

Editorial

Lighting, ADAS, Glare, And Flicker!

While Paul-Henri and the DVN Chinese team were busy in Shanghai last week, I was busy over here in North America.

It's a monumental moment for technology-based vehicle safety on the North American regulatory island. That's because NHTSA has just completed a piece of work they started some years ago: upgrading the US NCAP protocol to look at more kinds of ADAS, to add America's first-ever effort at encouraging less pedestrian-hostile vehicle design, and to plot out a pathway for potential future NCAP upgrades.

This all makes good sense, and is a very fine development in context of the wrong-way trend of increasing pedestrian deaths near American roadways in recent years. For those of us who take a professional interest in the constellation of issues and aspects centred round crash-avoidance, it might seem puzzling that NHTSA chose to exert this effort through NCAP, rather than by promulgating regulations. But there are solidly valid reasons why NHTSA's choice might have been the smarter one.

As originally proposed, the NCAP upgrade was to have awarded points for high-performance, low-glare low beam headlamps, and for better (amber rather than red) rear turn signals. None of the lighting provisions made it into the final upgrade, though. In your DVN newsletter this week, we look at the evolution of this particular NCAP upgrade, and we review our reporting along its timeline.

We also bring you a show-and-tell report on my DVN field trip to the Pacific Northwest National Laboratory in Portland, Oregon, where some really cool research happens. They're looking at glare, flicker, colour rendering, and a whole constellation of lighting-related phenomena.

We also bring you a short summary of last week's DVN event in China; the detailed report will come next week—your DVN team is hard at work to bring you important news from all around the world!

Through the night brightly,

A handwritten signature in blue ink, appearing to read 'Daniel Stern', written in a cursive style.

Daniel Stern
DVN Chief Editor

In Depth Lighting Technology

DVN @ PNNL: Flicker & Glare Research and Magic



By Daniel Stern, DVN Chief Editor

Naomi Miller, a Senior Scientist at the U.S. Pacific Northwest National Laboratory in Portland, Oregon, specializes in aspects of illumination including glare and TLM—temporal light modulation, commonly called "flicker". She gave a keynote speech at the 2023 US DVN Workshop (slides available as the second item on [this page](#)), and this past Summer we [reported](#) on the early stages of research into how TLM can have seriously negative effects on roadway safety and wellbeing for drivers and their more-vulnerable fellow traffic participants, such as cyclists and pedestrians.

TLM is a new item on the list of potentially troublesome effects of vehicle lamps and lights. It has grown relevant as solid-state lighting—LEDs and OLEDs in all their forms—have supplanted the glowing filaments and arcs of past vehicle light sources. Until that happened, the lamps on a vehicle were fed with steady direct current, which was more or less constant; it did not oscillate at speeds that could cause flicker. Most of today's vehicle lamps, on the other hand, are powered with pulse width modulation: a rapid series of brief power pulses.

Unlike past light sources, LEDs react immediately to the onset or cessation of power, no matter how fast or brief the pulses might be. So, pulsating input power results in pulsating output from it; that is flicker that is visible, or at least measurable. Often the flicker isn't visible to an observer looking directly at the lamp, particularly when the

vehicle and the observer are standing still. But when they are in motion relative to each other, the flicker can be quite pronounced.

The main relevant manifestation of TLM in the vehicle context is the Phantom Array Effect, also called the Bead Effect because the lamp, as it moves across a person's visual field, appears not as a solid line (like past light sources did) but as a string of light-beads. This can degrade a person's ability to get a reliable fix on the lamp's position by following its trails within their field of view. Since driving safely requires keeping constant track of the position of other vehicles, this represents a potential safety detriment.

Too, the eye is involuntarily drawn to whatever especially salient thing might enter our view. If the item attracting a person's gaze is a flickering, high-luminance light, their involuntary stare at it can worsen the glare effect (and if that light's spectrum is rich in blue, that makes the discomfort glare much worse for any given level of intensity).

All of those effects are more or less universal, but TLM poses an even bigger hazard to those individuals especially sensitive to it. Such people experience aggravated distraction and other cognitive disruption as well as significant disorientation, headache, nausea, fatigue, and migraines, as a reaction to amounts of TLM not perceptible (or not bothersome) to others.

Research recently carried out at PNNL has found that earlier examinations of TLM in vehicle lights might have improperly characterized and/or underestimated its threats to roadway safety, and that the recommendations for TLM mitigation springing from those earlier examinations may also be misguided and ineffective. Moreover, TLM from vehicle lamps can interfere with the performance and accuracy of machine vision systems used in ADAS and AD systems.

