

Editorial

Light Sources: Always A Step Ahead



In the last 30 years, vehicle and lamp designs have dramatically changed—and that's in large part thanks to light source innovations. From halogen to LED, lamp design has transformed car exterior design. Look at the Lotus Therory 1 pictured here, and the Lynk & Co 02 covered in this DVNewsletter as examples.

And it's not just design. Performance and visibility by night have dramatically improved; no longer is the choice between small headlamps that don't work well or large headlamps that do.

The origin of this revolution is innovation, especially from tier-2 light source and semiconductor manufacturers who develop and make diodes, including LEDs and lasers. Volkswagen are presenting this week their new Tayron with microLED technology—a great example of tier-2s' diode and semiconductor innovations, applied!

Needless to say, LEDs are now the predominant technology, having replaced most competing light sources in most applications. And laser-diode based lighting is emerging for special applications.

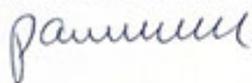
In this week's DVNewsletter we bring you our exclusive interviews with Nichia President and CEO Hiroyoshi Ogawan; with Lotus' head of exterior design, and with Kyocera SLD. We are also publishing the Nichia company profile written with the support of DVN Senior Adviser Jean-Paul Ravier, with the helpful coöperation of Nichia teams from Germany and Japan.

Very regrettably, we also bring you sad news; one of the vehicle lighting community's great experts— Olaf Schmidt—has passed away.

Onward through the night brightly,

Paul-Henri Matha

DVN Chief Executive Officer and Lighting General Editor

A handwritten signature in blue ink, appearing to read "pamm", positioned below the printed name and title.

In Depth Lighting Technology

DVN Interview: Hiroyoshi Ogawa, Nichia President & CEO



By Paul-Henri Matha, DVN CEO

DVN's Paul-Henri Matha: Ogawa-san, It is a pleasure to meet you in person. I am grateful for this opportunity. Please tell us about yourself and your involvement with Nichia.

Hiroyoshi Ogawa: Born in 1966, I grew up in the neighborhood of Nichia's headquarters in Anan, Tokushima. I spent my childhood there until I moved to Tokyo at 18 to attend university. I graduated from the Faculty of Economics at the University of Tokyo in 1988, and subsequently worked at Mitsubishi Electric for five years.

In 1993, I joined Nichia Corporation, and in November of that year, Nichia made a groundbreaking announcement: the world's first high-brightness blue LED using Gallium Nitride.

My family has a long history with Nichia; my grandfather was president when I was born in 1966, the same year Nichia began mass-producing phosphors for fluorescent lamps. The current chairman served from 1989 to 2015. Since the spring of 2015, I have had the honour of serving Nichia Corporation as its president.

DVN: How is the evolution of LED efficacy going to effect vehicle lighting?

H.O.: While the theoretical maximum efficacy of LEDs is around 270 lm/W, many companies are already mass-producing products that exceed 200 lm/W. At this level, further efficacy competition become less significant. Instead, the focus should shift to

the benefits of switching from traditional light sources (bulbs and tubes) to solid-state light sources, as well as the quality of light, focusing on the spectrum.

The challenge is not only how to transform and evolve traditional lighting with solid-state light sources such as LEDs and laser diodes, but also to enhance the quality of light, rather than merely increasing the quantity of light measured in lm/W.

In automotive applications, the electrification of vehicles requires the development of more efficient lighting and signals with lower power consumption using solid-state light sources. This is related to our concept of μ PLS (micro-pixelated light source), a vehicle lighting system that serves both as illumination and a form of human-machine interface. It can project signals and messages, functioning as more than just simple lighting—it also acts as a projection system. We are focusing on what can only be accomplished with solid-state light sources like LEDs or laser diodes.

Beyond automotive applications, we offer products that adjust the circadian rhythm to contribute to comfortable living environments. These products can change their spectrum according to the time of day. In terms of design, we call these 'stealth downlights'. What the market demands for lighting fixtures is that they remain as invisible as possible. We believe this principle applies to automotive headlamps as well; the lighting units should be as discreet as possible. In fact, hidden lighting units can unlock new design possibilities.

DVN: Why is there an efficacy differences between LEDs for general lighting (200 lm/W) and for vehicle lighting (160 lm/W)? What efficacy levels do you target for 2030?

