Thu, 12 May 2022
Weekly Newsletter

DVN-I
Automotive Interior

NEWSLETTER #111

Editorial

Industry News Confirms Interior Trends

BMW 7-SERIES (BMW IMAGE)

We are gratified by all the positive feedback we've been getting after this recent (and first in-person) DVN-Interior Workshop, and we've had many new subscribers. Remember, all the presentations are available as videos on demand for DVN Interior members and all Workshop participants; anyone else can purchase access on an à-la-carte basis—just click the Video tab on the **Workshop page** of the DVN website.

One of the workshop sessions was about driver and occupant monitoring systems. It included six lectures, all looking at DMS-OMS techniques and development processes. This is a red-hot technology, and it's the subject of this week's in-depth article. You'll also find news comporting with the other themes explored at the Workshop, confirming their pertinence as the main trends for the interior of the future. Take a look at the AMS Osram-TactoTek collaboration on smart surfaces—reported here first! We've also got news of Magna's FreeForm; Transys' work on upcycling; JLR/Panasonic for air quality; Forvia's new approach for OTA comms, and a new BMW system-integration technique. We're glad you're here with us; let's keep at it—together!

Sincerely yours,

Philippe Aumont
General Editor, DVN-Interior

In Depth Interior Technology

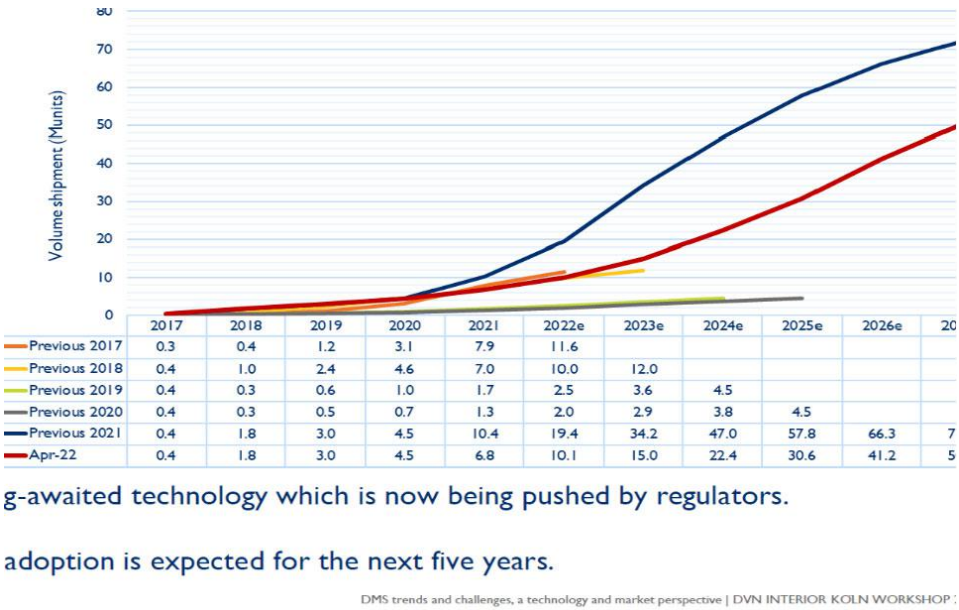
DMS-OMS Market, Technology Boom

The market for driver and occupant monitoring systems (DMS-OMS) continues to grow at a galloping pace, and so does its technical and technological development. It was the topic of a key session at the recent DVN Interior Workshop with contributions from Yole; Fraunhofer; Ansys; Lumentum; Elmos, and Melexis.

The DMS-OMS push is driven by safety concerns stoked by the need to keep task-relieved drivers alert and ready to resume car control instantly when autonomy's limits are reached, and by the drive to address infant/pet-left-in-car tragedies. Starting this year, this kind of in-car monitoring feature is considered a key safety criterion in Euro NCAP's evaluations; that organization's 2025 roadmap in pursuit of Vision Zero includes evaluation of distraction, fatigue, and responsiveness as the three stages of driver behavior with two points toward the 5-star assessment—that's DMS' job—and the Euro NCAP protocol also includes "life detection" to safeguard infants and pets; that's for OMS.

The field is crowded with companies working on DMS-OMS: Adient; Aisin Seiki; Aptiv; Autoliv; Bosch; Continental, Delphi; Denso; 3D Emotion; Forvia; Hitachi; Magna; Omron; Panasonic; Samsung; Seeing Machines; Smart Eye; Tobii; Valeo; Veoneer, and ZF—and that's surely not an exhaustive list!