During my visit to PNNL, I saw a variety of intriguing experiments and trials under way. Most of them involved unique equipment and facilities. For example, the lab has a room with highly specialized LED overhead lighting. What look like ordinary white-LED office lighting panels built into the ceiling are in fact controllable to produce whatever spectrum might be desired. This allows to study the effects of various wavelengths (colours of light) on wellbeing, cognition, attention, alertness, and more.

A great deal of colour-rendering experimentation has been done in this room, and there have been some fascinating findings. For example: common wisdom that increasing the blue content of a white light's spectrum makes the light seem brighter might not be quite right, or at least not quite so simple. In this spectrum-tunable room, it's been found that adding *red* makes white light seem brighter. I got to experience this for myself: the room is full of colourful items like candy packages, colour-coded file folders, and fruit.

When the red was increased in the room light spectrum, white items still looked the same as before, but coloured items suddenly popped with increased vividness and—yes—everything looked markedly brighter. Not just red and orange items, either; even blues and greens, yellows and browns looked brighter (it is worth noting that many commercial white LEDs are deficient in red). More, there was a very curious experience involved, so unusual that it is difficult to describe accurately: it is not that I saw a red flash when the red was switched on; rather, I *felt* a red flash. The effect was quite prominent and, as I say, very difficult to describe in a way that makes sense to someone who has not experienced it.

Here is a video going back and forth between high and low levels of red. It is not as good as being there in person, but the effect can still be seen:



In another part of the lab, there was a sphere dotted with individually-controllable lights spaced at uniform intervals:



There is an opening for an observer's face, with a chin rest arrangement much like one finds in the office of an ophthalmologist or optometrist. This apparatus is used for (among other things) experiments looking at glare as related to the intensity and angle of a light source:



L to R: PNNL scientists Lia Irvin, Belal Abboushi, Naomi Miller

Still another area of the lab contained an adjustable "uniformity array" consisting of a grid of LEDs which can selectively be brightened, dimmed, masked, and the grid of LEDs made to appear more dotted or more uniform/diffuse:



At the other end of a corridor from it, study participants assess brightness, glare, and other aspects of the light:



Naomi Miller kindly answered DVN's questions about her work:

DVN: What have you found in terms of the main ways TLM (flicker) affects human and machine vision?

Naomi Miller: Human health is the greatest concern. Distraction, nausea, headache, migraine, disorientation for people. For machine vision, the frequency of the camera capture often interacts with the frequency of the TLM from the taillight or traffic signal light and may produce delayed or missed critical information for the car or device.

DVN: What do you think are the biggest misunderstandings about TLM among the general public?

N.M.: Many people do not see TLM at all. Or if they do, they do not perceive it as a problem, so they dismiss the complaints about TLM as frivolous or overblown. It's a little like peanut allergies, which can be deadly serious; Those who don't have a peanut allergy (aren't sensitive to TLM), might think the person who asks that peanuts not be served on the airplane (objects to light flicker) is just being a pain in the neck, and that they should just get over it. That isn't how it works!

DVN: Aside from vision, how else are humans affected by TLM, and what do you think are the major implications?

N.M.: Non-visual responses to TLM are real. They include disorientation, because the light patterns produced by the phantom array effect can give an observer a distorted or inaccurate idea of where a lighted object is moving from and to. The retinal light pattern suggests the object is moving in a direction other than it really is, or that it is jumping

around, because the light is not continuous. Also, light can enter the eye through the eyelid or through an indirect, glancing blow to the cornea. Many people sense the light even though it is not directly imaged on the retina. Sneaky stuff, that light!

DVN: What aspects and effects of TLM do traffic participants have to be concerned about – drivers, passengers, pedestrians, cyclists?

N.M.: There's the distraction of TLM pulling attention away from the most important elements on the roadway. There's the misinterpreted movement of a car or bicycle, there's the nausea that the instrument panel [or other displays] may produce for a driver or passenger. These can be issues without the observer recognizing what the cause is.

DVN: During my visit, you mentioned equipment upgrades and new glare research. Can you elaborate?

N.M.: We have a new LED board installed in the uniformity apparatus, and we are studying how the pattern and spacing of LEDs in the visual field (like in a headlight) affect the perception of glare. We are early in this work, but it may help explain why so many people are complaining about increased glare from LEDs, and the frightening loss of visibility at night that it produces. It looks like LEDs spaced close together may be producing a greater perceived glare response than normal glare science would predict. That may help explain why headlights feel so bright.