H.O: Regarding these differences, the structure varies depending on the lighting equipment. Generally, indoor lighting fixtures still have enough space to use several LEDs and cannot accommodate large heat sinks, so they are used in relatively efficient current ranges. In vehicle lighting, especially in headlamps, there is no space to spare, so each LED is used with a higher current, which results in lower efficacy. Nichia believes that improving quality of light, rather than just engaging in an efficacy competition, ultimately benefits the customers and the market.

Additionally, it is crucial to understand that not only LED efficacy but also the overall improvement of the lighting fixture's performance is important in the end.

The target value for efficacy by 2030 is around 240 lm/W.

DVN: What do you mean by 'stealth'?

H.O: Stealth in this context simply means as invisible as possible. Additionally, through task and ambient lighting, which deliver necessary light to where it is needed, we contribute to energy saving. We believe that our challenge is to continue developing LEDs and laser diodes that can contribute greater values in fields other than automotive applications, too.

DVN: How is the laser market evolving, and how are Nichia innovating in that sector?

H.O: Laser diodes were once used primarily in Europe for additional high beams, but their demand has been decreasing. The need to illuminate distances over 1 km with additional high beams has not been as significant as initially anticipated. Similar to aforementioned stealth downlights, the key feature of laser headlights is that they can be miniaturized even more than LEDs. Interestingly, lasers have also gained momentum in other industries, starting with blue pickup lasers for Blu-Ray and other optical

memory devices, and later in projectors and cinema applications. This technological crossover highlights the versatility of laser diodes as very small light sources with high brightness, which we expect will further expand their potential in future automotive uses.

In the domain of human-machine interface, while LEDs are predominantly used for HUD light sources, laser diodes are emerging as a superior option for projectors. This shift is expected to gain momentum in the coming years. Additionally, as ADAS (Advanced Driving Assistance Systems), continue to develop, there is a growing market trend to use laser projection functions in both white and RGB formats as ADAS evolves. Recognizing this evolution, we aim to provide RGB laser diodes for automotive applications.

Of course, ADAS is used in a variety of ways to enhance vehicle safety and improve driving convenience. For example, the technology assists drivers to maintain awareness of a car's surroundings, including the distance to vehicles in front, behind, and on either side, while helping to keep the vehicle aligned centrally. This includes systems such as adaptive cruise control, lanekeeping assistance, and collision avoidance. ADAS can extend to the interior of the vehicle, providing features like alerts when the car ahead becomes too close or overtaking is blocked by a fast-approaching vehicle.

Expanding beyond automotive applications, there are niche markets for laser diodes in various industrial applications, measuring instruments, medical devices, and light sources for 3D printers. With the rise of vehicle electrification, the demand for copper materials have increased, highlighting the importance of copper metal processing. Given copper's absorption properties, short-wavelength blue laser diodes are more effective light sources than the traditional infrared ones, particularly in laser welding applications where high precision is needed. We are focusing the development of these diodes. Our current focus is on hybrid blue + infrared laser diodes. Besides visible light applications, we will continue to explore new areas in metal and other processing applications.

DVN: How does Nichia avoid shortages and manage geopolitical risks?

H.O: Several years ago, when many companies experienced parts shortages, Nichia remained unaffected. We consistently maintained sufficient capacity and inventory levels to meet demand.

Fundamentally, we are focused on developing comprehensive databases for our supply chain and enhancing traceability management. This effort extends to our suppliers, their suppliers, and even up to the third-tier suppliers, although this process is ongoing.

Regarding the in-house production of key raw materials and components necessary for LED production: while we do source from external suppliers, we are also advancing the in-house production of important industry components within the industry.

In addition to components, we also internalize the production of equipment, including the metal organic chemical vapor deposition (MOCVD) system used to form the emitting layer of LEDs.

However, it is impractical to completely end sourcing raw materials from regions with potential geopolitical risks. For resources being developed outside of China, we are willing to accept slightly higher costs to ensure procurement. By using various procurement routes and maintaining adequate inventory within the supply chain, we aim to minimize geopolitical risks.

DVN: Is your equipment produced in-house?

H.O: While we do purchase new equipment occasionally, most of it is produced in-house.

Given the relatively small size of optoelectronic devices—unlike cars—we can efficiently manage costs and minimize supply chain risks by concentrating production in this region. We consistently maintain sufficient capacity to meet market demands, so we do not feel the necessity to establish new production bases in Europe or the United States, nor do we have any plans to do so.

