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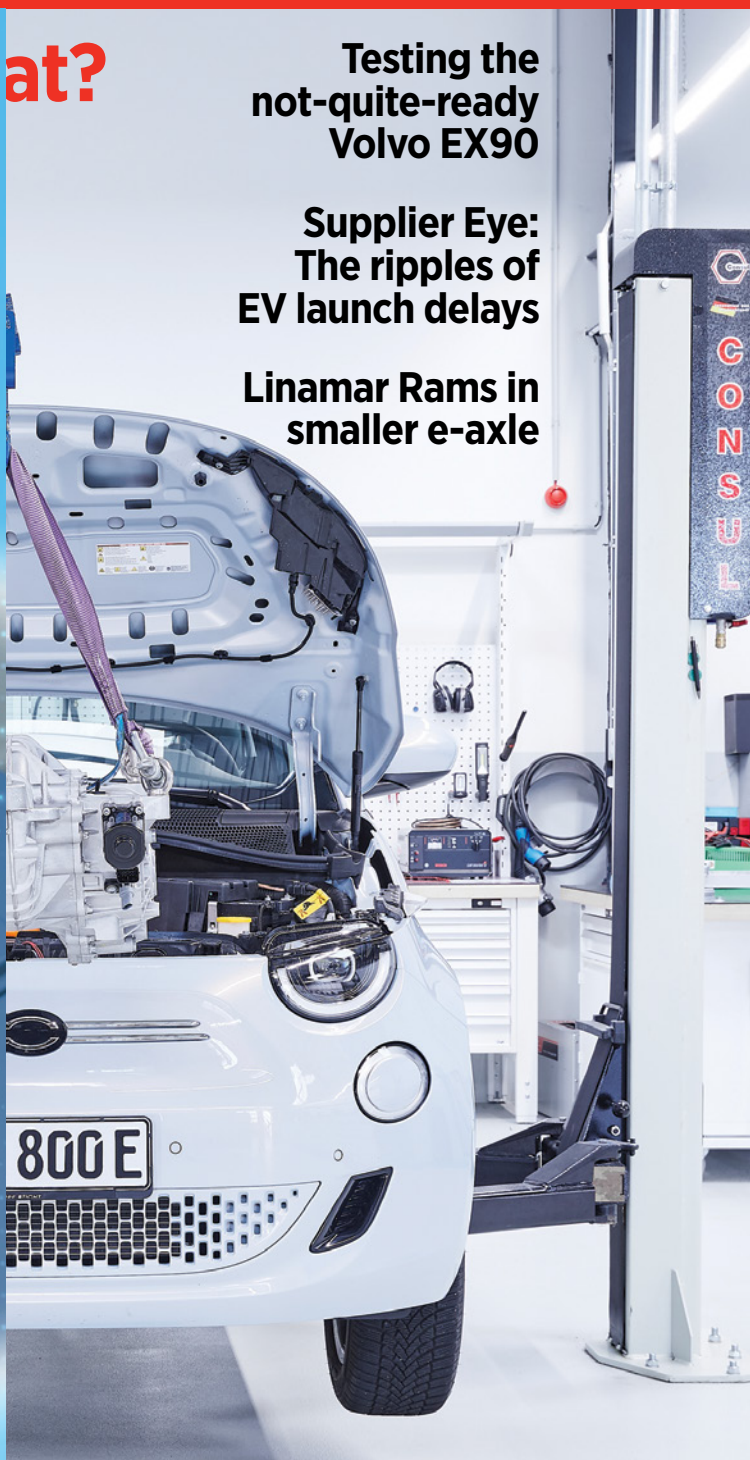

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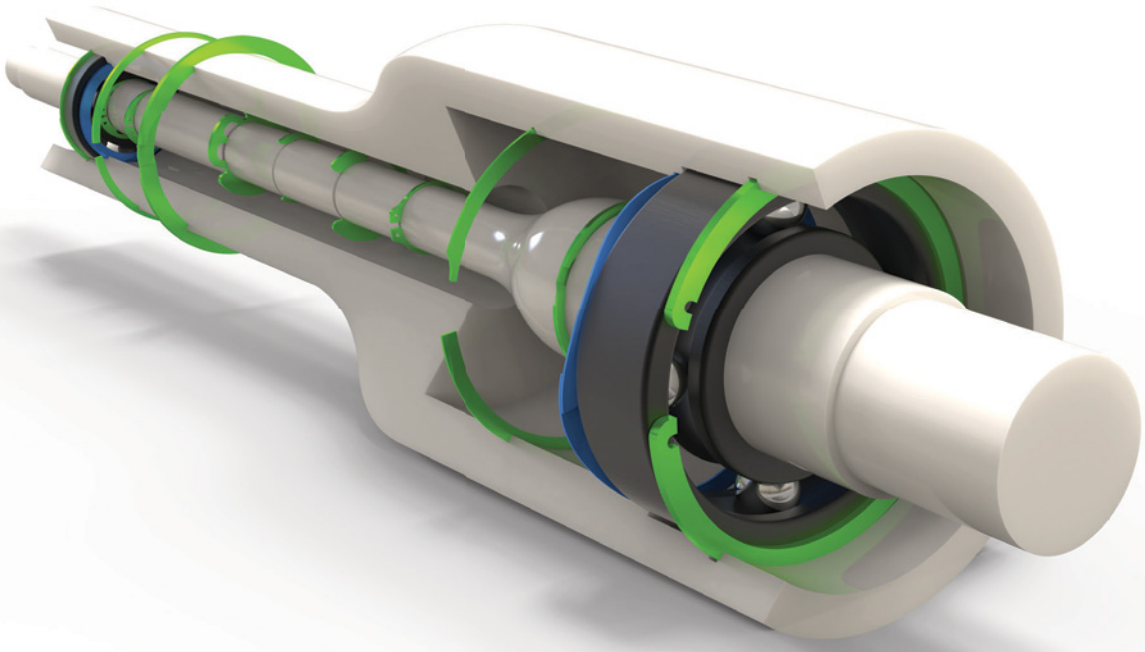

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ON THE COVER

One big way to make an EV more efficient is to get its traction motor to run cooler. We take a look at emerging thermal management technology. (Image: GKN)

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EDITORIAL

Reader comments worth sharing

We don't get a gigaton of reader letters here at *Automotive Engineering*, but our inbox hasn't been a total spider's nest during the first year of my tenure. I asked for contributions and comments when I took the reigns, and wanted to check back in with some of the readers who sent in their thoughts.

First off, thank you to everyone who suggested topics or stories to cover. From NEF flow battery technology to materials advances to incredibly specific topics outside of our scope, we do appreciate the ideas. Some have already led to published stories, and you can expect to see more in the months ahead.

We also had a reader ask about our method of presenting imperial and metric measurements. They wanted us to always put imperial units first because, "inches, feet, yards, miles, pounds and degrees Fahrenheit make more intuitive sense to me." As a publication based in the U.S., it does indeed make sense for us to put imperial measurements first, and that's what we usually do. The one exception is when the number is something quoted by a company. In this case, we put the quoted number first, as we do not want our conversion to introduce any confusion to the stated claims.

Mostly, though, I want to give some space to a reader who wrote in on the SDV discussion we've been having. Here's some of what he wrote (lightly edited):

I am a mechanical guy and "feel" a bit offended by describing a vehicle as "software-defined." I understand that it comes from the increasing role of software in a vehicle, but without mechanical and E/E hardware, software is nothing. I really see the positive effects software can bring into current day's products, but if I was able to establish the right wording or abbreviation, I would propose "SEV" or "Software Enhanced Vehicle." In my opinion, that would meet the reality much better. I would see, even more, the term "Hardware Defined (and) Software Enhanced Vehicle" (HDSEV). That would not over-emphasize the software, but that would meet the core of today's vehicles. If you develop bad hardware (mechanically or electrically), you will not be able to have a better vehicle than one with good hardware (assuming comparable software). I know that "SDV" is an industry-wide term that has been established, but it somehow does not appreciate the role of the hardware and all the people developing it.

I'm a mechanical guy and 'feel' a bit offended by calling a vehicle 'software-defined.'

I understand that a Level 4 or 5 SDV/SEV could use the same (updated) software across several vehicle hardware generations. In the smartphone world, often suggested as a "good example" of where cars need to go, we see another direction. There, we have extremely short cycle times for hardware and for each SW generation, we see new hardware, which seems to not really be sustainable. In my opinion, we need to develop reasonable hardware platforms (with sufficient calculation power and maybe even upgradable computation units) so that SW may unfold its full potential for several years and no one needs to dump their vehicle because a new SW version needs better hardware to be installed to keep the car secure.

Thank you for writing in. I look forward to reading and sharing more of your thoughts. Since I didn't say this last time, please mention in your letters if you'd be fine with me sharing your name should we publish it. For that reason, I didn't include any names above.

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A New Planning Dynamic

The impact of the upcoming U.S. federal election, global trade turmoil, a mediocre U.S. economy and the slumping ICE-to-EV (internal combustion engine to electric vehicle) transition must be considered. In my last column, we explored the growing use of scenarios to provide guardrails for future strategy. Suppliers can no longer rely upon a single forecast to drive future planning.

The main culprits clouding the planning environment are program delays, rescopes and EV strategy shifts accompanied by the extension of ICE/hybrid models. The trajectory of EV launches and new offerings is decidedly ahead of the skis of consumer acceptance. This supply-and-demand mismatch is an ongoing challenge. It is important to understand the severity of program changes amid this slowing EV growth environment.

Level 1: Minor Retiming or Launch Curve Shifts

Our industry has experienced multiple-week delays in production starts (also dubbed SOP, or start of production) for decades. There are thousands of parts and processes to line up, as well as the timing of marketing and sales programs, to launch in concert. A short delay can be an unwelcome, though common, reality. Additionally, OEMs are also known to stretch launch curves due to restrictive part output or new process challenges.

The upstream impact of a short delay or launch curve shift within the supply base is usually minor. Most OEMs can make up the volume within the first production year with overtime or improved production efficiency. When EVs are considered, though, most launches thus far have not followed the expected launch plans. Within the supply base, this is a new and unwanted standard.

Level 2: Multiple Month Delays & Elongated Launch Curves

Of late, there have been more multi-month delays in EV programs than anyone expected.

Michael Robinet
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When EVs are considered, many launches thus far have not followed the expected plans. Within the supply base, this is a new and unwanted standard.

While there have been ICE offerings that have slipped their launch date by multiple months in the past, the industry has grown accustomed to ICE launches taking place as expected. The EV launch experience has, unfortunately, been completely different. The lack of consumer enthusiasm for EVs and upstream launch readiness (both OEM and supplier) has driven multiple late-timing changes, many within a 12-month window of the expected launch. This critical industry no-no underscores an increase in stranded capital and negates the ability to pivot elsewhere.

Slow launch curves and reduced capacity planning volumes (CPVs) from OEMs are significantly altering supplier profitability and facility utilization performance. The combination of reduced program volumes and substantive timing delays is new and unwanted territory.

