



Editorial

Assessing Car Lights In Situ

DVN was given a first sneak preview first of the world's first goniophotometric system for assessing and characterising the performance of lights as installed on vehicles. It was at LMT in Berlin, where an extensive red-brick factory complex dating from the 1900s—one of Osram's very first lamp factories, is LMT's headquarters and the premises of an inconspicuous warehouse. Upon entering the warehouse, once one's eyes adjust to the darkness comes the wow effect: An ultra high-tech light testing hall under darkroom conditions, at least 8 m high and 35 m long; a BMW 3 series placed on rotating-table, 6m in diameter with built-in road spurs, at a height of about one metre. In the corner there's a mock-up vehicle with fixing points for many headlamps and 4 wheels which do not touch the ground. In the far distance a measuring screen covers the entire wall—the only reflective surface in the hall; at the right edge of the screen towers a linear axis thicker than an I-beam, at least 8 metres high.

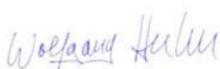
A carriage mounted to the oversize I-beam moves slowly up and down, making that distinctive LMT goniophotometer sound.

During our visit LMT's top specialists were finalising a new goniophotometric test stand to measure the light intensity distribution of headlamps as installed on the vehicle. This is a completely new principle of measurement for vehicle lighting. LMT have branded the system VELAS[®], short for Vehicle Lighting Assessment System. One is reminded of the Spanish "Vela" which means "candle", candela being the SI unit for photometry related measurements.

Taking a closer look, the rotating table is in fact a precision goniometer able to handle even the largest of vehicles. Light distributions projected onto the screen by the vehicle are photo-stitched in a rapid fashion with the help of a Technoteam luminance camera, or scanned directly at 25 metres by an LMT photometer head mounted to the carriage of the 8m vertical axis. The exact position of car and headlamps on the turn table is crucial and is measured precisely before the lighting tests can start. The mock-up near the entrance is the "dummy" or reference vehicle used as a calibration system for both cars and headlamps. The lab enables headlamp performance assessment based on the CIE TC4-45 or any other such specification.

Overall, the system is an impressive piece of technology in service to the push for performance-based standards for vehicle-integrated lighting systems, and it is further evidence of the rapid pace of innovation we continue to witness in the vehicle lighting industry. We look eagerly forward to a presentation of the complete system at one of the next DVN Workshops.

Sincerely yours,



WOLFGANG HUHN
DVN ADVISER

In Depth Lighting Technology

Interview: LMT's VELAS® Brings the Road Into the Lab



LMT'S CARSTEN DIEM (LEFT) AND THOMAS REINERS (RIGHT)

DVN was given a sneak preview of the world's first on-vehicle goniophotometric test stand, VELAS®, enabling light intensity distribution testing of headlamps under lab conditions. We posed a few questions to LMT's Drs. Carsten Diem and Thomas Reiners during our visit:

DVN: Carsten and Thomas, thanks for this excellent preview. How long will this system stay in Berlin, and where it will go next?



INTENSITY MEASUREMENT OF LAMPS INSTALLED ON THE VEHICLE

Carsten: What you see here is the system completing its validation before it will be disassembled, boxed into a container, and send to our customer in China this Summer.

DVN: What were the key points of the development?

Thomas: Our customer requires a system for testing headlamp performance to the CIE Standard 021, which was developed by TC4-45. Our target was to bring the road into the laboratory, measuring vehicle lighting performance without the influence of weather and local road conditions like reflection and relative flatness. It's

the only way to achieve measurement reproducibility when testing on-vehicle headlamp performance. In the lab tests can be done any time of day and you do not have to wait for the right weather.



CAR INSTALLED, READY FOR HEADLAMP MEASUREMENT

Carsten: And of course, bringing the road into the laboratory needs to be as practical as possible. We are not using a 100-metre light tunnel here, but a reasonably-sized building. We employ a 25-metre test distance, the same as in headlamp component goniophotometry worldwide. Over the course of the project, we have constantly cross-checked the results coming off of the vehicle goniophotometer with data for the same headlamp coming off a component goniophotometer. The agreement between the two systems has been outstanding. With this new technology we are closing the gap between component testing and road-based lighting testing, the data are gathered under controlled conditions which are transparent for all parties.

DVN: Did LMT develop the system alone or was there a collaborative effort?