DVN: Are there traffic- and safety-relevant matters related to TLM that aren't presently being looked at, that you think should be?

N.M.: Gosh, yes! Glare, health issues, comfort issues, visibility at night, safety; these are all affected by LEDs used on roadways and in vehicles—day and night. The degree and nature of the effects are affected by the electronics that drive the LEDs and their waveforms. We know far too little yet, but manufacturers need to be aware they may be introducing new hazards into the driving environment.

It is increasingly apparent that the problems caused to human beings by TLM (like those caused by blue light, also a research topic) are bigger and more serious than just an annoyance. Contrary to existing practice, a quick and easy fix doesn't apply. The assumption, including in our vehicle lighting world, has been that it's sufficient to just avoid PWM frequencies that produce obviously visible flicker—the common wisdom has been 'keep it above 200 Hz and it'll be fine'. But PNNL's deep and broad research is revealing that bad effects persist well beyond readily-visible flicker; they can be avoided only by eliminating TLM altogether, or at least dramatically reducing its amplitude.

This will mean using techniques other than PWM to control solid-state light sources. It might be hard to quit such an addictively lovable strategy as PWM, which offers easy, inexpensive control over effective output of LEDs and OLEDs, but it surely won't be the first such difficult breakup. The history of industry and science is full of eventually learning deleterious effects of a strategy or technique spoil what previously seemed like a lopsidedly favourable cost-benefit ratio. Leaded gasoline comes to mind, or the use of mercury and asbestos. The question eventually comes down to whether industry will responsibly acknowledge and address the matter, or wait until regulations force the cleanup to be done in more costly and burdensome ways.

PNNL's ongoing research will surely be of keen interest to all of us whose work involves the interaction of humans and light!

Lighting News

DVN Shanghai Event: A Quick Review

LIGHTING NEWS



DVN Shanghai gathered more than 350 participants in Jiading last week. Our DVN senior expert team is preparing the detailed report for next week.

What a pleasure to meet again with the automotive Chinese community, to network all together. My five main takeaways:

- A lot of connections between China, Japan, Europe, India and America, all together at the same place. Everybody wants to see and feel what is happening in China, and DVN is a perfect venue for that.
- A clear overview was done by CATARC and SMVIC about new regulations and ratings in discussion for 2027 (automatic levelling, ADB field testing, lighting while parked, apparent surface modifications, symmetrical requirements, and more)
- Interesting discussion during the design panel discussion on how to develop fast in China with close collaboration between automaker designers and lighting tier-1s.
- With demonstration cars this year, it was a great experience to really see and feel new lighting, interior, and UX trends in China.
- Most of the exhibitors, demo cars, and lectures were presenting V2X communication with displays, projections, and the importance of user experience. One example was the impressive lecture from BYD about their projection roadmap.





November DVN Report: Lighting Regulation

LIGHTING NEWS



Last week, in parallel with the DVN Shanghai event, [we published a status report](#) about worldwide lighting regulations, mainly written by Eric Blusseau. We have gathered in this document all the lighting regulations from the world's regions, including what is specified and how certification or approval is achieved. Included regulatory regimes include UNECE, EU (Europe), FMVSS (USA), CMVSS (Canada), KMVSS (Korea), AIS (India), GB (China), CONTRAN (Brazil), GCC (Gulf Cooperation Council of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates), Taiwan, and Japan.

We hope this report will be of great use to the DVN community. As usual, feel free to contact us if you need further information. One of the DVN platform's goal functions is to facilitate and bridge gaps between regulation, innovation, and the lighting community.

Zeekr Wins CDN Best Lighting Design Award

LIGHTING NEWS



Last week in London, the Zeekr design team scooped up the CDN People Award for Best Lighting Design, for their work on the 'Stargate' illuminated grilleboard on the Zeekr 007.

They were in competition with the Verne design team, Mercedes-Benz exterior detail design & light engineering teams, Audi light design team, and Hyundai lighting design team.

Congratulations to the Zeekr team who presented their work at DVN Munich this year, where they received a DVN award for the best lecture.



ADAC Favours LED Retrofit Bulbs

LIGHTING NEWS



ADAC, the German automobile club, is advocating the installation of LED bulbs in halogen headlamps. A wide variety of LED bulbs are available from legitimate makers (aside from a mountain of them with little or no engineering in them, from less reputable outfits). Some of the legitimate-brand ones are approved in certain individual European countries for use in specific headlamps on specific vehicles. These approvals are *not* comparable to the ECE or DOT markings on a regular headlight bulb, indicating it will work safely, effectively, and legally in any lamp designed to take that kind of bulb. Rather, the LED bulb approvals are the result of specific countries testing specific bulbs in specific lamps. If a combination meets the testing country's minimum standards for headlight performance, it is added to that country's OK-list.

