2018 CES • Las Vegas

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About the author

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

Executive Summary

The CES show has, with seeming suddenness, become highly relevant to the automotive industry—especially in the fields of driver assistance, autonomous driving, vehicle communications, and machine vision. DVN attended CES for the first time this year to generate this report, a sampler of the relevant exhibits and ideas on display, described here in 30 pages and 55 images.

There was strong automaker presence, though certain technology-focused automakers were surprisingly absent. On the other hand, the array of suppliers and startups was truly impressive. Magneti Marelli and Varroc were the two driver- and vehicle-vision suppliers with the biggest and best showcases at CES, and there was also an interesting panorama of vehicular and traffic technology and technique displayed by the likes of Texas Instruments, Pioneer, Osram, Velodyne, Delphi, Denso, Magna, Continental, Bosch, Garmin, Osram, Valeo, ZF, Mobileye, Stanley, and Koito. As well, there was an intriguing variety of small companies and startups eager to bring their ideas and innovations to fruition in the driver and vehicle vision and visibility realm (even when the "driver" in question is on a bicycle).

New ideas were numerous not only for how to make AVs but how to use them—both Toyota and several startups showed driverless cars that bring shops and stores to people, instead of the other way round, for example. There was extensive innovation on display in the V2X communications field, and Nissan showed off an interesting inversion of that concept, as well.

Virtual-reality simulations, autonomous-car demonstrations (despite the severely rainy and windy weather), and new-product announcements were heavy on the ground, as were coöperative developments such as a system put forth by Osram and Velodyne Lidar.

Introduction

This, DVN's 124th report, is a specialised sampling of automotive technology at the 2018 CES. For the first time this year, DVN attended this, the Consumer Electronics Show in Las Vegas. It's the largest of the many trade shows held every year in the sprawling exhibition centres amidst the garish gambler's paradise that is the Las Vegas strip, and this year's show broke all previous attendance records; an estimated 200,000 people walked the halls, not counting exhibitors. That's particularly impressive in light of the fact that the show is closed to the general public; it's an industry-only trade show and attending involves a vetted application process. 2018 was the fifty-first year of the show's existence, but until recently it was just stereo systems, television sets, audiovisual equipment, computers, and related...consumer electronics! But as the electronics content of vehicles has smashed free of the previous boundaries confining them to unseen functions like powertrain management, as cars have become computers (and living rooms) on wheels, as the electronics world and the automotive world merge and converge at an accelerating pace, and the auto industry's Silicon Valley diaspora grows big and strong, automotive technology has come to be a substantial, important chunk of CES.

This year's roster of automaker attendees included Nissan, Ford, Mercedes-Benz, Honda, Hyundai-Kia, Jeep, and Chinese EV startup Byton chose CES 2018 to show their first concept car for the first time. It (and they) appear to have Tesla in their very clear sights. Audi were conspicuously absent—a puzzlement, given their vanguard position in the car tech race and "Vorsprung durch Technik" (progress via technology) motto. On the other hand, Jeep, rather than waiting another week for NAIAS, showed the brand-newly redesigned iconic Wrangler, which boasts advanced new LED headlamps from Magneti Marelli's AL division (see details on those in the NAIAS DVN Report published recently).

This is report is not intended as a telephone book listing each and every exhibitor that has any connection to vehicles. Rather, it is a sample of the high points and interesting eye-catchers relevant to us in the vehicle lighting, driver vision, and machine vision realms. It sets a foundation from which for us to build in future years as CES (and DVN) continue to evolve.

And now...come join DVN as we walk the CES!

Byton

Former BMW executive Carsten Breitfeld, who led the development of the i8 and is now CEO of EV startup Byton, stood watch over the startup's launch of their car concept presented as "a next-generation smart device to enrih your experience as a driver and giver you time to enjoy whatever you enjoy doing", in the words of the startup's marketing VP Henrik Wenders, who added "We're not redefining cars, we're redefining life". Maybe so. Meanwhile, the car is conceived as an electric SUV starting at USD $45,000, that will go 400 km on a full charge, driven by its 272-horsepower single motor. A more expensive dual-motor version has 476 horsepower and will go 528 km on a charge. Byton's ambitious goal is to launch a production vehicle by the end of this year, with the controversial SAE Level 3 autonomy—and the ability to upgrade to Level 4 sometime after 2020.

The dashboard...isn't. Instead, there's a full-width screen display, with an additional tablet in the centre of the steering wheel. All these are controlled by touch, voice, face recognition, and hand gestures, the lattermost read by a group of cameras.

ront and rear lights are a mix of mockup and module at this stage. There's an upper row of three small oblong ice cubes with LEDs behind them, faired into the bodywork with white crisscross lines joining into a slim transverse white line underscoring the white-lit stylised "B" company logo.

Below that, in the bumper fascia, there are two more lights per side.

The rear lights are slimline items that appear to be more toward the mockup end of things, with a red version of the crisscross-lines ornamentation.

Clic-Light

Motorcyclists exist in a deadly grey zone: part bicycle, part motor vehicle. Standard motorbike lighting

does a job that doesn't measure up to the task of conveying the motorcyclist's presence, position, and intent quickly and accurately enough to get the message across to other traffic participants. Here's a startup with a new idea to tackle that problem: the Clic-Light is easily attached to the motorcyclist's helmet, clothing, or backpack, and readily works with the motorcycle's native controls by means of a wireless interface. It's got left and right turn blinkers and a bright central stop light. It's rechargeable, with a long claimed charge life, and the company are also working on a product for pedalcycles.