Background information and data



	2017	2018	2019	2020	2021	2022e	2023e	2024e	2025e	2026e	20
Previous 2017	0.3	0.4	1.2	3.1	7.9	11.6					
Previous 2018	0.4	1.0	2.4	4.6	7.0	10.0	12.0				
Previous 2019	0.4	0.3	0.6	1.0	1.7	2.5	3.6	4.5			
Previous 2020	0.4	0.3	0.5	0.7	1.3	2.0	2.9	3.8	4.5		
Previous 2021	0.4	1.8	3.0	4.5	10.4	19.4	34.2	47.0	57.8	66.3	7
Apr-22	0.4	1.8	3.0	4.5	6.8	10.1	15.0	22.4	30.6	41.2	5

YOLE IMAGE

According to NHTSA, in the United States 3,477 people were killed and 391,000 were injured by distracted drivers in 2015 alone. The American Automobile Association says 21 per cent of fatal crashes involved a drowsy driver. And 54 per cent of fatal crashes in Europe are said to be related to fatigue and distraction. For that reason, DMS will contribute 25 per cent of the ADAS evaluation and occupant condition monitoring score in Euro NCAP's assessments.

Since the DMS is becoming effectively mandatory for $L^{2/2+}$ AD systems, the global market is rocketing from about one million units in 2020 to an estimated 22 million units in 2025. International Automotive Components (IAC) Group is a global supplier of innovative and sustainable instrument panels, consoles, door panels, overhead systems, bumper fascia's and exterior ornamentation. They are headquartered in Luxembourg, and they report that a driver's eyes off the road for 5 seconds at 55 mph is basically driving the length of an entire football field while blindfolded; texting has the same effect on driving reaction times as consuming four alcoholic drinks within an hour; 660,000 drivers are using their phones while (nominally) driving at any given moment, and distracted driving killed 10 per cent more people in 2019 than in 2018.

Seeing Machines

We've **reported before** on Canberra, Australia-based Seeing Machines. They specialize in computer vision-based technologies, and a primary application is DMS-OMS. Seeing Machines and Magna collaborate on fully-integrated driver monitoring and mirror solution.

MAGNA IMAGE

We **previously reported** on Magna's mirror-inbuilt DMS. The Seeing Machines collaboration focused on a demonstrator with a fully integrated DMS combining camera, electronics, and interior mirror technology. It melds Magna's mirror technology; camera design; and integration and packaging expertise with Seeing Machines' approach to an optimized and co-designed optical path; embedded processing, and enhanced AI vision algorithms for DMS. Magna says this addresses the critical challenges associated with managing vehicle electronics integration; cost, and seamless camera packaging in diverse vehicles.

Seeing Machines' enhanced Fovio eDME (embedded Driver Monitoring Engine) algorithms and processor-optimized and -accelerated software bring an optimized processing footprint; low thermal dissipation, and the small size and weight needed for a viable all-in-one mirror-based DMS.

Seeing Machines says they have addressed the difficulties associated with a movable mirror/camera combination by dint of vision-based dynamic real-time detection and calibration techniques. The integrated mirror location also offers an effective cabin camera position and field of view for driver and occupant monitoring; the camera is not too high in the vehicle cabin to obtain information critical for NCAP and regulatory standards associated with driver distraction and impairment, and not too low for an expanded interior occupant view, enabling a range of safety and convenience features inside the cabin.

Seeing Machines and Autoliv

AUTOLIV IMAGE

In 2017, Autoliv and Seeing Machines started collaborating on a DMS to detect distracted and drowsy drivers by accurately measuring eye and head position; driver attention, and fatigue.

Autoliv offers passive safety systems including modules and components for airbag systems; seatbelts; steering wheels; battery cutout switches; anti-whiplash and pedestrian-protection systems, and connected-safety services for riders of powered two-wheelers. Sales in 2021 amounted to about USD $9.3bn.

Reliable understanding of driver state will also enable Autoliv's development of technologies critical for supporting highly autonomous driving functions, with safe hands-off-wheel operation. Within the collaboration, Autoliv serves as a tier-1 supplier to automakers to produce DMS for future awarded business.