Level 3: Wholesale Strategy Shifts

There have been several well-publicized multi-year delays in ICE to EV conversions at many OEMs. In some cases, these changes have been 12-18 months before SOP. These strategy shifts have ranged from reversing course on announced investments from ICE to EV production (Ford's Oakville facility, for example) or OEMs announcing multiple-year SOP delays for EV and battery production projects. From a supplier perspective, due to lead times, many had already prepared existing or new feeder plants per the earlier timing structures. This extreme exposure to stranded capital is a troubling development, especially for smaller suppliers deeper in the tiers without the financial flexibility to pivot.

Additionally, the opportunity cost of instead pursuing programs with more stable volumes while launching on time is key. The industry is learning several valuable, albeit expensive, lessons through this ICE-to-EV transition. Hindsight certainly is 20/20. ■

INSIDE STORY

Adhesive technologies have been supporting the automotive industry for more than 60 years, explains Andreas Lutz, Global Technology Director, DuPont in this interview. These technologies help make vehicles stronger, lighter, safer and more comfortable. But not all adhesives are created equal. DuPont Centers of Excellence and in-house advanced engineering capabilities help accelerate solutions from concept to commercialization for body structures and electric vehicle battery assemblies. We welcome working together with customers to develop solutions that support mobility for today and tomorrow.

Automotive Engineering: **You've stated that not all adhesives are created equal. What sets DuPont adhesives apart?**

Andreas Lutz: At DuPont, our capabilities set us apart. The key differentiator between specifying a material and specifying a solution is advanced engineering. Experts at our COEs, technical and R&D centers worldwide concentrate on specific challenges that can be addressed by disciplines that allow for:

- Accelerated assessment of important factors like reliability, performance, cost optimization, time-to-market and consumer appeal (safety, comfort, durability, long service life)
- Fast application development to help validate individual new concepts or refine existing ones in concise timeframes

AE: **Why is having in-house capabilities important to you?**

Lutz: The automotive landscape is very dynamic. Customers are always looking for ways to accelerate solutions to the market and we want to gain their confidence in working together to solve their biggest challenges. Having in-house expertise allows us to do that. Formulation of a great product is just one important element. Making sure the formulation suits the desired characteristics of the application and can be validated to perform over the lifetime of the vehicle is crucial for a successful outcome.

AE: **What kind of methodologies do you use to support application development and concept validation for your customers?**

Lutz: We have in-house capabilities and use the same methodologies as OEMS and Tiers including:

- Ideation enhanced by VR, AR, 3D printing and prototyping
- Application testing (electrical, safety, thermal, mechanical, rheological)
- Analytical lab (tomography, thermal conductivity, electrical properties, elemental analysis, chemical separations, thermal and thermomechanical characterization)
- Advanced simulation tools for design and correlation analysis (CAE/CAD)
- Scale-up pilot plant capability – including optimization of process efficiencies that make our solutions high-volume manufacturing/assembly capable using industry standard equipment

AE: **What kind of engineering principles do you apply to your adhesive technology and material science expertise to develop the right solution for customers?**

Lutz: We want to help ensure that all our solutions deliver on the performance our customers desire and that consumers demand. To that end we utilize:

- Advanced material testing
  - Advanced mechanical characterization specifically suited for engineering analysis
  - High-rate testing
  - Fracture mechanics
  - Fatigue and durability
- Advance CAE
  - Material model parameter identification and correlation
  - Development of advance simulation codes
- Component design and rapid prototyping
  - 3D printing to prepare parts and mockups to demonstrate adhesive application and benefits
  - CNC router to prepare samples and prototypes
- System level engineering
  - Full vehicle system level analysis
  - Battery assembly and thermal management engineering
  - Aftermarket windshield repair drive-away optimization

AE: **What are some current focuses for you?**

Lutz: DuPont adhesive technologies have been market leaders for glass, structural, elastic and multi-substrate bonding of vehicle components and structures for decades. That know-how uniquely allows us to continue to deliver excellence in body structure assembly while utilizing our expertise for some of advanced mobility's biggest challenges in battery assembly and battery thermal management.

We can help build a better battery by using adhesive technologies to provide battery case structural integrity, durability, ease of cell-to-cell, cell-to-pack and other bonding configurations, and sealing options that allow for ease of serviceability. And, we formulate and test our solutions to include electrical and thermal-conductive properties to help ensure safe operation while achieving faster charging, longer range, improved hot and cold weather performance, increased reliability, durability and longer service life.

To learn more about how you can utilize our Centers of Excellence and Advanced Engineering capabilities to dEVelop with DuPont, please visit **https://www.dupont.com/mobility/innovations/centers-of-excellence-automotive-electrification.html**.

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PROPULSION

It's nearing primetime for off-highway hybrids

Cost and battery-packaging constraints prevent John Deere from fully electrifying the 944 X-Tier wheel loader used for a variety of quarry applications.

Vocational off-highway vehicles are piling on the miles with power provided by an internal combustion engine (ICE) with additional hybrid technology. "We often get asked the question, especially by those outside the industry, 'Why don't we just electrify everything?' The reason is the current challenges we have with battery-electric vehicles," Grant Van Tine, product manager for electric vehicles at **John Deere**, said during a webinar hosted by SAE Media Group.

Van Tine and Mihai Dorobantu, **Eaton Mobility Group**'s director of technology planning and government affairs, cited facts, figures and in-field and in-development examples of why hybrid innovations are especially relevant today in a session addressing "The Future Role of Hybrids in Off-Highway Vehicles."

Since 2015, the John Deere 944 X-Tier electric-drive wheel loader has showcased hybrid technology instead of an all-electric powertrain, and with good reason. "Even if we were able to package enough energy onboard, which would make the machine extremely larger than what it is now, a 54,000-lb (24,500-kg) battery pack is not something that can be packaged within the current vehicle frame," Van Tine said.

An all-electric version of today's 944 loader, according to Van Tine, would need to be charged multiple times during a typical day's 12-hour shift. A fully electric version would also cost three to four times higher than the current hybrid machine. "That's just not practical or feasible for anyone," he said.

Deere's hybrid setup

The current 944 X-Tier wheel loader's powertrain uses a John Deere 13.5-L diesel engine producing 536 hp (400 kW) that runs at either a limited speed range or a constant speed. The output shaft connects to a gearbox that houses the hydraulic pumps and two generators, which convert the engine's rotational energy into three-phase AC electrical energy. There is no mechanical transfer of power. Each wheel's electric motor converts the AC power back to rotational energy and torque in the final drive. Power electronics control the commands to the drive system based on operator input.

Recaptured energy is recycled into the system in certain situations, Van Tine said. "In certain applications, such as truck loading, we've seen up to a 33% reduction in fuel consumption compared to a conventional diesel machine," he said.

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JOHN DEERE

"We can deploy a large fleet of hybrid vehicles as an industry much faster than we can save on carbon emissions with battery-electric vehicles."

Other benefits associated with the machine's electric drive system include a longer lifespan for tires, which is important since the vehicle typically operates in a quarry. "In abrasive rock environments, wheel spin is bad and can deteriorate tires. So, independent control of each wheel can limit the torque when slippage begins to occur, and that extends tire life," Van Tine explained.

The 944 and 644 X-Tier electric drive vehicles have accumulated more than three million customer hours. Additional X-Tier loader models, the 744 and 824, launched earlier this year. The 850 X-Tier dozer is next for market deployment. "We've learned a lot, and we're applying that knowledge to future electric drive models and our battery-electric projects," Van Tine said.

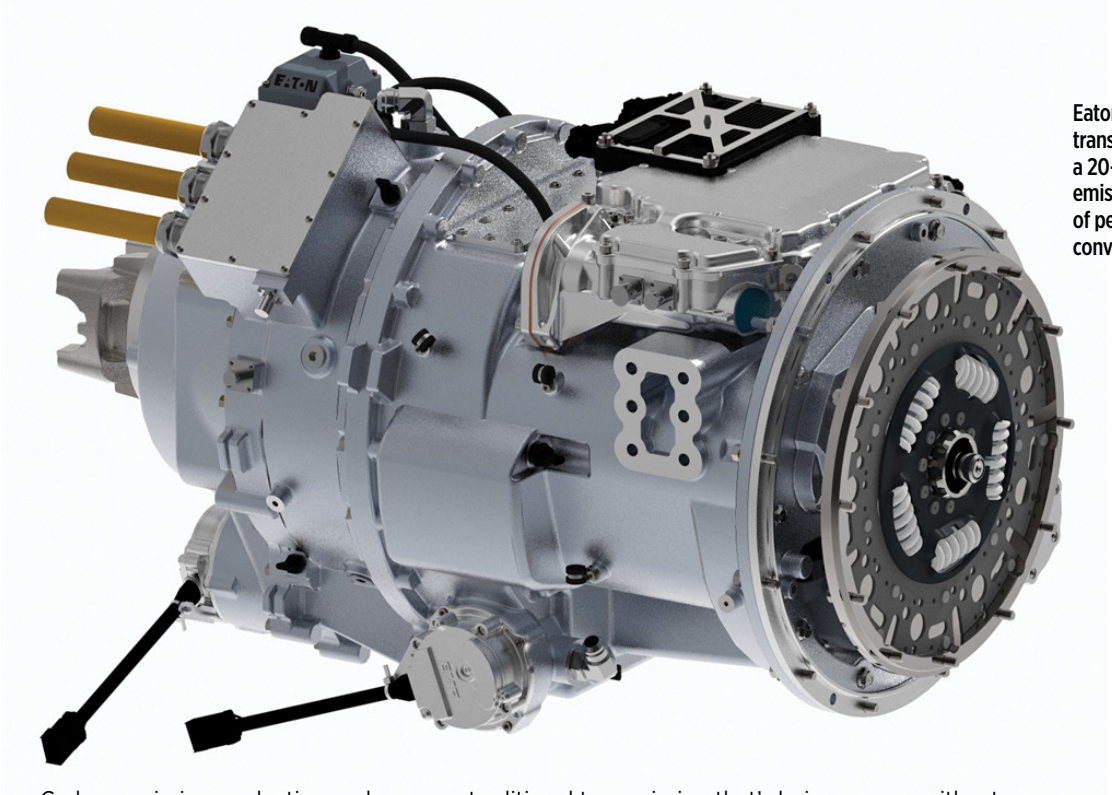
Hybrid technology is a powerful emissions-reduction resource. In a fuel emissions comparison of vehicles powered by one of three sources – diesel-electric, diesel-electric with renewable fuel, or battery-electric – each provided a double-digit percentage carbon emission savings versus a conventional diesel engine.

In a 2,500-hour usage example, an engine using renewable fuel (R100) provided a carbon emissions reduction estimate of 74% when compared to a conventional diesel engine. John Deere's calculated values are based on machine telematics data and **Argonne National Laboratory**'s GREET (Greenhouse gases, Regulated Emissions and Energy use in Technologies) model for fuel emissions factors.

