment, tooling, systems and software. Organisers say the exhibition aims to act as a platform for providers and users to show the latest digital technologies. “Everyone is talking about digitalisation – in the Digital Way special show we will show



AMB 2018 will be spread over a total of 120,000 sq.m

how business and production processes can be optimised in very specific terms and what digital business models are available,” explains Kromer von Baerle.

## Digitalisation with practical relevance

Current studies are said to indicate that German companies see greater potential in digitalisation, and a group of surveyed decision-makers are optimistic that Industry 4.0 can help them achieve higher sales while simultaneously reducing costs. According to the organisers, these surveyed companies are expecting an average 10% increase in sales and cost savings over a period of three years resulting from higher productivity among employees and improved efficiency of machines.

“Mechanical engineering and plant construction in Germany is one of the strongest national industries, but also in an international comparison. This position must be strengthened and extended still further. This objective can only be achieved through a leading edge in digitalisation within the framework of Industry 4.0. ....,” says Kromer von Baerle.

“Exhibitors have confirmed to us that capacities in the industry are currently running at the highest level since 2008. Now would be the right time to make necessary investments,” adds Gunnar Mey, department director, Industry, at Messe Stuttgart.

In addition to an expert conference, which is being developed in cooperation with the Software and Digitalisation Association in the German Engineering

This year’s AMB industrial metal working show promises to be bigger than ever with digitalisation a key theme



Federation (VDMA), and a supplementary accompanying exhibition, showcases will demonstrate the interaction between networked processes in companies and explain the value they add.

The accompanying exhibition will feature manufacturers of software solutions in the areas of digital business models, digital production, digital product development, digital services and customer service, and software development, as well as service providers and manufacturers of hardware.

Further opportunities for interaction between Digital Way exhibitors, visitors and exhibitors at AMB and conference delegates will be available due to the extended opening hours of Digital Way on the first day of the exhibition, with an additional networking event.

“Companies want to know how Industry 4.0 and digitalisation of processes can be implemented. What providers have already successfully implemented projects? What applications or models are available and are relevant to the respective company? The Digital Way special show at AMB 2018 will enable us to bring solution-oriented supply and demand together,” explains Mey.

Commenting on its cooperation in the Digital Way special show, Prof. Claus Oetter, deputy managing director of the Software and Digitalisation Association in the VDMA, says: “Innovation in digitalisation is actually created by the synergy between IT and the software industry, and mechanical engineering and plant construction. In the digitalised world only industry can manufacture new products which are beneficial to producers and customers.

“Digitalisation permits entirely new solutions and business models for future products and services in industry. Whether in areas such as usability or user experience, the digital twin for simulation and commissioning, or machine learning for optimising machining processes and maintenance, the range of topics is enormous and also helps to increase customer loyalty.”

The German Engineering Federation will provide information on the spot about its numerous activities and will present new technologies during a live demonstration. These topics will also be examined more closely during an exclusive conference on digitalisation in production.

### More space, more innovations

With the increase in the exhibition space the topics in the exhibition areas will be restructured: machining tools and chucking tools will be presented in the L-Bank Forum (Hall 1) and Hall 3. Hall 4 and Oskar Lapp Hall (Hall 6) will focus on lathes and automatic lathes. Hall 5 will feature grinding machines, tool grinding machines and all related equipment and services. Alfred Kärcher Hall (Hall 8) will present innovations in sawing and cutting-off grinding machines, surface technology, marking systems, hardening and heating machines, lubrication and cooling, and safety and environmental engineering.

Halls 7, 9 and the new Paul Horn Hall (Hall 10) will round off the exhibition programme with milling machines, metal-removing process machine tools, measuring systems and quality assurance, as well as flexible production cells/ systems, machining centres, gear-cutting machines and drilling machines. Suppliers of control and drive systems, CAD/CAM/CAE and production software will also be found

from now on directly at the Entrance East and in Hall 2 at the entrance to the trade fair grounds.