Cognitive Technologies, a software firm founded in 1993 by a group of Russian programmers, have been edging their way into the autonomous-driving ecosystem. Yuri Minkin, who heads Cognitives autonomous-drive activities, says the company's C-Pilot software takes inspiration from the hippocampus— a part of the human brain key to spatial navigation. C-Pilot determines the most important information at a given moment so that the car can react optimally.

The system sees everything near the car in a 360-degree view, identifies the horizon line and cars, pedestrians, motorcyclists, bicycles, and suchlike. It then uses AI to predict what each object is going to do. Cognitive VP Roman Tarasov says, "For example, the system sees a kid and an old lady. The kid is much more likely to jump in front of a car than the old lady. The system analyses the scene and predicts possible behaviour of the objects and acts accordingly."

Cognitive call this "foveal computer vision", focusing on the centre of the field of vision as objects enter the frame, like a car entering a lane or a pedestrian stepping off the footpath. C-Pilot uses less computing power, added Tarasov, as it only stores what it deems to be the most important information that it has gathered.

Major international supplier Continental had an interesting live demonstration of their "High Resolution 3D Flash Lidar" set up to watch the comings and goings of showgoers throughout an impressively broad and long range of distance.

Another technology Continental showed included a world-first 3D-surface touch screen, which won honours from the CES innovation awards committee in the "in-vehicle audio/video" category. Continental say it can be operated instinctively, thus increasing safety. "Drivers can operate the various functions without having to take their eyes off the road", explained Dr. Frank Rabe, who heads Continental's Instrumentation and Driver HMI business unit.

Central to Continental's presence at CES was the latest version of their autonomous concept vehicle BEE ("Balanced Economy and Ecology") which bristles with the supplier's latest AV and AI technology.

Cub Tek

Cub Tek, the operating brand of Taiwan's Cub Elecparts corporation, had a small display booth focusing on their products intended for the aftermarket, semi-OEM, and upfitter sectors. An example: a blind spot monitoring system that can be added to most any vehicle. Cub Tek say the system gives OEM-level performance, and has sensors for bumper placement that can be affixed to the vehicle by hard mounting or with an adhesive bracket of the company's own design.

Denso

Japan-based megasupplier Denso's expo space centred round a model city of the future with QR-coded billboards showing how Denso's V2x, connected-car, ADAS, and AV technology can improve safety, comfort, and traffic harmony and throughput in tomorrow's smart cities.

Denso's 5G-based high-speed and large-capacity communications technology are an infrastructural building block for connected cars, and the supplier's quantum computing algorithms are readily integrable into communications-based solutions to traffic congestion.

In vehicles themselves, Denso's interface technologies include organic electroluminescent displays to manage and present safety-critical information to the driver in the safest, most appropriate manner. Meanwhile, Denso say their AI technology adjusts the vehicle environment based on changing road conditions, and their AV technology recognises and intelligently prioritises obstacles and movement of other vehicles to determine the best and safest route on a real-time basis.

EyeSight

EyeSight specialise in smart sensing systems for use inside automobiles. The EyeSight system tracks a driver's presence, as well as the movement of the eyelids, head, gaze (by iris tracking), upper body, and can also see when the driver is using a mobile phone. This information is used for real-time detection of driver fatigue and distraction. The system's output can drive audio, visible, and/or tactile alarms, or can be fed into other ADAS elements. For example, detection of a distracted driver might prompt the car's adaptive cruise control to keep a longer distance to the vehicle ahead.

The system can also be used for driver identification, so automakers can provide automatic personalisation by adapting the vehicle to the individual driver. As soon as the driver sits down, the system can provide the preferred seat position, interior temperature, radio volume and program, etc. The same sensor that monitors the driver's alertness also enables car control by means of simple hand gestures. This reduces the risk of distraction and minimises the cognitive load on the driver's brain

Ford

Ford's CES presence was enormous, with just one of their several exhibits covering an area the size of at least three of the largest standard-size expo spaces. In that jumbo showcase, Ford presented their foreview of future mobility centred round the notion of streets rather than roads. "Streets", Ford elucidated, "are for living. Roads are for cars." Perhaps this is a latter-day effort at atonement for Ford's zeal to carve up and pave the world's countrysides last century, to the detriment of the communities Ford now seem to have in mind. The main idea is that the streets in the smart cities of tomorrow ought to cater to all comers—whether on foot, on four wheels, on two wheels (or, we suppose, on one wheel)—and not just to motor vehicles. When advanced automobiles make it safer and easier for pedestrians, bicyclists, and motorists to commingle in shared space, there'll be less need for traditional hard barriers dividing the space into "car" and "other" zones. This will facilitate a greatly expanded mix of uses for the streetscape.

Of course, vehicles will carry on playing a prime role, and Ford have just the thing: they displayed two of the experimental autonomous vehicles, previously described in DVN, which they're developing with the Virginia Tech Transportation Institute.

And one of the vehicles on display was set up as an autonomous food-delivery vehicle—a drone on wheels, as it were.

Gentex

Gentex displayed several variants of their "SmartBeam" automatic high/low beam switching system as well as mirrors with value-added functions. One new item not shown before was their SmartBeam motorcycle headlamp. It looks like their own rendition of a headlamp closely inspired by JW Speaker's LED headlamps, but while JWS offer motorcyclists a headlamp with inbuilt dynamic adaptivity to countervail the seeing deficits brought on by banking into a curve or turn, Gentex' lamp has an inbuilt automatic high/low beam selector.

They also hinted at what they are calling "SmartBeam for Matrix Beam Headlamps", a system that appears to be Gentex's effort to be ready when American regulations begin permitting ADB.