"From John Deere's perspective, we don't see a single solution that will win out and work in every single application," Van Tine said, underscoring the relevance of combustion engines running renewable fuels, hybrid and all-electric technologies for off-highway vehicles. "We continue to invest in ICE technology, looking at solutions from both a compression ignition and spark ignition standpoint, to enable a variety of renewable fuels for the future," Van Tine said.

'Novel' hybrid transmission

Looking back several years, hybrid technologies were essentially stalled out. "For vocational vehicles, hybridization makes sense today based on a combination of fuel savings and added performance, and this situation is fundamentally different than it was 15 years ago," said Eaton's Dorobantu.



Eaton's P2/P3 hybrid transmission concept provides a 20–30% reduction in carbon emissions and a higher level of performance compared to a conventional transmission.

Carbon emissions reduction and performance that exceeds what's possible with conventional powertrains highlight a new technology Eaton developed in partnership with the U.S. Army. The hybrid transmission – an electrically power-shifting automated manual transmission (AMT) – is undergoing various field tests.

"This is a novel architecture," Dorobantu said. "The transmission has the ability to switch between two standard hybrid modes. Electric power is being introduced ahead of the transmission in some modes of operation. And in other modes of operation, the electric power goes directly into the prop-shaft."

Potential applications for the hybrid transmission include military and vocational vehicles. "For instance, with a traditional transmission that's being used in difficult launches such as mud or on high grades, if you need to interrupt the torque while shifting, the vehicle will stop or it will start rolling backward," Dorobantu said.

Initial test results with the electrically power-shifting AMT have demonstrated an ability to launch a 36-metric-ton vehicle on a 60% grade in third gear EV-only mode in both forward and rearward directions. The hybrid transmission also has shown low-speed maneuverability at speeds less than 2 mph (3.2 km/h), and it is 1.25 times better at reaching 55 mph (89 km/h) compared to a conventional transmission.

"Electrically generated torque helps with acceleration," Dorobantu said. "For example, the wide-open throttle time from zero to 55 mph is 60-plus seconds with a torque converter automatic transmission compared to 50 seconds with this technology."

Testing also reveals that the hybrid transmission can cut carbon emissions by 20% to 30%. No production plans have been announced yet for this electrically power-shifting AMT.

Government regulations for truck fleets tag a 40% reduction in carbon emissions by 2030. "The choice is open as to how to achieve the target," Dorobantu said, noting that one battery-electric vehicle provides the same emissions reduction as three hybrid vehicles. "We can deploy a large fleet of hybrid vehicles as an industry much faster than we can save on carbon emissions with battery-electric vehicles," he said.

Kami Buchholz

EATON

MANUFACTURING

Intel edge computing manager: Get ready for Industry 5.0

If you're just getting comfortable with Industry 4.0, which saw the beginnings of smart manufacturing, digitization and real-time decision-making in factories, a senior leader at Intel says the world is already moving on to Industry 5.0.

What's Industry 5.0? A joint study by many researchers (link: Industry 5.0: A Survey on Enabling Technologies and Potential Applications (**oulu.fi**)) describes 5.0 as merging human creativity with intelligent and efficient machines to deliver customized products quickly. But it will take a lot of change and learning to get there.

Sunita Shenoy, **Intel**'s senior director of product management for edge computing and Internet of Things (IOT)

technologies, says manufacturing will evolve so that semi-autonomous machines will become "collaborative" and able to make decisions independently.

Speaking during the annual **Siemens** Realize Live conference in Las Vegas, she said automobile and semiconductor factories are nearing this already. "If you've seen any visuals of an Intel factory, you'll see a room with no humans in it," she said. "It is already designed to self-cooperate, and the only humans are sitting behind a control center."

But she said that's still not truly autonomous. "They have a little bit of AI, but they are preprogrammed to do certain tasks," she said, emphasizing her point of view that AI is not a new concept. "AI has gotten very advanced in machine learning and accelerated learning with neural networks, hardware-assisted accelerators, and 'no-code' software designed by large language models." That, she said, makes it possible for AI to increase the autonomous nature of factory machines rapidly.

It doesn't hurt that management is pushed towards an AI-driven future by the current labor shortages that started severely during the COVID-19 epidemic. The crisis also meant depressed demand for cars, so some manufacturers began making HVAC equipment, personal protection equipment, and more. She said industries that had already aligned their factories in a primarily digital way were able to meet new demands rapidly.

Shenoy also said that one area Intel is working on is the integration of AI into robots themselves for more autonomous decision-making and efficiency in industries, including urban air

INTEL

Intel's HQ in Santa Clara, California.

Intel edge computing project manager Sunita Shenoy said that people will not be displaced with AI, as long as they learn how to apply it to specific jobs.

mobility. That underscores the need for more powerful edge computing that operates locally (i.e., not in the cloud). Outside of manufacturing, she cited autonomous driving as a use case in which the cloud is not a good solution due to the inherent speed lag. Immediate decision-making and data privacy concerns will drive investment in edge solutions, she said.

Shenoy dismissed the concerns of many who worry that developments, particularly in AI, will displace large numbers of workers on the factory floor and elsewhere. "People will learn how to use these machines and technologies and AI and to improve their productivity," she said. "No, I don't think humans will be replaced. The humans are always necessary for solving complex problems." She said that even in the transition from Industry 1.0 to 2.0, people adapted. "Everybody learned to retool themselves. So I think the people are not going to disappear. There are already people shortages, right? But they will have to learn new skills. We are learning new skills, right? Even I am learning new skills, learning how to use AI in my day to day life."

Along those lines, Shenoy said that Intel is working to make AI more natural to use. "Rather than focus on developers... we created some models, we put a simple UI dashboard, and we present it to small and medium manufacturers," she said. "And we have been innovating and co-inventing with them on what it should look like." She said the company is commercializing it for teams who want to take it directly from Intel to their system integrator channels. But for those who want to build their own application, we want to make it simple to consume.

"That is one of our biggest learnings: The more complex we make the technologies, the less it will get used."

Chris Clonts

MANUFACTURING

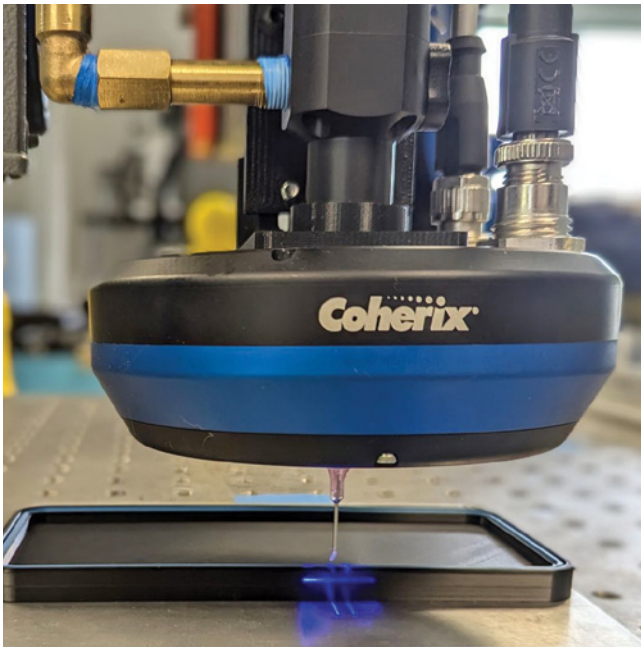
Coherix's computer-vision system improves electronics manufacturing

An industry-first 3D laser-based, computer-vision system can monitor and control the application of adhesive beads as tiny in width as two human hairs. This unique inspection system for electronic assemblies operates at speeds of 400 to 1,000 times per second, considerably quicker and more effective than conventional 2D systems.

"Difficulty in precisely dispensing adhesives or sealants, especially in extremely small or complex electronic assemblies, can lead to over-application, under-application, bubbles, or incorrect location of the adhesive bead," Juergen Dennig, president of Ann Arbor, Michigan-headquartered **Coherix**, told SAE Media. Improper application of joining material on electronic control units (ECUs) and power control units (PCUs) can result in poor adhesion, material voids and short circuits.

With its small footprint, the new Coherix 3D Mini system performs adhesive inspections inline, a cycle time-saver in comparison to post-assembly inspection systems. All production data is retrievable, providing part traceability for every assembled part. "This eliminates tearing apart a finished manufactured part to ensure the sealant/adhesive is in the correct location and meets location, volume and width specifications, a process that is often done two to three times per shift at manufacturers that currently do not use a robust inspection method," Dennig said.

The 360-degree vision system uses Coherix's proprietary i-Cite software, providing real-time 3D information about the



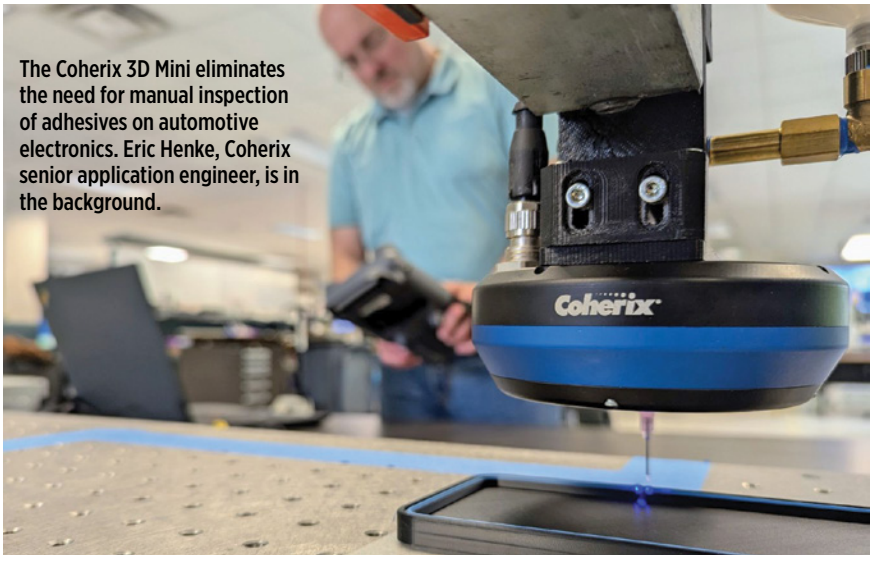
Coherix 3D Mini controls the adhesive dispensing applications for automotive electronics.

FROM TOP: SAE/CHRIS CLONTS; COHERIX

height, width, volume, and position of the sealant/adhesive application. An intuitive user interface provides direct feedback to the operator about whether the adhesive application passes or fails, according to Dennig.

Patented Coherix adaptive process control software enables the system to correct variations of adhesive applications. For instance, if a material gap is found, the 3D Mini prompts the adhesion-applying robot to fill in the gap and avoid the necessity of scrapping the part for poor quality.

Dennig claimed Coherix's 3D system can potentially reduce operating costs by up to 20%. "The beta test of the Coherix 3D Mini system demonstrated significant cost savings," he said, adding that a major automotive electronics manufacturer estimates more than $160,000 in annual operating savings with the installation of eight 3D sensor systems on a single assembly line.