### Focus on flexibility

While high-volume production dominates in the automotive industry, flexibility down to batch size one is the order of the day for commission manufacturers. Universal suppliers who serve all industries with a single product have long since become a thing of the past.

This fact is confirmed by drive and control specialist, Bosch Rexroth. As Hansjörg Sannwald, head market and product management, CNC Systems, remarks: “A high degree of flexibility is especially important in the automotive sector so that smaller batches can also be produced cost-effectively.”

Machine connectivity is the first step towards Industry 4.0. Accordingly, open interfaces to common real-time Ethernet protocols and OPC UA are becoming increasingly important. “In this connection, we support the standardisation of a new OPC-UA-based interface ‘Connectivity for Industry 4.0’, initiated by the German Machine Tool Builders’ Association,” he adds.

### Challenges for toolmakers

Andreas Enzenbach, vice-president, marketing and product management, at Mapal, sees the future in terms of digitisation requirements and more importantly, aiming for a zero-carbon footprint. In the automotive industry this means hybrid drives and all-electric vehicles, and new challenges. “Due to the high speeds involved in machining the housing for electric motors, maximum precision is essential,” says Enzenbach



**The industry faces a trend towards the use of materials that are increasingly difficult to machine and higher standards in surface quality**

Reiner Wendt, sales director for south Germany at precision toolmaker Paul Horn, says he’s not prepared to make any predictions as to the impact of electric vehicles in his industry. While all-electric vehicles reduce the number of machined parts, hybrid drives actually increase the proportion of parts that need to be machined. However, a trend shared by all industries is “towards materials that are increasingly difficult to machine, paired with higher standards in surface quality, narrower tolerances and the miniaturisation of parts,” notes Wendt. This calls for completely new solutions. \*

For more information visit [www.amb-messe.de](http://www.amb-messe.de)



# March of the machines

**E**very other year, the International Manufacturing Technology Show (IMTS) plays host to over 2,000 exhibitors showcasing their latest solutions to around 115,000 visitors. It is dubbed the largest and longest running trade show of its kind in the US, and will be marking its 32nd year in 2018.

As well as experiencing new technologies first-hand at the exhibitor booths, visitors are invited to attend educational conference sessions. There will be 69 in total, starting on Monday, September 10 and running through to the evening of September 13. They will touch on a wide variety of subjects, from processes such as laser sintering to new techniques that help manage workflow on production lines.

The key trends from 2016 – additive manufacturing, robotics, automation and digitalisation – will likely dominate the show again. However, one of the changes attendees may notice is the size of the additive manufacturing pavilion. According to the organisers, it will be three times larger this year with 56 exhibitors present, up from 21 two years ago.

## Exhibitor highlights

ATI Industrial Automation will showcase a variety of technologies, such as robotic tool changers, robotic collision sensors, utility couplers and compliance devices. It will also hold an interactive demonstration of its Axia80 force/torque sensor, which enables dynamic contour following in a simulated polishing application. The sensor measures all six components of force and torque with high resolution, stiffness and accuracy. According to ATI, this makes it ideal for robotic assembly, grinding, and polishing applications.

Robots and additive manufacturing technologies will arrive in large numbers at this year's International Manufacturing Technology Show, which takes place in Chicago from September 10-15

The surface treatment global business unit of BASF's Coatings Division, operating under the Chemetall brand, will be presenting two new products: Tech Cool 35058 and Tech Cool 35037. These are both newly launched, and part of the award-winning Tech Cool line of metal working fluids for metal fabricators. The company says they exhibit enhanced water tolerance and increased emulsion stability, while in-service cleanliness allows for long-term system life without the formation of heavy, tacky, water insoluble residues.