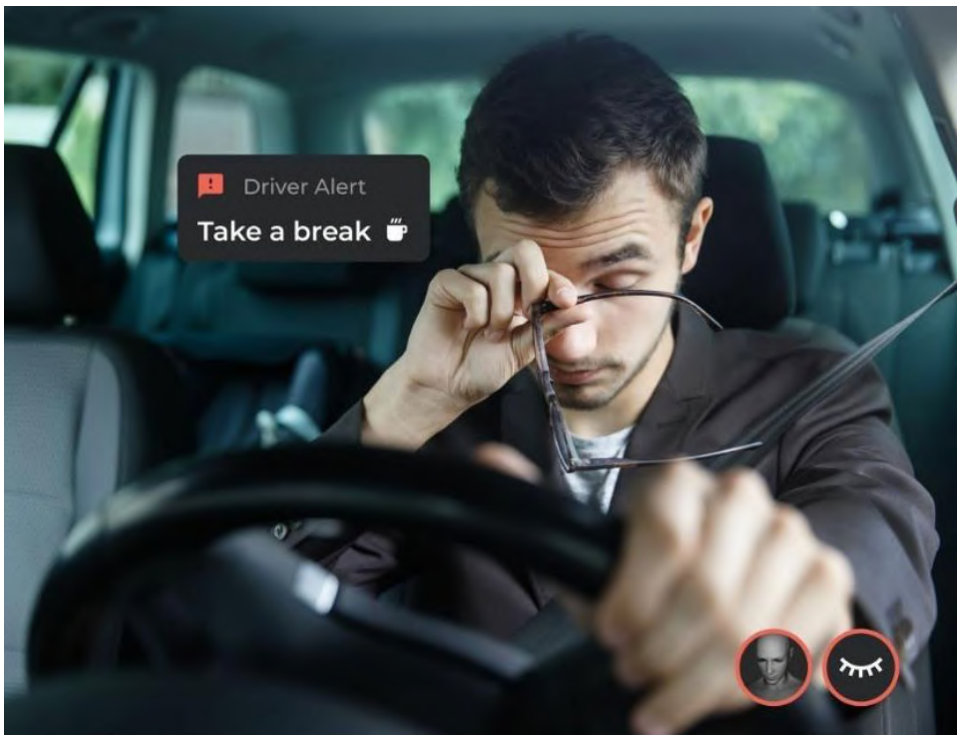
AUTOLIV IMAGE

Autoliv recently announced their next-generation crash detection technique, which uses sensors from a smartphone and contextual data—**watch the video.**

Valeo's Interior Cocoon

Valeo’s interior cocoon brings together several onboard technologies for improved passenger safety in the vehicle: camera-based DMS to analyze the driver’s face using AI; cabin monitoring to detect occupant behavior, and a life-detection system, which signals if a child or animal is in the rear of the locked vehicle.

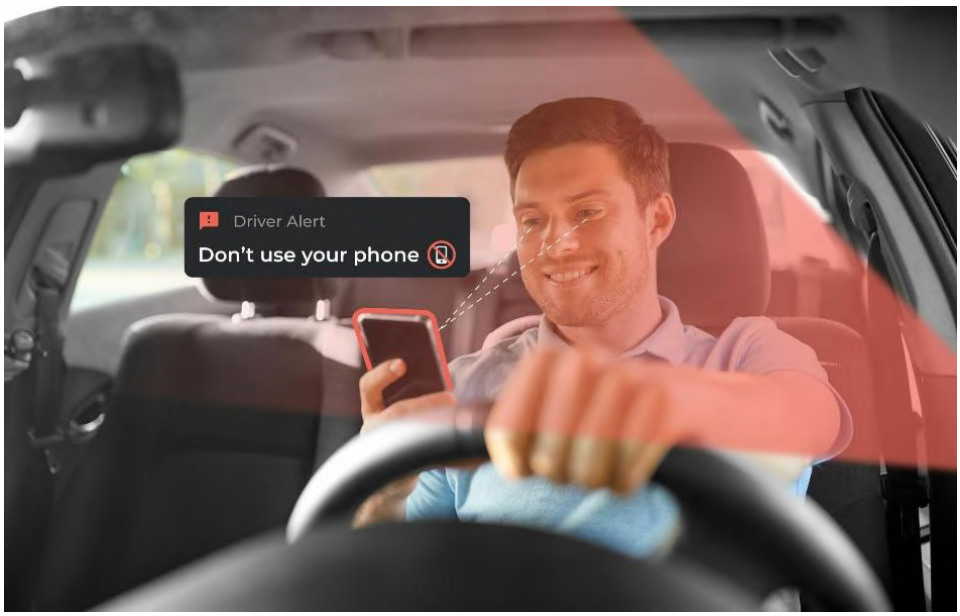
Valeo’s DMS detects distraction and drowsiness; identifies drivers, and recognizes emotions as expressed on the driver's face. When it detects signs of sleepiness or distraction, the system transmits alerts to get the driver’s attention back onto the driving task. The system’s camera, mounted on the dashboard, also keeps watch to see that the driver has their eyes on the road.



VALEO IMAGE

Other applications are also possible, such as driver identification for personalized settings and adapted driving modes.

Valeo’s DMS is in mass production with deep learning algorithms, including a scalable ECU and cameras for driver identification; accurate head-and-eye tracking, and monitoring driver gaze for distraction or drowsiness. Camera-based driver identification also provides an additional level of security compared to key or badge-based access systems.



VALEO IMAGE

VALEO IMAGE

Thanks to the Valeo Interior Monitoring System, the vehicle is able to adapt to the internal context by knowing the characteristics of occupants such as their posture, and then adapting elements such as the air temperature or the driving mode. In addition, in the event of an accident, the intensity and deployment timing of the airbags can be adjusted according to the position and size of each passenger.