The Coherix 3D Mini eliminates the need for manual inspection of adhesives on automotive electronics. Eric Henke, Coherix senior application engineer, is in the background.

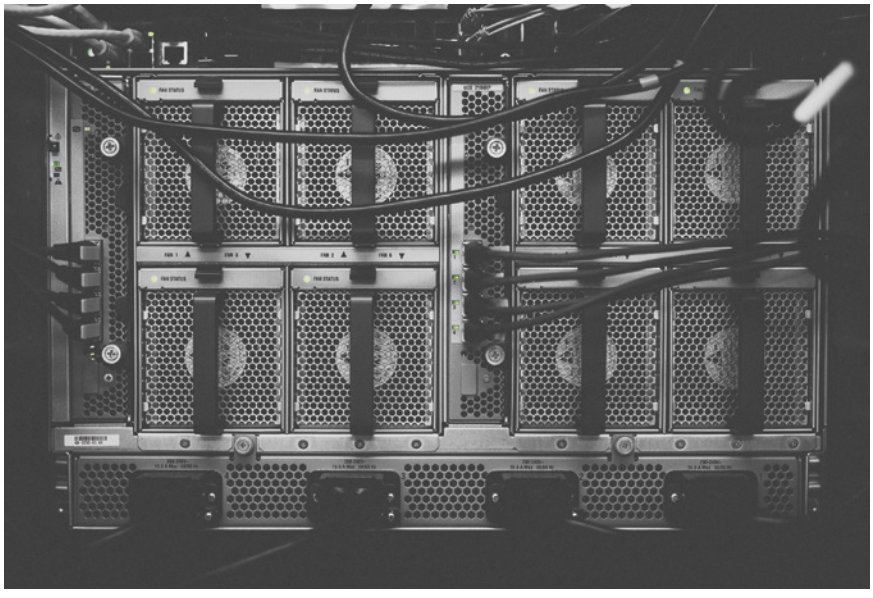
COHERIX

China is initially expected to outpace Europe and North America in usage of the new tech." China's rapidly expanding production of electric vehicles and other electronic products makes it the single largest potential market for this new technology," Dennig said.

Kami Buchholz

CYBERSECURITY

Security expert says Crowdstrike, CDK Global incidents are wake-up calls



While the Crowdstrike incident was not the result of hacking, the effects on the public were the same, said Upstream Security's Boaz Hartal.

KVISTHOLT PHOTOGRAPHY

When cybersecurity firm **Crowdstrike**'s platform went down in July, it became the most significant outage in the history of information technology, according to The Guardian. About 8.5 million Microsoft operating systems were affected, including almost every sector of the economy.

In the wake of the crash, which was traced to a faulty software update pushed by Crowdstrike, the automotive business is among those developing new policies to avoid repeat incidents.

During the **Center for Automotive Research**'s Management Briefing Seminars, SAE Media spoke with Boaz Hartal, VP of mobility and operations with automotive cybersecurity firm **Upstream**. "When you look at Crowdstrike, it wasn't a cybersecurity event. But it looks exactly like that in the world," he said. "But we can look at it as a glass-half-full event" because it wasn't a malicious attack, he said.

Still, it raises questions that must be answered, especially for companies that did not have a playbook for the event. Hartal said that Upstream has a step-by-step process for determining the cause and scope of any given problem, as do many companies. "But if they didn't have a protocol before Crowdstrike, they will have a protocol, that's for sure," he said.

He said Upstream's 17+ automotive clients were not affected, largely because their operating systems are not versions of Windows.

Hartal drew a contrast with the **CDK Global** incident, in which thousands of U.S. and Canadian dealerships were taken offline by what was a malicious ransomware attack. Comparing the IT practices of large corporations and automakers to small family-owned dealerships or dealership chains, "they don't necessarily

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Upstream's Boaz Hartal says that while state actors are sometimes involved, the vast majority of hackers are motivated by money.

SCOTT FOSGARD

have the best IT," he said, adding that "some of them rarely update their systems" even when updates are available.

There is a lot of cyber regulation standardization, including ISO/SAE 21434 and the EU's R155, but "it is not enough, to be honest with you," he said. "We see different approaches regarding cybersecurity. [All this means is that] you can comply with the regulations totally, but not be secure at all."

Hartal said Upstream will remain focused on threats to vehicle systems since that is where the biggest danger is. "It's a different moral we face now; these groups [force us to] really work on the deep and dark web with our customers to understand exploits that these groups are trying to find.

The groups are highly sophisticated and highly equipped with better computers," he said, which means they can earn more money with them. They are looking for the weakest link, and wherever they can get the biggest ransom payment and threaten the most damage.

Asked about the developing edge-computing technology that many feel will be necessary to enable higher levels of autonomous driving beyond SAE Level 3, Hartal said that kind of computing, which takes place on-board the vehicle in a closed system, would be more secure for some vehicle data, but not all.

But, he said, there will still be apps and other software that make up the software-defined vehicle that will have to be able to take over-the-air updates. And that means the security threat will remain. "This is a place that you can get in and get your malicious code into [a vehicle or system]."

Chris Clonts

Volvo's EX90 electric SUV needs OTA updates to feel finished

Contrary to what you may have heard, Americans are buying more EVs than ever. But they tend to like 'em big. After production delays due to software development issues – a problem that continues to plague automakers from **Volkswagen** to **General Motors** – **Volvo**'s EX90 will look to lure families who live for three-row luxury SUVs.

Based on a recent media drive in Newport Beach, California, Volvo may still have some work to do. The twin-motor EX90 did impress us with its 510 hp (380 kW), confident handling, leading-edge safety and sparkling high-resolution displays. But a software glitch dinged our test car when a section of its 14.5-inch (37 cm) center screen blanked out. Other journalists reported issues with a phone-based digital key that briefly left one driver stranded when it wouldn't connect with the Volvo. This is another reason I never rely on an automaker's digital key and always ask for a hard backup.

The EX90 will also be missing some key features when the first models ship from South Carolina (production is slated to start in the fourth quarter this year). The list includes the must-have **Apple** CarPlay, which Volvo promises to add ASAP via an over-the-air update. An industry-first **Luminar** lidar unit will be limited to gathering data on its drivers and physical environment until it's updated to support advanced driver assistance systems (ADAS) some time in the future.

The 2024 Volvo EX90 will start production in late 2024, but the first units will need some updates to provide the full experience.

Teething pains aside, the Volvo is smartly engineered to take on three-row EVs including the **Kia** EV9 and luxury **Rivian** R1S, **Tesla** Model X and Mercedes EQS SUV. It all begins with the EV-only SPA2 platform that also underpins the Polestar 3.

The Swedish automaker, owned by China's **Geely**, put that elegant platform on naked display on California's coast. The skateboard battery's 17 orange modules tuck between high-strength protective steel rails, with a metal cooling plate and status monitors for 204 nickel manganese cobalt (NMC) cells. They're bookended by a pair of permanent magnet synchronous motors with 402 hp (300 kW) – or 510 hp in the Performance version. This all-wheel-drive powertrain integrates a torque-vectoring rear differential. A dual-chamber air suspension and active shock absorbers boosted ride-and-handling in the Performance Ultra models we drove.

The 2025 Volvo EX90 will likely have an EPA estimated range of 308 miles (496 km), according to Volvo.

VOLVO

On the road

From the coast, we headed inland in the handsome Volvo. The SUV sets off from a standstill in AWD to ensure traction. Above 19 mph (31 km/h), the EX90 can rely on front-axle propulsion to save energy, and dial in juice from

Volvo uses a skateboard battery with 17 modules and high-strength protective steel rails in the 2025 EX90.

the rear wheels according to driver demand. Press a screen button, and the Volvo locks and loads into a Performance AWD mode for maximum thrust. And thrusty it is, with a 4.7-second jump to 60 mph (97 km/h) and a 112 mph (180 km/h) top speed, aided by a mammoth 671 lb-ft (910 Nm). Standard 408-hp models clip 60 mph in a reasonable 5.7 seconds.

Our EX90 supported its claim as history's quietest Volvo, breezing through Orange County burbs with mere whispers of wind noise and road hum through optional 22-inch (56-cm) wheels. A full battery has 107 usable kWh and a total pack size of 111 kWh. The EPA hasn't weighed in, but Volvo figures a driving range of up to 308 miles (496 km). En route to Temecula, including some fast canyon switchbacks, the Volvo slurps 37 kWh of energy per 100 miles (161 km). That equates to 290 miles (467 km) of real-world range, and a lighter foot could surely boost that efficiency.

A small screen on the steering column can display where other vehicles are in relation to the SUV.

Interior space aplenty

The low-key-stylish Volvo takes advantage of its SPA2 platform with flat-floor interior packaging and spacious seating for six or seven. In a tastefully neutral-toned cabin, light ash wood trim is backlit at night in a glowing pattern inspired by Scandinavian homes. Hygge, indeed. A padded, cantilevered tunnel console hovers above open-floor front storage. Enveloping seats bring near-orthopedic comfort, with seat massage and soft-closing doors among the perks on Ultra trims. Soft-textured tailored wool upholstery combines responsibly sourced sheep trimmings with recycled polyester. And the EX90 ditches any trace of leather in favor of available, faux "Nordico." It's not as supple as the real deal, but the sustainable, weight-saving material combines pine oil from Scandinavian forests with recycled PET bottles and corks.

The third row offered just enough headroom and knee room for this six-foot-tall (1.83 m) tester, with power switches in the cargo area to raise or lower seats. A frunk up front can fit a modest backpack plus odds-and-ends, though the space gets too hot for beverages or anything chocolate.

As in Teslas, several features are adjusted entirely on screen. Traditionalists needn't fret: The hassle is minimal. Those include the side mirrors, steering wheel and a head-up display. But a

BOTH IMAGES: VOLVO

The front-facing sensors on the 2024 Volvo EX90.

handsome row of recessed air vents rightly keep physical switches. The Volvo's handsome UI – when it's working properly – and vertically oriented center screen have a blessedly short learning curve. They're backed by the Android Automotive platform and Google's industry-best navigation maps and directions, rendered here with eye-popping clarity and detail. An optional Bowers & Wilkins audio system tops anything I've heard in a Volvo, incorporating 25 speakers, including in the front headrests. Onboard apps include Tidal audio, Spotify and the Vivaldi browser, with Google Assistant voice controls and a raft of offerings through Google Play Store.

A smaller, equally sharp display perches atop the steering column. It flaunted animated depictions of surrounding vehicles with Tesla-level accuracy, including oncoming traffic. An onscreen switch amps up regenerative braking for one-pedal driving. Its "Auto" mode is a performance highlight, smartly adjusting regen level depending on traffic ahead. Steering is a bit numb, in EV fashion, though its assist level can be firmed up, along with the suspension. The air suspension revealed a mild case of jitters over rough pavement, but generally delivered the soft tuning and serene control favored by Volvo fans.