Germany, France, and Switzerland head up the small list of countries engaging in testing and approval of this kind, and the combined list of approvals comprises more than 900 car, motorhome, and motorcycle models. LED bulbs are also sold for fog lamps, parking lights, and numerous other vehicle applications—with and without safety approvals.

ADAC is appropriately emphasizing that it is important to use only approved LED bulb/headlamp/vehicle combinations. Legitimate makers provide approved-compatibility lists on their websites. The management of vehicles in service in Europe—periodic technical roadworthiness inspections strongly linked to the validity of the vehicle's traffic authorization and insurance—make this approach feasible. Under it, an unapproved LED bulb/headlamp/vehicle combination can subject the owner to fines, the car can flunk its periodic inspection, and its insurance and/or operating licence can be suspended. Without a structure like this (for example, in North America), an approved-combinations strategy like this is not possible.

LED replacement bulbs for halogen lamps are gradually evolving toward universal drop-in applicability, but there are significant challenges to be overcome. For example, the rotative position ("clocking") of a single-filament halogen bulb exerts relatively minor effects on the beam pattern; engineers have long used bulb clocking to fine-tune the photometric performance of the lamp—for example, to move an internal filament

support to a position where its reflections will not cause unwanted glare light. Bulb clocking is also widely used to provide clearance for the physical fit of the bulb, especially for bulbs with 90-degree bases.

But the 2-sided/back-to-back structure of an LED bulb is a significant departure from the cylindrical-filament light source in a halogen bulb, optically speaking. LED bulbs are designed with the assumption that they will be installed with straight-up clocking: the two LED chipsets facing 9:00 and 3:00. But in many headlamps, that's not how the bulb sits, which makes a universal drop-in LED bulb difficult. Also, the PWM feed applied to headlamps either for DRL-dimming or for regular low- and high-beam voltage regulation is invisible with glowing-filament light sources, but it can cause noticeable, distracting flicker with instant-on/off LEDs. Too, there is the question of what to do when a halogen headlamp's inbuilt self-thawing system is taken away by a cold LED bulb replacing a hot halogen one.

Work is actively under way in GRE and SAE to build toward a future LED retrofit bulbs are more widely applicable. In 2023, UN Regulation № 37 was [amended](#) to provide a structure for future type-approvals of LED bulbs, and that regulation will soon contain specifications for LED H11s.

Marelli h-Digi Wins CLEPA Innovation Award

LIGHTING NEWS



Marelli, for their h-Digi microLED technology, have been named a Top Innovator by CLEPA—the European Association of Automotive Suppliers. CLEPA's Innovation Awards recognize and celebrate groundbreaking ideas in green and digital technology across the automotive supply industry.

Based on a new multipixel LED matrix light source, Marelli's h-Digi microLED module enables fully adaptive, dynamic headlight operation and high-resolution image projection on the road for driver assistance in a more affordable, compact, lightweight module than any other solution currently on the market. This expands the affordable availability of high-resolution ADB.

With pixels smaller than 0.1° , the resolution of the illumination matrix system is 10 times greater than that of conventional LED glare-free high beam systems. And it creates a significantly longer illumination range. The high-resolution system offers benefits also in the low beam mode, as it provides the opportunity for adaptive lighting functions, like dynamic light bending on country roads, special light patterns on highways during high-speed driving, and adaptive lighting in adverse weather situations. It can project graphics onto the road in the driver's line of sight to communicate safety messages, warnings, or driver assistance patterns such as lane guides. It offers the opportunity for individualization and, potentially, also personalization through attractive welcome/farewell projections.

Two configuration options are available: one with 25,600 pixels in an aspect ratio of 1:4, and the other with 19,200 pixels and an aspect ratio of 1:3. The light source is combined with a special optical lens system and a new electronic control, both engineered in-house by Marelli.

Marelli Automotive Lighting & Sensing President Frank Huber says, "The CLEPA 'Top Innovator' Award is a fantastic recognition for us as technology leader in lighting. We have created a unique customer experience with our digital light solutions. Our extremely efficient h-Digi microLED sets new standards in road safety and driving comfort at an affordable cost. I am proud of our teams and our successful co-creation with customers and partners".