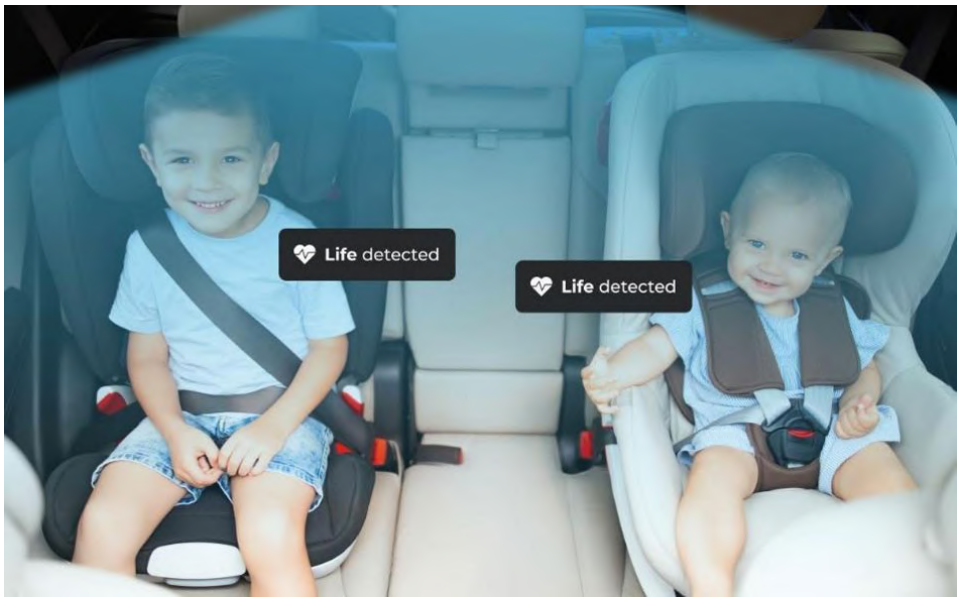
The cabin monitoring system's camera also allows entertainment functions such as taking selfies (so as to meet the very important, urgent need to post them to social media immediately).

VALEO IMAGE

Valeo Gesture recognition offers a natural and intuitive way to interact with the vehicle for even safer driving. Based on machine-learning algorithms and a Valeo-made compact 3D camera, the feature is embedded in the dome module.

VALEO IMAGE

The life presence detection system uses interior radar and AI algorithms to detect if there are live creatures in the car. Result: no more children or pets forgotten in the car. Once the car is parked and locked, if the system detects a person or pet still inside the vehicle, it activates an audiovisual alarm on a smartphone. The system works on 60-GHz radar using a millimeter-wave detection system to keep track of occupants' body movements in real time—as subtle as breathing-related chest movements, even under visual obstacles such as clothing or blankets.



VALEO IMAGE

Such systems with passenger movement detection are usually integrated in the vehicle overhead system and must be able to detect or assess the presence of a child or a pet in a locked vehicle and either provide warnings for as long as necessary or intervene (windows down? Blower on?) to mitigate the risk of heatstroke.

Interior News

AMS Osram, TactoTek in Molded-Electronics Pact

INTERIOR NEWS

MICHAEL BRANDL IMAGE FOR OSRAM

AMS Osram and TactoTek are cooperating to bring communication, emotion, and senses to new spaces in the form of smart surfaces.

TactoTek develops and licenses their in-mold structural electronics technology (IMSE®) for a broad range of industries, with especially strong interest from the automotive market.

Part of the first harvest of this cooperation is a demonstrator: AMS Osram's Osire E5515, the first side-looking automotive RGB LED created for traditional electronics but which will just as comfortably integrate into IMSE structures—qualification for which is now in final phases. This LED will enable thin; seamlessly integrated, three-dimensional illuminated structures with no precedent in the car environment. Driven with modern controllers, illuminating the surface from within, this LED sets the mood; informs, guides, and adapts to the designer or user needs, with the broadest color gamut on the market.

Announcement and first prototype display were both at DVN Interior Workshop in Köln, at Osram's expo booth—a typical (and terrific!) illustration of how community members leverage the DVN platform for levelling-up their business and technology innovations.

Magna FreeForm Seat: Eco-Friendly Design Freedom

INTERIOR NEWS

MAGNA IMAGE

Magna says their FreeForm seating technology (see **previous DVN-I coverage**) will be launching on four new vehicles within the next year or so; valued by automakers for providing a sculpted and seamless styling surface and allowing versatile design possibilities.