Safety? Naturally

Volvo further touts the EX90 as its safest car yet, fully hardware-enabled for future unsupervised autonomous driving. This software-centric SUV adopts Nvidia's Drive Orin and Drive Xavier platforms for most core and neural-network operations, with a combined 280 trillion operations per second; along with Qualcomm's Snapdragon cockpit platform.

For now, the ever-cautious Volvo offers a Pilot Assist feature that delivered trusty lane centering, self-steering and automated lane changes on highways. Unlike most rivals, the Volvo decides what your active-cruising following distance should be, automatically widening the gap as speeds climb.

VOLVO

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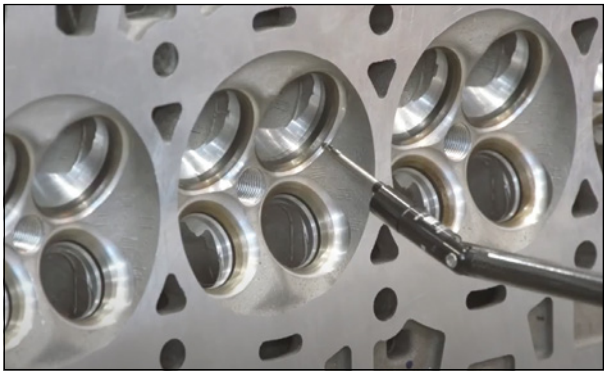

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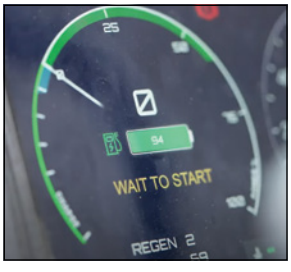
Self-Driving Cars, Explained

Are self-driving cars safe? In this video, Dr. Matthias Schmid — who builds fully autonomous vehicles that can navigate through forests where paths don't exist — answers the question in an unexpected way.

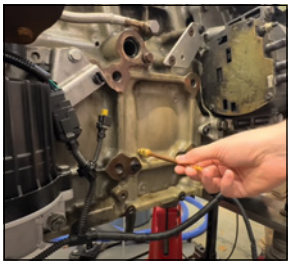
www.techbriefs.com/tv/self-driving-cars-explained



Converting an Old Truck into an EV

Rice University engineering students converted a 1997 Chevy P30 delivery van into an electric vehicle in less than a year, using parts scavenged from out-of-use vehicles, custom-built elements, and off-the-shelf items.

www.techbriefs.com/tv/ev-conversion



Seeing Inside ICEs with Wireless Sensors

Wireless temperature sensors installed in pistons allow us to "see" inside the combustion chamber while an engine is running. The sensor data is used to create models of flame propagation and combustion events.

www.techbriefs.com/tv/wireless-temperature-sensors

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ROAD READY

The third row of seats in the new EX90 can fit a tall person, when required.

One of two cabin-facing cameras monitors drivers to ensure eyes on the road, while a capacitive steering-wheel sensor dictates hands on the wheel. That's part of a breathtaking safety suite that creates a real-time, 360-degree view of surroundings, via the roof-mounted lidar sensor, five radars, eight cameras and 12 ultrasonic sensors.

The Volvo can charge at a speedy 250-kW maximum through its CCS plug, for a 10-to-80% charge in about 30 minutes, or 110 miles of added range in 10 minutes. That's despite the EX90's 400-volt architecture, versus the 800-volt systems used by brands such as Lucid, Hyundai and Porsche. Volvo engineers said a Tesla NACS adapter will be available at launch. And like nearly every automaker, Volvo plans to eventually segue its EVs to those NACS plugs. For now, one cool feature is a bi-directional home charger. Volvo says the unit could save a typical Californian $1,800 a year by using the EX90's battery to power home electricity for just a few hours each day, then recharging the Volvo at off-peak rates.

Sourcing battery cells from China's CATL makes the Volvo ineligible for tax breaks, but consumers can make an end-run around the rules by leasing an EX90 and securing a $7,500 discount through dealers. That will ease the blow of an $81,290 starting price, or a peak $90,640 in Performance Ultra guise. Let's hope Volvo can get Apple CarPlay and lidar-supported ADAS aboard, pronto. That way, owners will get all the tech they're paying for.

Lawrence Ulrich

VOLVO

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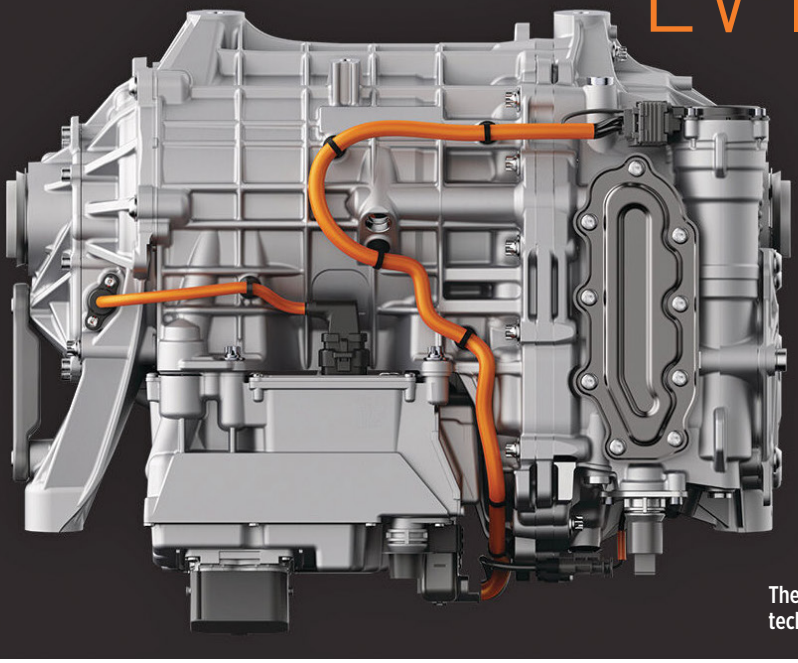
Thermal management lies at the heart of EV INNOVATION



Cooling strategies are evolving to meet the needs of tomorrow's improved EVs.

by Andreas Mair, director of mechanical engineering at GKN Automotive

The pursuit of efficiency is a major driver of innovations in eDrive technologies, to improve EV range and performance.

At the heart of innovations that have powered EV range and performance improvements lies the pursuit of efficiency. Today's electric drivetrains convert over 85% of a battery's electrical energy into mechanical energy. By comparison, internal combustion engines (ICEs) convert less than 40% of their fuel's chemical energy into mechanical energy.

As a result of this greater efficiency, we have seen major gains in electric motor performance, with today's motors operating at up to 25,000 rpm compared to the 15,000 rpm common ten years ago. So, what's driving this increase in efficiency? As with any complex system, there are several variables at play: optimized winding configurations, improvements in magnet layout and materials, and better integration between components. However, one of the major heroes of EV efficiency improvements has been thermal management technologies.

Why thermal management matters

Simply put, temperature represents the average kinetic energy of particles in a substance – that is, how fast particles move around. For electrical components like wires, this means that their constituent ions vibrate more as the temperature rises. This, in turn, means that these ions are more likely to collide with one of the free electrons that make up an electric current. As a result, electrical resistance rises with temperature, reducing an electric motor's efficiency.

Despite having fewer moving parts than traditional ICE architectures, EV motors still produce a significant amount of heat in their operation. This is due to intrinsic electrical resistance, eddy currents, and other factors like mechanical heat. Combined with the fact that electrical resistance increases heat output, this means that electric motors risk being trapped in a feedback loop of declining efficiency.

At its most basic level, energy lost through heat dissipation in a closed-loop system is wasted energy that could be useful elsewhere, for example, by finding marginal gains in extending a vehicle's range. Finding ways to improve thermal management is thus a major driver of efficiency gains in electric motor design.

Generally, to maintain efficiency and maximize an electric motor's longevity, engineers target maintaining a temperature of less than 365 degrees F (180 C). In practice, this is typically done via indirect or direct cooling.

Indirect cooling

Indirect cooling methods are techniques that don't allow a coolant to directly touch the motor or heat sources, instead using a heat exchanger to run coolant in a separate closed loop. This is analogous to the traditional cooling setup that we see in ICE vehicles, which circulates coolant from a jacket around cylinder blocks and heads to a radiator that dissipates the heat into the surrounding air.

For EVs, indirect cooling methods were historically the preeminent technology until recently, building off the decades of expertise automotive engineers have with comparable ICE setups. A typical indirect cooling setup for EVs uses a water jacket, embedded in the stator of an electric motor. This water jacket, usually filled with a water-glycol coolant, helps provide constant passive cooling to the copper windings in the stator to prevent them from overheating.

A water jacket is a simple, reliable, and cost-effective way to cool an electric motor. However, its inherently passive nature means that it cannot ramp up activity in the face of temperature spikes. More problematically, water jackets are also less effective in helping to cool the rotor and active parts of an electric motor, since they can only surround the stator.

As a result, we've seen a far greater focus on the development of new direct cooling methods for EVs, particularly for high-performance drivetrains.

GKN

Andreas Mair is the director of mechanical engineering at GKN Automotive.

Direct cooling

In contrast to indirect cooling methods, direct cooling methods directly expose a liquid to a motor and respective heat sources. Because water is a conductor, this means putting an oil-based coolant in direct contact with a motor's windings, stator and rotor.

The major benefit of direct cooling is that it helps deliver exactly what indirect cooling via water jackets cannot. Direct coolant can be sprayed inside an electric motor, providing cooling to a rotor and the interior surface of a stator. It can also be throttled up or down, helping stabilize a motor's temperature in the face of spikes, such as if a motor is having to do extra work to haul an EV up a steep hill.

There are a variety of direct cooling methods in development and undergoing deployment. One is manifold drip cooling, which precisely and uniformly sprays coolant onto the electric motor's winding heads. Rather than bathing the rotor in coolant, manifold dripping requires minimal coolant and reduces drag on the rotor. The downside is that this method requires a higher-pressure oil pump to properly apply the coolant to the winding heads.

Another method, for instance, is shaft centrifugal cooling. This method builds the coolant sprays into the rotor shaft, spraying oil onto the winding heads as the rotor turns and works. Once a rotor is turning at full normal speed, this uniformly covers the winding heads and provides excellent cooling. However, shaft centrifugal cooling does produce some drag in the motor and does not provide even cooling coverage when the motor is only turning slowly.

