CES 2023 Report

Technical Content
Lighting, Interior, Lidar

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EXECUTIVE SUMMARY

CES has become the world's premiere showcase for auto innovations. Attendance was more than double the 2022 figure—over 115,000 people, of whom more than 40,000 were foreign visitors. There were 3,200 exhibitors versus 1,900 in 2022, and this year there were over 4,800 media attendees. That's a giant rebound from the lean and spindly Covid-constrained events of the past few years, though still not yet back to pre-pandemic 2019 levels (over 185,000 visitors and more than 4,500 exhibitors). Below, the main technologies presented by car makers and their suppliers.

BMW i Vision Dee Concept

The front, rear panels become displays with emotional content. Lighting are used to be emotional.

Peugeot Inception Sets EV Design Direction

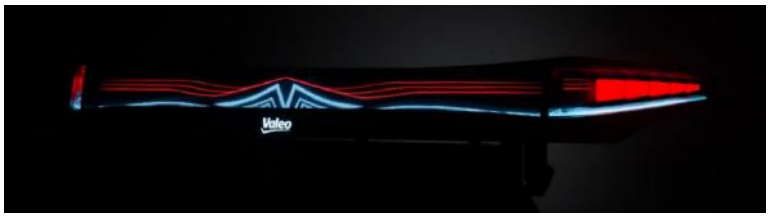
Grilleboard includes Peugeot's signature claw shaped DRLs, with single piece of glass incorporating lighting and sensors. A 'tech bar' running horizontally along the door sends messages to the driver.

New Sony-Honda EV Brand, Prototype Unveiled

Front and rear exterior includes what SHM are calling a 'Media Bar' which will use light to communicate with people in the car's vicinity. The Lidar sensor is placed on the roof in a central position above the interior mirror. A perfect position for the function.

Valeo: Dynamic OLED and Front/Rear

Vehicles will have to communicate with their environment, making lighting a key tool. Intelligent pixelated surfaces can be used to share clear, real-time information.



Extended lighting features offer ways for customers to get creative and personalise their space.

FORVIA/HELLA

World's first SS HD headlamp

The technology offers the ability to project digital symbols in front of the vehicle that can define vehicle width within a construction zone driving path illumination

Dynamic Lighting with superior styling.

It provides up to 80% reduction in energy consumption compared with conventional taillights, and digital, flexible integration options configurable for automaker-specific design needs, including the Digital Headlamp Solid State Lighting High-Definition.

FlatLight in Production as DRL

Based on micro-optics
Size of 15µm

Mobis: Prism module and lenticular grille lighting

New product called prism module.
Lighting product combines low beam and DRL into a single module just 12 mm thick,
Gives headlamp designers a much greater degree of freedom.
Also presented lenticular grille lighting.

About the Authors

Dr. Wolfgang studied from 1981 to 1986 Electrical Engineering at the TU Darmstadt. From 1987 to 2000 he was with BMW. From 2001 to 2020 he worked for Audi as executive director development lighting and switches, later development lighting and vision systems. In 2021 he started at DVN as Sr consultant and is still chairman of the GTB working group strategy.

Philippe Aumont is a highly experienced executive with almost 40 years in the automotive interior supplier industry. He acted as CTO at Faurecia Seating between 2011 and 2017. Previously he worked at Roth Frères, Johnson Controls, and Faurecia in various positions including R&D, marketing, management, costing, and sales.

Daniel Stern, DVN's Chief Editor based in Vancouver, BC, Canada, is one of the five greatest lighting experts in North America. He is an appointed member of the US transportation Research Board Visibility Committee, which steers North America research on matters related to automotive conspicuity, lighting performance and regulation.

About Driving Vision News

DVN is the vehicle lighting and ADAS industry's journal of record, dedicated to keeping the community informed and communicating about the latest progress and developments. DVN's three pillars are:

• **LEARN** from Technological watch on new emerging technologies, with weekly electronic newsletters bringing news, analysis, and crucial information on innovation in lighting, ADAS, and smart car interiors; there are also monthly technical reports with sharp focus on cutting edge technologies, company profiles, regulatory matters, and other relevant content available only from DVN

• **NETWORK** with high-level decisionmakers, researchers, innovators, practitioners, academics, and regulators

to make new business connections with two workshops per year in rotating locations throughout America, Europe, China, Japan, India, and Korea. DVN Workshops gather over 300 participants.

• **PROMOTE i**nnovations from DVN's 180 member companies—we facilitate the promulgation of knowledge of innovation, which in turn paves the way for commercialisation, enabling to build new relationships through DVN Community to forge new business worldwide. The DVN Gold membership roster includes 180 companies including automakers; lighting and ADAS tier-1 and -2 suppliers, and a wide variety of universities; research outfits, and consultants. DVN Gold members receive all publications and attendance privileges at all DVN Workshops.

Car Makers

BMW

BMW presented their new i Vision Dee (for **D**igital **E**motional **E**xperience) midsize sedan concept, with an emphasis on blending real and virtual experiences**.** Concept seems a perfect reflection of CES, and the overlay of the old automotive world and the digital/metaverse world. BMW described how projection across the entire width of the windshield allows information to be displayed on the largest possible surface, which only becomes recognisable as a display once it is activated.

The i Vision Dee was presented by CEO Oliver Zipse, assisted by Arnold Schwarzenegger himself for some great storytelling about Dee, with emotion and experience. The presentation was high on vision; rather low on actual specific capabilities of the vehicle.

It's not just a chameleon inside with the shy-tech windshield display; the vehicle is also a chameleon outside. The exterior has 240 'e-ink' segments that can be controlled individually; you could go with a solid colour if you want, but each separate panel can be customised, so you can go wild with patchwork designs.

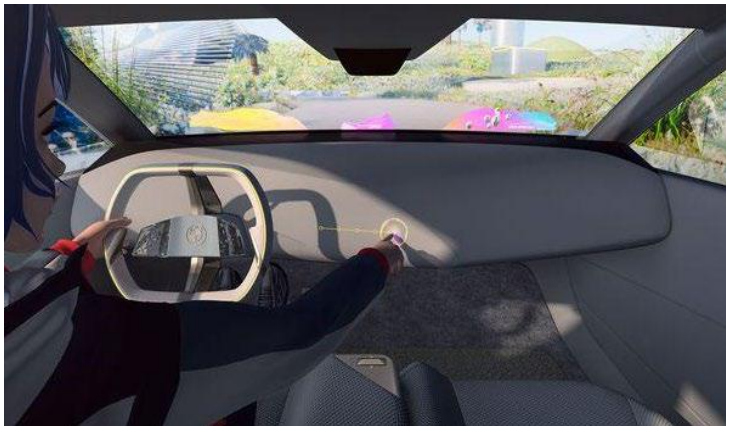
Lighting

The front and rear panels are displays with emotional content. Voice and lighting are used to be emotional. The DEE also shows the new BMW lighting signature slated for introduction in 2025, coördinated for front and rear. The family kidney design shrinks to the size of the headlamps, and comprises them. The headlamps change to two vertical lines which lean about 15° outboard. In the technical solution including the homologation we could either see an additional headlamp underneath the new DRL/position light signature, or the slits become a full headlamp. We are looking forward to being able to describe it in detail after the presentation of the production car.

Zipse said the car showcases what is possible when hardware and software merge: "we are able to exploit the full potential of digitalisation to transform the car into an intelligent companion".

Interior

The immersive interior experience, with its head-up display, is the door to a new realm—to take you there so completely that you may forget you're in a car stuck in traffic!



Some of the tech seen here will be on BMW's 2025 'Neue Klasse' EVs. But the ability of the Dee's interior technology to take you to the projected fantasy world of your choice will require L^4 or L^5 autonomous driving capability to be fully deployed.

BMW chose to extend the screen pillar-to-pillar by simply widening the head-up display in the car, turning the windshield into a kind of infotainment screen. BMW said the production version of this HUD will be used in models starting in 2025.

Drivers use a 'mixed-reality slider' to dial-in the amount of navigation and traffic information they want on the windshield; from there they can retreat ever further into their own fantasy world. "I want to be more than just a car," Dee said in a soothing voice; "I'm your portal to the virtual world, but also back to the real world. Together we will enjoy our drive wherever you want to go. No matter where you are, where you want to be".

In parallel, dimmable windows can also be used to gradually fade out reality—BMW said "Mixed reality can be experienced in BMW i Vision Dee in an immersive way that engages different senses without requiring any additional tools, creating a new dimension of driving pleasure for the user".

Mercedes-Benz

At Mercedes-Benz, technology is a key driver of desire. That's the communication pitch they used at CES, particularly in a specific event at their booth. It means making life easier by realising automated driving; substantially improving in-car entertainment, and giving Mercedes users back some of their precious time.