Magna Seating Systems president John Wyskiel says "Automotive seat design has become an even more important consideration in light of the rapidly evolving mobility landscape and the resulting shift toward interiors and in-car experience. We are seeing an increasing demand from both traditional customers and new entrants alike seeking to offer superior comfort and design features and create a more 'homelike' cabin, as well as utilize more eco-friendly materials. FreeForm technology can deliver on all fronts". FreeForm first hit the market in 2020 on the Cadillac XT5, and will now launch with other automakers on a large SUV; a midsize crossover; a sedan, and an all-electric SUV.

According to Magna, FreeForm can achieve design details as sharp as a 1-mm radius compared to 20-25 mm for traditional cut and sewn solutions. This allows automotive stylists greater design possibilities to achieve various shapes and forms. It competes more with bonded and pour-in-place technology, but at lower cost, and with better reliability. It also offers improved back comfort thanks to more than 10 cm of concavity —nearly impossible with traditional cut-and-sew techniques. Coupled with bolsters, this offers enhanced support for the lower back as it reduces fatiguing micro-motions of the spine. Furthermore, FreeForm is created with a foam laminate which results in a moldable surface four times more breathable than comparable molded trim products (depending on the particulars of the textile or leather surface).

The back panel seats also contain up to 50 per cent polyols derived from recycled PET (polyethylene terephthalate—the kind of plastic water and soda bottles are made of) and the seating surface contains up to 20 per cent renewable materials from a bio-feedstock.

Upcycled Interior Concept From Hyundai Transys

INTERIOR NEWS

HYUNDAI TRANSYS IMAGE

Hyundai Transys—part of the giant Hyundai Motor Group chaebol—supplies transmissions, axles, and seats. They have shown off their latest future mobility seat concept at the Lineapelle International Leather Fair in Milan, Italy. Tanned leathers are used in the seat sections where durability is required, and woven leathers are used in the seatback bolsters, giving contrasting textures while minimizing leather waste from cutting. Leather scraps were ground to powder and reconstituted into yarn, which was later combined with yarn made from recycled PET bottles to create a regenerated fabric for the floor area.

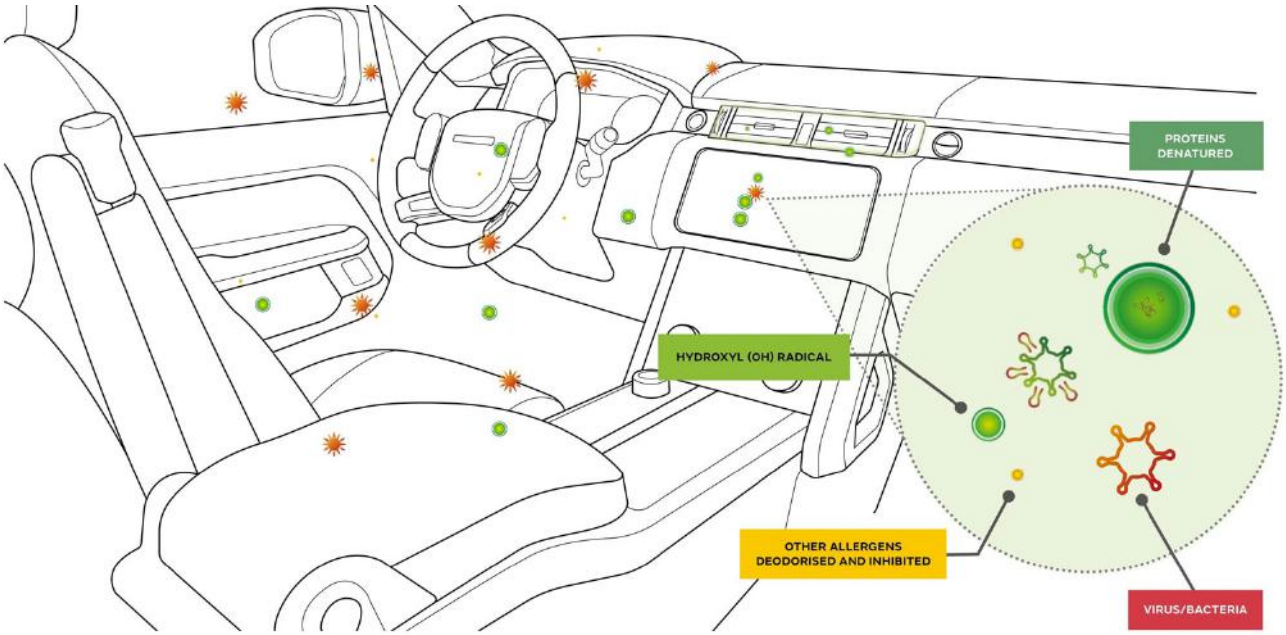
HT also used upcycled felt fabric and 3D printing to structure the headrest out of recycled aluminum powder to give the model a cohesive look while demonstrating sustainable applications. The seat frame is also an upcycled product from 2018, brought back for this project to provide a sustainable approach throughout.