Given that they can cool the interior of a motor in a way that indirect cooling methods currently struggle with, direct cooling methods are seeing a major surge in development. In a way, this transition reflects the overall maturity

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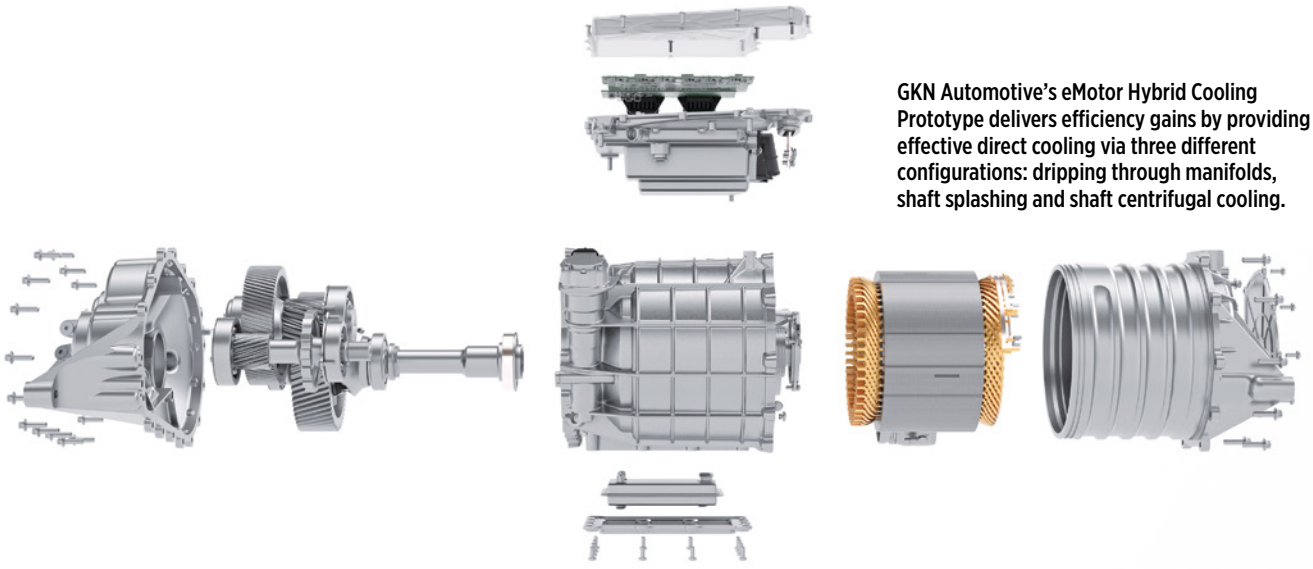


GKN Automotive's eMotor Hybrid Cooling Prototype delivers efficiency gains by providing effective direct cooling via three different configurations: dripping through manifolds, shaft splashing and shaft centrifugal cooling.

of the EV category as a whole: moving from a reliance on ICE-derived indirect cooling methods towards best-fit cooling methods that reflect the unique needs and architectures of EVs.

There likely is a future for indirect cooling in EVs. However, the rise of direct cooling and the continued miniaturization and integration of components like oil pumps is making this technique an ever-more appealing option. As a result, direct cooling is enabling many manufacturers to jettison the need for a water jacket altogether, to deliver lighter, higher-performance, and more affordable powertrains than ever before.

Modeling and digitization

Along with rapid innovation in cooling methods, a major trend in EV thermal management is the use of technology to better design more thermally efficient vehicle architectures. AI and digital technologies have been major boons to the engineering toolkit for better design, helping to radically speed up system testing and development.

One of the best ways to computationally model structural, thermal, and fluid performance is through Finite Element Method (FEM) tools. With computing resources becoming cheaper and more efficient amid the AI revolution, engineers are finding it easier than ever to optimize the placement and configuration of EV components to provide the best thermal performance.

AI offers the chance to further democratize and speed up the development and testing process. Rather than having to manually analyze options in response to customer requests, AI can reliably help select the most efficient electric motor and drive system for a given customer's needs in minutes or seconds. AI can also help designers, engineers, and customers model and understand what cooling method may be best for their needs in rapid time, helping them navigate the trade-offs that may exist between various direct and indirect cooling techniques. ■

GKN

Reducing the Weight of EV Batteries with SPECIALTY THERMOPLASTICS

SABIC's Battery Pack demonstrator showing housings, covers and trays made with NORYL™ NHP5054 resin, and rocker panel structures made with NORYL GTX resins, all of which are subject to impacts.

Eight arguments for these resins, compounds and composites.

by Somasekhar Bobba

Weight reduction in EV battery components is an important factor in optimizing battery energy density, which in turn is critical to extending vehicle range and boosting power and performance. Although traditional metals such as steel and aluminum are widely used in EV batteries, the ongoing push for higher energy density is opening new opportunities for thermoplastic resins, compounds, and composites.

The main advantage of these materials vs. metals is their inherent lighter weight – particularly in the case of lower-density polymers. Thermoplastics can be 30-50 percent lighter than metals. They also increase design freedom, which permits further weight-out through part consolidation and thin walls.

Of course, to successfully replace metals altogether, or to augment them in hybrid, multi-material components, thermoplastics must provide much more than lighter weight. Each component of an EV battery requires specific performance properties, such as flame retardance (FR), electromagnetic interference shielding, electrical insulation and dimensional stability.

Some of these requirements are becoming more stringent as battery technology advances. For instance, UL94 V0 FR requirements for some components are trending down to 1.0 mm and below. These are significantly thinner gauges than those previously specified. Likewise, wall thicknesses are decreasing from 1.5 mm to 1.0 mm or less as system designers seek to maximize energy density by shrinking the battery footprint.

Specialty thermoplastics well suited for diverse battery components

Leading thermoplastics suppliers are developing new products that can meet stricter EV battery requirements while delivering performance comparable to that of metals, plus weight, design and processing advantages.

What follows are some EV battery components that can benefit from specialized thermoplastic materials.

Battery module enclosures

Depending on the design, battery modules require suitable enclosures to protect cells and electrical components from damage, unwanted contact and exposure. These enclosures may also reduce fire propagation in the event of thermal runaway. They must be mechanically robust and appropriately flame retardant to pass applicable safety tests.

Battery module insulation

The industry is transitioning to higher-voltage EV batteries (600-800 volts) to help shorten vehicle charging times, extend range and improve energy management. Higher voltages can pose a greater risk of short circuits and fire propagation. Next-generation thin insulation films can help protect EV battery modules from these exposures while saving valuable space in the battery pack.

Cylindrical cell retainers

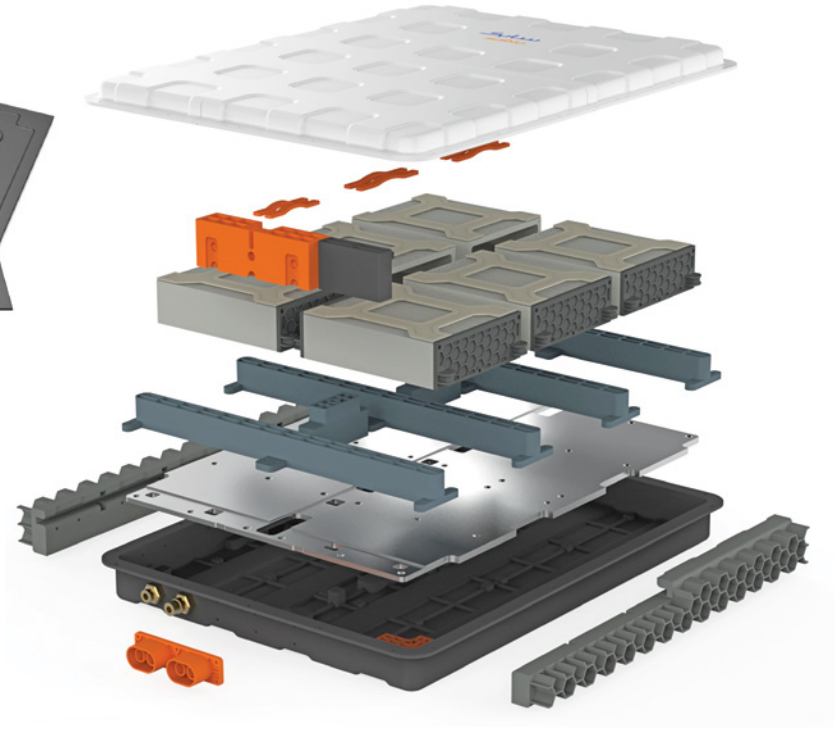
Major EV manufacturers already use cylindrical cells, and others are considering using them. This technology is cost-efficient and mature, making it easy to manufacture. For optimal function, retainers that hold the cells in place require excellent impact resistance under a wide range of temperatures of-60-100 C (140-212 F) and FR and tracking resistance. An emerging trend is transparency to enable UV curing of the glues used to attach the parts of the retainer structure.

SABIC

Reducing the Weight of EV Batteries with SPECIALTY THERMOPLASTICS

An emerging trend is transparency to enable UV curing of the glues used to attach the parts of the retainer structure.

Thermoformed insulation film samples made with NORYL NHP8000VT3 resin.



Exploded view of SABIC's Battery Pack demonstrator that shows the various EV battery components that can be developed with thermoplastics to further enable lightweighting.

BOTH IMAGES: SABIC

Battery pack covers, housings and trays

Some battery packs are becoming larger to meet consumer demands for greater power and range. Regardless of size, battery enclosures and other protective components must deliver excellent impact resistance for safety.

Busbars

EV battery busbars connect hundreds or thousands of cells and distribute electric current throughout vehicle subsystems. These connectors must be durable, able to withstand high vibration levels from vehicle operation, and rigid enough to maintain the integrity of the battery module assembly. Electrically, busbars must handle large amounts of current from the cells and voltage levels of up to 5.0V per cell.

Rocker panel structures

Reinforced rocker panel structures absorb energy during a crash, protecting the battery from intrusion and shock. Conventional steel or aluminum rocker panel structures are typically heavy and require several secondary steps to attach to the vehicle frame.

Thermoplastics can replace or augment metal in several different rocker panel designs, including all-plastic versions, multi-material over-molded designs and modular options. All three are based on injection-molded thermoplastic honeycomb cores that offer light weight, good energy absorption, a high performance-to-weight ratio and ease of manufacturing. Testing has shown that these rocker panel solutions can be up to 40 percent lighter than steel/aluminum solutions, with similar crushing behavior for energy absorption.

Wireless battery management systems

Battery management technology, required on vehicles with lithium-ion batteries, monitors each cell for safe operation based on specified voltage and temperature ranges. Battery management systems can be centralized or distributed and wired or wireless.

Thermally conductive composites can be used because they are electrically insulative and are formulated with non-brominated/non-chlorinated FR additives. They are also radio frequency (RF) transparent to help permit wireless communication.

Lighter weight and much more

The EV battery sector is growing rapidly and constantly adapting to emerging regulatory requirements, which are focused primarily on safety. Despite these changes, a common theme persists: the need for additional lightweighting to boost range, load capacity and power. One proven approach to cutting battery pack weight is adopting thermoplastics to replace or augment heavier metals, and expand design options with thin walls, space-saving geometries and part consolidation. Specialty thermoplastics can deliver equivalent performance to metals while adding significant value to a wide range of battery pack components. ■

Somasekhar Bobba is the global technical manager of automotive at SABIC.