The new MB Burmester audio system boasts 1,750 watts powering up to 31 speakers and eight exciters that transfer vibrations, creating an acoustic environment where you hear and feel every sound. They are also creating perfect harmony between the sound experience and premium content in collaboration with Apple Music; Universal Music Group, and Dolby. "Approved in a Mercedes-Benz" recordings make vehicles the best place to listen to premium high-fidelity music, and Mercedes recently added ZYNC to ensure the best quality streaming content is available.

The booth also held a visionary interior material presentation, complete with catchy animation.

Stellantis

CEO Carlos Tavares said during his keynote address that Stellantis are becoming a mobility tech company who want to improve how people move; socialise, and entertain themselves. He said the company are massive in scale, but with the soul of a startup: "The need to innovate for our future is greater than ever. Companies must be both transformative while profitable; be tech minded but driven to serve human needs…humans are, first and foremost, seeking a sense of safety in this uncertain, chaotic world that is marred by crisis after crisis".

Tavares sees the European auto industry at a crossroads in competition with the Chinese one. Europe's auto industry could be forced to massively reduce its production capacity in the face of rising competition from China, Tavares said: "The price difference between European and Chinese vehicles is significant. If nothing is changed in the current situation, European customers from the middle class will increasingly turn to Chinese models. The purchasing power of many people in Europe is decreasing noticeably…regulation in Europe ensures that EVs built in Europe are about 40 per cent more expensive than comparable vehicles made in China; if we don't optimise our cost structure, we cannot absorb the additional cost of electrification", which risks leading to elevated car prices and a shrinking market: "If the market shrinks, we don't need so many plants. Some unpopular decisions will have to be made".

Ram 1500 Revolution EV Truck Concept

Lighting

There's a double-wishbone DRL signature, with the pointy ends of the wishbones flanking an illuminated **RAM** callout in the centre of the grilleboard. The wishbones frame a four-line arrangement reminiscent of the Porsche design, with an additional line down below in the fog lamp location.

Interior

It is a full-size truck, so the interior is naturally big, with a roomy-looking passenger compartment. There's a big glass roof and a reconfigurable interior; a one-button setting adjusts the entire cabin experience. Options include productivity; social; party; relaxation, and custom modes. A pass-through into the frunk can carry items up to 5.5 metres long. The midgate also features jump seats, which act as a third row of seating.

The rest of the interior is very concept-looking, clearly visible thanks to no B-pillars. with an oval steering wheel and highly stylised seats. Infotainment provisions include a big centre touchscreen. The driver gets a screen too, and the touch-sensitive screens total up to 28" of area, complemented by a HUD. The lower display has three different positions depending on the task at hand—minimal view; extended view, and full screen view—and can be removed and used in different areas of the truck. The upper screen can also slide on the Ram Rail attachment system.

Seating and console flexibility is a focus; the centre console can be removed for more space, or its armrest converts to a workstation surface. Lightweight seats feature integral belts; grab handles, and speakers with the ability to fold flat along with extended recline or when using the jump seats.

Smaller than traditional truck mirrors, the rearview mirror is packed with a range of sophisticated technologies including a reversing camera with 360-degree views; speakers, and receivers compatible with voice assistants such as Alexa and Siri. Digital sideview mirrors highlight the onboard advanced technology.

Peugeot

Peugeot say their Inception concept introduces a simpler, more refined design language to appear on models launched in 2025 and beyond. More specifically, the Inception will broadly set the design direction for the next generation of Peugeot EVs and will be used to varying degree for midsize and large high-performance vehicles from other Stellantis brands including Alfa Romeo; Chrysler; Dodge, and Jeep. The design is called Feline Future, a reference to the Peugeot lion logo.

Lighting

The car bears Peugeot's signature claw-shaped DRLs, with a single piece of glass incorporating lighting and sensors. A 'tech bar' running horizontally along the door sends messages to the driver, who can also be recognised so the car automatically adjusts settings and preferences. The bar also displays battery state of charge and incorporates other sensors.

Interior

Instead of a conventional steering wheel, there's a 'Hypersquare' control system with a square tablet-style screen inspired by video games, for digital electric controls and steer-by-wire technology.

The car is conceived as an L^4 AV; when the car takes on the driving task, the Hypersquare retracts into the dashboard and a large screen slides out from the floor.

The Inception's user interface is based on the latest generation of consumer electronics, presented as touch-tap-swipe commands.

The interior continues Peugeot's i-Cockpit design with a small, low-set steering wheel (er, Hypersquare) which does not block the instrument panel. The screen displays information and has various controls accessible using thumbs at each corner, as well as voice recognition.

The centre of the Hypersquare is a tablet-type screen dedicated to control information. The pictograms for the different features—HVAC; radio, ADAS, etc) are displayed on the two side panels to facilitate access to the chosen control. The latter is located inside the circular recesses and can be accessed by moving the thumb only, without taking your hands off the steering control.

Chrysler

Interior

At CES, Stellantis demonstrated a mockup of their two-seat Chrysler Cockpit Synthesis layout.

The Synthesis design incorporates several upcoming Stellantis tech platforms, including STLA Smart Cockpit; STLA Brain, and STLA AutoDrive. The automaker brands the trio as "Advanced Technology for Real Life", and says it will be able to adapt and enhance the user interface over time, including machine learning to adapt to use preferences.

Chrysler has said the OTA approach will link together hardware and software generations. The Chrysler Synthesis is shaped by the Harmony in Motion design language that Stellantis says is "contemporary, sustainable and technology focused." The dashboard is sleek and angular, evocative of science fiction display.

Audi

This year at CES, Audi is back to offer current content and a new VR game through 'experience rides'. Following the launch in Germany, the VR entertainment offering will become available in other European markets next year.

Audi is the first automaker to bring virtual reality entertainment by Holoride to series production. It's a new technology that adapts the virtual content to the car's driving movements in real time. For example, if the vehicle takes a right turn, the spaceship in the virtual world will also fly to the right. If the car accelerates, the spaceship speeds up, meaning a ride in the car becomes a multimodal gaming event. A bonus is that by synchronizing the user's visual and felt experiences, holoride reduces the risk of motion sickness, which many passengers experience when watching movies or other dynamic content in a moving car.

Cariad, VW's automotive software company, developed the technical requirements to use Holoride in selected Audi models. For the first time, Cariad was also present at CES with a Central Plaza pavilion, presenting innovative solutions including some from Audi or with Audi's involvement.

Afeela: New Sony-Honda EV Brand

The joint venture between Honda and Sony revealed the marque they're planning to apply to the EVs they'll eventually offer—it's Afeela. And they did it in grand style, by applying it to a concept car. Sony Honda Mobility CEO Yasuhide Mizuno says the vehicle will move toward mass production, with orders opening earlier and sales beginning later in 2025. "Afeela represents our concept of an interactive relationship, where people feel the sensation of intelligent mobility and where mobility can detect and understand the people and society by using sensing and AI technologies", he said.

Lighting

The vehicle's exterior includes what SHM are calling a 'Media Bar' which will use light to communicate with people in the car's vicinity. There will be L^2 driver assistants tailored for urban driving scenarios, and SHM say they plan to work toward L^3 autonomous driving capabilities. The prototype has 45 cameras and sensors all in all, inside as well as out. Over 40 sensors—including cameras; radars; ultrasonics, and lidars—will be embedded all over the exterior of vehicle, enhancing its ability to detect objects and drive autonomously. The lidar has an interesting position in a little scoop, similar to a GPS antenna, on the roof in a central position above the cameras. From a functional point of view, this lidar position makes good sense.

Interior

The interior features digital displays of a type that are certainly new for Honda: spanning the dashboard for front occupants, plus two more for the rear passengers, and video camera sideview mirrors—legal in most of the world, but not yet in the U.S. The electronics in the vehicle are run by the Qualcomm Snapdragon Digital Chassis and use infotainment software developed by Epic Games and based on a fully integrated PS5 for gaming and entertainment. According to Mizuno, the plan was to "develop a car as hardware that will cater to the entertainment and network we would like to offer". Sony see cars as a crucial platform for the future of their tech and entertainment products. They want to take on the design and development process too, even if making cars is incredibly risky and expensive—especially for a company who have never done it before. Of course, Honda are on board, and they've been developing their own lineup of EVs, starting with the Prologue in collaboration with General Motors.

Vinfast

VinFast is a trending name in the EV world. At CES, the Vietnamese automaker gave a closer look their latest VF6 crossover and VF7 SUV, already presented in the DVN and DVN Interior Los Angeles Auto Show report and the DVN-I Paris Autoshow in-depth review.