Valeo's New Plant at Martos, Spain

LIGHTING NEWS



Valeo's new facility in Martos will bring together the site's lighting R&D teams. The building, which has been certified with an 'A' energy class and is designed to foster team creativity, can accommodate up to 400 engineers from disciplines including electronics, mechanics, and optics.

Valeo Martos, one of the Group's largest lighting R&D centres and one of their top three lighting production sites in the world, contributes to the socioeconomic development of the province (Jaen) where it is located, and to the implementation of an educational cluster in collaboration with universities and professional schools.



Driver Assistance News

Denso, Canatu Sign MOU to Apply Carbon Nanotubes

DRIVER ASSISTANCE NEWS



Denso Corporation have signed a memorandum of understanding (MOU) with Canatu to advance the practical application of carbon nanotube technology. The two companies aim to advance autonomous driving technology and the realization of carbon neutrality.

As autonomous driving technology continues to evolve, vehicles must accurately detect their surroundings using cameras and other sensors. Frost and condensation can obstruct visibility and spoil the ability of cameras and sensors to do their job. So Denso are developing products that use transparent conductive films made from flexible, transparent materials; carbon nanotube technology is the key.

Carbon nanotubes are extremely fine structures, characterized by high strength, light weight, and excellent electrical and thermal conductivity. They hold great promise for a wide range of applications. Canatu have innovative technology to facilitate efficient production of highly pure carbon nanotubes using proprietary materials, and the company have strong abilities in transparent conductive film formation.

Denso have been collaborating with Canatu by combining Canatu's advanced transparent conductive film technology with Denso's expertise in automotive technology and mass production. This past April, the two companies successfully developed a reactor* at Canatu's production facility in Finland, significantly enhancing the productivity of carbon nanotubes. They have also been jointly developing transparent heaters for vehicle cameras and windshields. Now, they will continue to drive efforts toward commercializing transparent heaters and expanding their application to environmental technologies.

Cooperative initiatives will include:

- Developing new applications for carbon nanotubes, including transparent heaters and solar power technologies
- Collaborating to improve manufacturing equipment and processes to achieve the quality required for mass production
- Exploring the establishment of a reliable supply system to ensure stable and consistent delivery of high-quality products.

US NCAP Upgrade: New ADAS; VRU Protection, but No Lighting

DRIVER ASSISTANCE NEWS



Last week, the U.S. National Highway Traffic Safety Administration finalized a major update to the US NCAP protocol, which will now look at more ADAS and at pedestrian protection

The US NCAP will now scrutinize vehicles for four more kinds of ADAS: pedestrian automatic emergency braking, lanekeeping assist, blind spot warning, and blind spot intervention. There are also more stringent performance criteria and a new test procedure for automatic emergency braking, which was already included in the protocol before the updates.

Too, there are new criteria to evaluate the ability of a vehicle's front end to mitigate pedestrian injuries and fatalities in vehicle-to-pedestrian impacts, as well as mid- and long-term roadmaps to accommodate future updates amidst ongoing research and technological advancements in vehicle safety, including crash avoidance and crashworthiness improvements to protect bicyclists and motorcyclists, and an updated rating system.

The updated NCAP is considered a key component of the Department of Transportation's National Roadway Safety Strategy, and of their work to significantly reduce serious injuries and deaths in traffic.

U.S. Transportation Secretary Pete Buttigieg called the NCAP update an "important step toward addressing the crisis on our roads and achieving the Department's ambitious, long-term goal of zero road fatalities (...) Like our move earlier this year to make automatic emergency braking standard on new passenger cars and light trucks, these changes to [NCAP] will speed up adoption of technologies that reduce the frequency and severity of crashes, while helping consumers make informed decisions about buying a new car".

NHTSA Chief Counsel (top lawyer) Adam Raviv says NHTSA's goal with NCAP "has always been to help consumers choose safer vehicles and to encourage manufacturers to improve vehicle safety. With these NCAP updates, we're ensuring consumers have more useful and relevant information on the latest safety technologies and that the program keeps up with the pace of technological change and innovation".

The official Final Decision Notice, setting forth the program changes in complete detail, is [available online](#).

DVN Analysis by Chief Editor Daniel Stern

This update to the US NCAP is interesting in a variety of ways. It's enormously encouraging and gratifying to see official recognition of the safety benefits that flow from ADAS technologies, and to see NHTSA's openness to adding more kinds of driver-assists to the NCAP protocol as the technologies evolve and safety-benefit evidence accumulates.