Our factories for automotive LEDs and laser diodes are equipped with earthquake-resistant or seismic isolation structures. At the Tatsumi factory we have implemented tsunami safety measures, including cooperation with national and prefectural authorities to construct levees. Additionally, we have elevated the building as a precaution. We are striving to establish a production system that maximizes efficiency and safety by concentrating operations in this region.



Nichia's Tatsumi plant

DVN: What is Nichia's strategy for sensors, IREDS, and lasers for lidar?

H.O: Currently, our product portfolio does not include lidar, IR LEDs, or IR laser diodes. While the market primarily demands light sources, we have received inquiries about our plans for sensor technology. We have successfully produced red laser diodes in-house, and using the same material system, we can extend production to near-infrared (around 1,000 nm). This development provides us with technical foundation to produce both red and near-infrared laser diodes and LEDs in the future.

DVN: What is Nichia's strategy for combined LED + IC (like Infineon's microLED development)?

H.O:We are proud to announce that Porsche have adopted our intelligent lighting technology for one of their applications. We believe that the potential for expansion of both applications and lineup will be significantly enhanced by strengthening our collaboration with Infineon through our existing alliance.

Additionally, while we are slightly behind our competitors in terms of the lineup of RGB LEDs with IC, we plan to expand our lineup of these general LEDs with IC, alongside our innovative and advanced products.

DVN: What are Nichia's strategies for displays?

H.O: We consider that the unchanging value required for automotive displays is safety, meaning visibility as an information display device is the most important aspect.

As for the display application, we have structured our lineup based on different distances. The key elements for all these Nichia solutions are the provision of high brightness and visibility.

Our strength as a light source manufacturer is the ability to consistently offer a comprehensive lineup of high-performance products supporting automotive display applications.

About OLED, while it has seen partial adoption, we believe that LCD currently offers more advantages for automotive display applications. This assessment considers factors such as high brightness essential for visibility, as well as reliability, cost, supply chain, stability and power consumption. We are actively developing thin, high-brightness LED products specifically for automotive backlighting.

Our showroom features μ LEDs, and we have successfully commercialized displays in the several-hundred-inch class. However, their adoption for automotive use will require extra time, primarily due to cost considerations. A significant breakthrough is needed for wider implementation.



Nonetheless, μ PLS technology, with its self-emitting system, offers many advantages such as a wide color gamut and low power consumption. We are committed to continuing our internal research and development in this area.

In terms of in-car information displays, there are various applications including laser diodes. We plan to continue developing new applications to enhance the functionality and efficiency of these systems.

DVN: Are you also considering extending your interior display tech for exterior applications?

H.O: As a potential application, we consider car body lighting, but there are challenges including cost and reliability.

DVN: What do you think about new Chinese LED competitors?

H.O: We recognize there is potential for various situations that could arise based on OEM perspectives. Particularly for cars developed and sold in China, many parts might be used without our awareness. China is such a vast market, but for products that can be sourced domestically, we anticipate increasing challenges in selling our products there.

On the other hand, competition within China is intense, and there is a trend to adopt the latest technologies even faster than Europe or Japan. If we can provide products that Chinese LED manufacturers cannot, we believe there is room for us to capture the high-end market in China.

Besides China, Chinese LEDs will likely be prevalent in large markets such as India and ASEAN. However, outside of China, we believe our standard LEDs and production systems have an advantage over Chinese new players, particularly in terms of quality and reliability. In markets outside of mainland China, while we may not be able to compete on price, we are confident in our ability to compete in terms of innovation with the quality and performance of our latest technology products as well as our standard mass-produced items.