Volkswagen

ID.7

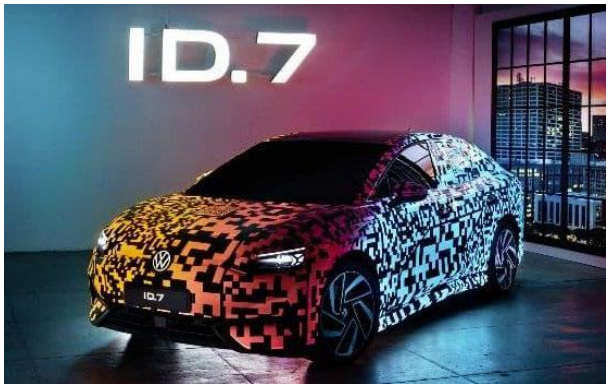
VW showcased their first fully-electric sedan based on the modular electric drive matrix (MEB). It was presented with a smart camouflage, which uses unique technology and multilayered paintwork to create light effects on parts of the vehicle. The ID.Aero3 concept vehicle provided a preview of the new model, with an aerodynamic design and range of up to 700 kilometers (WLTP).

Lighting

Full-width light bands have become *de rigueur* fashion accessories, and the ID.7 has them. The white one in front is a fine-line design, sweeping outward from a central round VW logo, eyebrowing the compact four-jewel headlamps, and wrapping round to the sides of the fenders. And the red rear band has a fine-line central part, swooping into ramps as it zags outward to encompass the taillights. It's mirrored down below in the bumper fascia, as a reflector band.

Interior

As a premium sedan, the ID.7 offers climate and comfort experience including a new display concept; an augmented-reality HUD; a 15-inch screen; new HVAC controls in the first level of the infotainment system, and illuminated touch sliders.



The camouflaged sedan features a digital design with unique paintwork, which lights up the ID.7 interactively. 40 layers of paint have been applied, some of which are conductive while others have insulating properties. A total of 22 areas of the vehicle can be controlled separately; they're electrified below the top layer of paint for electroluminescence. If all this is connected to a sound system, the rhythm is animated by illumination of individual areas—no word on whether and how much this might distract other traffic participants or mask the car's signal lights.

The new HVAC concept offers several adaptive functions: the car can detect when the driver is approaching based on their key, and will precool the interior on hot summer days or preheat the interior on cold days before the driver gets in. Newly designed 'smart air vents' control the flow of air and move dynamically to distribute the air over large areas as quickly as possible. If there are passengers, the air can be directed straight to the body or ventilate the interior indirectly. These functions are always visible on the new large display, and can be activated and saved individually for each user. Special requests can be activated using voice commands. If the user says "Hello Volkswagen, my hands are cold", for example, the ID.7 responds by heating the steering wheel while warm air is directed towards their hands.

Volvo

At the Luminar booth a Volvo XC90 was on display with an interesting new ZKW headlamp. The main lighting functions are hidden behind the DRL/position light. When low beam is called for, the DRL element opens mechanically, clamshell-style: half to the upper and half to the lower side. This is indeed a very surprising and attractive new highlight; find more detailed coverage in the DVNewsletter.

ZKW also were present in the LG private area. DVN was invited, and CEO W. Steger; CTO U. Hornfeck, and Head of Predevelopment G. Böhm introduced the new BMW 7 headlamp with the Swarovski crystal elements; the Volvo XC90 headlamp, and a smart grille with interesting functions and versatility.

Tier-1 suppliers

Bosch

Bosch presented their company as a pioneer and market leader in microelectromechanical (MEMS) sensors—one of the most important and widely used sensor types today. Since they began manufacturing them 27 years ago, they have produced a total of more than 18 billion MEMS sensors.

Interior

Bosch's camera-based safety feature has been improved with the addition of a cabin sensing radar. Not only can this detect driver drowsiness and distraction, but can also sense whether a small child has remained in the vehicle. This sounds similar to Toyota's Cabin Awareness system, which uses high-resolution 4D imaging radar to detect occupants or pets that have been left behind.

A CES Best of Innovation winner is the Bosch RideCare companion, a platform which provides an enhanced safety experience for rideshare drivers and passengers through its ability to monitor and respond with two cameras; communications via smartphone or an SOS button, and sensors.

Sensor Tech

The off-zone crash detection system, another Innovation Award winner, is an example of using software to get more value out of existing hardware. By combining airbag sensors with a new software algorithm, it can reliably detect the exact angle of impact in case of a side collision and trigger the airbag in time, for better protection of the occupants.

To manage the complexity of in-car systems, Bosch are moving towards a sole vehicle computer for driver assist functions and infotainment. The company see a central E/E architecture setup as the right solution, and say this next-generation information domain computer will incorporate things such as surround-view cameras and infotainment features.

Continental

Interior

Continental's Curved Ultrawide Display goes across the entire width of the cockpit. The design creates a new dimension of user experience while the innovative operating concept based on an invisible control panel ensures greater safety and comfort.

Continental are not only focused on making driving safer, but also more intuitive and immersive for drivers. As user experience is becoming a key factor for car buyers, Continental's display technology will show how the interior of the vehicle is becoming the locus of competitive advancement—the 'new horsepower', to compare to the engine output competitions of the past. In the Curved Ultrawide Display, 'Ultrawide' means a width of more than 1.2 metres, arching from one A-pillar to the other. The display design creates a new dimension of user experience while the innovative operating concept based on a shy control panel ensures greater safety and comfort.

Safety for tomorrow mobility was the focus of Continental's presence, including lidar; a domain zone control unit, and software for window lifts; software-defined radio; motion and manœuvring packages for automated driving and remote parking, and many more. Continental have also expanded their portfolio for assisted driving with Ambarella's scalable and powerful system-on-chip family for faster processing of increased sensor data in the vehicle, paving the way towards autonomous mobility.

ADAS

Continental's head of AD Frank Petznik showed an 'ADAS Jacket' built to be perfectly seen by all ADAS sensors. The jacket's materials have a high reflection of all lidar; radar, and visible-light wavelengths which can help for quick, accurate sensor discernment of pedestrians and especially bicyclists.

Forvia

Forvia, the 7th-largest global automotive supplier, revealed several world premieres at CES including, for the first time, the combined portfolios of constituent companies Faurecia and Hella.

At their press conference, CEO Patrick Koller said Forvia are “focused on tackling climate change, leading the way as the first automotive company to gain SBTi validation for our net-zero ambition for 2045. We also have to make the freedom of mobility affordable to all. A key challenge is making smaller and affordable electric vehicles. And we’ll need solutions to customize, upgrade and extend vehicle life”. And École Polytechnique professor Thierry Rayna gave an inspiring keynote on how to reinvent mobility to bring positive social and economic impact as well as tackle climate change.

Forvia launched Materi’Act to accelerate the development of advanced sustainable materials with low and ultra-low CO2 footprints. The company’s ambition is to achieve 85 per cent CO2 reduction by 2030 by using a clear path from feedstock to sustainable materials and fostering its cutting-edge technologies with numerous strong industry partnerships.

Lighting

Forvia's Hella division showed off what they billed as the **world's first solid-state high-definition headlamp**. It can project digital symbols in front of the vehicle that can define vehicle width within a construction zone or driving path illumination. The technology will commercially launch very soon, in this first quarter of 2023.

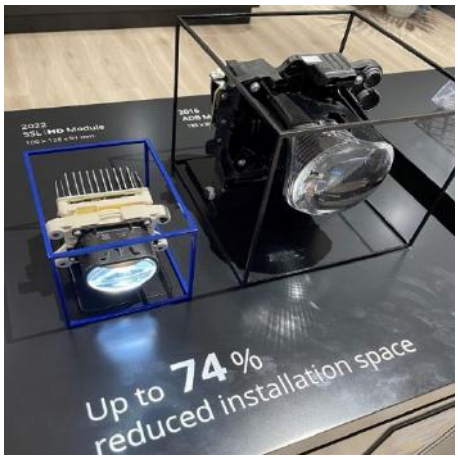
Reactive Dimming: a combination of gaze monitoring with smart dimming applied on an eMirror will help to reduce cognitive load, driver distraction and fatigue.

There was also **Dynamic Lighting With Superior Styling** providing down to an 80-per-cent reduction in energy consumption compared with conventional taillights; and digital, flexible integration options configurable for automaker-specific design needs.

Smart Presence Detection was shown as building on Forvia's ultra-wideband Smart Car Access system with advanced functionality for child and intrusion detection.