DMG MORI says its NHX 6300 2nd Generation provides a solution for flexible and efficient production in the automotive sector. The horizontal machining centre, which is produced locally in Davis, California, is equipped with a standard 12,000rpm, 75hp powerMASTER spindle with maximum torque of 595ft/lbs. There is also a high-speed, 16,000rpm spindle available and a high-torque spindle with 1,042ft/



ATI Industrial Automation will showcase technologies including robotic tool changers and collision sensors





Four EMAG machines will make their debut at IMTS, including the HLC 150 H

lbs of torque for heavy duty machining. The machining centre has space for pallets up to 25 x 25 inches, comes with a workpiece height of 51 inches and a maximum loading capacity of 3,300lbs.

EMAG will debut four machines to the North American market at IMTS this year, and will showcase several others. One of its latest is the HLC 150 H – a new horizontal gear cutting machine that the German company says can help lower production costs for gears and steering pinions.

EMAG will also show a new solution for the electro-chemical machining of rotor carriers, called CI 400. Rotor carriers are components of electric motor housings for hybrid vehicles and are being produced in increasing numbers. Electro-chemical machining, or ECM, offers decisive benefits for the production of these parts. With a variety of different features and functions, the company's booth will be evidence of its ability to provide solutions that fit a large range of applications.

A new laser marking imaging technology will take centre stage at the FOBA Laser Marking + Engraving booth ahead of its official market launch. It makes part fixtures redundant, which are usually required to keep the product in the intended position, speeding up device handling while drastically reducing overhead costs. Visitors can experience live presentations of how the automated mark alignment works with randomly positioned sample parts. The company will also show its M1000 marking system, which as a 20 Watt fibre laser, and the IMP imaging technology, as well as its M3000-R with rotary table and an integrated marking laser especially for precise paint removal on backlit components for day-night-visibility.

### Additive additions and others

As mentioned previously, additive manufacturing has a greater presence at this year's show. ATOS is one supplier adding to that presence, as it will showcase two new high-speed sensors. With an ultra-powerful light source, the company says both measuring systems achieve high-precision data in a short measuring time. The GOM data quality is evident in the detail sharpness of the 3D models – for example, in the precise display of smallest details, rib structures, narrow radii and hemmed edges.

Furthermore, both systems can be easily integrated into production thanks to interference-free data transfer via fiber optic cables, the independence of the surrounding system environment and the sensor-controlled monitoring of the calibration status. The systems reach their maximum efficiency in automated applications, such as the ATOS

ScanBox series. For example, an ATOS 5X in the ATOS ScanBox Series 8 accelerates a process by a factor of four when measuring and inspecting large and complex objects.

Also on display is Renishaw's latest SPRINT system with SupaScan, which the company says offers the world's fastest workpiece setup cycles and enables multiple measurement types to be performed with a single sensor, revolutionising the viability of on-machine probing. Visitors to the additive manufacturing pavilion will be introduced to Renishaw's latest additive manufacturing system, the multi-laser RenAM 500Q, which increases productivity in the most commonly used machine platform size.

In its goal to provide customers with the exact tools they need to increase productivity, KOMET will present its extensive portfolio of milling, turning, drilling, reaming and threading tools. This will include a number of new developments that help make machining especially efficient. The company says it has development teams permanently working on developing new precision tools and optimising the performance of the its product range.

Renishaw's high-productivity manufacturing cell, featuring integrated process control solutions, will demonstrate how high levels of automation and connectivity can be incorporated into CNC machining operations to improve productivity and process capability. The demonstration reflects closed-loop process control techniques, which Renishaw uses to achieve consistent, automated and productive metal cutting in its own production facilities.

Tornos plans to show a large range of technologies at its booth, from single-spindle to multi-spindle lathes, as well as its own 'Industry 4.0 software' which is dubbed TISIS. One of the highlights from the company will be the SwissDECO 36 – a new lathe making its US premiere. The company says it is equipped with optimised programming tools and ergonomics for quicker parts programming and fewer setups, making it suitable for use in the automotive, medical, electronics and aerospace industries. Three Tornos products will also be represented by Tornos' distributor, Methods Machine Tools.