Hyundai Transys (HT) describes their interior concept as showcasing the shift to regenerative mobility. It features HT's Color-Material-Finish (CMF) concept seat, developed using sustainable leather and other recycled materials in partnership with Italian and Korean manufacturers to make use of tanning waste; **see video**. Overall, it's about upcycling: transforming byproducts and wastes into new materials or products perceived to be of higher quality; utility, and aesthetic value. HT design team leader Sung-Kyung Hong says, "When autonomous driving mobility spaces become everyday places in our lives, material research and development from the eco-friendly perspective shown in this concept seat will become more important for the future of mobility".

Lineapelle is the top international exhibition dedicated to leather: accessories; components, and synthetics for footwear; garments; furniture, and now automotive applications, too.

JLR-Panasonic IAQ System Zaps Viruses, Bacteria

INTERIOR NEWS



JLR/PANASONIC IMAGE

Jaguar Land Rover says their future cabin air purification technology can reduce airborne viruses and bacteria by up to 97 per cent. The prototype HVAC system will use Panasonic's Nanoe X technology to help prevent unwanted bacteria or viruses from entering the interior space.

Together with microbiology and virology lab Perfectus Biomed, JLR carried out a sealed-chamber test in which the vehicle's ventilation system was simulated for 30 minutes. 97 per cent of viruses and bacteria were unable to enter the cabin, and during a two-hour sealed test program, the system 99.995 per cent effective at eliminating the SARS-CoV-2 virus which causes Covid.

JLR chief medical officer Steve Illey says "Our customers' wellbeing is of paramount importance to us, and now more than ever we are all looking for technological solutions that can help take care of our loved ones".

Panasonic's revised Nanoe air purification system is said to be 10 times more effective than the previous version **covered in DVN-I** last year. High voltage is used to create trillions of hydroxyl (OH) radicals enveloped in water nanodroplets; these OH radicals then envelop the virus and prevent its growth.

JLR research engineer Alexander Owen says "This technology is a great example of being able to harness the power of nature. Hydroxyl radicals are some of the most important natural oxidants in chemistry and have been helping to clean our atmosphere for millennia, removing pollutants and other harmful substances. The creation of this technology and our advanced research is the first step in deploying this scientific phenomenon within vehicle cabins of the future".

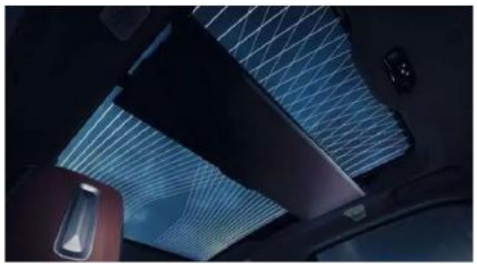
New BMW 7 Series • Interior Highlights

INTERIOR NEWS

The new BMW 7 Series is a luxury car bristling with innovations. The focus is on a driver-oriented connection with all functions. For starters, there's a curved display—**as in the X7**—which consists of two displays united under a glass pane. New is the "Interaction Bar". This effectively backlit functional unit with a crystalline surface structure extends below the trim strip across the entire width of the instrument panel and far into the door trim. It includes touch-intensive controls for functions including HVAC, hazard lights, and opening the glovebox. In between the control zones on the bar are ambient lighting elements.

Another new feature is the optional automatic opening and closing of the rear doors. Twelve ultrasonic sensors prevent unwanted collisions with other road users. If the door does have to be opened manually, an integrated servo mode makes it effortless.

With the optional 31.3" theatre screen with integrated Amazon Fire TV, the RSE (rear seat entertainment) system creates a cinematic experience. The optional Sky Lounge panoramic glass roof creates night ambience with dynamic lighting effects, as well.




BMW IMAGES

Two 5.5" touchscreens are integrated into the rear doors and allow operation of the infotainment system; the theatre screen; automatic climate control; seat adjustment, and more. The optional B&W (Bowers & Wilkins) Diamond Surround Sound System produces a "4D" audio experience with about 2000 watts through 40 tweeters and mid-range speakers and central woofers and shakers.

Newly-developed comfort seats are standard equipment; BMW says they offer wider seat surfaces than the outgoing model, as well as extensive electric adjustment; heating, and lumbar support for the driver and front passenger. An Executive Lounge option adds a reclining function for the rear seats with integrated leg-rest behind the front passenger seat, plus an optional quilted and heated armrest with glass insert and integrated smartphone tray for inductive charging. A torso angle of 42.5° can be achieved between the seat surface and backrest, which BMW claims is a new benchmark in this segment.

The car comes with Merino leather trim in a variety of color options, and the company’s latest Veganza synthetic leather is available as a no-cost option. The seat materials can also be combined with cashmere wool trim.