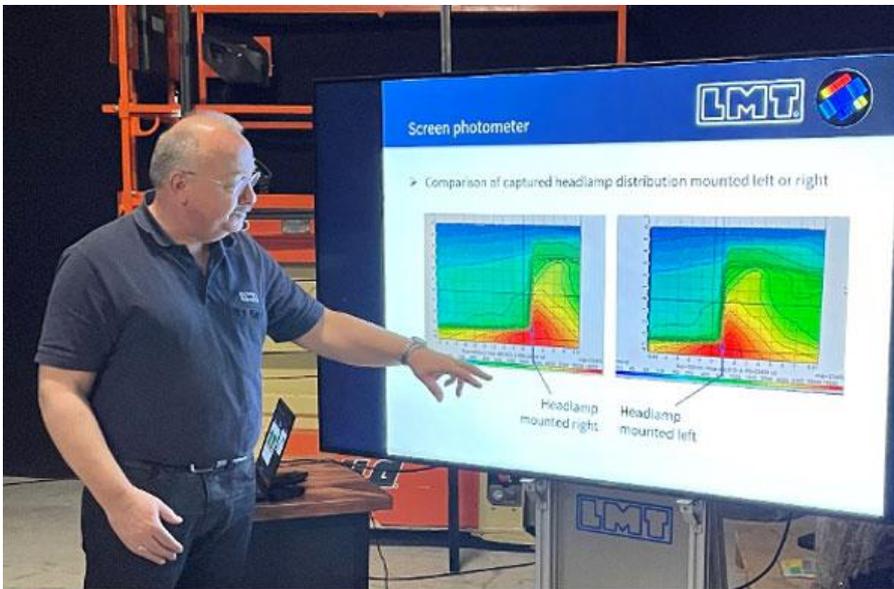
Thomas: LMT have been building goniophotometers for component based automotive lighting testing for over 40 years, so we have the experience and the staff. The VELAS[®] system was developed completely in-house: Concept, design, mechanical engineering, software and validation. One key technology is the screen-based indirect light distribution measurement, a key feature for speeding up the test procedure, where we rely on Technoteam's high-performance imaging luminance cameras.

DVN: What is the maximum weight and size of the test cars?

Carsten: The system has been designed for vehicles up to a length of 6.5 m and a weight of 3.5 t, which means in UN vocabulary, M1 and N1 vehicles. However, the goniometer is extremely robust and can certainly handle more.

DVN: Can the system check the exact absolute position of the cutoff line?

Thomas: Once the vehicle position has been determined, VELAS[®] calculates the legally mandated cutoff position and projects it onto the screen. Afterwards, the software compares this location with the cutoff position as presented by the vehicle. There are then two options: Either allow VELAS[®] to measure the light intensity distribution as is, or the user can adjust the headlamp inclination on the vehicle. Of course, the system has gathered the data and headlamp adjustment can be done at any later juncture.



THOMAS REINERS DEMONSTRATES AGREEMENT OF ADB ISOLUX CURVES GATHERED ON THE VELAS[®] WITH CURVES GENERATED ON A COMPONENT GONIOPHOTOMETER

DVN: How do you detect the position of car and headlamps precisely?

Carsten: We employ two subsystems, each individually designed for a specific task. Car position and driving direction are established using the wheel rims—their centres and angle of orientation—as the reference. VELAS[®] includes a tactile measurement system which registers the wheel's centre based on multiple measurements off the rim. Once we know this we can check for consistency and calculate the median longitudinal plane of the vehicle with regard to the vehicle positioning table of the goniometer.

Thomas: After establishing the vehicle's direction we establish the headlamp reference point using the same tactile system. If the headlamp manufacturer has not marked this point on the outer lens, we determine the centroid of the headlamp radiance in the plane of the outer lens. This procedure requires some experience by the VELAS[®] operator. For instance, in case of multiple light emitting apertures it is necessary to decide which headlamp module is most important for the cut-off. In the end, any potential rating of vehicle lighting performance is based on road illuminance, which means the location of the reference point during measurement will be mostly cancelled out.

DVN: What is the 8 m high tower good for?

Carsten: The tower is basically a motorised linear axis, a kind of photometer goniometer. While the vehicle goniometer moves the vehicle on a horizontal plane, the tower positions a photometer vertically. Together, both VELAS[®] axes constitute a CIE Type III goniophotometer. Light distribution is captured on a cylindrical surface. 8 metres of vertical linear axis is more than generous, but this allows us to easily gather light distribution from 7D to 6U at a test distance of 25m. This range is required for the C-NCAP rating to be implemented by our customer. Of course, the system can be built more compactly and still deliver pertinent data.

DVN: What was the most difficult part of the job?

Thomas: There is no clear favorite! We had numerous design iterations, and of course in each phase we had a number of hurdles to overcome, but we had an excellent team who worked miracles. In the end I feel the software was the greatest challenge, trying to address the particular customer requirements and at the same time allowing maximum flexibility for future applications, for instance for enabling vehicle-based testing of dynamic lighting features, our next goal with this system.

DVN: Anything else what you want to tell us?

Carsten and Thomas: Actually, the system went from the drawing board into construction at the beginning of the Covid lockdowns. We had to deal with the pandemic-related constraints with home-office and delivery delays, but on the other hand due to travel restrictions the entire LMT team was grounded for a good part of the year in Berlin and was able to work intensively on VELAS[®]. In the end we were really able to go the extra mile for the customer and complete the system in record time. Huge thanks go to all our colleagues who have contributed to this project!



WOLFGANG HUHN WITH THOMAS REINERS AND CARSTEN DIEM

Lighting News

DVN was Present at the Inauguration of CASIC: Historic Moment for China and Worldwide Harmonisation

LIGHTING NEWS



from Geoff Draper, DVN Senior Regulatory Adviser

DVN Readers will recall that Xie Dongming, Vice-President of CASIC, the Chinese Automotive Standards Internationalisation Centre (Geneva), chose the **DVN Shanghai Workshop** in April 2021 to make the first public introduction of the China Automobile Standards Internationalisation Centre.