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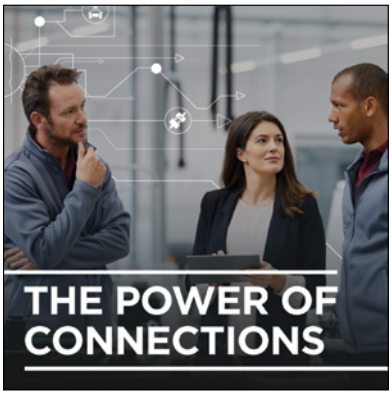
About Our Company

Every connection has the power to engineer something bigger. TE Connectivity (TE) has long partnered with automakers to design innovative connectivity and sensing solutions that make a connected, more sustainable world possible. By leveraging decades of deep experience, established design partnerships and world-class engineering capabilities, TE's product portfolio touches nearly every vehicle imaginable — from traditional to electric and fuel alternatives for both passenger and commercial vehicles — helping pave our planet's transition into green transportation. With an expansive range of automotive technology solutions spanning more than three-quarters of a century, TE is uniquely positioned to support the latest trends in vehicle electrification, data connectivity, and autonomy.



Target Markets

OEMs, battery manufacturers, subsystem manufacturers/suppliers, and distributors.

Products/Services Offered

If electricity goes there, so does TE.

TE is a trailblazer in connectivity and sensing solutions for the **charging path, battery pack, auxiliary systems, e-drive systems**, and the **connected car.**

TE's **tooling solutions** create high-performing, reliable connections in extreme environments. From crimping a terminal onto a wire or pressing a connector onto a board, our tooling, equipment, and field engineering services are counted on by customers across a range of industries and applications.

www.te.com

RISING STAR AWARDS
WOMEN IN ENGINEERING

Trailblazing Innovators:
Meet Rising Star Award winner Bruque Argaw

The inaugural Women in Engineering: Rising Star Awards program proudly honors women engineers who are driving innovation and making significant contributions to the engineering profession across six key categories: Aerospace/Defense, Automotive/Transportation, Electronics, Manufacturing, Medical, and Sustainability.

This prestigious recognition shines a spotlight on those whose work not only advances their fields but also serves as a source of inspiration for future generations of women in engineering.

Organizations from around the globe were invited to nominate outstanding women engineers whose achievements have positively impacted both the industry and society. Winners were chosen by a panel of judges and editorial staff, based on the compelling evidence provided in the nominations. We had an exceptional pool of nominees from all corners of the world, making the selection process both challenging and gratifying. The winners exemplify excellence and are a testament to the remarkable talent and leadership that exists within the field they were nominated in. The inaugural Women in Engineering: Rising Star Awards program celebrates and recognizes women engineers who are enhancing the engineering profession through contributions to the industry and society in six categories: Aerospace/Defense, Automotive/Transportation, Electronics, Manufacturing, Medical, and Sustainability.

Organizations were invited to nominate woman engineers whose contributions have had a positive impact on their profession and their exemplary work inspires the next generation of women engineers. Winners were selected by a panel of judges and editorial staff based on information provided in the application form. With the high caliber of nominees, the winners represent the best of the best.

Written by Sherrie Trigg, editor and director of content for Medical Design Briefs.

AUTOMOTIVE/ TRANSPORTATION
RISING STAR AWARDS WINNER
2024

Bruque Argaw

Functional Safety Integration Engineer
General Motors
Milford, Michigan

EDUCATION: Master's of Engineering, Global Automotive & Manufacturing Engineering
EXPERIENCE: Bruque Argaw is a functional safety integration engineer at GM, where she started in 2015. Previously, she worked in the civil engineering field, but made a deliberate professional shift to automotive. GM has benefited from her many previous roles at the company, including interior studio design engineer, interior issue resolution team co-chair, pneumatic seat comfort systems design release engineer. Her robust background in product development now helps her foster collaborative relationships across diverse, cross-functional teams.

What's the most exciting part of your work?
I am thrilled about the unique exposure I have to our vehicles, which sets my role apart from many others. I get to fully experience the end product, seamlessly incorporating everything that so many colleagues have supported and developed. There's not much more exciting than doing a wide-open-throttle in a cool, new electric vehicle with the massage system you developed in a previous role! It's an unparalleled blend of excitement and fulfillment that truly sets my work apart.

What is one major challenge you've faced in your career?
A major career challenge I faced was understanding the importance of advocating for oneself. While hard work and excellence are valuable, I learned that vocalizing needs, goals and aspirations is crucial for others to provide the necessary support to help me along my career.

What advice do you have for young women engineers aspiring to be leaders?
Embrace the role of a leader, regardless of your title. Every day presents an opportunity to develop and demonstrate your leadership skills. Approach your work with integrity and build trust among your colleagues. Cultivate a strong network, in and outside of your organization. Additionally, actively advocate for yourself.

How do you stay motivated and continue to grow?
I stay motivated by the endless opportunities for growth in the auto industry, especially in the electric and autonomous vehicle space. Working with diverse, curious teams who embrace a "one-team" attitude makes the work enjoyable and fuels my desire to learn and develop.

Can you describe a pivotal moment in your career that significantly impacted your trajectory?
A defining moment for me was transitioning from civil engineering to the auto industry. Being in Michigan, I had numerous friends employed by the Big Three. Through insightful conversations and gaining an understanding of their roles, I realized my passion lay in product development. Also, receiving praise from a satisfied customer for a vehicle they adore is just a bit more gratifying than receiving accolades for a sidewalk they traversed.

How do you balance technical expertise with leadership responsibilities in your role?
It is important to have a solid foundation of technical expertise, and I constantly seek opportunities to expand my knowledge. I foster an environment of open communication and collaboration where others can share their knowledge and grow, too. I appreciate diverse perspectives and expertise, using them to make informed decisions that benefit the team and achieve our collective goals for the organization.

What role has mentorship played in your career, and how do you pay it forward?
I owe my current position to the mentors in both my personal and professional life. Their guidance has challenged me to pursue my goals with determination, step out of my comfort zone, and unlock my full potential. I pay it forward through volunteerism and non-profit endeavors, inspiring and empowering the next generation to achieve their own aspiration. ■

PRODUCT BRIEFS

SPOTLIGHT: SIMULATION TOOLS & SOFTWARE

Testing simulation

RoboDK (Ottawa, Canada) and **KEBA Industrial Automation** (Linz, Austria) have announced a collaboration that enables users to create and test several robot cell scenarios from the desktop and set up the real production cell. The companies state that there are many advantages to collaboration. These include advanced simulation that enables users to create and test robot cell scenarios virtually, reduced setup times that minimize commissioning times and conserve employee resources by simplifying programming tasks and setup procedures, and automatic generation of robot paths along with new parts or products to be processed by the robotic system. The systems also enable enhanced monitoring and maintenance with digital twins, ensuring quick identification and resolution of issues.

https://www.keba.com
https://robodk.com

Experiential simulators

VI-grade's (Darmstadt, Germany) Driver-in-Motion Full Spectrum Dynamic Simulator (DiM FSS) is a real-time, driver-in-the-loop simulator that enables the complete experience of accurate motion, vibration and sound over the complete spectrum from 0 to 20kHz. VI-grade states that the DiM FSS is the first simulator capable of creating full vehicle motion with 9 degrees of freedom over a multi-meter workspace, with accurate sound and vibration, resulting in a completely immersive experience. The DiM FSS follows a 3-stage approach: the lower stage delivers primary vehicle motion, the middle stage provides full 6 DOF motion, and the final Hyperdock stage with a carbon-fiber cockpit delivers higher frequency vibration thanks to transducers at key driver touchpoints, while sound is provided through in-cockpit speakers or headphones.

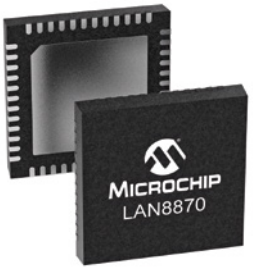
https://www.vi-grade.com

Rapid prototyping

Maxon's (Bad Homburg, Germany) Parvalux system can produce prototype motors at a rapid pace. Maxon states that it has designed and manufactured a series of modular components that are easily mixed and matched so that users get a paired system from one manufacturer rather than piecing together components such as motors, gearheads, brakes, and encoders from various manufacturers. In a three-step selection process, designers can purchase a motor built to order using the company's online configurator. Maxon states that using a modular system provides a range of options that allow designers to determine their required output performance and make a quick selection. Users of the online configurator can fine-tune their selection using a range of accessories, including brakes, encoders, shaft extension kits, and controllers.

https://www.maxongroup.com

Ethernet transceivers



Microchip Technologies (Chandler, Arizona) expanded its SPE solutions with its family of LAN887x Ethernet PHY transceivers supporting 100 Mbps to 1000 Mbps using 1000BASE-T1 network speeds and cable lengths up to 40m for extended reach. The LAN887x PHYs are designed to be fully compliant with IEEE® 802.3bp for the 1000BASE-T1 specification and IEEE 802bw-2015 for the 100BASE-T1 specification. Microchip has collaborated with the University of New Hampshire InterOperability Laboratory (UNH-IOL) to create the development test platform for 1000BASE-T1 conformance. For many automotive and industrial applications that operate in harsh environments and need to withstand extreme temperatures, these devices are also designed to be ISO 26262 functional safety ready with ASIL B classification.

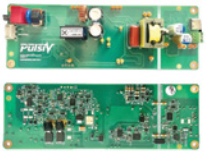
https://www.microchip.com

Sensing platforms

Melexis (Tessenderlo, Belgium) has reached ASIL C safety compliance with its smart current, voltage and temperature sensing platform. The Hall-effect MLX91230 and Shunt interface MLX91231 both achieve ISO 26262 ASIL C(D) architecture for critical vehicle functions such as battery management systems (BMS), smart pyrofuses, and high-voltage charging systems. Melexis states that current sensing plays a vital role in critical vehicle functions, such as BMS, smart pyrofuses and high-voltage charging systems. Therefore, ensuring a high level of functional safety is imperative. Both devices integrate a wide range of smart functionality, including the microcontroller unit (MCU) with on-board flash memory that supports custom software deployment and extensive compensation of system imperfections.

https://www.melexis.com

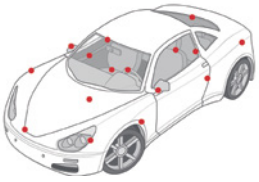
Power supplies



Pulsiv (Cambridge, United Kingdom) announced its new 65W USB-C GaN optimized USB-C reference design developed to address the complex challenges associated with thermal performance in power supplies. The PSV-RDAD-65USB reference design combines Pulsiv's OSMIUM technology with a QR flyback and highly optimized compact magnetics. Pulsiv states that this product represents the first in a series aimed at pushing the boundaries of power conversion by drastically lowering operating temperatures, minimizing losses, and reducing size to create a sustainable platform for the USB-C standard. Pulsiv states that their OSMIUM reference design reduces critical component temperatures by more than 30% compared to other designs.