Hudway

Hudway, who previously floated the idea of an attachment to turn a smartphone into a HUD (head-up display), were flogging their new Hudway Cast product: an integral HUD for aftermarket retrofitment, taking data from a smartphone and/or a vehicle's OBD2 port and providing it to the driver via a high-quality curved transparent lens. Navigation information, vehicle information (engine RPM and road speed, for example) and control over audio volume and telephone calls are all available via the Hudway Cast, which Hudway say is readily legible even in bright sunlight.

The projector virtualises a projection such that it appears to be about 3 metres ahead of the car, which is said to be a good balance between providing information in the driver's line of sight without interfering with safe visibility of other road users.

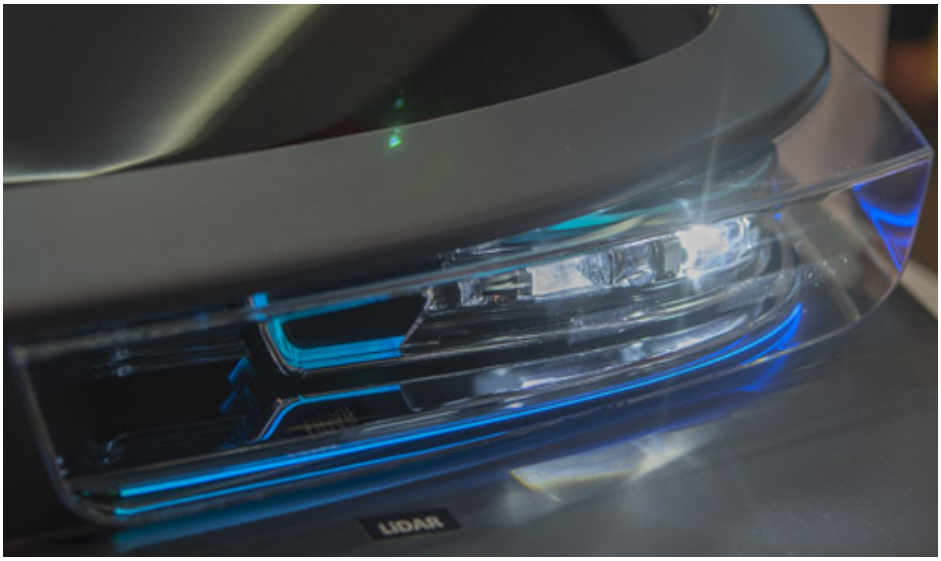
Imagry

Imagry are developing a cameras-only platform for Level-4 and -5 autonomous driving. They say it will cost only a fraction of solutions that integrate radar, lidar, cameras, and GPS. The Imagry AI technology is based on "Deep Inverse Learning" algorithms which are said to accelerate the training and performance of the software for end-to-end perception, planning, and control, particularly in complex unseen scenarios. It is a new approach for training on large unlabeled datasets. An Imagry represenative says this method allows collection of data from both real-world driving and simulation runs without manual labeling. Imagry's algorithms train the driving model which controls the car, by extracting the most useful driving parameters and abstract models of the road.

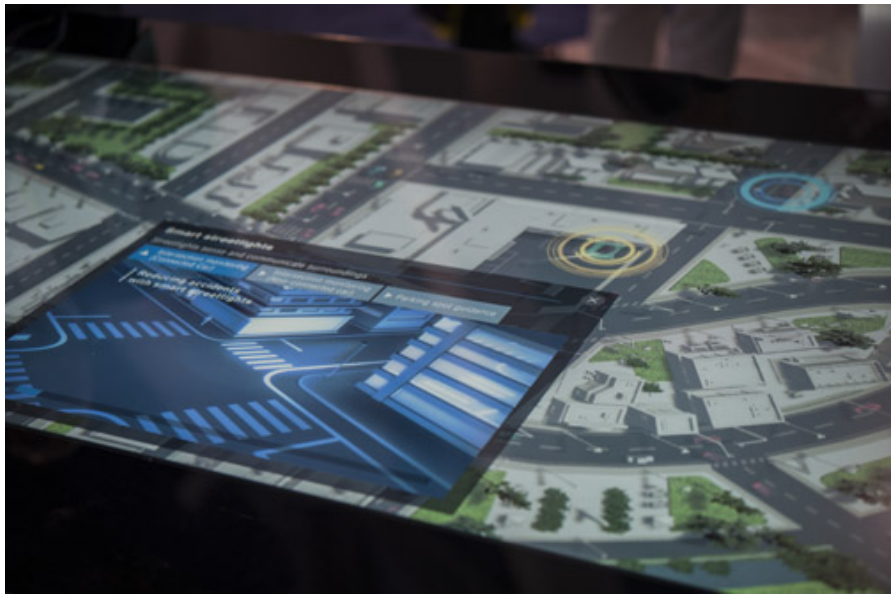
Koito

Japan-based lighting heavyweight Koito and their subsidiary North American Lighting came to CES to show off their advancements in integrating ADAS and AV sensors into vehicle lamps—some of which also showed other spiffy new technology.

A snazzy OLED-looking rar combination lamp and a cool blue-rimmed LED front fog lamp showed Koito's skill and talent at producing lamps with inbuilt sensors that seem to disappear completely, well hidden in the works and styling of the lamps. These integral sensors—a lidar sensor in the front fog lamp, for example—allow for easy, cost-effective equipment on vehicles.