In his presentation, Xie Dongming outlined the purpose to:



- **Promote** China's automobile industries and relevant institutes to participate in the standards internationalisation activities in a more sustainable and international way.
- **Support** and liaise with global intergovernmental and non-governmental organizations (such as the UNECE, ISO, IEC, etc.) based on Geneva.
- **Bring** together experts to contribute knowledge for standards internationalisation and provide solutions to global challenges.

See [Xie Dongming's presentation](#).

On June 21, 2021, the China Automobile Standards Internationalisation Centre (CASIC) was inaugurated at an impressive ceremony with an invited audience of international and Chinese VIPs. Due to COVID travel restrictions, the event was held live at the CATARC Headquarters in Tianjin, China from 15:30 to 17:10, with the International VIPs joining via a very efficient video connection and simultaneous translation between Chinese and English.



I was honoured with an invitation to the event because of my work to promote harmonisation and my close involvement with the Chinese experts of C-GTB and the TC-114/ SC-21, responsible for the development of the Chinese GB Standards. I contributed to the opening ceremony with a short greeting video wishing CASIC every success and committing to strongly support its work.

In my greeting I introduced myself as the ex-President of GTB, and **senior regulatory advisor of Driving Vision News** to emphasise my international involvement.



The Inauguration Ceremony of CASIC was opened by An Tiecheng, President of CATARC and Li Wei, Vice President of CATARC

Speeches of the officials from Chinese and Swiss governments

- Li Yubing, Deputy Director General, Department of Standard Innovation, SAMR
- Shang Peng, Deputy Director, Bureau of Planning, SASAC
- Guo Shougang, Deputy Director General, Equipment Industry Department I, MIIT
- Mr. Morath, Counsellor of Commerce, Embassy of Switzerland in China

Speeches of cooperation partners

- UN Inland Transport Convention and the Development of Mobility
- Standards Facilitate the Modernization of Global Governance System
- Congratulating Message from ISO Central Secretariat
- Openness, Cooperation and Win-win - Co-found the Global Standard System for the "New Automobiles"
- JASIC's Steps to Harmoniz. with WP.29
- Building Trust in Global car Supply Chain

- Li Yuwei, Director of the Sustainable Transport Division of UNECE
- Zhang Xiaogang, Former Chairman of ISO
- Henry Cuschieri, Director of the Division of Membership, ISO Central Secretariat
- Wang Jun, President of Chongqing Changan
- Kunihiko Kumita, Director of JASIC
- Hao Jinyu, President of SGS China



About CASIC

The following is extracted from a detailed announcement of the inauguration ceremony.

“Under the guidance of the China General Administration of Market Supervision, State-owned Assets Supervision and Administration Commission, Ministry of Industry and Information Technology and other ministries, to promote the coordination of Chinese automobile standards with international standards and regulations and promote the integrated development of the global automobile industry, The China Automotive Industry centre (CIAC) jointly established the International centre for Automobile Standards (Geneva) in Geneva, Switzerland.

Adhering to the principle of joint consultation, joint contribution and shared benefits, CASIC will be open and cooperative in an all-round way and participate in the formulation and coordination of international standards and regulations by the United Nations, the ISO and the IEC. CASIC will:

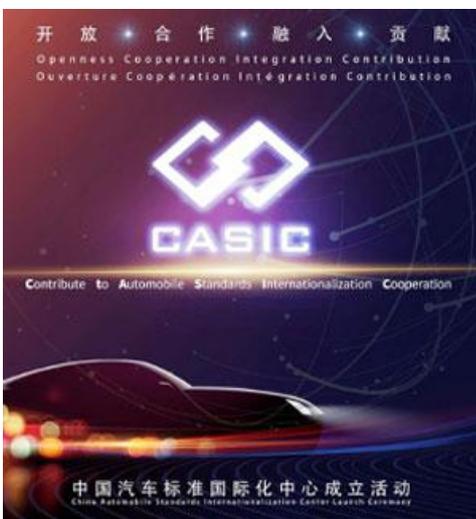
- encourage China's automobile industry to integrate more actively into the international market,
- provide technical guidance and work assistance for domestic and foreign enterprises and technical experts to participate in the coordination activities of international automobile standards and regulations.
- conduct bilateral and multilateral exchanges and cooperation with international organizations, governments and major enterprises and institutions, build bridges for cooperation between international organizations and government agencies and relevant industries, and contribute to China's strength.

CASIC is an unprecedented exploration and attempt of Chinese standard system overseas, which is of great significance for Chinese automobile industry to integrate into international automobile development wave and internationalization of China automobile industry.

All parties concerned, regard the CASIC as an innovative breakthrough and key layout for China's standards internationalization. It is hoped that it can realise the innovation of working mechanism, set up the benchmark of Chinese standard internationalisation, expand the circle of friends abroad, do a good job of organizational support internally, enhance organisational strength, influence, and benchmark other well-known international organizations.”

Comment

I truly believe that the establishment of CASIC is an historic moment for China and Worldwide Harmonisation because it will firmly underline and practically support the commitment of China to actively engage in the work of the UN World Forum for Harmonisation of Vehicle Regulations (WP.29) and its subsidiary Working Groups, including GRE (lighting and light-signalling).



Since the late1980's I have worked closely with the Japanese JASIC, and I have experienced its positive influence on harmonisation. More recently I have worked with the Korean KICAS that has similar objectives to

JASIC and CASIC; I am convinced that these organisations are a winning formula.