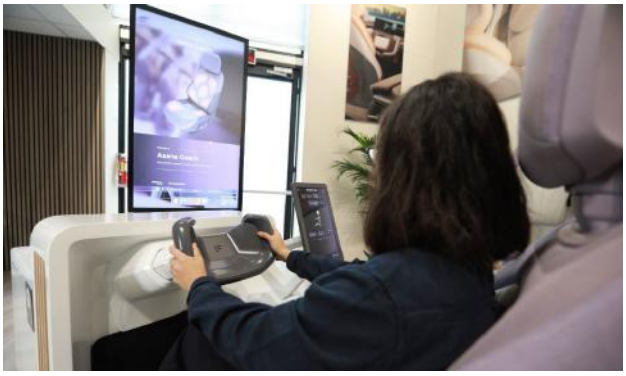
FlatLight for Front Lights, Too

The Hella FlatLight concept, initially designed as a rear combination lamp, will migrate also to front lighting. FlatLight is based on microoptics. These are extremely small optics, less than 15 µm, and are thus significantly smaller than a grain of salt. On this basis, both the weight of the light module can be decreased and its installation space requirement can be reduced to 5 mm, allowing for numerous new possibilities in terms of vehicle and lighting design. DRL; front position light, and direction indicator functions can be implemented in just one single light element. The FlatLight technology also achieves a previously unattained homogeneity at the highest possible cost and energy efficiency.



Forvia also proudly displayed the dramatically **reduced volume** of their latest headlamp modules, down to a 74-per-cent reduction comparing the 2016 Hella ADB module to their newest SSL | HD module. And they also showed off their newest ideas in illuminated grilleboards, the latest fashion-and-function response to the EV-AV megatrends.

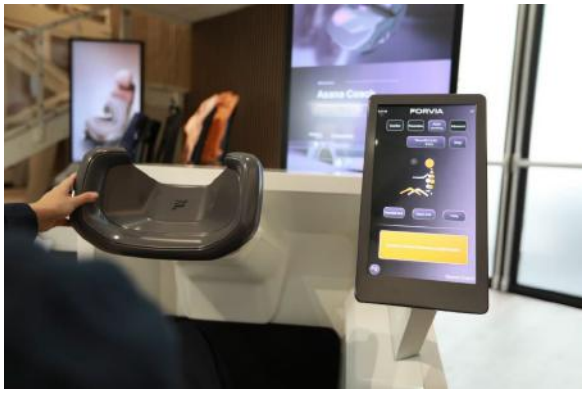
Interior
Key technologies and interactive interior experiences showcased by Forvia include:



Cabin Centrepiece 'Lumière' demonstrating highly versatile third-space cockpit design. It offers an innovative and customised mobility experience between front and rear seats that creates a homelike environment through configurable seating and an integrated bookshelf; reading lamps, and individualised-sound headrests. It features the world premieres of groundbreaking exterior lighting techniques; gaze-based intuitive HMI on multiple driving displays, and brake-by-wire integration.

Vibe technology is a new haptic solution that offers an immersive and safe experience, where tactile sensations are embedded in the car seat, stimulating the user's sense of touch. This technology helps reduce cognitive overload and increase biomechanical benefits. It provides three services:

music and entertainment: 4D sound automatically creates vibratory accompaniment of any sound—music or video or game soundtracks; **wellness:** an immersive experience providing relaxation; recovery, and energy-enhancing programs; **safety:** ADAS with haptic alerts for blind spots; lane changes; speed limits, and drowsiness.



Through their Seat For Me innovation program, Forvia delivers solutions that cater to people during their driving experience. The Asana Coach solution will drastically reduce back pain and in the meantime the Vibe and Smart Massage Mat will act for wellness and comfort. All has been done with an advanced ecosystem of partners and experts—Human Fab, Aurasens, AGR—and validated through end-user tests under medical control.

Next steps involve a system that records and processes the driver's current health status, using sensors that measure pulse and breathing rhythms. It will detect alertness, impending drowsiness and/or stress levels. Based on the information received, the system can immediately play music, spread refreshing fragrance, or change the interior lighting to help rectify a potentially risky situation.

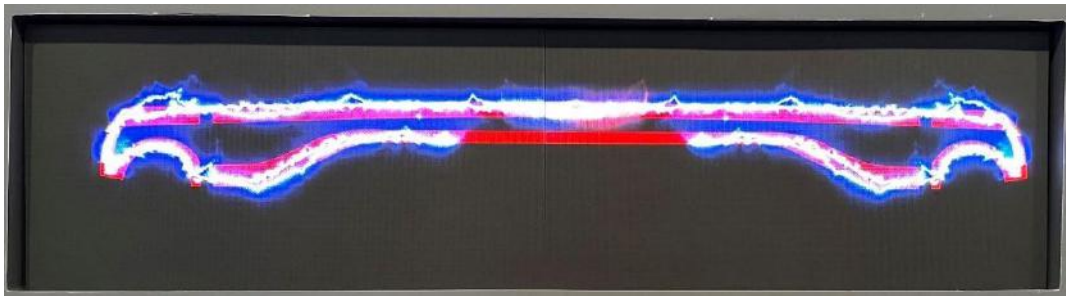
The Seat For the Planet innovation project to use less-better-longer spurred this modular design with embedded sustainable materials while addressing benchmark manufacturing and engineering efficiency. These products are circular economy-compatible, as for example Forvia proposes the first seat with fully-recyclable trim.

Macroblock

Macroblock, who are actively developing in new fields, have recently entered the automotive market. Major automakers have successively adopted Macroblock's LED automotive driver ICs. Their exhibits included LED headlamps and rear lights, and FALD (Full Array Local Dimming) LED backlight modules for in-vehicle displays.

Macroblock demonstrated their ADB system by using 100 LEDs driven by the supplier's MBI6353Q chip, which offers flexible current; 4,096 brightness-adjustment steps to respond to ambient light changes, and ASIL-B safety compliance.

At the moment, automakers are designing rear lights as full-width light bands. Macroblock showed how their controller chips can offer independent control of LEDs, and welcome light animation effects can be programmed.



Marelli

Visitors to Marelli's hospitality suite experienced the company's latest technology portfolio that drives vehicle personality and performance. An enormous range of vehicle interior technologies, techniques, materials and wow-factor surprises were on display, including innovative controls and displays—a no-goggles-needed 3D video manifestation of a digital personal assistant, for just one example. There was a digital configurator where guests could define their brand's personality by configuring their own vehicle, choosing from a curated selection of lighting; sensing; electronics, and interior options featured in Marelli's Digital Design Studio. Users had the option to select their features from designated personality styles, or create their own unique designs.

Lighting

Marelli showcased their latest technologies, including near-field ground projections that expand communication and safety features beyond the vehicle. The ground projection technology plays a key role in the 360° illumination of the car.

Static; semidynamic, and dynamic projections provide opportunities for various welcome, safety and communication scenarios to be displayed on the ground surrounding the outside of the vehicle. Equipped vehicles can be customised with animated and personalised logo projections or welcome messaging; provide amplified and better-visible alerts with extended turn indicators and reversing and rear fog lamps, and communicate key information like charging status. Static and semidynamic projections are realised using colour pictures; gobo, or multi-lens array technology, while dynamic projections are done with digital light processing technology.

Laurent Meister himself presented Marelli's smart grilleboard, riding the wave of a major lighting megatrend. A wide variety of signal lighting technology and technique was on display, including OLEDs and completely hidden (dead black when off) tail-stop-turn.

Laurent Meister, R&D Marelli AL director

Interior

The Marelli showcase highlighted the material collection display shown here. Their 'Interactive Smart Surfaces' provide a seamless and optimal solution for HMI integration into the vehicle's interior, providing two-way interaction between the vehicle and its occupants, enhancing in-cabin safety, providing voice recognition and eliminating mechanical buttons, replacing them with haptic-feedback, shy-tech surface-touch zones. The material collection display comprised an enormous range of surface finishes—woods, leathers, stones, metallics, and more.

The Diorama Display technology provides high-quality reflections on the bottom edge of the windshield, depicting images for navigation, indicators, telltales, and warnings from a TFT source. It ensures clear visibility and legibility no matter what time of day or road environment. The solution offers a much larger viewing angle compared to most HUDs, with the ability to span and display information to all vehicle occupants. Alternative to a single display, the pillar-to-pillar modular configuration allows a driver to easily recognize objects in their blind spot.

Other presentations included OTA software and data management solutions on Marelli's next-generation Cockpit Domain Controller (CDC) Unit, by Sibros. Marelli's MInD-Xp provides a single platform and domain control unitto run multiple guest operating systems and in-cabin functions including infotainment; clusters; driver assistance systems, and head-up displays to enhance driver and passenger experiences in a coherent HMI, underpinned by a BlackBerry QNX Hypervisor with cloud-connectivity to AWS. It also includes near-field ground projections that expand communication and safety features beyond the vehicle itself. Static, semi-dynamic, and dynamic projections provide opportunities for various welcome, safety, and communication scenarios.