Lighting News

Laser Lighting on Latest Lotus

LIGHTING NEWS

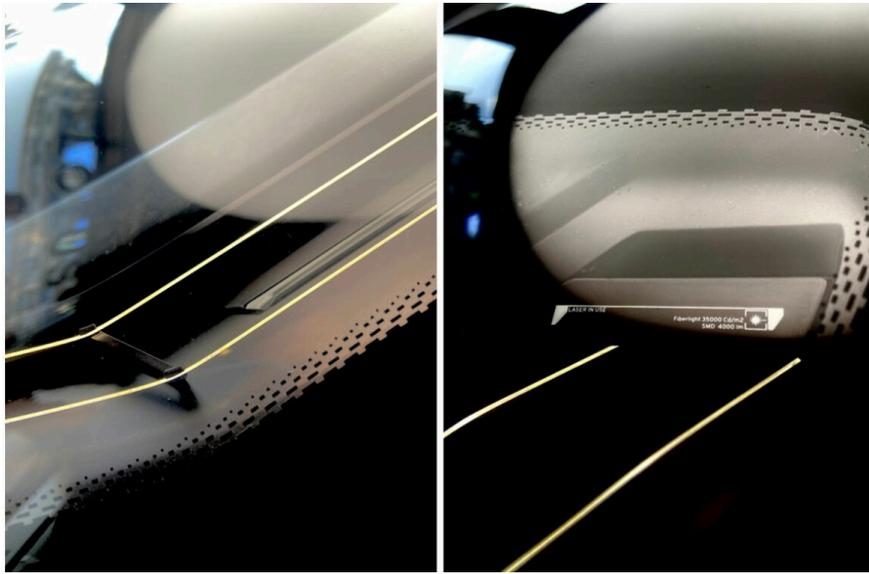


Lotus have unveiled the Theory 1, a concept car they say 'embodies the future of intelligent performance vehicles'. DVN were invited by Lotus and Kyocera SLD to talk about the advanced lighting on the car.

Lotus worked with the team of Josip Kovačević, who is Kyocera SLD's Global Automotive Business Vice President, to realize a laser-powered interior and exterior lighting system; it delivers powerful and advanced lighting performance with dramatically reduced component size and weight.

There are new laser-wire DRLs, less than a millimetre in diameter. The front position and daytime running lamps are done by two laser diodes, with two beam bumps and two optical fibres in between. The yellow colour of the optical fibre (when switched off) is a perfect fit; yellow is a longtime brand-identity colour for Lotus. This neat trick is possible because the phosphor conversion is done in the optical fibre, not within the light source.





High and low beams are delivered through 7×35 mm lenses. There are four SMD laser diodes per lamp; one per projector unit. Each diode produces 1,000 lumens, and runs at 15 watts.



The rear lighting is done by an RGB laser diode which provides both red light for the rear position lamp, and turquoise-green light for the charging status indicator.



The interior lighting concept is to use laser diodes and reflections on the windshield to communicate information to the driver, such as obstacle detection, braking, turns and more. For example, two laser lights on the dashboard wings indicate left and right turns, working in harmony with the haptic inflation materials on the seats.



This is not the first time Lotus have used laser diodes; that honour belongs to their Evija model.



DVN: Why did you decide to make such a highly laser-based lighting system for the Theory 1?

Lotus Design Group VP Ben Payne: First is the importance of light weight for Lotus, and with laser you can get the correct number of lumens in a very tiny package. Second interesting thing with laser diodes is to go beyond lighting. You can use laser for sensing, night vision, displays). Exploring new technology is important for Lotus and is from its heritage. Precision, packaging size, weight, remoting the current light source location to somewhere else is something magic that can create a totally new way of thinking.

DVN: How did you develop the lamps with Kyocera SLD?

B.P.: Some years ago we invited some startups to investigate new technology, and SLD was one of them. Laser and optical fibre was really interesting to investigate. At first step it looks to be impossible to fix in a car. Engineers had to find the solution. This is how engineers and designers can work together to create something new.



DVN: Can you tell us about SLD's history and the acquisition by Kyocera?

Josip Kovačević : As an independent spinoff from Soraa, SLD Laser were founded in 2013 by leading global pioneers in solid state lighting, including Dr. Shuji Nakamura, a 2014 Nobel Laureate in Physics for his groundbreaking work with LEDs. SLD Laser were acquired in 2021 by Kyocera Corporation and commenced operations as a Kyocera group company under the name Kyocera SLD Laser. Kyocera was founded as Kyoto Ceramic Company in 1959, and renamed Kyocera in 1982.

DVN: How did the Theory 1 system turn out, in technical terms of light sources, efficiency and performance?

J.P.: Our SMD is the world's only class-2 laser trans-reflective system in a single 7 × 7 mm package. We are starting product options with 1,000 lm @ 18 W, then later 1,000 lm plus infrared, and will go beyond 1,500 lm in midterm as our package allows to contain up to 4 laser diodes which will achieve even better efficiency along the product roadmap. Our fibre solutions are remote solutions, pumped by blue laser and being transmissive along a glass fibre with phosphor jackets.

DVN: What's doing in blue laser development? Flux, efficacy, price, something else?