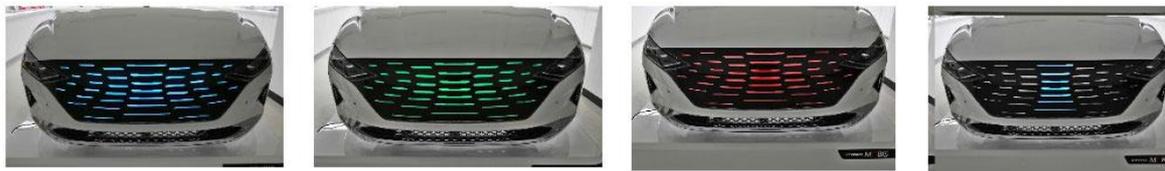
CATARC established C-GTB as the GTB member representing China and I now expect to see a more active role for the Chinese experts in GTB. As Xie Dongming mentioned during the DVN Shanghai regulatory panel session, there is an opportunity for both GTB and DVN to contribute to its Strategic Advisory Group; GTB will contribute as the NGO with special consultative status to ECOSOC and DVN will provide its impartial assessment of the trends and needs of the world-wide industry.

My personal independent initiative to establish [national interest groups](#) will also offer its conclusions, encourage a new initiative to achieve world-wide harmonised technical requirements and, more importantly, encourage the national administrations to develop a pragmatic arrangement to synchronise the development of the UN technical requirements with their timely introduction into national legislation. This is my motivation to come out of my retirement to realise my long-held conviction that innovation for safety need good worldwide harmonised regulation!

I wish Xie Dongming and CASIC a great success.

Mobis' New Lighting and Movable Grill Technology

LIGHTING NEWS



Hyundai Mobis have developed what they call a 'lighting grille', which turns the entire grille into a lighting device. This helps make a first impression, and also integrates their other new grille-integral active air flap technology.

Over the years, the automotive grille has been regarded as a vent for cooling the engine and as a design element that determines the first impression of the vehicle. But with electric vehicles becoming more popular, the grille is being transformed to have different uses including lighting and sound systems and displays.

Hyundai Mobis' lighting grille can implement various scenarios such as the AV mode, the EV charging mode, the welcome light function, the sound beat display, and an emergency warning light display. It can be used as a means of communicating with other vehicles or pedestrians, and it can also create unique, strong design effects depending on how the lighting patterns are applied.

Mobis completed development of the technology earlier this year, and are now verifying its reliability for commercialisation purposes. After next year, they're planning to start mass-production through customer promotion.

Mobis' moving grille technology, meanwhile, automatically controls the outside air to cool the engine as the grille moves and provides the lighting function as well. If this device is applied to a vehicle, it can improve fuel efficiency as it reduces air resistance when outside air is blocked, and reduces emissions by improving the cooling efficiency inside the engine room. The advantage of the grille-integrated air flap is that it can implement differentiated design patterns through its lighting while also enhancing the eco-friendly effect.

Jabil Optics Introduces Powerful Omnidirectional Sensor

LIGHTING NEWS



Jabil Inc. last week announced that its renowned optical design center in Jena, Germany is currently developing a novel omnidirectional sensor for robotic and industrial platforms. By combining a custom optical assembly with an innovative active illumination approach, a new 3D time-of-flight (ToF) depth sensor with an industry-leading 360° x 60° field of view is being developed. The ground-breaking, solid-state design is one of several sensing systems Jabil's optical business unit (Jabil Optics) is designing to support lower-cost autonomous mobile robotics and collaborative robotics platforms.

In contrast to conventional ToF cameras, the immersive field of view of Jabil's omnidirectional sensor allows for seamless detection and tracking of objects in a robot's path, aimed at improving both obstacle avoidance and worker safety. Additionally, Jabil's inventive use of scene information to dynamically control illumination significantly reduces sensor noise while improving both data quality and power management.

"The Jabil omnidirectional sensor is one of the most innovative implementations of the ADI depth-sensing technology we have encountered. Jabil's wide field-of-view, depth-sensing approach is opening up new possibilities for human interaction with robots." said Donnacha O'Riordan, director of Analog Devices, Inc (ADI).

The Jabil Optics team is optimizing the performance of the omnidirectional sensor to address the needs of the rapidly changing robotics industry. "Our design goal is to provide customers with optimal sensor performance in the smallest, lowest cost and lowest power solution possible," said Ian Blasch, senior director of business development, Jabil Optics.

For nearly two decades, Jabil Optics has been recognized by leading technology companies as the premier service provider for advanced optical design, industrialization and manufacturing. With more than 170 employees across four locations, Jabil Optics' designers, engineers and researchers specialize in solving complex optical problems for its customers in 3D sensing, augmented and virtual reality, action camera, automotive, and industrial markets.

Jabil is a manufacturing solutions provider with over 260,000 employees across 100 locations in 30 countries. The world's leading brands rely on Jabil's unmatched breadth and depth of end-market experience, technical and design capabilities, manufacturing know-how, supply chain insights and global product management expertise.

Aspöck FlexLEDs for Versatile High Design

LIGHTING NEWS



As light designers for the commercial vehicle sector, Aspöck Systems' product portfolio has long grown to meet new needs and break new ground. Now, they've released their FlexLED light strips.