Based on segment-matrix LCD or full RGB TFT, Marelli's Horizon Head Up Display projects information

for navigation, indicators, and warnings close to the bottom edge of the windshield, allowing objects in the driver's blind spot to be easily recognised. It ensures clear visibility through high-contrast images, with a distinctive appearance at a competitive cost

Other presentations included OTA software and data management solutions on Marelli's next-generation Cockpit Domain Controller (CDC) Unit, by Sibros. Marelli's MInD-Xp provides a single platform and domain control unit (DCU) to run multiple guest operating systems and in-cabin functions including infotainment, clusters, driver assistance systems and head-up displays to enhance driver and passenger experiences in a coherent HMI, underpinned by Blackberry QNX® Hypervisor with cloud-connectivity to AWS. It also includes Near Field Ground Projections that Expand Communication and Safety Features Beyond the Vehicle – Marelli's ground projection technology plays a key role in the 360° illumination of the car. Static, semi-dynamic or dynamic projections provide opportunities for various welcome, safety and communication scenarios. Further customize your vehicle with personalized logo projections or welcome

Mobis

President Cho Sung-hwan at media Showcase (Mobis image)

Hyundai Mobis had a large display, with concept vehicles showing their innovations in sensors; sensor fusion, and software development for safety control. The company's growth strategy was embodied in their M.Vision TO concept car, an autonomous electric vehicle with an integrated solution of combining its drive module battery system to pillar modules centered on an 'e-corner' system of autonomous driving sensors and communication lighting. The car is envisioned as a mobility solution with scalable shapes and sizes to meet different purposes. It also extends freedom of movement by performing tricks like 'crab driving' and zero-radius turns by dint of wheels which pivot 90°. The idea is to meet a wide range of needs, like maneuvering in narrow downtown streets and transporting cargo for minimum load-unload hassle.

Cheon Jae-seung, head of the FTCI (Future Technology Convergence Institute), also took the stage as a presenter at the media showcase, where he emphasized software and semiconductors as the core competitiveness of integrated solutions. Mobis are developing a software platform around their autonomous driving controller as the key component for implementing L^3 and higher autonomous driving; development is slated to be finished in the first half of this year.

Lighting
Mobis unveiled a new product called prism module. Thanks to new achievements in prism optics, this lighting product combines the low beam and the DRL into a single module just 12 mm thick, to give headlamp designers a much greater degree of freedom.

Also on display: lenticular grille lighting. Featuring Mobis' patented lenticular lens, this premium grille design creates a 3D look that appears to change depending on the viewing angle.

Mobis described their ongoing development of a software platform, where the autonomous driving controller introduced by Mobis is the key component for implementing L^3 and higher autonomous driving, slated to be finished in the first half of this year.

Plastic Omnium

PO's CES display showed and told how 2022 was a busy, active year for the supplier. They set up a new lighting division to provide all sorts of vehicle lights and lamps. Two of PO's latest product solutions won CES Innovation Awards the Dynamic Welcome Light Projection, and the Intelligent Off-Road Mobility Lighting System. The Dynamic Welcome Light Projection greets a vehicle's driver and passengers with an animated image projected onto the ground as they approach. The module can be fitted to the sills or in other nooks and crannies around the vehicle. It's based on a microlens array, a lens system which projects four different graphics independently from a single unit, thus enabling partial or full surround projection of all kinds of light patterns including warning symbols.

The intelligent offroad lighting system has a road-legal mode as well as a much more powerful off-road mode. Switching between the modes is fully automatic, controlled by GPS, and is designed to make off-road driving—very common in North America—safer and more comfortable.

Plastic Omnium are developing a new generation of projections that can feature not only animated images, but also on-demand video content. This opens up a whole new market for automakers in content management for innovative experiences.

A Digital Micromirror Device (DMD) is an efficient optical system comprising high-performance LEDs; the DMD itself, and the associated electronics, including the software and components needed to control the system. Its high precision improves contrast and minimizes stray light and phantom images. These are small modules that can be fitted all over the car, inside as well as outside

The system includes the patent-pending multifunction projection unit that uses an array of individually controllable LED light pixels which enable several lighting modes. Using data fusion, the system processes internal signals such as the acceleration and steering of the vehicle together with external data such as GPS to seamlessly adapt the illumination of the chosen path. This lighting system is compatible with a wide range of off-road vehicles and two-wheelers

In signal lighting**,** surface LEDs are the latest innovation. The patented technology combines an ultra-homogenous OLED look with all the advantages of classic LED light guides: They have a particularly thin design, support multi-colour and 3D lighting, and are cheaper to manufacture while lasting longer. Plastic Omnium's latest development "ILLUVISION" combines profound lighting expertise with know-how in advanced manufacturing technologies and marks a milestone for the group's LED family, further increasing design freedom.

And PO used CES to announce OP'n Soft, their new activity dedicated to the development of software for the supplier's own products and services. 120 employees are predicted this year; 250+ by 2025, to focus on mobility solutions as the CASE megatrends carry on gaining traction—connected; autonomous; shared, and electric.

Plastic Omnium CEO Laurent Favre said at the CES demo that OP'n Soft "will enable Plastic Omnium to offer [our] customers a unique range of integrated solutions and services, such as merging radar data processing software with lighting technologies. This is an exciting new adventure for Plastic Omnium, and a wonderful opportunity for our teams to unleash their tech creativity".

The new business activity will implement Aspice certification and Autosar platforms that make it easier for PO customers to access plug-and-play applications. PO also will leverage the latest AGILE methodologies and the benefits of DevSecOps3 in developing and supporting these future products and services.

Toyota Boshoku

Toyota Boshoku positioned themselves as "Interior Space Creator" by providing comfort, fun and convenience solutions based on the premise of safety and the environment. At CES, they featured vehicle interior space solutions for the MaaS market mated for autonomous technology in the future.

Interior

Their MaaS rideshare space concept MX221 is a vehicle interior space for ride-hailing mobility with *L*⁴ automated driving based on the concept of 'diversatility', **diver**se passenger needs and usage scenarios met through ver**satile** space layout and interior modules that can be easily interchanged. The vehicle has six advanced systems that can be optimally controlled according to each passenger's conditions and needs, to provide a permanently clean and comfortable moving interior and an entertaining user experience for passengers including wheelchair users.

MaaS service space concept "MOOX"

This interior concept responds to various service needs in the era of L^5 automated driving. It is equipped with the Tailored Space System (removable and interchangeable seats and interior items), and exhibits a wellness space that estimates the degree of fatigue and stress from the seat and contributes to relaxation and refreshment by controlling the five senses with the onboard device.

MaaS share-ride space concept "MX221"

A vehicle interior space for ride-hailing mobility with L4 automated driving based on the concept of "Diversatility (Diversatility": A term coined by combining the words "Diversity" and "Versatility). diverse passenger needs and usage scenarios are met through versatile space layout and interior modules that can be easily interchanged. The vehicle is equipped with six advanced systems that can be optimally controlled according to each passenger's conditions and needs, to provide always clean and comfortable moving interior, an entertaining user experience for passengers including wheelchair users.

And their MaaS service space concept "MOOX" responds to various service needs in the era of L^5 automated driving. It has the Tailored Space system of removable and interchangeable seats and interior items, and exhibits a wellness space that estimates the degree of fatigue and stress from the seat and contributes to relaxation and refreshment by catering for the five senses—no word on how those with chemical/fragrance allergies or aversions will be catered for on the olfactory front.

Toyota Boshoku also showcased their Mobility Interactive Experience zone, an open innovation zone exhibiting new solutions developed with various collaboration partners including SmartGlidr, a new rehabilitation and wellness product providing affordable, portable, versatile therapeutic exercise from a seated position. The company's VP of business development Dan Koester said he tries to "find a balance between business success, and doing work that benefits society. I'm happiest working on products that have an impact on people who are in need—underserved populations [such as the elderly]".

Valeo

At their CES press conference, Valeo emphasized their 100-year anniversary in innovation, and presented their latest innovations for cleaner; safer, smarter mobility.

Valeo showcased their "eXtended Reality Experience": wearing a virtual-reality headset, passengers can completely immerse themselves in a universe of their choosing and enjoy an intuitive and interactive experience while on their journey. Interaction with the virtual world is facilitated by an array of Valeo sensors throughout the cabin. Sensors located on the vehicle exterior combine elements of the real world with the virtual one. Valeo are banking on these advances in connectivity and VR to enable users to make the most of their time while their vehicle battery is charging—by working; catching up with friends and family, or just relaxing.

Driver Monitoring

Valeo's DMS is camera-based, and tracks driver alertness by identifying the driver and monitoring their attentiveness. The system alerts the driver when it detects signs of drowsiness or distraction. It also ensures that the driver has their eyes on the road when they need to resume driving in manual mode, in an L^{2+} AV.

Future features to come include driver authentication and emotion recognition.

Another immersive experience Valeo offered CES visitors was to climb aboard a vehicle with transformative lighting. Interior lighting is being reinvented and extended across surfaces to create a more immersive experience for passengers. It can be used for a variety of purposes such as delivering navigation information, visualizing music, creating personalized, relaxing atmospheres, etc. Immersion is made possible by engaging multiple senses such as sight, sound and touch.