J.P.: Our SMD blue laser efficacy improvement over the coming years will enable lower power consumption, higher efficiency at fixed luminance, and high luminance and small emission area to enable the freedom to design compact headlamps. We are aiming optical power improvement up to 6W and the wall plug efficiency will achieve 60 per cent. And all these efficiencies will be realized at lower pricing.

DVN: The rear lamps use a blue laser and conversion, instead of a red laser. Why is that?

J.P.: The tail light function can be handled with filters to have direct red emission to enable the level of legal requirements. To manage a brake light, we would use a red phosphor fiber to do the conversion job, while still having a blue laser.

DVN: How about red and RGB lasers?

J.P.: Kyocera is working on full-RGB lasers to be industrialized and auto-certified by calendar year 2028. We are closely working with the Kyocera corporate ceramics packaging team to bring the Si- and ceramic-based package for RGB integration for interiors and exteriors. We see the need for high resolution and visibility by daytime where lasers can make the difference.



VW Tayron: a Look at the Lights

LIGHTING NEWS



The new VW Tayron is a large SUV positioned between the Tiguan and Touareg models. Orders opened in Europe on 10 October.

The optional IQ.Light HD matrix headlamps have 'Dynamic Light Assist' ADB. There are over 19 kilopixels in each lamp, and they produce road projections such as lane lines for the likes of construction zones. Below the ADB cut-in speed, high/low beam control is automatic. Animated turn signals are optional. The new Tayron's signature light bears light strips on the radiator grille and on the rear; surround lighting; illuminated door handles, and lit VW logos front and rear.



Welcome/farewell light animations make the driver feel special.



Lynk & Co 02 Revealed

LIGHTING NEWS



It was a pleasure to be invited by Stefan Rosén, President of Lynk & Co Design, for the Milano introduction of the brand's first BEV, their 02 for Europe (badged as the Z20 in China)..

Created in Lynk & Co's design studio in Gothenburg, the 02 was brought to life through an industry-first collaboration between 01 plug-in hybrid SUV customers and the brand's in-house design and engineering teams. Customers significantly influenced the new car's character, contributing over 6,000 messages about the most desired features via the Co:lab function—one of Lynk & Co's in-car apps that allows users to provide feedback digitally from inside the 01.

The Lynk & Co 02 became available for online sales in Europe on 11 October, with prices starting from €35,495.

Looking at the lighting:

At the front, the signature Lynk & Co LED headlamps and DRLs project high-energy welcome/farewell animations.



The lower section of the car presents a technical look with gloss black active shutter intake at the front, with minimalistic sensor integration (radar and camera). This lower black area is incorporating low- and high-beam functions, with projector module size 60w × 30h mm. The lower edge of the lower beam's lit area appears to be right at 50 cm above the pavement, the exact minimum height requirement in R48 (¶ 6.2.4.2). Lamp aiming is done, as usual, from the top of the lamp with trunk open to gain physical access for horizontal and vertical aiming.

Stefan Rosén gave insight about the second-generation Lynk & Co design signature with a larger distance between both vertical lines, to be especially more recognized from a long distance (this distance changed from 20 mm on the 01 to 80mm on the 02). Lynk & Co kept also the willingness not to have flush design between exterior body and lamp, compared to most automakers who prize seamless integration.



The rear lights are integrated into the rear spoiler.