https://www.pulsiv.com

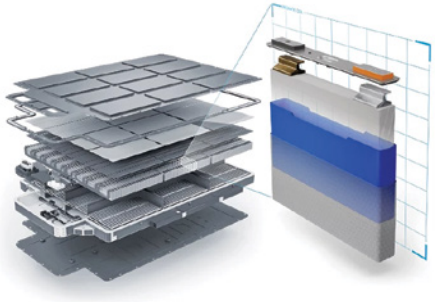
Foam tapes



Avery Dennison (Painesville, Ohio) introduced a collection of tapes for bonding foam and fiber materials throughout vehicles. This new portfolio includes a range of functional bonding and protection tapes built on multiple pressure-sensitive adhesive technologies. The specific bonding applications include interior and exterior gasket bonding, heat shield bonding, acoustical absorption bonding, buzz/squeak/rattle solutions and interior trim padding bonding. Avery states that as more vehicles transition to electric propulsion, the need for foams and fibers will increase due to the lack of engine noise that covers up other noise sources.

https://www.averydennison.com

Battery cell envelopes



Freudenberg Sealing Technologies (Weinheim, Germany) announced its new battery cell envelopes are ready for series production. The company states that the envelopes consist of nonwoven materials that wrap the cell stack to protect it during the assembly and provide the necessary electrical insulation. According to Freudenberg, nonwoven envelopes consist of a fiber network forming an ultra-homogeneous pore structure. The fibers are surface-treated for permanent electrolyte wettability. This results in a lower risk of entrapping gas bubbles as the cell is filled and helps to keep the cell stack wetted over the lifetime. Compared to conventional foils, nonwoven materials filled with electrolytes also lead to improved heat management within the cell due to the resulting higher thermal conductivity.

https://www.freudenberg.com

UPCOMING WEBINARS

AUTOMOTIVE HARDWARE SECURITY MODULES: FUNCTIONALITY, DESIGN, AND APPLICATIONS

Monday, October 7, 2024 at 11:00 am U.S. EDT

In the automotive industry, security is paramount for protecting the integrity, confidentiality, and authenticity of data. Automotive hardware security modules (HSMs) play a crucial role, enhancing the security of cryptographic keys and cryptographic processing. This 60-minute webinar will explore a wide range of topics — from the functionality and design of advanced HSMs to their application in AUTOSAR, SHE, and PKCS11 — and will provide a demonstration on a popular microcontroller.

Sponsored by: wolfSSL

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For additional details and to register visit: www.sae.org/webcasts

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THE TESTING EQUIPMENT YOU NEED TO KEEP PACE WITH EVOLVING EV BATTERIES

Tuesday, October 15, 2024 at 11:00 am U.S. EDT

EV battery manufacturers and designers constantly face challenges in soaring demand and increased capacity. Adding and expanding power to battery test systems takes up valuable floor space, and production and testing safety concerns surface as voltage test requirements keep rising. This 30-minute webinar will explore common obstacles and new equipment being designed to help overcome challenges and meet the cutting edge of EV battery testing.

Sponsored by: EA Elektro-Automatik Tektronix

Hosted by: SAE INTERNATIONAL

For additional details and to register visit: www.sae.org/webcasts

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ADVANCES IN ZINC DIE CASTING DRIVING QUALITY, PERFORMANCE, AND CARBON REDUCTION IMPROVEMENTS

Wednesday, October 16, 2024 at 2:00 pm U.S. EDT

Recent technological advances in the zinc die casting industry are responsible for a variety of processing improvements, which are increasing productivity, reducing costs, and lowering the overall carbon footprint of casting components. These advancements offer automotive engineers and designers new opportunities to design lightweight and sustainable components in zinc. This 30-minute webinar will provide an in-depth look at some recent advancements in the zinc die casting industry.

Sponsored by: ZINC | international zinc association

Hosted by: SAE INTERNATIONAL

For additional details and to register visit: www.sae.org/webcasts

WEBINARS ON DEMAND

MEETING THE CHALLENGES OF SOFTWARE-DEFINED VEHICLES WITH HIGH-PERFORMANCE VEHICLE SIMULATION

Available On Demand

A robust virtual prototyping strategy is a necessity for software defined vehicles (SDVs). A cloud-ready, flexible simulation interconnect technology is essential to creating a truly representative vehicle-level software test platform that seamlessly integrates physical and environmental models with multiple vECUs at different abstraction levels. This 30-minute webinar covers the world of vehicle-level simulation, exploring its demands from both a scalability and performance perspective.

Sponsored by: SYNOPSYS®

Hosted by: SAE INTERNATIONAL

For additional details and to register visit: www.sae.org/webcasts

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REVOLUTIONIZING ELECTRIC MOBILITY: ADVANCEMENTS IN PHYSICS SIMULATIONS AND CAE METHODS

Available On Demand

The transition to electric vehicles demands a paradigm shift, challenging manufacturers to surpass the performance of traditional combustion engine vehicles. In the aerospace sector, the rise of electric vertical take-off and landing (eVTOL) vehicles introduces a new frontier. The challenges of eVTOL design necessitate physics simulations for optimal performance. This 60-minute webinar explores how enhancements in physics-based simulations can bolster productivity and achieve sustainability goals.

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APPLYING MODEL-BASED DESIGN TO SDV DEVELOPMENT: A PRACTICAL EXAMPLE

Available On Demand

The shift towards software-defined vehicles is driving a significant change in how we design, build, and validate software. Model-Based Design (MBD) stands as a key strategy to navigate these software challenges, now enhanced to better align with DevOps methodologies. This 30-minute webinar explains how MBD can be integrated with DevOps and cloud technologies to enable continuous, scalable software releases and meet the evolving needs of modern automotive engineering.

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Q&A

What it takes to add an e-axle

During a recent **Bosch** tech showcase, we spoke with Joe Dear, engineering manager for electric propulsion systems at Linamar. The Guelph, Ontario-based parts manufacturer is no stranger to building unsung components for the auto industry, including gears, camshafts, connecting rods, and cylinder heads. The Linamar team was demonstrating a modified **Ram** 2500, a collaboration between Bosch and Linamar, that was outfitted with a prototype electric powertrain and new e-axles: a rigid axle on the rear (with a Bosch motor and inverter) and a steering axle up front.

Tell me about the reason for this project. Why are you working on these particular axles? Why are you showing them off today in this truck?
The class 3 and 4 segments are expanding pretty quickly with electrification. Municipalities in places like California are required to go all-electric at some point very soon, so they're looking for an application like this. We thought it'd be best to get into that market. We currently have class 5 and 6 production axles available, but the goal was to demonstrate what we could do with class 3 or 4 as well.

What were some of the engineering challenges, and how did you overcome them as you worked on this?
We're pretty good at making gears and drivetrains, so that wasn't the hard part. We struggled quite a bit with the integration, just getting everything to play nice together and start up well and communicate. It's prototype batteries, essentially it's prototype axles. It's using Bosch's system, which is a production system, so you have to play to that as well.

We had to talk to the electric system instead of the gas system. The vehicle ECU is going to try to talk to an engine controller, which you don't have anymore. We had to take and replace the entire electrification system from the control perspective because the axle is just looking for a torque command. We're telling it we want this much torque. It says, I can do that, or I can't do that, and then applies that torque, which is a much different strategy from an ICE engine.


Joe Dear

"The vehicle ECU is going to try to talk to an engine controller, which you don't have anymore."

This is well designed for either a hybrid, an electric or a hydrogen system, and that's where the whole industry is going. How is Linamar preparing for the powertrains that are coming?
Architecture is a big thing for your hybrids, particularly because they're putting motors in the front of the vehicle. In this axle, everything is compacted into the center section. Well, now I don't have that space because I have an engine that sits there, so you have to go to different gear designs, typically coaxial, instead of the parallel axis. From a packaging perspective, it's very challenging. And then, of course, it has to have the ground clearance. It has to be narrow enough, and then you have a big old engine coming through the middle. The rear is pretty much free space. There's not a lot back there to get in your way, so you're a little bit more free to do different designs there. Packaging is tough.

Sebastian Blanco

Bosch and Linamar collaborated to install an electric drivetrain and Linamar's new e-axles into this modified Ram 2500.

BOSCH

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Government/Industry Meeting

January 28–30, 2025 | Washington, DC

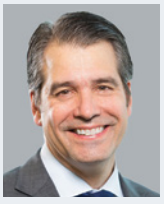
Unlock Exclusive Insights into the Politics of Mobility

For over 40 years, the Government/Industry Meeting has been the leading event for automotive executives and government leaders to shape mobility technology and regulatory policy. Following a record setting year for attendance, 2025 is shaping up to be bigger and better.

Meet the Keynote Speakers

Thursday Morning Keynotes

Jennifer Homendy
Chair
National
Transportation
Safety Board



John Bozzella
President & CEO
Alliance for
Automotive
Innovation

Thursday Lunch Keynote

Mike Murphy
Republican Party
Political Media Consultant

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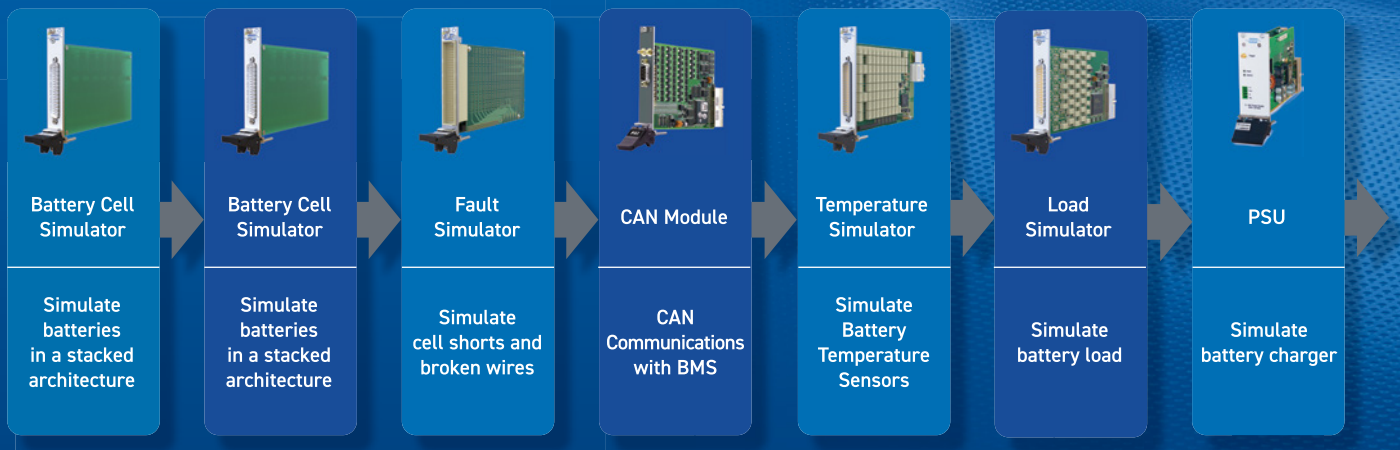
PXI

Industry-Standard PXI Platform



Example Of Pickering's **PXI-Based BMS Hardware-In-The-Loop (HIL)** Test System

SCAN ME Learn more at: **pickeringtest.com/bms**

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