And it's well worth celebrating the addition of pedestrian-protection provisions. The UN Regulations used outside the American regulatory island first began exerting pedestrian-protection requirements over half a century ago in 1972, when injurious projections (rigidly-mounted sideview mirrors, hostile hood ornaments, etc) were banned on new vehicles by ECE R26. Over the decades and years since then, the UN Regulations have been progressively strengthened on this matter; in 2013 UN R127 codified modern pedestrian-protection requirements.

But the US Federal Motor Vehicle Safety Standards have never contained any pedestrian-protection requirements. One might ask why NHTSA wouldn't issue a new FMVSS to compel automakers to address that issue, rather than opting to use NCAP, to encourage automakers without actually forcing them. On first thought, it might seem as though the NCAP route wouldn't advance the safety interest as forcefully as the regulatory route. But in practical fact, the opposite is likely true. The regulatory process in the US is a slow and difficult one for NHTSA for reasons ranging from historical to legal, as I explained in detail in [my keynote at a DVN Workshop](#) a few years ago.

That means even if NHTSA's dedicated safety experts, devoted to the worthy goal of reducing and eventually eliminating traffic violence, all wanted to put in new requirements, it would take many years and a vast expenditure of agency resources—and that's if industry (the regulated parties) were more or less onside with the idea. If not, it would be even harder and more resource-intensive. There are only 24 hours in a day, even at NHTSA! Non-regulatory mechanisms like NCAP have proven highly effective in moving vehicle design, configuration, equipment, and safety performance in good directions.

Often, this favourable movement is greater and faster than could practically be achieved by putting in a new mandatory safety standard. The reason why is fairly obvious: a periodically- and progressively-updated NCAP protocol incentivizes automakers to get the best possible score, because their customers actively seek out high NCAP scores. Market competition drives innovation in safety performance and cost-effectiveness on an ongoing basis, probably to a degree greater than a mandatory regulation. So NHTSA's choice of mechanism here is valid and laudable.

It's worth taking a look at the history of this particular action. The process got started early in 2016, and we [first reported](#) on it in January of that year. In its initially proposed form, the NCAP upgrade would have included provisions more or less in line with last week's announcement, but also several lighting-related criteria: NCAP points for low beams giving better seeing and lower glare, and for amber rather than red rear turn signals.

At the start of February 2016, we [analyzed](#), in depth, the parts of the proposal related to low-beam performance. And at the end of February, we did a [deep dive](#) into the responses to NHTSA's request for comment on the proposal. Many comments—from industry, advocacy groups, and private individuals alike—were enthusiastically in favour of the lighting proposals, though automaker opinions were divided on technical aspects of the low beam performance ideas and on the turn signal colour matter; Ford, for

example, said amber turn signals required "more research and development to demonstrate appropriate reliability" before they should be eligible for NCAP points.

In March 2022, we [reported](#) on NHTSA's proposal for an NCAP upgrade, the details of which were fairly similar to last week's finalized protocol updates (and we noted at that time that the lighting-related parts of the 2016 proposal had been withdrawn).

Looking back at this timeline, one can't help noticing it is measured in a number of years. And that emphasizes the point: however long it might have taken to get NCAP upgraded in ways that will surely accelerate the prevalence in traffic of cars with effective safety equipment and design they didn't have before, it almost surely would have taken longer if NHTSA had pursued new regulations instead—and the outcome might well have been less certain.

So while it might be unfortunate from the American driver's-eye view that equipment long considered basic elsewhere in the world (low-glare low beams, turn signals that don't look the same as brake lights), it is worth noting that headlight glare is a hot topic around the world right now, so perhaps now these meritorious ADAS and pedestrian-protection upgrades have been made, some attention might be turned toward lighting. If, as, and when it happens, you'll read about it in *Driving Vision News*!

General News

Avatr 06 Pics Drop

GENERAL NEWS



06 has been chosen as the designation for the next forthcoming model from Avatr, the premium EV brand jointly backed by Changan, Huawei, and CATL.

Along with the name, the automaker also released exterior images of the new model in an [online video](#), and there's a fair good amount to see—it could reasonably be compared to a Tesla design, except the Avatr 06 has integrated lidar sensors, while Tesla boss Elon Musk continues to insist lidar is silly. The Avatr 06 also appears to offer advanced features like an ISD (interactive social/signalling display) and sideview cameras instead of mirrors.



To go further ...

Ultrasonic wire-embedding and high pressure forming Process details by FORVIA Hella

To go further ...