Immersive Cabin Fascia—award-winning technology

Interactivity and safety are central to this unique system, which looks like a crystal and integrates HMI; dynamic lighting, and backlighting solutions. When the system is activated, its surface goes transparent and the interactive interface is displayed. The system's lighting can be used to change the ambiance, and includes enhanced safety features such as driver alerts. It has a metallic appearance when switched off, and a sparkly-diamond design when activated.

Lighting

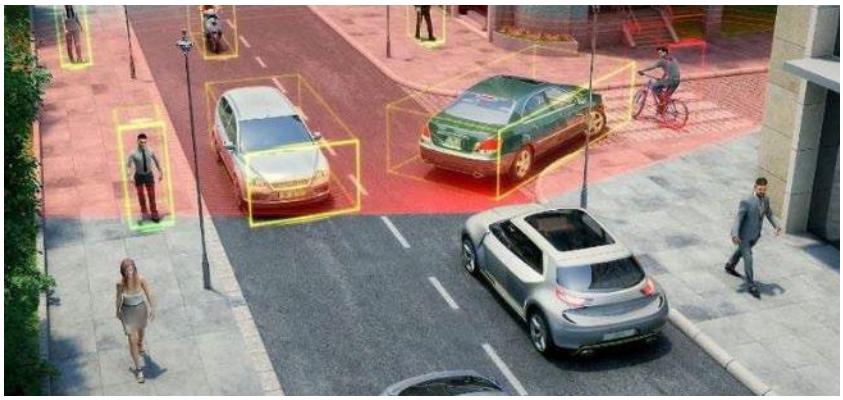
Valeo presented innovations in mechatronics; electronics, and software for safer, more sustainable mobility. There was an innovative front end, shown here, Valeo made in collaboration with OLEDWorks. This very compact solution allows seamless integration; design freedom; high-end finishing, and customisability as well as a first level of communication to road users.

Valeo's messaging on these grilleboards and tailboards: electric vehicles don't need radiator grilles, which frees designers to assert their style and brand signature through lighting. And as they are becoming increasingly autonomous, vehicles will have to communicate with their environment, making lighting a key tool. Pixelated surfaces can be used to clearly share real-time information such as the vehicle's charge level; eventually they will also be able to provide information on traffic conditions. Dynamic lighting inside the vehicle will alert the driver to information in emergency situations. These extended lighting features offer multiple ways for customers to personalise their space.

Lidar

Valeo are the only global supplier to series-produce automotive lidar. More than 170,000 units have already been produced, and the technology is protected by more than 500 patents. Valeo's third-generation Scala-3 lidar recreates a 3D image of the vehicle's surroundings using a point cloud, with resolution unmatched in the automotive realm. It sees everything, even objects that are invisible to the human eye. It can also identify objects such as a tire left on an unlit black asphalt road more than 150 meters ahead that the driver, cameras and radars can't discern. Stellantis has already chosen Scala-3 for multiple models from 2024.

Pantomime tech to protect VRUs



Valeo's new Pantomime technology is to help vehicles better anticipate the actions that pedestrians; cyclists, and other vulnerable road users take on roadways.

System uses algorithm to help cars 'understand' the movements of other road users and anticipate potential actions they might make. Valeo say it can also follow instructions from police officers or other authorities.

Harman

Interior

Harman image

At CES, Harman announced their Ready Vision product, a set of augmented-reality and HUD hardware and software products designed to enhance driver safety and awareness.

Ready Vision is part of Harman's range of new products that are road-ready and have demonstrated they deliver compelling in-cabin experiences. Each product is designed to work independently to deliver specific vehicle safety, well-being, and connectivity benefits, while also integrating seamlessly with other Harman Ready products for an even more enhanced experience. For example, Ready Vision is compatible with Ready Care, which offers extended situational awareness through enhanced audiovisual alerts when driver distraction is detected.

ZF

Interior

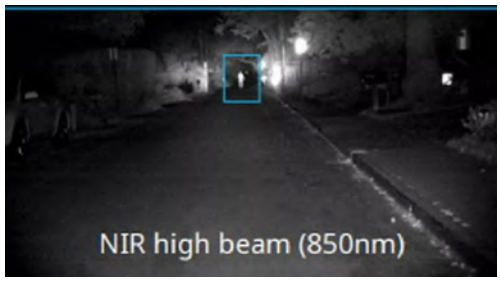
At CES, ZF showed a heated seatbelt they say could increase EV range by up to 15 per cent by reducing the energy required to keep passengers warm.

ZF's 'Heatbelt' concept for EVs promises to save battery energy, and it sounds like something drivers will want. Heated seats and steering wheels have almost become something standard today, and automakers and suppliers haven't really extended other heated elements in the car.

The technology relies on a special webbing that integrates heating conductors, designed to give a uniform sense of warmth positioned close to the body. The 'Heatbelt' is only marginally thicker than a standard seatbelt, and heats up quickly to around 38 °C. They decrease cabin-heating energy usage compared to conventional space-heating methods. ZF also made a world premiere at CES of an L^4 shuttle delivering a highly modular solution for mixed operating environments, capable to maneuver in mixed traffic without a safety steward. With this, ZF is enabling the operation of autonomous transport systems in densely populated areas with no need for segregated or dedicated shuttle lanes.

Integrated into ZF's autonomous driving system with the ZF ProAI at its core is the Virtual Driver software stack. It consists of two major parts, the performance path, and the safety path. Together, both enable an operation of L^4 shuttles or other transportation carriers in a safe and reliable way. The safety path monitors comprehensive situations under safety aspects, defines virtual guardrails for the performance path, and intervenes if necessary to help mitigate critical situations. Meanwhile, the performance path enables smooth driving in complex scenarios. ZF developed this in partnership with Oxbotica, a leader in autonomous vehicle software for businesses.

KSLD



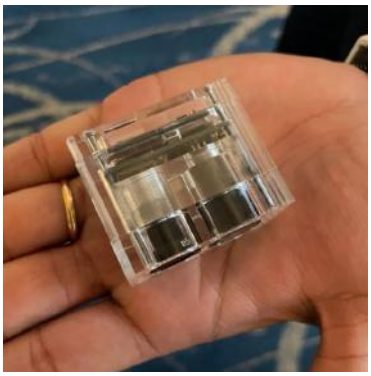
Kyocera SLD Laser showed off their world's first LaserLight™ headlamp modules that deliver high-intensity white and infrared (IR) illumination for night vision and sensing for increased safety and visibility in automotive and mobility applications. At CES, KSLD demonstrated the new headlamp modules and the rest of their award-winning LaserLight product range, as well as innovations in efficient optical power transfer; fast LiFi communication, and ingenious, highly-efficient new laser-illuminated flexible light guides. Following the successful commercialisation of the first KSLD LaserLight module in high beam booster applications in 2019, they're now offering these LaserLight headlight modules producing highly efficient and performant low and high beams with white and IR dual emission in precise U.S. or rest-of-world beam patterns with minimum glare to maximize driver visibility and optimize IIHS scores.

The IR illumination increases night vision camera visibility of pedestrians and of foggy or smokey roadways, while also enabling new forward lighting functions including ranging and 3D flash lidar sensing. The modules are arranged in a set of four per headlamp: two for low beam, and two for high beam. The modules are ultra-compact with a slim profile of less than 12.7 mm lens height, and can be configured in a horizontal; 2 × 2; vertical, or offset layout.

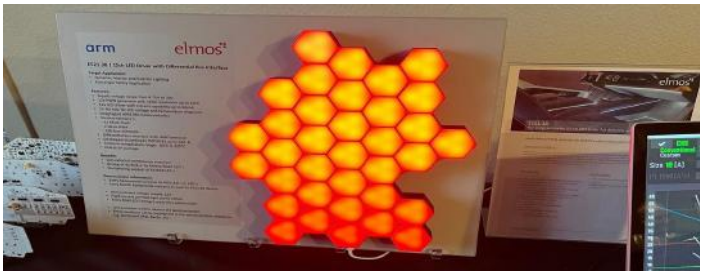
At their legendary night event in the desert, half an hour outside Las Vegas, KSLD showed a 200-metre light guide powered by just one 3-watt laser diode. The first envisioned application is as a first-responder zone delineator for rescue missions, firefighting (it's fireproof) and other suchlike; future applications could include emergency exit guide lights Laser headlamp demos were given with a buggy equipped with extremely powerful laser headlamps with a range of several kilometres—somebody not involved with the event apparently called the police in response to the unexplained super-bright lights!

There was also an amazing drone show producing electric fireworks with KSLD lighting technology.

Elmos



As usual, Elmos had a suite—a bit difficult to find, in the Westgate Hotel—to show their automotive products. Their well-known LED driver chips which enable nice animations were shown, as well as different ultrasonic applications. New this year: a super-small lidar module for detection ranges up to 45 metres.