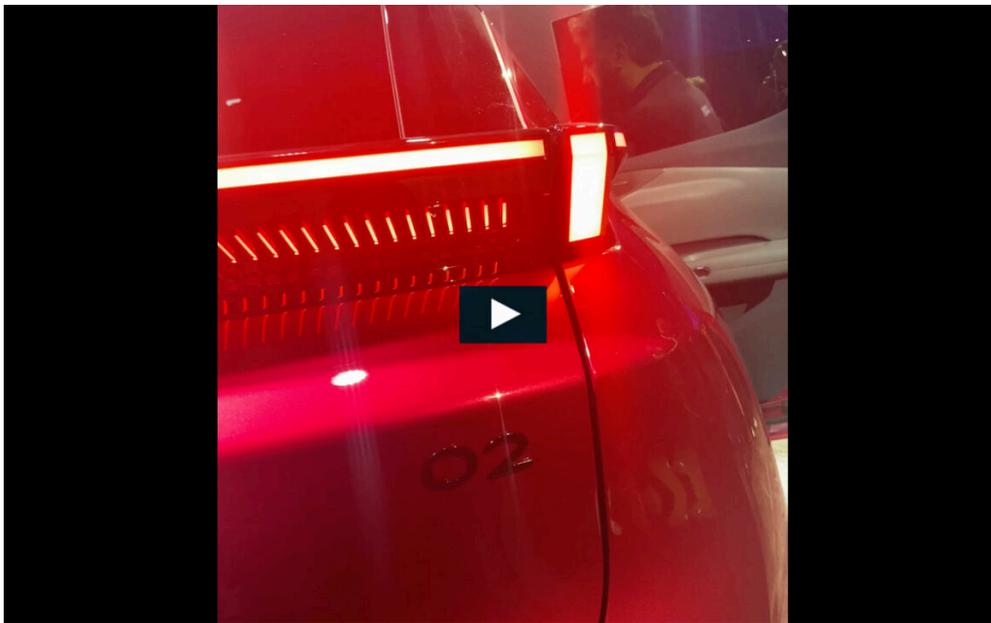


The outer lens is a 3-shot (red-black-crystal) piece, to reduce visible gaps and complexity of optical system with inner lensing components. Visibility of red light to the front and white to the rear looks like a challenge on this vehicle. Markings were not visible to check if a homologated side marker light function is provided by the rear body lamp.

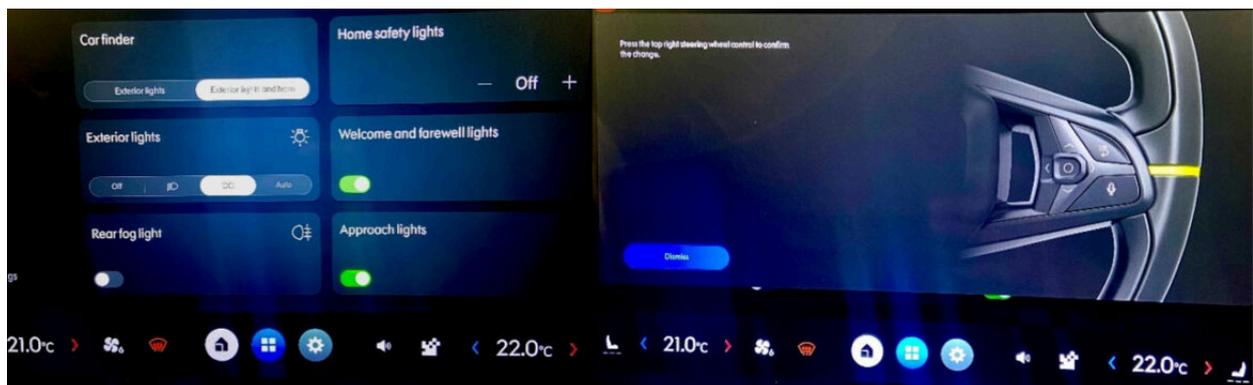
In a similar way, it was not possible to see where is hidden the rear turn indicator function. Our best guess so far is that turn signals are only on the trunk lamp and when the trunk is open, an additional turn indicator is activated in the bumper area—or perhaps the stop light function on the body is superseded by the turn signal function.



Because the body lamp has a very small surface compared to trunk lamp, in order to be able to have a homogeneous luminance between body and trunk lamps, the body tail lamp flux is reduced when the trunk is closed, and boosted when it is open. That's a solution already seen on premium vehicles in order to always fulfil minimum and maximum rear position lamp intensity between 4 and 17 cd.



Lamp activation on central display: we find an interface similar to that on the Volvo EX30 for lamp activation: low beam activation is automatic, and low beam deactivation (off or position lamp) is possible with a double confirmation by a button on steering wheel. The physical stalk controls only the high/low beam selection and the turn signal.



The Infinity Light is a standout new feature that creates an endless tunnel of light effect, maximizing the sense of space. With four different mood settings—Fireworks, West Coast, Moonlight Love, and Neo City—it allows users to craft their perfect environment through light and sound.



On central stack display, you can select the ambient colour you want, which pulses to the music rhythm if you want.



The Infinite Light looks like a deep and thick optical lens, giving a very modern and premium appearance. Indeed technical concept is similar to the well-known semitransparent mirror concept seen in rear lamps such as those on the DS3.