Forvia Aptoide Infotainment Tech For Mercedes

INTERIOR NEWS

MERCEDES-BENZ EQS (MERCEDES-BENZ IMAGE)

Forvia's Aptoide technology has been selected by Mercedes-Benz to power navigation and other vehicle infotainment functions in a crucial win against Google and other digital technology firms to control car dashboards.

Starting next year, the joint venture between Forvia and independent open-platform app store Aptoide will be integrated into Mercedes' MBUX multimedia system. Vehicle users will have access to Aptoide's wide array of around 250 apps including navigation; traffic; streaming; payment; parking and charge station information, and more.

Tech giants like Google, Apple and Amazon are in a race for a bigger share of the growing vehicle infotainment market. Faurecia-Aptoide's deputy general manager, Thomas Belin, told Reuters that the Mercedes contract helps boost his company's position.

"Today, with such contracts we see that we have this critical mass (…) and that we are legitimate in this market," he said.

The Forvia-Aptoide joint venture already has contracts with Volkswagen Group and BMW to provide app service for their vehicles' Android Automotive systems. Negotiations are also under way with a French carmaker and premium car brand to offer a tailor-made product carmaker can brand as their own in Europe.

"We are going to provide a much more customizable app store offer, where each manufacturer will be able to really appropriate the solution, choose their ecosystem and have control over personal data, which is an important issue", Belin said.

For instance, Belin said Faurecia-Aptoide can offer VW users a "MyVolkswagen" account instead of a Google account. Forvia says as of this past January, three million vehicles worldwide use the Aptoide platform, not including the new BMW and Mercedes contracts.

The Design Lounge

Tata Avinya: Design for Maximum Space, Minimum Screens

THE DESIGN LOUNGE

TATA IMAGES

The Avinya concept is a major step towards future EVs from Tata Passenger Electric Mobility (TPEM). Based on Tata's gen-3 architecture, it's a premium hatchback blending the luxury and versatility of an SUV with the roominess and functionality of a minivan.

The name "Avinya" is derived from the Sanskrit language, and stands for innovation. The concept car introduces a new design that liberates enormous roominess and comfort, not restricted by traditional segmentation. It comes packed with new technology; software, and artificial intelligence that work in the background to deliver wellness and tranquility during transit.

There's a sky dome that enhances the overall sense of space and natural light; a functional, console-inspired steering wheel; a voice-activated interface, and sustainable materials throughout. There's also an aroma diffuser which JLR says will create a serene, soothing ambience—no word on whether there's an off-switch for those whose preferences or allergies mean they want or need an unscented environment.

The concept has no screens, to exclude distractions inside the car and create a stress-free environment for the mind and soul, says Tata.

This architecture is built with advanced, lightweight materials and techniques to minimize overall mass. **See video**.

News Mobility

Cao Cao LEVC Taxi to Maximize Convenience

NEWS MOBILITY

CAO CAO IMAGES

Cao Cao Mobility, the ride-hailing platform of Chinese automaker Geely, has agreed with Geely-Lifan JV Chongqing Livan Automotive to field the Maple 60S, the first battery-swappable EV. In the meantime, Cao Cao Mobility launched two new services called Zhuanche and Huixuan. Cao Cao CEO Gong Xin says Zhuanche is designed to offer users a premium ride-hailing service and seating experience at an affordable price, while Huixuan is designed as a lower-cost car-hailing service.

Established in 2015 and backed by Geely, Cao Cao Mobility principally engages in offering green mobility services with NEVs (new energy vehicles). Last September they closed series B funding with C¥3.8bn (USD $588.6m) raised.

At the fundraising launching ceremony, Cao Cao Mobility announced a new strategy dubbed "N^3", which stands for three businesses Cao Cao will focus on: New cars (made specifically for ride-hail service); New Power, and New Ecosystem.

Cao Cao is operating in the Paris region. London Electric Vehicle Company, the UK-based Geely subsidiary that manufactures the (now electric) new versions of the iconic British taxicab, will supply EVs to drivers. According to Cao Cao, the Taxi TX will initially be equipped with umbrellas; power outlets, electronic air conditioning with separate settings and easy payment systems. Other equipment could be offered in a few

months depending on passenger requests. By supplying electric cabs, Geely's English factory is ramping up and putting more cars on the road. Yet to be announced is whether other-brand hybrids will complete the Parisian Cao Cao fleet.

NASA Chooses Canoo for Launchpad Shuttles

NEWS MOBILITY

CANOO IMAGES

Astronauts and space tourists prepare for a flight at a location not within easy walk distance of the launchpad—that's just a basic safety precaution—and so vehicular transport is required. Now, NASA has signed a deal with EV manufacturer Canoo to provide launchpad shuttles.