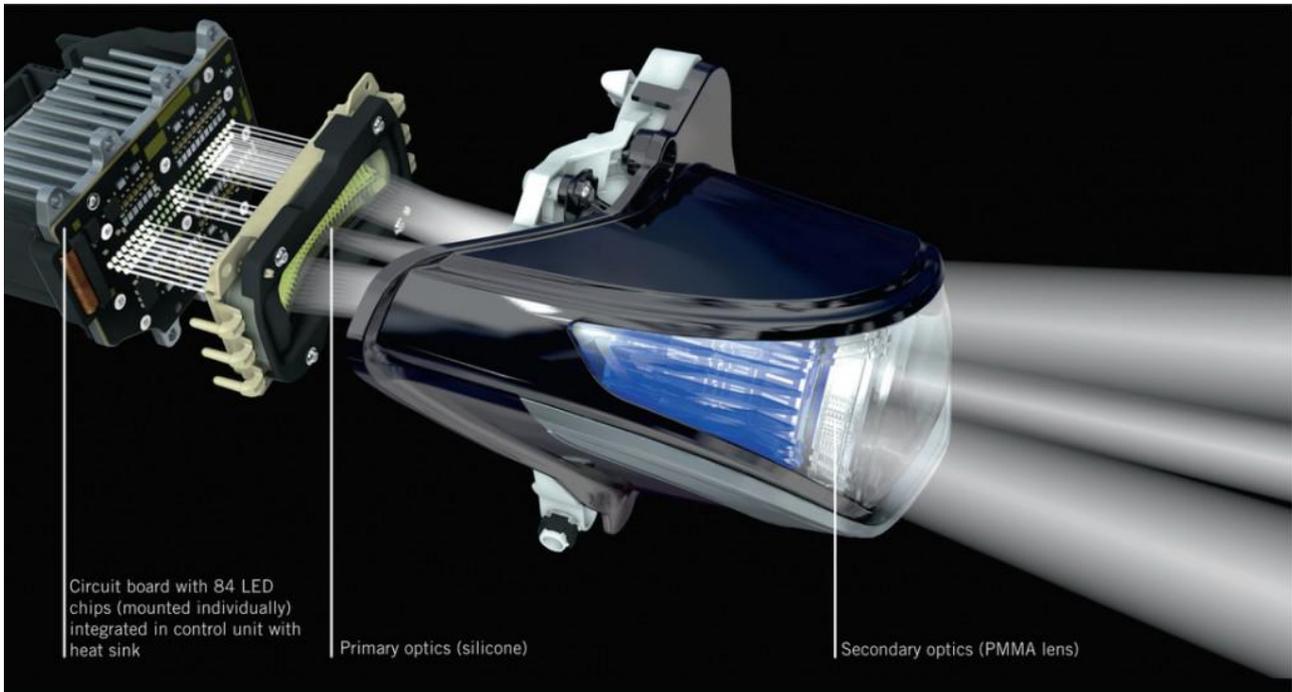
The appearance of metropolitan areas and their numerous buildings would suffer if insufficiently illuminated, and the same holds true for vehicles: for a long time, light in this sector was justified only by the issue of safety. And yet today, trucks, cars, construction machinery, emergency vehicles or caravans are all equipped with both safety-related and design-emphatic light sources in their interiors and exteriors. The functions and silhouettes of all customer-specific requirements are now implemented using efficient LED solutions.

Aspöck offer a variety of LED strip versions in clear or diffuse design: **FlexLED small**, the space-saving light; **FlexLED medium**, the universal-use light, and **FlexLED large**, the robust light. These are available in single-colour green, blue, red, yellow, and multiple different whites, as well as RGB and RGBW versions; **FlexLED ECE** (red, white, yellow) caters for rear lights, navigation lights, and third brake lights.

*For almost 45 years, **Aspöck Systems** have been active on a global scale with trend-setting lighting and system solutions for vehicles. These are developed in-house and accompanied by simulations before being implemented and mass-produced. Eight sales offices around the globe extend the reach of company headquarters in Upper Austria, giving a broad international sales and service network.*

SILASTIC Moldable Optical Silicones to Make ADB

LIGHTING NEWS



HELLA HEADLAMP EQUIPPING MERCEDES-BENZ

SILASTIC Moldable Optical Silicones from Dow are helping to create smarter, safer, visibility-improving headlights in the automotive lighting market. Enabling the design of intricate, light-guiding optical parts, these unique silicones help Adaptive Driving Beam (ADB) headlights adjust the light to where it's needed and divert it from where it's not.

Moldable silicones are high performance materials that provide:

- Improved design flexibility (form factor, undercuts, optical features)
- Strong optical performance
- Superior environmental stability

Dow is the world leader in silicone technology with 10 years of optical silicone experience and 5 years of use in production ADB systems.

Mobis Will Develop Chips For Hyundai-Kia: Report

LIGHTING NEWS



Hyundai Mobis will develop internal automotive chips for the parent company, according to a new report. With the ongoing chip shortage continuing to disrupt the supply chain, particularly in the automotive segment, Hyundai are turning to resources inside the company to develop future semiconductors as a potential solution.

Hyundai plan to use their Mobis division to develop their way out of the chip shortage, after Mobis absorbed the semiconductor business from Hyundai Austron last december and formed a new chip designing team under their own research and development division early this year. The first chips to be developed will be power-management ICs and microcontrollers critical to automotive electrification.