Musk's Latest Cybercab Promise: 2027

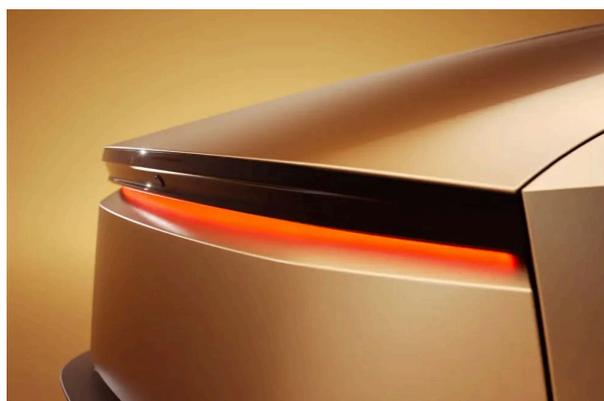
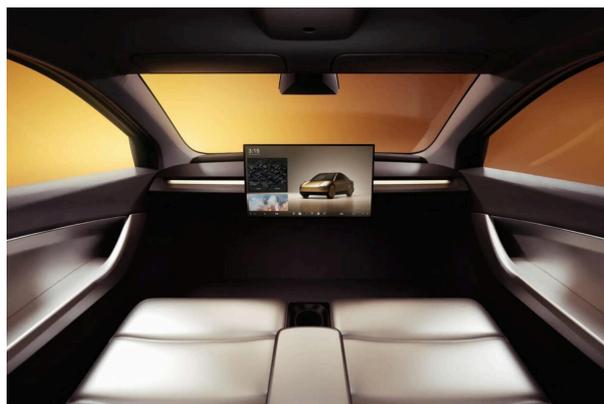
LIGHTING NEWS



Elon Musk is now claiming production of the Tesla Cybercab will begin before 2027. The vehicle will have no steering wheel, pedals or lighting controls, meaning production can start only once all regulatory approvals are in place. Like other Tesla models, the Cybercab gets a minimalist interior layout, with seating for two and a large centrally-mounted screen that controls almost all functions.

The Cybercab has a single full-width LED light bar similar to the Cybertruck. There's no body-mounted rear lamp, and the required additional stop-tail-turn lamps in the bumper certainly look distinctive.

Butterfly doors mark a first for any Tesla vehicle. At the rear, there's a large boot, but like the Cybertruck (or Polestar 4), the Cybercab lacks a rear window. It also gets full wheel covers, which Tesla say help with extracting more range.



Alpine A390_β

LIGHTING NEWS



Alpine has just revealed their A390_β showcar, one week before the Paris motor show's opening.

The concept will inspire a production car in 2025 that will use the Renault Group's Ampere Medium EV platform. The A390 Beta, inspired by the 2022 [Alpenglow concept](#) called 'the mother of all future Alpine cars', is described as 80-per-cent production-ready, with the front end planned to remain relatively unchanged, including the Le Mans-inspired central fin.

Lighting-wise, here's what's what:

- Front and rear lit logo. It looks like they're compliant with UN R148 and R48; the logo is wired up as part of position lamp function, lit size less than 100cm², distance with other position lamp apparent surface below 75 mm.
- There's a floating element for the rear position lamp.
- Super-slim low- and high beam with height below 15mm.
- Vertical lit area in rear bumper, side Alpine lit logo, and France blue-white-red lit flag may be difficult to get homologated. Information is also missing so far for turn signals, stop lamps, and reversing lamp.



General News

Memoriam: Olaf Schmidt

GENERAL NEWS



By Rainer Neumann, GTB Chairman Working Group SVP

I am sad to say that far too early, Olaf Schmidt passed away a few weeks ago. Olaf was one of the few real experts in lighting legislation worldwide. He knew not only the details and spirit of the ECE and SAE rules, he also saw in advance what had to be done to implement innovative technical ideas.

Olaf joined Hella R&D 1985 and was responsible for directing the legislative and regulatory affairs relating to lighting and signalling issues for Hella International. In addition to chairing the GTB Signal Lighting Working Group, Olaf was a regular contributor at the UN meetings of WP29 and GRE, and an expert member of the SAE Lighting Systems Group. Olaf was Head Delegate for the GTB German delegation and chairman of the CLEPA Technical Regulations WG – Lighting and Signalling.

I could call Olaf (even though he worked for a competitor) to ask information and explanations about regulation items. With Olaf gone, we have lost a good friend and colleague; let us remember him well!