Canoo's CTV (Crew Transportation Vehicle) met NASA's requirements for being zero-emissions, having a range of at least 50 miles, and being able to seat eight people—one driver, three support staff, and four suited-up astronauts.

The CTV will be based on Canoo’s LV model, an all-new EV based on Canoo’s proprietary multi-purpose platform to maximize cabin space, utility and productivity on a compact footprint.

Canoo vehicles are engineered from the inside out, vertically integrating drive-by-wire function in a modular multipurpose platform which liberates valuable interior space for passengers and cargo. The team focused on

optimizing function and form, so each component and space of the vehicle has a purpose for the driver, passenger and the mission.

The CTV, to be manufactured in Arkansas and Oklahoma, will go into service for NASA's forthcoming Artemis lunar exploration missions, which are to send astronauts back to the moon starting in 2023.

General News

Forvia Strategy: Software, Electronics and Talents

GENERAL NEWS

DVN IMAGE

Faurecia bought Hella; the resultant group, called Forvia, is the world's № 7 equipment supplier and announces a turnover expected to reach €33bn in 2025. Forvia has also just gained independence, via a spinoff, from their historic main shareholder Stellantis. The company is working hard on hydrogen with their joint venture Symbio and recent partnership with Air Liquide.

Automotive short to mid term challenges are material shortages (chips and wire harnesses; aggravated by Russia's war on Ukraine); general inflation, and Covid, still, because of China's lockdowns.

From a structural standpoint, the challenges are mainly the shift to digital, and talent management. A new operating system development represents activities for 15,000 software engineers. Electronics and software represent 25 per cent of the vehicle value while supporting differentiation which is happening mostly through the car interior—where the humans interact with the machine.

Talent is hard to get hold of now times, as Covid has sidelined many out of the system. To address this, Forvia will create a hub network to allow people working mainly from home to meet regularly with limited commutes. After the purchase of Clarion and other relatively small companies, Hella will allow the Forvia and its Faurecia Clarion Business Group to change dimension in terms of electronic and software skills.

DVN was invited to a lecture by Forvia CEO Patrick Koller about his strategy. Here's a quick summary:

On Faurecia's acquisition of Hella:

Hella represents a great complementarity with Faurecia activities with their expertise in electronics and geographic footprint; the great future of lighting which is a wonderful product range, and their B2C activity in diagnostics, here again with an expectation of great growth.

On Uncertainly and change:

We're in a time of great change from planned word to event-driven actions, through sustainability/climate change. Covid outbreaks and lockdowns in China; Russia's war on Ukraine, and the semiconductor shortage mean we're in an inflationary period for awhile; these and The social tension and unrest all over the world also mean short-term consequences which will reduce vehicle volume this year. Meanwhile, there's fierce competition to recruit talent, mainly in electronics and software.

On Forvia's priorities:

- Inflation and squeeze management
- Forvia synergies
- Inventories
- Portfolio management
- Anticipate 2023

Plastic Omnium Buys Varroc Lighting

GENERAL NEWS

Varroc Engineering has agreed to sell their more-than-three-wheeled-vehicle lighting business to French supplier Plastic Omnium for €600m. The impetus behind the sale: Varroc wants to reduce debt while focusing on their electronics, connectivity, and EV product ranges in the high-growth Chinese and Indian markets and on the 2-wheeler segment globally.

Varroc will divest their 12 lighting system operations in the USA; Brazil; Mexico; Poland; Czechia; Germany; Turkey, and Morocco. But they're keeping their 4+-wheeler lighting operations in Asia, and will continue to operate their Chinese JV and other international 2-wheeler businesses in countries like Italy and Vietnam, and global electronics businesses in Poland and Romania. The company is retaining their 4-wheeler lighting operations in Asia.

Varroc's lighting activities operate as Varroc Lighting Systems, and are based in Plymouth, Michigan. The company's roots date to the 19th century, and it was part of Ford's Visteon unit until Varroc acquired it in 2012. Varroc's lighting division lost money in 2021, largely because of underutilized production capacity, Plastic Omnium CEO Laurent Favre said, adding that utilization rates are about 50 per cent and sales were about €800m last year.

Varroc Lighting Systems is the № 6 vehicle lighting maker globally, with a 5.6 per cent share (in 2020) of the market to supply headlamps, auxiliary lamps, and signal lamps for the world's automakers such as Ford, Jaguar Land Rover, GM, and Volkswagen. Plastic Omnium is a leader in car modules and intelligent exterior systems, with a market share of 18 and 15 per cent, respectively. Their acquisition of the Varroc lighting business will complement their existing activities so they can offer more content per vehicle to their automaker customers—the largest of whom are the Volkswagen Group, accounting for 26 per cent of PO revenues, followed by Stellantis (17 per cent); Daimler (11 per cent), and BMW (9 per cent).