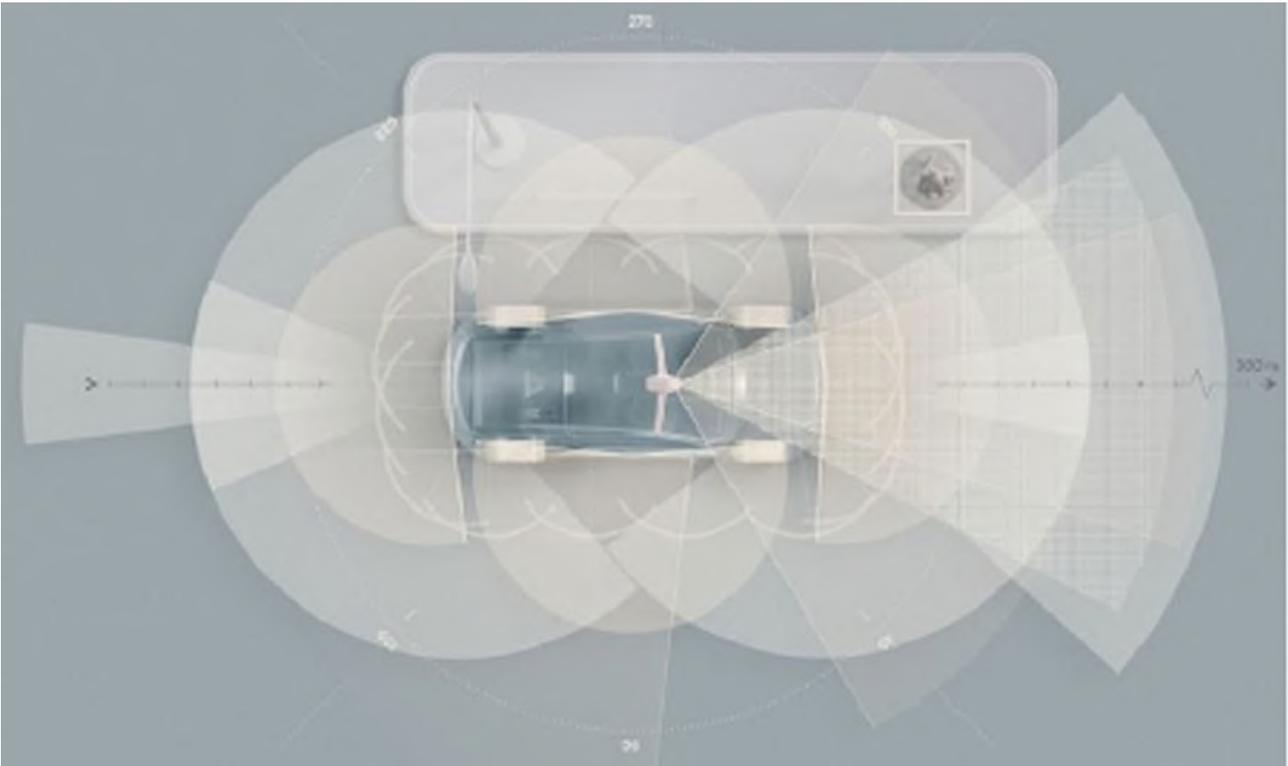
Covid-19 was the root cause of the semiconductor shortage after lockdowns and stay-at-home orders caused much of the semiconductor manufacturing industry to temporarily halt production and companies to reduce capacity. Korea is taking other measures with Hyundai planning to develop its own chips, which will likely have strong government backing and investment.

Additionally, Samsung are considering potential coöperation with Hyundai for development of autonomous vehicle chips. Currently less than 5 per cent of automotive chips are manufactured in Korea, with the bulk coming from NXP, Renesas Electronics, Infineon Technologies and Texas Instruments.

Driver Assistance News

Volvo's Electric XC90 Has Lidar As Standard

DRIVER ASSISTANCE NEWS



Volvo intend to make lidar sensors standard equipment in a new generation of their XC90 large crossover next year as part of a strategy to deploy more advanced safety and automated driving technology that relies on precise images of the world around the vehicle.

The decision by Volvo to fold lidar sensors into the base price of the vehicle is a bet that customers will pay for the additional capability.

The Chinese-owned Swedish automaker are taking a sharply different road from Tesla, whose notoriously mouthy CEO has said lidar is for losers, recently dropped radar as well, and is focusing on just cameras and software for Tesla automated driving systems.

Luminar Technologies will supply Volvo with Iris lidar and Sentinel software in combination with software from Volvo in the electric XC90 crossover that will be built in South Carolina, USA, and go on sale in 2022. The new technologies are designed to address traffic situations that often result in severe injuries and fatalities. Over time, the technology will become more capable and will increasingly intervene to prevent collisions. "By having this hardware as standard, we can continuously improve safety features over the air and introduce advanced autonomous drive systems," Volvo Cars CEO Hakan Samuelsson said.

Lidar sensors, which use laser light pulses to render precise images of the environment around the car, are seen as essential by many automakers to enable obstacle detection and avoidance in advanced driving assistance systems and eventually in fully automated vehicles.