Finally, Zeiss will be showing its recently expanded computed tomography (CT) line, which, according to the company, can allow companies that are active in various different industries to substantially improve production processes. It will also offer visitors the change to get up-close and personal with its CMM sensors and robotic sensor displays, while also showing its CALYPSO 2018 software – a CAD-based tool that allows users to measure tolerances of production equipment on a daily basis. \*



FOBA's laser marking machines will be on show at IMTS

For more information, visit [www.imts.com](http://www.imts.com)

# innovations

Showcasing the latest technologies and products in the companies' own words

## 3D focus-variation measuring instrument

Said to be suited to production measurement, the  $\mu$ CMM 3D focus-variation system offers users the advantages of tactile coordinate measuring technology with optical surface measurement to identify dimensions, position, shape and surface finish of components with the one optical sensor.

Alicona says it provides the ability to measure small surface features with sub-micron accuracy and in addition to geometric position, users are able to measure surface finish in the same measurement cycle.

The spectrum of measurable surfaces is said to include all common industrial materials and composites, such as plastic, PCD, CFRP, ceramics, chrome, silicon and so on, including matt and polished, reflective components.

\* [www.alicon.com](http://www.alicon.com)



## Compact welding robot

Designed for manufacturers with compact floor spaces that manage large workpieces, Fanuc says its ARCMate 100iD/10L is suitable for high-batch production lines where the quality and function of the weld are critical.

This robot has capacity for 10kg of additional tooling, such as welding torches and offers a footprint of 343mm x 343mm. It can be mounted either upside-down or at an angle and all cables and welding hosepipes are routed internally.

Fanuc says the robot features integrated software and its R-30iB Plus controller can guide an operator through set-up and programming.

\* [www.fanuc.eu](http://www.fanuc.eu)

## Scan system for mass production

The excelliSCAN system features a SCANahead servo control and galvanometer scanners with precise digital angle sensors, says Scanlab.

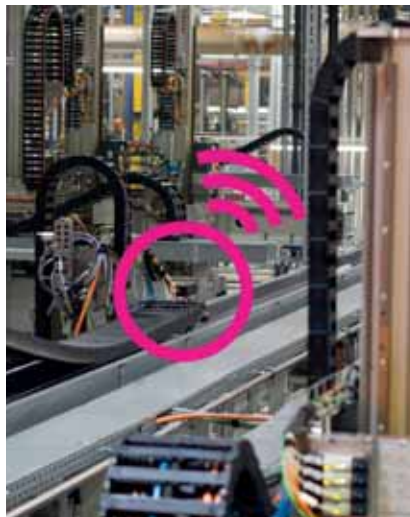
It is claimed the scan head is able to autonomously calculate its own control parameters and anticipates in real time the optimal navigation of curves.

The company says that integrated functions like online status monitoring or acquisition of operating times and process data allow integration into networked structures, and also retrospective process analysis.

\* [www.scanlab.de](http://www.scanlab.de)



## Improving plant safety with smart plastics



igus has been developing its family of smart plastics with improved 'isense' sensors and monitoring modules that add intelligence to energy chains, cables, linear guides and slewing ring bearings.

The company claims these will measure wear status and alert the user early enough to plan repair or replacement.

The new modules are equipped with a serial interface and are claimed to be able to be integrated into a control cabinet. A data logger allows these values to be stored on an SD card.

The company says there are various options for integration into the customer's own infrastructure, including allowing the 'icom' to send the data from the sensors to a PC or integrate the data via the computer into the customer's existing software environment and intranet solution.

\* [www.igus.co.uk](http://www.igus.co.uk)

## Tychem personal protection equipment



DuPont now offers Tychem garments, including gloves, to help provide workers with the protection required in hazardous environments.

To enable users to select the correct garments and gloves appropriate to chemical exposure hazards, the company has its SafeSPEC personal protective equipment (PPE) selector tool.

The Tychem gloves collection consists of 13 gloves in all.