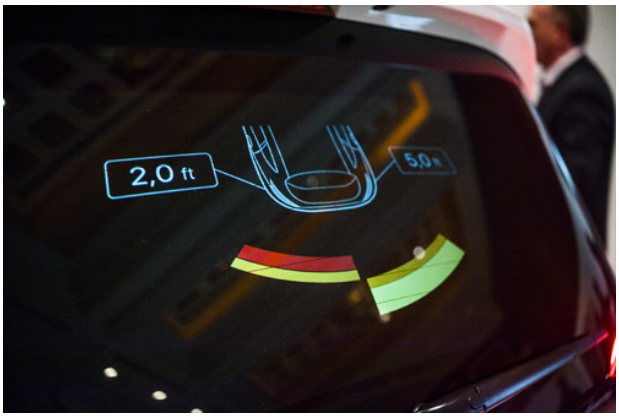


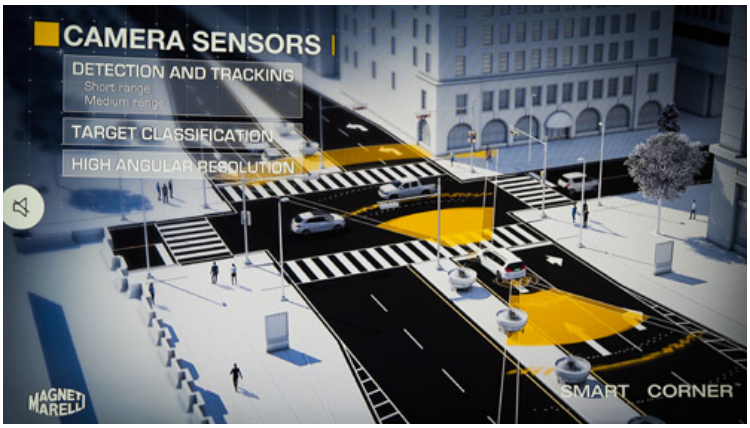
The Koito-NAL booth also had a sophisticated V2I demonstration board showing the company's diverse activities and polyvalent solutions in the vehicle-to-infrastructure communications realm.



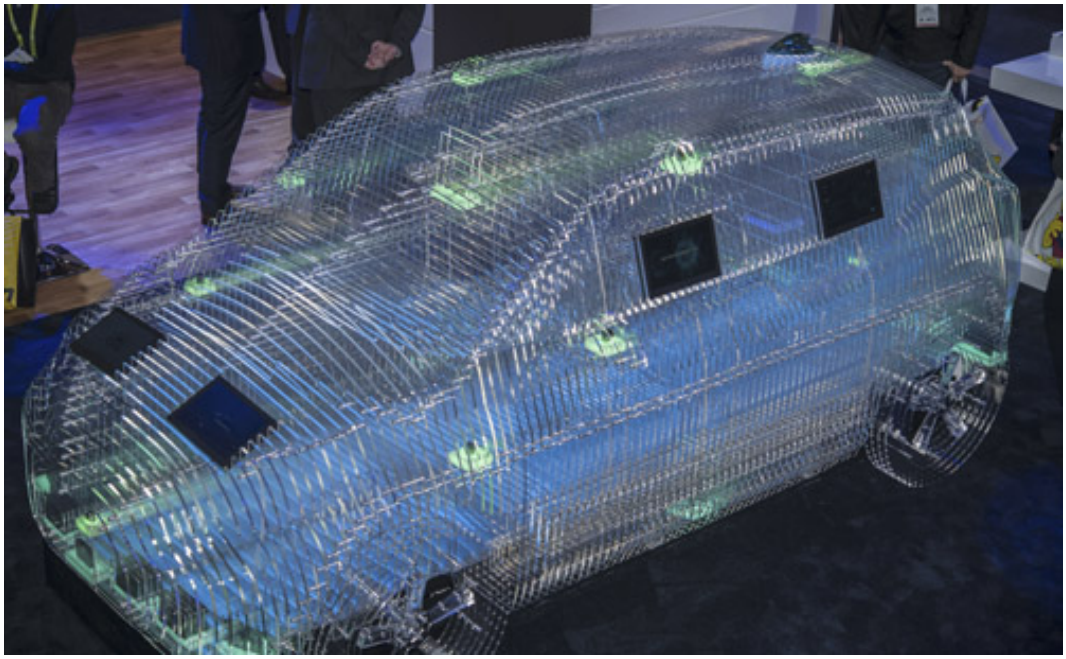
Magneti Marelli

The grand Magneti Marelli suite was in a hotel ballroom where all sorts of advanced technology was on display. From AL's wide array of headlamp modules and componentry to the company's expansive and highly advanced latest work in V2X hardware and algorithms, new packaging concepts, and an impressive Chrysler Pacifica demo vehicle fitted with "Smart Corner" multifunction lamps, front and rear, containing lidar and radar units, cameras, pressure-jet sensor cleaners, LED ADB headlamps, swiping turn signals, the works. That car also has wraparound status lighting (charging, autonomous-drive mode, etc), a variable-message display built into the backglass, and the ability to project warning graphics and messages on the ground to the rear. This can be used for everything from owner-drive identification and welcome/farewell, to vehicle-to-driver-behind communication on the road (to avoid collisions or convey pertinent information about yet-unseen conditions up ahead) or in the parkade (to let nearby parkers know it's time to stop). There was a fancy set of high-content full-LED Ferrari taillamps on display,