Until now, lidar has been too costly for automakers to implement as anything other than an option that costs extra. Luminar CEO Austin Russell said the pricing for its lidar is on the order of USD \$1,000 per unit.

Volvo Cars' chief technology officer, Henrik Green, said subsequent vehicles will add the lidar package as standard, and that this continues Volvo Cars' history of being first to standardise many safety features, including three-point seat belts and side-impact airbags.

The system will aim to provide automated driving, but only on highways, Luminar has said. It will use a computing chipset from Nvidia and also use cameras and radar sensors in addition to Luminar's lidar unit, but can be made to work with the cameras and radars that many automakers have already included in their vehicles. SAIC Motor, China's largest automaker, say they will offer self-driving vehicles in that market next year in partnership with Palo Alto, California-based Luminar.

Luminar previews 'Blade' lidar integration concepts

DRIVER ASSISTANCE NEWS



Luminar Technologies introduced Blade, their vision for the future of design and integration of autonomous technology across robotaxis, trucks, and consumer cars. They also showcased the first consumer vehicle fully integrated with Luminar's Iris lidar, which is on track for series production with the company's automaker partners starting late next year.

Luminar CEO Austin Russel says his company are "making the transition from the leader in lidar to the leader in automotive autonomy and safety. Historically, autonomous vehicle companies have been exclusively focused on robotaxis, but our focus has been building the technology foundation for autonomy starting with consumer vehicles and moving across verticals including trucks and robotaxis".

According to the company, Blade shows how autonomous technology can be seamlessly integrated into cars, trucks, and robotaxis. It stemmed from a creative collaboration between Luminar and NewDealDesign, led by acclaimed technology designer Gadi Amit. The aim is to create a foundation for a new vehicle architecture that auto makers can incorporate into vehicle development programs from the outset.

Luminar say Iris is the first autonomous technology designed to marry form and function: it seamlessly combines performance, auto-grade robustness, scalability and automotive aesthetic. It was designed from the outset to be cleanly integrated into a vehicle's roofline, displacing the protuberances up to now seen on autonomous development vehicles and leapfrogging bolt-on products in development.

Luminar unveiled two Blade blueprints, both integrating the sensing technology into the roofline of the vehicle, creating an autonomous 'blade'.

The robotaxi centred round a roomy, inspiring car design for autonomous operation on highways and in urban environments. The 'blade' runs down the centreline of the roof, incorporating four lidar units to provide 360° coverage. The truck concept featured a three-lidar setup to provide long-range coverage and the ability to be retrofitted to existing class-8 trucks.

Quanergy, Latest Lidar SPAC with \$278M NYSE listing

DRIVER ASSISTANCE NEWS



Quanergy Systems is set to become the 7th lidar company to list on the US stock market through a SPAC merger in little over a year. The proposed deal, with Cayman Islands investor CITIC Capital Acquisition Corp (CCAC), should release \$278m to support the company's development.

If the SPAC agreement proceeds as expected, it will see Quanergy join rivals Velodyne, Luminar Technologies, Ouster, Aeva, Innoviz, and AEye on the public markets.

The transaction will take place under Quanergy CEO Kevin Kennedy, well known to the photonics industry from his previous role as CEO of the optics giant JDS Uniphase. Kennedy highlighted how the OPA approach, unlike time-of-flight or MEMS lidar schemes, more closely imitates phased array radar sensors, which are an established technology in the automotive industry.

"It is important to realize that the auto industry ships over 20 million phased array radar sensors per year, an important reason why this architecture is seen as the best fit," he said.

But while automotive applications are eventually expected to create the biggest single market for lidar sensors, it will be some time before such units are sold and shipped in volume, and at the kind of prices demanded by the auto industry.

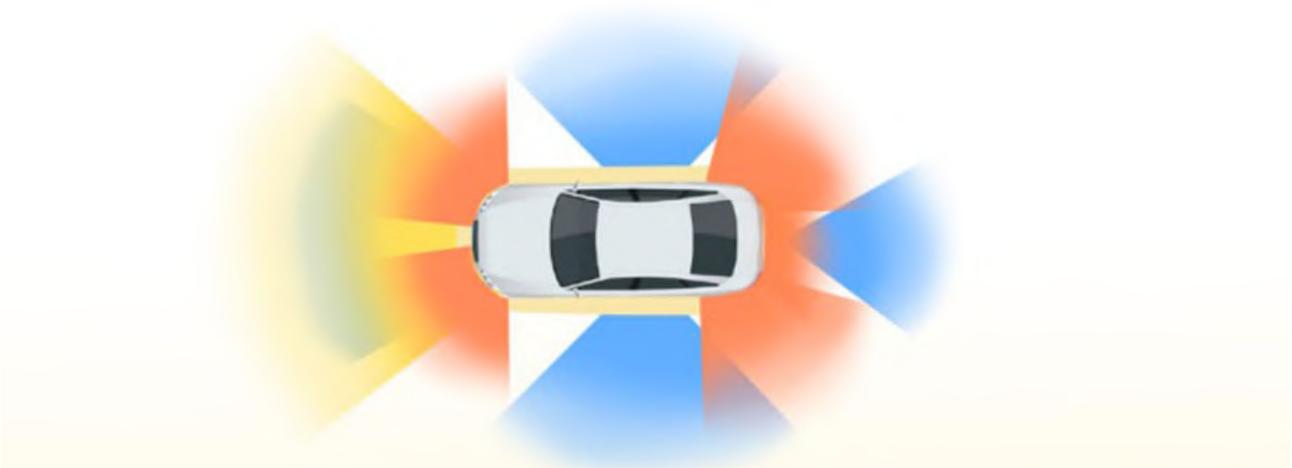
In the meantime, Quanergy will be targeting more established sectors where the 3D perception provided by lidar is already in demand.