\* [www.dow-dupont.com](http://www.dow-dupont.com)



## New door latch to improve quality and feel

Magna says it recently developed the Comfort+ door latch to improve both the feel of a car's door when opening and closing, and the quietness of the cabin.

This design is said to turn sliding friction into rolling friction within the mechanics of the door latch, reducing the efforts required to open and close a car door and allowing for the increase of sealing around the door.

Magna says it has secured its first production contract to supply the new type of latch to a European automaker.

\* [www.magna.com](http://www.magna.com)



## Fibre laser cutting of large sheet material

Bystronic says its new BySprint Fibre 12020 laser cutting system is capable of processing sheet up to 12 metres long by two metres wide.

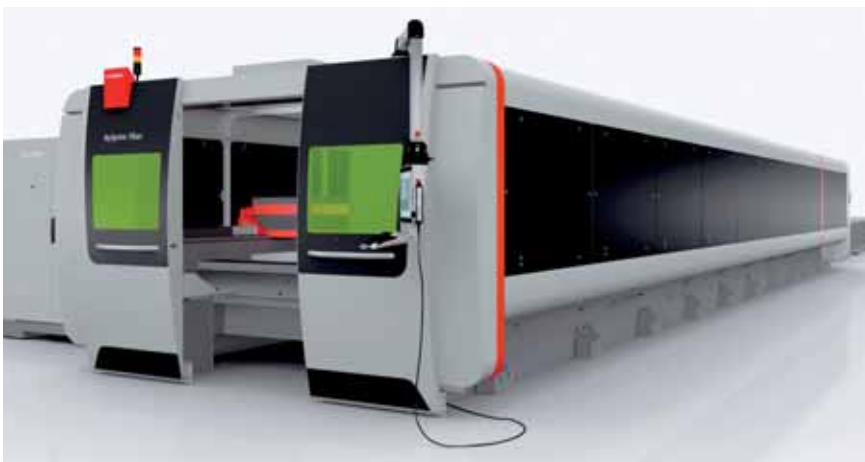
The company claims the machine is able to cut both large and small components, the smaller sheets processed by positioning them next to each other on the long cutting table.

This can extend uninterrupted production

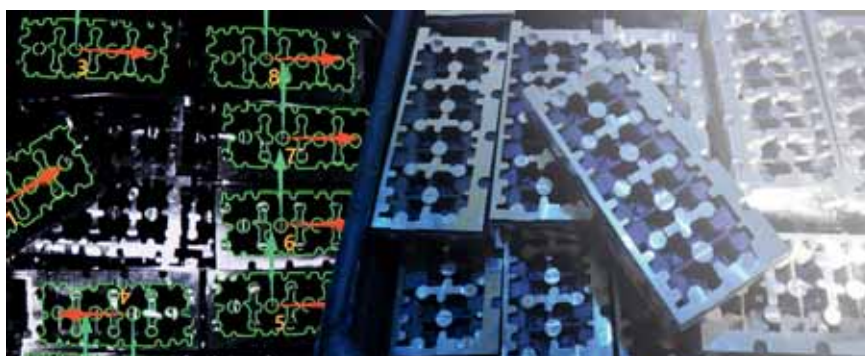
time compared with smaller machines and offers more efficient nesting, resulting in higher material utilisation.

The machine features proprietary BySoft 7 software and offers 3, 4 or 6kW laser sources depending on the intended applications.

\* [www.bysprintfiber.bystronic.com](http://www.bysprintfiber.bystronic.com)



## New sensors for touch and automate system



Isra Vision says its MONO2½D- and MONO3D 'Touch & Automate' sensors will now be equipped with embedded technology to speed up scanning times. The company is preparing a generation of connective sensors that can be navigated with smartphones or tablets and offer easy usability.

It is claimed these sensors will also be able to connect to a sensor network for communication with each other or databases, and will be able

to receive updates via Wi-Fi to adapt to their respective tasks.