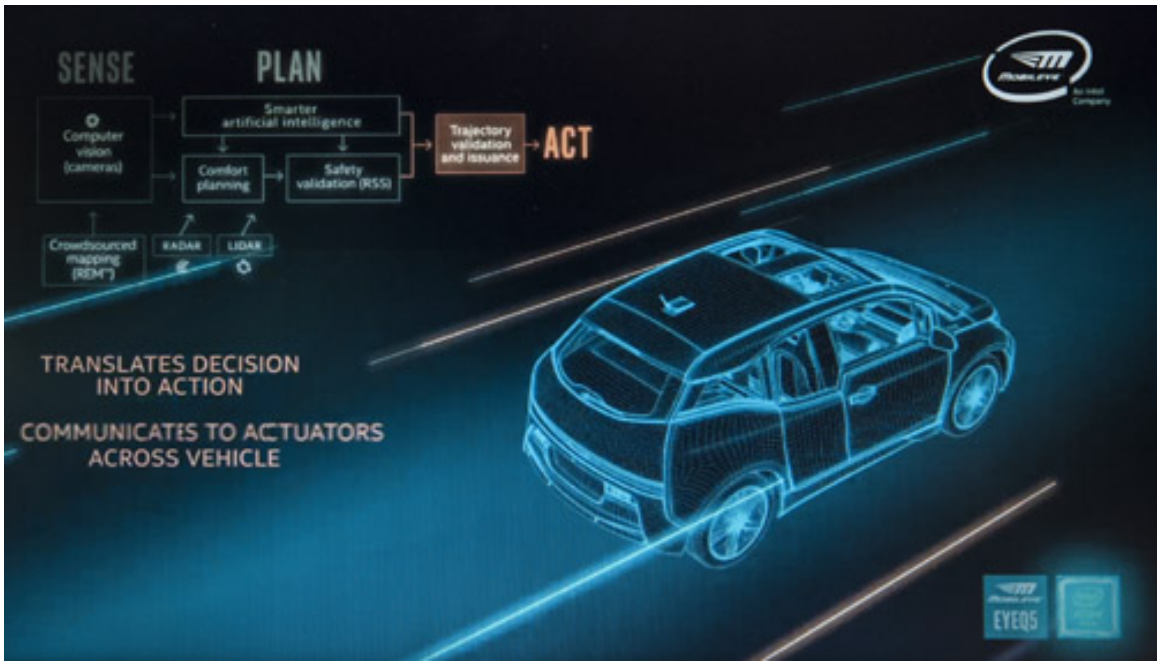


Mobileye



Mobileye's large, elaborate showspace was centred round a sculpture of a minivan, apparently made of "slices" of transparent plastic and bristling with Mobileye machine-vision, ADAS, and AV technology. Touchscreens located around the sculpture allowed showgoers to interactively learn about Mobileye's product offerings.

Mobileye disclosed their product roadmap to 2020, announcing plans to launch 15 autonomous driving projects with 14 automakers this year. Their "master plan" for 2018 involves working on L4 development partnerships, extending their L2+ program to increase the level of autonomy of current production vehicles, working on road experience management (REM) as a data strategy, and actively participating in the devisement and negotiation of safety standards with industry and regulatory bodies.



New features being launched this year by Mobileye include REM, 3D vehicle detection (3DVD), traffic light detection and recognition, and advanced road features including free space and path prediction.

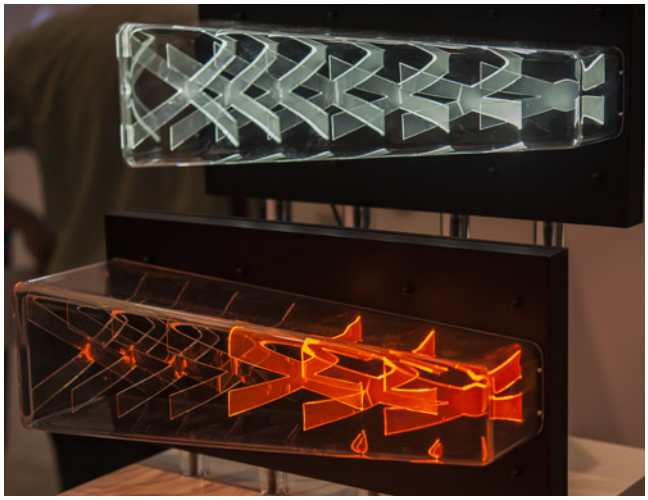
Nissan

The central chunk of Nissan's CES presence was devoted to what they call "brain-to-vehicle" (B2V) technology. At least in concept, it counters the trend of taking control away from the driver with ever-increasingly sophisticated ADAS and autonomous capabilities: B2V means to enhance the driving experience and make sure drivers don't become obsolete, Nissan say, by monitoring the driver's brain and interpreting its signals to help anticipate what the driver will do next. For example, the car could begin turning the steering wheel or accelerating based upon the data from the driver's brainwaves—interpreted in real time—before the driver's muscles begin moving the steering wheel or accelerator.

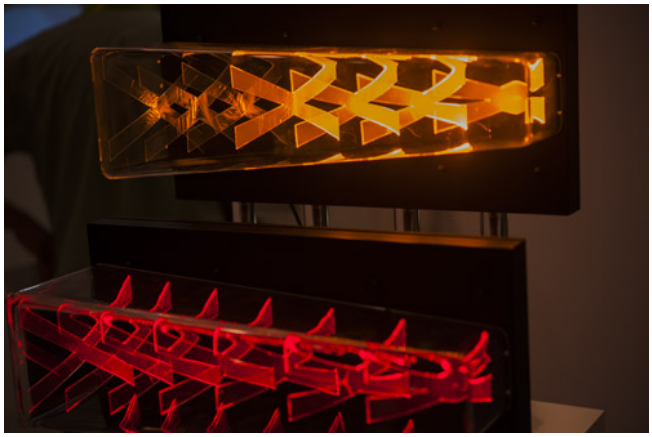
To some degree, B2V can read a driver's emotional state and level of discomfort, which could let the car adjust to the driving style and mood of any particular driver. Nissan say the primary main objective is to make driving more enjoyable, and that their B2V technology is the first of its kind. No word on whether or when Nissan might put it in production vehicles, at least in the form described at CES, but the technology is notable for its almost counter-AV orientation.