Elmos showcased new concepts for 'smart' switches for the next generation of gesture control, and high-performance ICs for controlling LED ambient lighting in cars.

An HVAC demonstrator with low-noise fan and active air flap control was presented, using Elmos motor controllers for water- and coolant-based as well as air-based applications.

Qualcomm

Interior

At CES, Qualcomm introduced a new concept vehicle showcasing how their Snapdragon Digital Chassis solutions integrate technologies from a diverse ecosystem of companies to deliver experiences that are highly personalized and intuitive, including immersive infotainment, driver assistance, and enhanced safety.

The Snapdragon Digital Chassis concept vehicle brings the software-defined vehicle to life, showcasing an array of applications and services that allow consumers to extend their digital life into their vehicle.

Software is creating more room for innovation, making traditional hand-controlled dashboard and menus an increasingly inadequate user interface. Intuitive voice control will be essential for assisting users when interacting with the vehicle, whether it's to adjust the seat, turn up the music, or make a purchase. All passengers benefit from having a conversational virtual assistant that's tuned into their specific audio-zone. Individual Immersive audio is also managed through the platform

Pontosense

Interior

Pontosense presented at CES their patented sensor, which measures micromovements of occupants to measure real-time respiration and heart rate Vitals measurements can discern stress and anxiety; drowsiness and fatigue; motion sickness; intoxication, and comfort levels. The generated data can work with in-cabin control systems to enhance the car ride experience and work with ADAS to actively ensure safe operation of the vehicle. The system is said to measure vital signs with medical-grade accuracy, using millimeter-wave radar (around 60 GHz) to capture micro-movements as small as a heartbeat.

Patented innovations include 'AI'-powered millimeter-wave sensors, and 'machine learning' with noise filtering algorithms measuring vital signs in a vehicle in motion.

Emotion 3D

Interior

At CES, Emotion 3D announced a novel system for enhanced road safety by combining camera- and vital-sign based drowsiness detection, system developed with SAT, with support of Garmin.

Smart RCS (Restraint Control System) is able to personalize passive safety systems in event of a crash. Using a 3D sensor for understanding the vehicle interior, the system considers a wide range of relevant, personal and situational factors such as body physique, position and pose, weight and gender. Emotion 3D already announced a partnership last year with Veoneer and AVL in that direction.

Visteon

Interior

Visteon displayed a wide range of digital cockpit technologies during CES, which enable automakers to create safer, connected and more convenient driving experiences. These features were prominent in two Visteon digital cockpit platforms: the Lightscape® Panorama Display and the Command & Control Display, which each captured a 2023 CES Innovation Award.

Innovobot

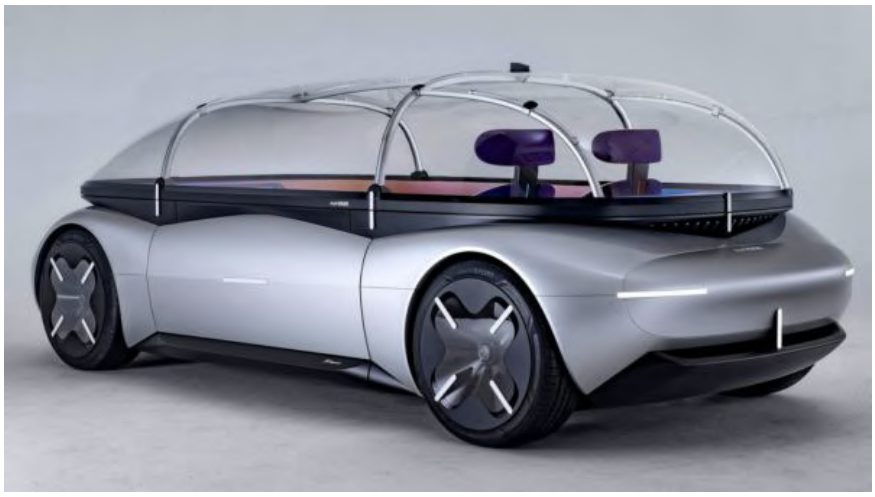
Interior

Through a collaboration with three technology companies, Montreal-based Innovobot Labs developed a new design for automotive displays.

TDK supplied their PowerHap actuators for sharper-feeling haptics; BOE Varitronix delivered a screen and the related controllers, and Microchip Technology brought their haptics electronics system which includes an amplifier and a microcontroller. Innovobot Labs was responsible for designing and integrating the overall system.

Asahi Kasei

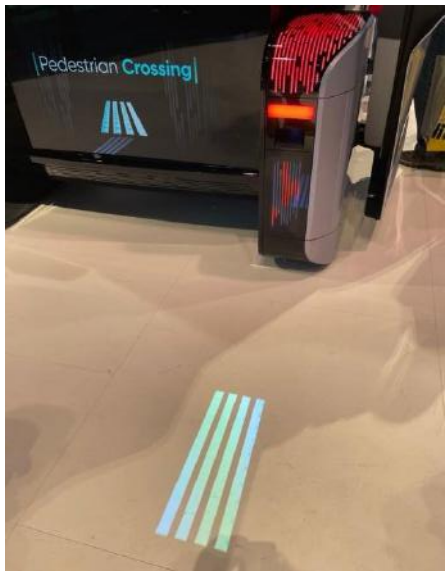
Interior



The concept behind the AKXY2 collects the evolving needs of car occupants into themes revolving around Sustainability, Satisfaction and Society—the '3 Ss' that will change how occupants use cars and how they will more thoroughly integrate into our lives.
From textiles and engineering plastics to elastomers, the Asahi Kasei materials integrated into the vehicle contribute to a lower carbon footprint. The interior surfaces are covered by Dinamica®, a premium microfiber resembling suede partially made of recycled polyester. Sage Automotive Interiors, an Asahi Kasei subsidiary, can also provide other sustainable fabrics utilizing raw materials that range from recycled PET, bio-based PET, natural blends, and ocean waste. The cabin's built-in CO_2 sensor allows optimal air quality while reducing energy usage to extend range. It includes:

Italdesign

Italdesign, a nameworthy design and development company from Torino, showed a self-driving concept with several lighting ideas. A rear lamp with customer-changeable signature—safeguarded by Italdesigned software to ensure fulfillment of the legal lighting performance, for example. Several road projection and display functions were demonstrated, too.



Kurz

Kurz are a global supplier of thin-film technologies for decorative and functional purposes. They surprised CES visitors with multilayer moulded samples for exterior and interior automotive applications, made with sustainable materials. Kurz have been working for lighting applications with German-based Lightworks, as well.

LG Innotec

LG Innotec showed their Nexlide technology: a thin, homogeneous light guide consisting of a PCB with the LEDs; two silicone layers; a condensing lens, and a bezel—all in a thin, unitised package. It comes in white; red, and RGB, and the LEDs are dynamically controllable.

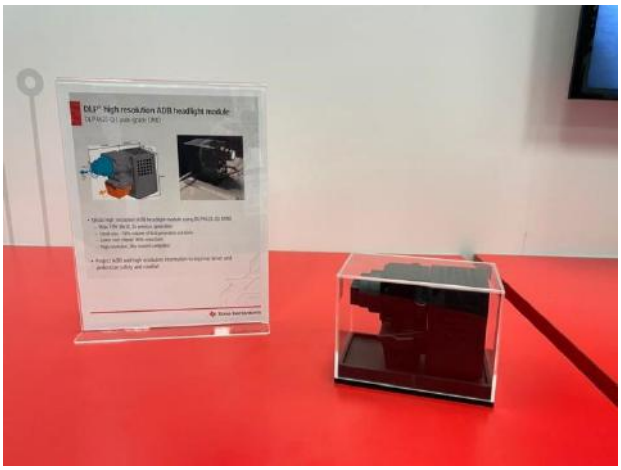
OLEDWorks

OLEDWorks showed a curved and segmented OLED, fully qualified for production. This is the next and necessary step, making the OLED more flexible for design purpose and package needs. Another really nice sample was shown with segmented OLEDs in 3D design including a legal stop light function. CEO David Dejoy himself was explaining the OLED technology to interested visitors.

Seoul Semiconductor

Seoul Semiconductor's booth was located in the central hall, close to their main customer LG. They displayed, with numerous examples, the galloping speed of progress in LED technology and applications—notably in displays. A board showed that over 18,000 patents are held by Seoul Semiconductor, and described that they defend them all over the world with lawsuits as necessary. A major focus for the supplier is natural and healthy lighting. They offer a range of LEDs providing very high quality light without the usual high blue spike in the spectral distribution—their SunLike range. Another new product is an LED with a batwing pattern to allow super slim lamp packages, demonstrated as a Wicop display.