The company says that by determining the object's distance and its rotation around the vertical axis (MONO2½D) or all the spatial dimensions including all rotations (MONO3D), the sensors allow for automated execution of pick-and-place tasks and 3D object recognition. Both systems use contour based detection.

\* [www.isravision.com](http://www.isravision.com)

## Robotic materials handling for industrial saws

Kasto claims it can implement combined storage and sawing systems for its customers in which all processes are automated, from storage of the raw material to retrieval of the cut parts.

The control software can be linked to existing ERP systems offering improved transparency and efficiency. Also the sawing can be integrated with other processes like turning or milling within a digitised, Industry 4.0 production environment.

The company notes that end-of-arm tool selection is an important factor and users have a choice of mechanical, magnetic or vacuum grippers, which should be as compact as possible to give the robot easy access to the cut parts.

\* [www.kasto.com](http://www.kasto.com)



## Slim nozzle torch body

A new torch body for robotic welding devices, from Fronius, features the MTB 350's gas nozzle, which has a diameter that is claimed to be 20% smaller than conventional torches.

The 20mm nozzle allows the welding torch to reach the interface more easily when working with challenging component geometries, and offers a high duty cycle at maximum output, says the company.

It is claimed the new torch body can be retrofitted to TPS and TPS/i robotic welding devices and it is available in various geometries (22°, 36° and 45°), including a longer torch body variant suited to the typical design of robotic welding torches used in Asia.

\* [www.fronius.com](http://www.fronius.com)



# more innovations...



## Triple-edge cutting for small series

Mapal is expanding its triple edged Tritan-Drill range, which now includes a new universal version, made from HSS, that has been developed for cost-effectiveness in small-series production. The company says this tool offers stable cutting edge corners, reducing

the chance of damage to the cutting edge and, it's claimed, higher feeds and longer tool life in operation.

Mapal notes that piloting and centre-punching aren't required due to the point geometry of the drill, and that it is available in a diameter range of 8mm-40mm.

\* [www.de.mapal.com](http://www.de.mapal.com)

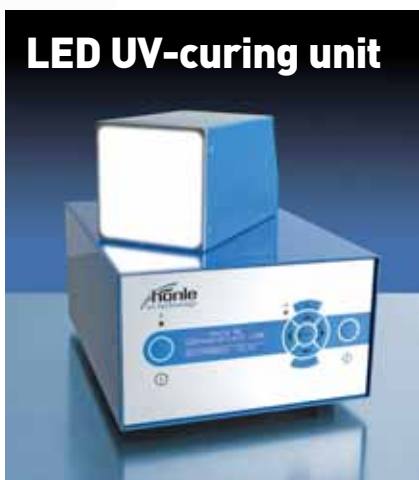
## Press lines for EV components

Schuler says it now offers systems for the economic serial production of components for E-cars, including body and structural parts, metal housings for batteries or electric motor laminations for engines.

It has developed a high-speed press to produce thinner laminations for the increasingly complex geometry of electric motor laminations.

Schuler says it has also extended the press bed of its e-mobility press SMARTLINE EV 3.8 from 3.30 to over 3.70 meters to allow for a larger die space needed to accommodate bigger diameter electric motors.

\* [www.schulergroup.com](http://www.schulergroup.com)



## LED UV-curing unit

The LED Spot 100 HP IC has been developed for all applications requiring intensive UV irradiation over a large area, claims Höpfe.

The company says applications include bonding, fixing or encapsulating of components. At a wavelength of 405nm the unit gives an intensity of 2,000mW/cm<sup>2</sup> and 460nm gives 3,000 mW/cm<sup>2</sup>, which is claimed to guarantee a reliable and fast cure to speed up the manufacturing process.

It features a monitoring function to deliver process stability so that repeatable results on fully automated production lines can be achieved even in short cycle times, says the company.

The LED Spot 100 HP IC is also available in the wavelengths 365, 385, and 395nm and has an irradiation area of 100mm x100mm.