Nissan also showed their IMx concept car mockup. It bristles with sensors and cameras, and Nissan showed some innovative uses for the data these electric eyes compile. An all-around vision system is one example: if someone is walking near the car, their image, where they are, is projected on screens integral into the paneling on the interior of the car. The IMx has no mirrors, only cameras. The central plate—located where a petrol-burning car would have a radiator grill—is designed to look something like an insect's compound eyes. The lights on the mockup suggest high-content LED front and rear lighting; simple red rear and white front plastic plates no longer get the job done, and these highly detailed mockups continue a trend we've seen at auto shows these last few years.

Osram

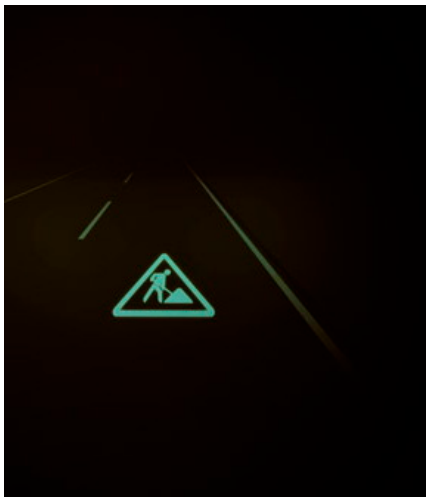


Osram had booths sprinkled throughout CES. Their main display area was a panorama of mostly automotive technology, including a pair-up with Velodyne called High-Definition real-time 3D Lidar for automotive applications. It boasts 32 channels using IR-pulse lasers with a 905-nanometre wavelength. The system gives up to 200 metres' range and a field of view 360° horizontal and -25° to +15° vertical. A demonstration unit provided strikingly accurate recreations of the shifting crowd of showgoers not just near the booth, but far away as well.

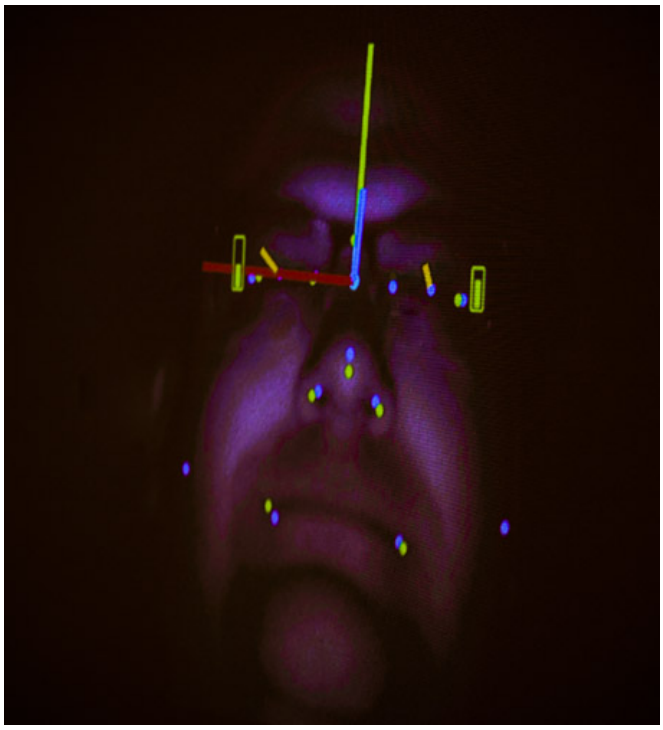


Also on display was a demonstration pair of sculptural car lights producing multiple colours from the same output area. Operational modes demonstrated were white/amber (DRL/turn signal) and amber/red (turn signal/stop-tail).

The increasingly notorious Eviyos advanced headlamp light source was also demonstrated, with simulations showing crisp, clear driver-information images projected in the foreground on the road surface.



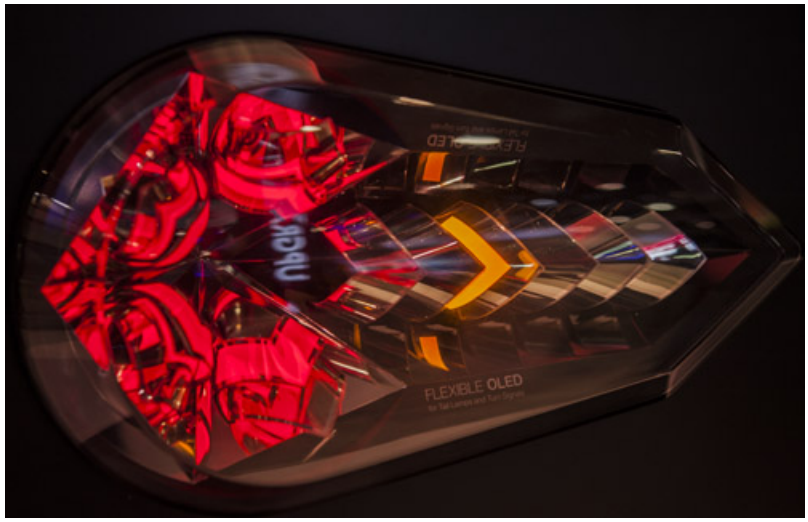
For vehicle interior applications, there was a driver monitor system shown that keeps track of the driver's gaze, eyeblink behaviour, and other characteristics to assess attentional level and direction, drowsiness, and other driver-related factors. This was positioned so showgoers could see how easily the system latched onto their face and found its features.