Texas Instruments



The most important automotive demonstration at the TI booth was clearly new HUD technology using DLP (digital light processing) projectors to enable HUDs on vertical windshields—just the thing for trucks and motorcoaches. Their new scalable radar chips were shown with interesting prospects for numerous ADAS applications.

The DLP projectors for automotive headlamp applications didn't play a big role, with only a small unlit model shown with a new size of the whole DLP module. Perhaps it's because these have already gained significant traction in high-end adaptive headlighting systems, and so aren't really groundbreaking news.

Lidar suppliers

26 notable lidar companies were present at CES, including some new names not seen before. Lidars are evolving toward compact, solid state units—a good thing; the big spinners just can't be tidily packaged into many vehicles. Lidar is surely coming to ADAS for L^3, as virtually every relevant party to the discussion agrees they are crucial for a competent, safe, effective system (only Tesla's Elon Musk scornfully disagrees). It looks like FMCW lidars are growing in importance. Five lidar companies are based in China: Benewake; Hesai; RoboSense; Vanjee, and Zvision. Five are headquartered in South Korea: AutoL; Itops Automotive; Kanavi Mobility; Soslab, and Vueron. Two are based in Israel: Innoviz and SiLC. The others are Aeva; Cepton; Continental; Innovusion; LeddarTech; Lightic; Lumative; MicroVision; Ouster; Outsight; PreAct; Scantinel, and Valeo

AEye

The AEye lidar demo, located is the open space in front of the West Hall, showed that a building more than 2 km away was clearly recognised. With AEye's MEMS technology, a bundling or spreading of the laser is possible depending of the driving situation.

Hesai

Hesai unveiled their new solid-state FT120 lidar. Designed for near-range blind spot coverage, the FT120 helps vehicles accurately identify small objects while turning; overtaking, and parking. The system has a 100° × 75° field of view and a maximum detection range of 100 m. Its data rate is 192,000 points per second in single-return mode; overall resolution is 160H × 120V.

The FT120, together with Hesai's AT128 long-range hybrid solid-state lidar, forms a complete automotive-grade lidar perception solution. Hesai have already received 'pre-orders' of a million FT120 units from top automakers, and will begin deliveries in the second half of this year.

Innoviz

Innoviz displayed their new Innoviz360 system, based on an innovative design to overcome the performance; cost, and size barriers of spinning lidars. It features up to 1,280 scanning lines per frame; configurable frame rate; 0.05° × 0.05° resolution, and 300-metre range. Its design leverages many hardware advances from its predecessor, the InnovizTwo, including a single laser; detector, and ASIC.

The Innoviz360's high resolution, large vertical field of view, and reduced cost could help overcome major challenges for automakers looking to achieve $L^{4\text{-}5}$ automation in robotaxis; shuttles; trucks, and delivery vehicles. It enables autonomy in automotive-adjacent applications, too, including heavy machinery; smart cities; logistics; construction; maritime, and more.

Lumotive

Lumot and Axibo, a developer of autonomous camera motion control systems, jointly presented a new solution wherein Lumotive's Light Control Metasurface (LCM) beam-steering chips have been integrated into Axibo's Precision eJib robotic arm. The result is a designed-for-cinema, six-axis robotic arm with 3D sensing capabilities. It grants photographers and videographers benefits such as smart object targeting and tracking; enhanced image stabilisation; automated scene capture, and new autofocus features to produce sharper images and videos.

Available initially for professional-grade cameras, and under development for consumer-grade cameras, the new photography and cinematography automation solution takes advantage of Lumotive's LCM beam steering chips that deliver exceptional performance and range in 3D sensing. Could automotive applications be possible? It's certainly fun to think about! Early versions of Lumotive's M30 lidar reference design are being evaluated for potential by consumer product companies; robotics systems developers; tier-1 automotive sensor suppliers, and automakers. The M30 reference design with enhanced performance and optimised for volume manufacturing is expected to be available by the middle of this year.

RoboSense

RoboSense presented their solid-state short-range flash lidar for the first time at CES. It has RoboSense's first chips developed in-house designed for a flash solid-state lidar platform, and their first 2D electronic scanning technology. With highly integrated chips handling transmission; reception, and processing, the new lidar greatly streamlines the circuit design and production processes. It enables performance and cost advantages while meeting the durability and reliability requirements of automotive blind spot lidars. It provides a 120° × 90° field of view; refresh rates exceeding 25 Hz, and has a ranging capability of 30 m at 10 per cent. Series production is slated to start in the second half of this year.

SiLC

SiLC Technologies demonstrated their compact, performant Eyeonic vision system. It boasts high resolution and precision and long range, and is said to be the only FMCW automotive lidar to offer polarisation information.

It's a versatile, turnkey solution to reduce time to market for manufacturers to build machine vision into their products. The Eyeonic Vision System (EVS) delivers the highest levels of vision perception with very low latency, to identify even those objects more than a kilometre away.

SiLC founder and CEO Mehdi Asghari said "When bringing vision to machines the criticality cannot be understated of ranging precision, direct monitoring of motion through instantaneous velocity, spatial resolution for recognition of fine features and polarisation for material detection. For machines to augment our lives they must have a vision solution that is powerful; compact; scalable, and unaffected by environmental conditions including interference from other systems. Our groundbreaking technology will empower the next generation of machine vision applications with bionic vision that will exceed that of humans and yet be compact, cost effective and power efficient."

At the heart of the EVS is the company's fully integrated silicon photonics chip. With roughly 10 millidegrees of angular resolution coupled with millimetre-level precision, it provides more than 10× the definition and precision of legacy lidars. This enables the EVS to measure the shape and distance of objects with high precision at great distances.

The new system couples the EVS and a digital processing solution based on a powerful FPGA (field-programmable gate array). The compact, flexible architecture of the system enables synchronisation of multiple vision sensors for unlimited points per second.

The EVS is highly versatile, supporting multiple scanner options and providing customers with the flexibility to tailor their designs to maximise performance for distance and field of vision for their application. It is accompanied by a broad range of accessories.

ZVision

ZVision formally launched their new short-range lidar ML-30s+ at CES. With an ultrawide field of view; enhanced imaging effects; new automotive-grade hardware and software architecture; and customised engineering solutions, the new system is expected to deliver excellent lidar experience for autonomous driving.

The ML-30s+ has a field of view of 140° × 70°, enabling it to detect a vehicle advancing from behind 1.4 metres earlier than 120° lidar systems. This, in turn, gives the regulation and control system an extra 300 to 700 milliseconds to respond. The system can effectively detect objects at ground level, such as low safety guardrails; bricks and rocks; stone abutments; safety cones, and other road obstacles, as well as accurately identifying lane and parking markings.

The system offers an angular resolution of 0.44° × 0.44° and a frequency of 512,000 points per second in single-echo mode. It can obtain 20 point clouds from a black-clad pedestrian 22 metres away, and six point clouds from a triangular cone barrel 25 metres away.

The ML-30s+ adopts a non-coaxial architecture design. A MEMS mirror module is responsible for the two-dimensional scanning of the transmitting module, while a pure solid-state receiving module is responsible for the gaze reception of the large FOV. The two do not interfere with each other. For reliability, the MEMS mirror module comes with new proprietary packaging, as well as temperature and humidity resistance and vibration shock resistance at the highest levels. The design life tops 50,000 hours, fully meeting the requirements of passenger vehicles.

The ML-30s+ also has good ranging capabilities under severe weather and difficult ambient conditions including direct sunlight, providing reliable 3D sensing capability for autonomous driving under all kinds of working conditions.

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List of the main DVN monthly reports

Main reports launched in 2008-2019

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Audi company profile
AL company profile
DRL, brand signature
Valeo company profile
Koito company profile
China lighting market
The Wonderful World of Passenger Car lighting
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US automotive lighting industry
Materials in Vehicle Lighting
The Future of Exterior Lighting
IAA Frankfort Autoshow

Main reports launched in 2020

CES Report
DVN Munich WS
GENEVA Autoshow
US Lighting
Marelli AL Profile
50 years Light Styling
ADAS and Lighing

Main reports launched in 2021

Evolution of LEDs
New Models July-October 2020
Audi Lighting & ADAS
Lighting in development countries
Nov. 2020-Feb. 2021
ADB Update
DVN Shanghai WS
Innovations in Rear Lighting
Global Landscape of Automotive LED Suppliers

Reports launched in 2022

Technologies presented in CES 2022
Laser light automotive lighting
ISAL report
DVN US workshop
Worldwide Demographic Development
Models launched May to August
DVN Shanghai report
VISION congress
Paris Autoshow + last Vehicle models
L.A. Autoshow

Reports to be launched in 2023

CES Report
TU Darmstadt Lighting Institute
DVN Paris Workshop
Universities and Lighting
OLED Technology
MLA Technology
Models launched in H1-2023
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DVN US Workshop
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