\* [www.hoenle.com](http://www.hoenle.com)



## Manufacturing execution system

Lantek says its MES Manager manufacturing execution system allows engineers to upload a bill of materials for the products being manufactured, including parts and subassemblies.

The company claims the full sequence of operations required for the manufacture of each part or subassembly is stored within the MES system.

The system can use standard touch-screen computers or tablets (via Lantek MES Wos) for data capture and to provide operators with details of the sequence of manufacturing operations.

Lantek says links to the machines record start and finish times for cutting, while for other tasks



employees can log on to jobs and operations recording the progress of each part around the workshop.

\* [www.lanteksms.com](http://www.lanteksms.com)



## New five-axis horizontal machining centre

The HF 3500 is a new model to Heller's five-axis, horizontal-spindle machining centre range.

The company says this machine is intended for five-sided or simultaneous five-axis dynamic machining of medium to large batches of complex prismatic parts, ranging from small workpieces to heavier components up to the 550kg maximum table load.

An optional Speed Package is said to allow 10m/s<sup>2</sup> acceleration and rapids of 90m/min to be achieved. The machine can be equipped

with a lift-and-rotate pallet changer for series five-sided production, while pallet automation solutions are available.

The company says four motor spindle options are available with speeds up to 18,000rpm and torques up to 354Nm, and the HF series machines are equipped with a Siemens Sinumerik 840D sl control and a double pivoting main operator panel with a 24-inch touch screen.

\* [www.heller.biz](http://www.heller.biz)



## Die-cut structural tape for bonding magnets



Lohmann Technologies says its DuploTEC structural bonding tape has been specified for the bonding of magnets direct onto an oil pump drive shaft and also to bond magnets onto shafts inside electric motors.

A pump manufacturer bonded the transducer magnet to the shaft, using the company's DuploTEC 10410 SBF (Structural Bonding Film), and found that all the required shear and tensile strength parameters had indeed been met, claims Lohmann.

In another application, a manufacturer of electric motors specified DuploTEC precision die-cuts, again for mounting magnets onto the end of a shaft, this time inside one of its new ranges of motor. Particular attention was paid to durability given the thermally dynamic environment in which the magnet is used.

\* [www.lohmann-tapes.com](http://www.lohmann-tapes.com)

## Compact, high-precision true colour sensor

Micro-Epsilon's new range of colour recognition sensors is designed for high-precision true colour measurement in industrial applications.

The new colorSENSOR CFO100 and CFO200 true colour sensors are said to be suitable for a range of industrial applications including colour inspection of interior automotive parts.

It is claimed the sensors offer high colour accuracy (colour difference CFO100  $\Delta E \geq 1$  / CFO200  $\Delta E \geq 0.6$ ), good reproducibility ( $\Delta E \geq 0.5$  / CFO200  $\Delta E \geq 0.3$ ), high light power (>220 lm) and a fast measuring

rate (up to 20kHz), which is said to enable the sensor to reliably detect the finest of colour graduations, even in high-speed measurement tasks and on low-reflecting surfaces.

\* [www.micro-epsilon.co.uk](http://www.micro-epsilon.co.uk)



## Gapgun solution for centred countersink measurement

A new countersink measurement solution for Third Dimension's GapGun range is said to calculate the dimensions of a countersink hole to accurately predict the flushness of fasteners.

The company says this new countersink inspection system is faster and more accurate than a mechanical gauge. Tolerance bands can be pre-set, the measurement is recorded against these and then the result can be read onscreen or automatically sent to a PC to enable comparison and analysis.

\* [www.third.com](http://www.third.com)

## Vice for cylindrical or prismatic parts

The PC80Z self-centring vice is available in a new, two-in-one version that accepts the manufacturer's optional round inserts, enabling cylindrical components or billets from 44 to 95mm in diameter to be clamped securely, says Roemheld.

The company says the vice can be converted back within a couple of minutes

to its conventional role of holding prismatic components. Parts from 17 to 139mm long can then be secured for metalcutting using the 62mm clamping stroke. It's claimed to be suited for use on 5-axis machining centres and in automated production cells employing pallet magazines.