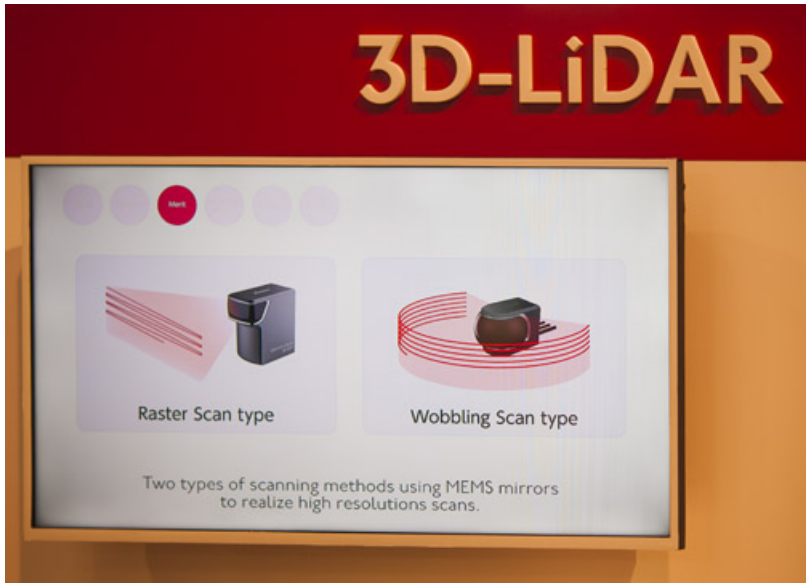
Pioneer

Pioneer, long known for their high-quality audio equipment, demonstrated an impressive array of vehicle technology. The flashiest item, in the middle of their display area, was a set of flexible OLED taillamps showing off the mirror-when-unlit appearance as well as the striking curvature of the OLED elements and their vivid, homogeneous lit appearance.

Beyond the glitzy OLED lights, there was also strong communication on Pioneer's rearview cameras, which the makers say excel at processing-out dazzle from the sun, headlamps, and streetlights so the driver gets a clear, glare-free view of the scene behind their car. They also showed their Tri-Telescopic lidar as well as their 3D lidar with raster or wobbling scan—both enabled by MEMS devices to provide unusually high resolution.



Then there was Pioneer's Concept Cockpit, a vehicle mockup buck where showgoers could sit and have a simulated experience with Pioneer's concept of the dashboard of tomorrow showing Pioneer's sensing technology at work.



Robomart

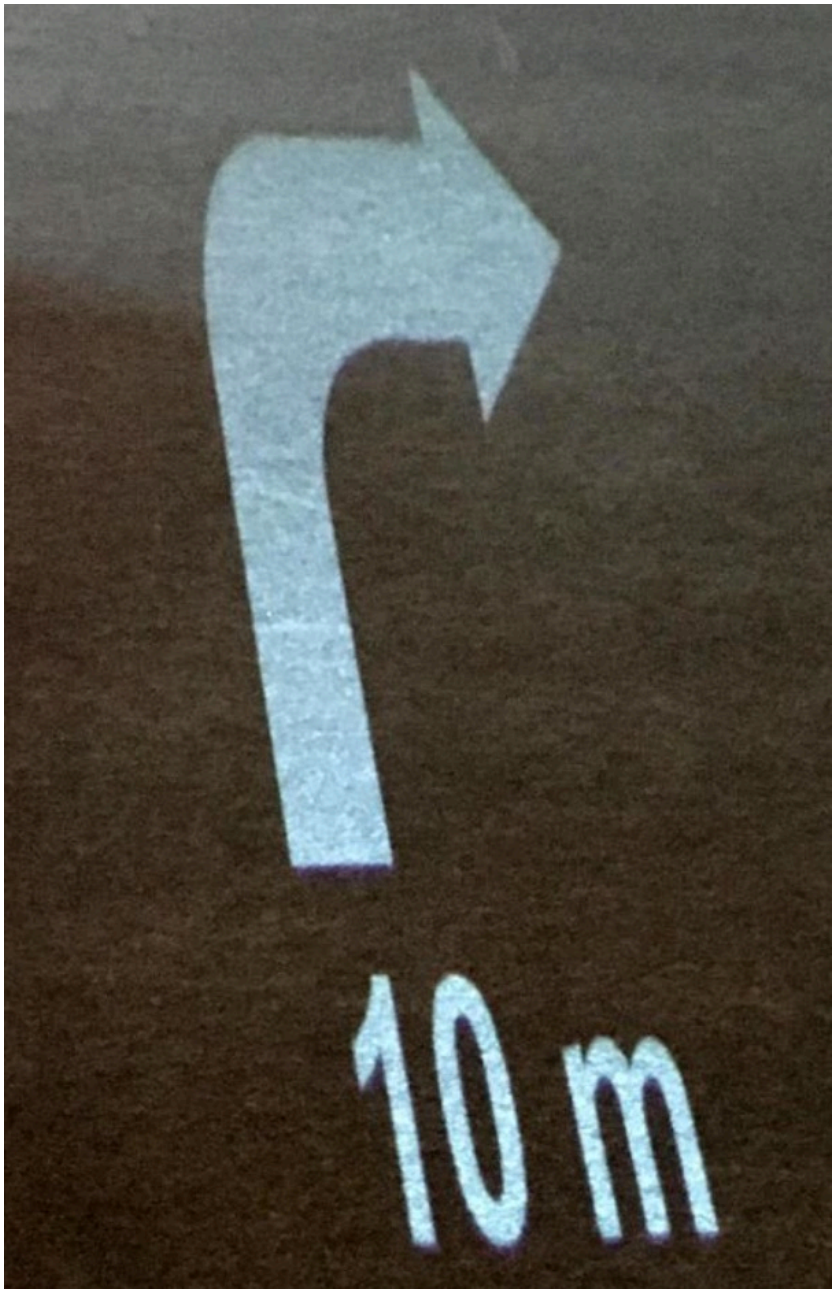
An outfit by the name of Robomart demonstrated that if the driver needn't drive any longer, neither must they be in the car. Instead of the autonomous vehicle taking the driver to something, the AV can bring something to the driver. Robomart's idea is a self-driving mobile greengrocery, bringing fresh produce to people who no longer have to drive somewhere to get it.