"Automotive is ultimately the largest market for lidar, but the growth curve is further out in time, resulting in a \$10 billion market by 2030. This market is the most demanding in terms of cost, and performance, and reliability," Kennedy explained.

In terms of technological development of the OPA for automotive applications, Kennedy pointed out that Quanergy had recently demonstrated single-emitter prototypes with a range of up to 100 meters outdoors. Further advances expected this year include extending that reach to 200 meters in outdoor sunlight. "This progress is a gateway to enable Quanergy to engage and update specific industry players at the end of 2021," Kennedy said.

Camera-Radar-Sonic-Lidar: Strengths and Weaknesses

DRIVER ASSISTANCE NEWS



Cameras

Cameras are great at capturing colour and providing texture and contrast data. But cameras can only detect when there's adequate lighting and reliable weather conditions. They can't provide distance information, and at least two cameras are required to acquire a 3D image.

Strengths	Weaknesses
High resolution and Long Range Colour information Compact size, Robust, Affordable	Dependent on environmental factors No direct 3D information

Radars

Radars can determine the distance information with great precision along with the speed of the object and can also operate in adverse weather conditions. But due to low resolution, they have a hard time differentiating and classifying objects.

Strengths	Weaknesses
Independent from environmental factors Reliable 3D information Compact size, Robust, Affordable Long range	Low resolution No colour information

Ultrasonic sensors

These can detect objects regardless of the material or colour. Still, due to the very limited range of <10m, they are only helpful for applications like parking assistance and blind-spot detection.

Strengths	Weaknesses
Independent of environmental factors Compact size, Robust, Affordable	Low resolution, Limited range No colour information

Lidars

Lidars are crucial, as they operate in both short and long ranges. Not only can they create a high-resolution 3D map of the environment, but they also help categorise objects with great precision and primarily independent of environmental factors.

Strengths	Weaknesses
Independent from environmental factors Reliable 3D information Robust High resolution, Long range	Expensive No colour information No established vehicle hardware

to make safe and dependable AVs a reality, sensor fusion incorporating the best elements of lidar and other sensors must be our go-to strategy.

General News

Audi R&D to Go Exclusively Electric for '27

GENERAL NEWS



Audi will end development of new internal combustion engine models by the end of 2026 and focus solely on full-electric drivetrains, German media reports are saying. After 2026, the automaker will only develop battery-powered models, according to *Automobilwoche*.

The decision was announced by Audi CEO Markus Duesmann last week at a management meeting at the automaker's headquarters in Ingolstadt, Germany, according to reports citing company sources.

Although Audi plan to stop developing new gasoline, diesel and hybrid cars, their new models launched by 2026 will continue to be built and sold until the early 2030s. After that time, Audi will become a purely electric car maker.

According to *Automobilwoche*, the A3 and A4 will not have combustion-engine successors but will be replaced by their battery-powered e-tron counterparts; the electric evolution of Audi's A5 and A6 models will follow a similar timetable.

The last internal combustion engine model built by Audi will likely be the Q8, which will launch in 2026 alongside an electric variant, the Q8 e-tron. The internal combustion engine Q8 will then be produced until 2032, *Handelsblatt* said, citing unnamed sources within Audi.

Audi's current full-electric cars are the e-tron, e-tron Sportback and e-tron GT. The e-tron and e-tron Sportback are based on Audi's MLB Evo platform while the e-tron GT shares its J1 platform with the Porsche Taycan.

VW's Diess sees AV Transforming cars more than EV

GENERAL NEWS



Volkswagen Group's CEO sees autonomous-driving technology bringing about an even bigger shift than electric power. "This change will transform the industry more than EVs does," VW Group CEO Herbert Diess said in an interview for Bloomberg's Qatar Economic Forum. "The car becomes so different when it's driving autonomously."

While driverless development is taking longer than many expected, automakers and technology firms are continuing to plow billions into trying to automate driving. The consulting firm AlixPartners expects the cost of highly and fully autonomous systems to drop at least 60 per cent by 2030.

With probably 10 times more lines of code than what is on a smartphone, cars are already software products and will be "the most sophisticated internet device you can imagine" when they are rendered driverless, Diess said.

VW are working toward offering autonomous driving in key markets worldwide. Joint efforts with Ford and affiliate Argo AI in the U.S. are making good progress, Diess said. In China, VW's largest market, they've partnered with local tech companies to be among the first to offer autonomous driving, mostly in private cars.

Regulation in Europe has improved recently, Diess said. VW announced last month they plan to offer a highly automated, electric version of the beloved hippie-era microbus, and will start test drives in Hamburg this year.

VW are spending about €2.5bn per year to boost their software capabilities. Although Diess acknowledged there is "still a lot missing" to turn Europe's largest automaker into a software powerhouse, he says "We are in quite a good position to remain a very strong player in this future automotive world, in 'new auto,' as we call it".