\* [www.roemheld.com](http://www.roemheld.com)

## Compact compressors

Gardner Denver says its new oil-lubricated, rotary screw compressors, part of the CompAir L-Series range, are available as 30, 37 and 45kW models, and are offered with both fixed and regulated speeds.

These units are said to be capable of delivering compressed air in pressure ranges from 5 to 13 bar and volume flow between 1.33 to 8.67m<sup>3</sup>/min.



All compressors are powered by an IE4-IP55 motor and drive system featuring a new, improved filter design. These new models also feature the new Delcos XL SE touch-screen control system, and are fully integrated with iConn, the company's cloud-based air management platform.

The company says these units can be monitored remotely too, so operators can ensure any potential issues are quickly resolved.

\* [www.gardnerdenver.com/en/industrials](http://www.gardnerdenver.com/en/industrials)

## Hot work tool steel

Deutsche Edelstahlwerke (DEW) says it has developed the hot work tool steel Thermodur 2383 Supercool for press hardening applications such as those used in the automotive industry.

The company says this tool steel, in quenched and tempered condition, offers a higher thermal conductivity of 44 W/(mK) at 100°C.

As such, a die insert made of this steel is said to be able to conduct heat from the heated sheet in a controlled manner within a short time.

In addition, it's claimed to be more resilient at consistently high temperatures, which is expressed by the lack of loss of hardness.

\* [www.dew-stahl.com](http://www.dew-stahl.com)



# ams september-october 2018

## OEM focus – Toyota

AMS looks at Toyota's production challenges after the company revealed plans to bring ten pure electric models to market by 2020 and electrify its entire portfolio five years later while also introducing a new vehicle architecture



Toyota recently said it would invest \$170m in its Blue Springs plant ahead of the launch of the new Corolla

## global focus – Central Europe

We report back from our travels around Central Europe during which we gained exclusive access to several vehicle manufacturing facilities



We get an inside look at several large plants in the region, including the Volvo Trucks facility in Kaluga, Russia

## production – motorcycles

The latest research from market consultants shows that the global motorcycle market is growing. AMS provides an insight into production at some of the active companies in the segment



We visit BMW's motorcycle production facility in Kaluga, Germany

## technology – digital manufacturing

Rapid prototyping and sophisticated software are playing an ever-greater role in the process of making cars and their components



Software programmes are helping many OEMs reduce the time between initial design and physical prototypes

## environment – recycling & waste management

Vehicle manufacturers are not just looking to reduce tailpipe emissions, but are examining ways to make production more sustainable and environmentally friendly



Recycling, waste management and renewable energies are key to emission reductions in manufacturing

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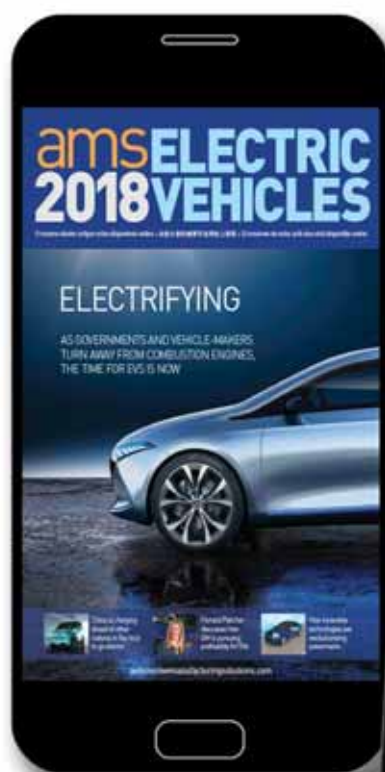
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A ballerina in a dynamic pose, wearing a dark orange leotard, is the central figure. Her arms are extended, and her body is arched. The background is a swirling, ethereal mix of orange, red, and blue light trails, resembling fire or smoke. The overall mood is one of resilience and grace.

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