As the Robomart people explain it, the roving stores will be wholly-autonomous Level-5 electric vehicles—which poses a bit of a problem for realisation in the short run, as we're still quite some years away from Level-5 vehicles. Nevertheless, Robomart are involved with NVIDIA's inception program to push toward this goal. The system will be app-driven: Consumers will tap a button in the Robomart app to request the closest robomart. Once it arrives, they go outside to meet it, unlock the doors with the app, and pick out the products they want, then close the doors and send it on its way. Robomart tracks what customers have taken using patent-pending checkout-free technology, and will charge them and send a receipt accordingly.

Stanley

Counterpunching Koito's presence at CES, Stanley put together a booth with a small darkroom containing simulator views of how their human- and machine-vision technology works. There was an extensive display about Stanley as a company, including an answer to the mysterious question of how a Japanese company came to have such a Western name. Photography was not permitted in much of their booth, but they were happy for us to photograph their sensor-equipped lights, set up in vehicle front-end bucks with monitors behind to demonstrate the lights' inbuilt sensors' function.

Texas Instruments



TI showed their DLP technology for high-resolution ADB headlight systems. They say their new DLP5531-Q1 chipset, to be broadly available the second half of this year, supports any light source including LED and laser and is the only offering on the market that combines full programmability and the highest resolution—over one megapixel.

The flexibility of TI's DLP technology, they say, allows for headlight systems that pair with programmable software and small optics to provide high lighting performance with new functionalities like the ability to project information for the driver on the road surface. TI say on-road light projection can enhance communication between drivers, pedestrians and other vehicles and provide customers with a way to address future communication requirements needed for autonomous and self-driving vehicle systems.

Toyota

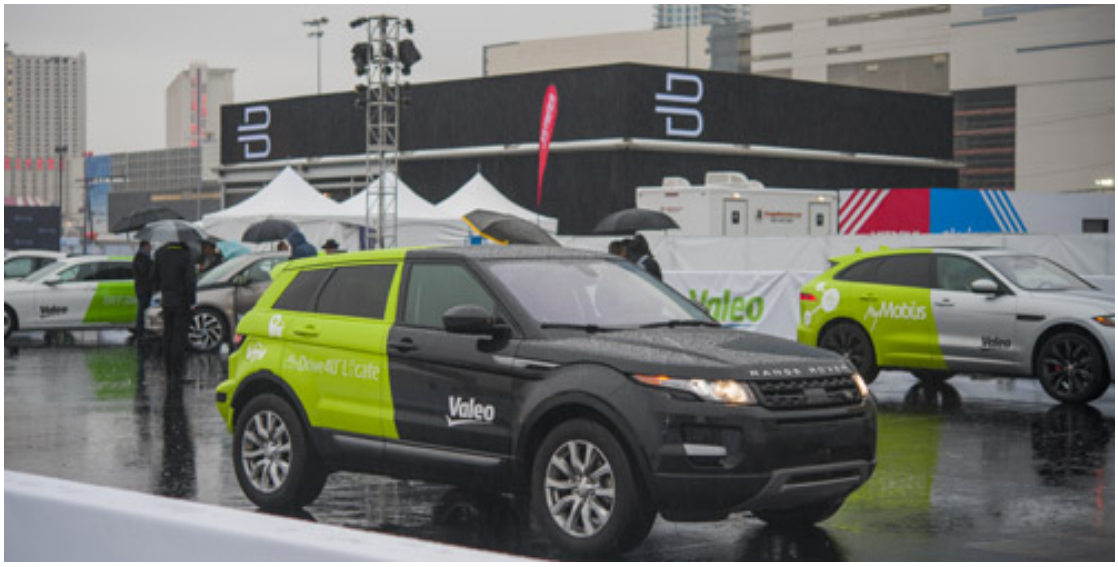
Toyota chose CES to unveil some very interesting technology. Company President Akio Toyoda declared that his goal is to "transition Toyota from an automobile company to a mobility company", and to that end, he announced their mobile retail space, called e-Palette and intended to provide opportunities for existing or new businesses to create on-demand services and, according to Mr. Toyoda, to "blur the lines between brick and mortar and online commerce". The e-Palette already has attracted interest and varying levels of commitment from the likes of Pizza Hut, Uber, Mazda, Amazon and Didi. Toyota plan to start testing the e-Palette in 2020.

Also on display was Toyota's heavily instrumented Avalon research vehicle being used for AV development and testing. There was also a family of prototype AV concept vehicles with variable-message signs intended to convey messages in plain language to following drivers.

One of Toyota's concept cars on display had snazzy mockups for the headlamps and taillamps:

Valeo

Like Osram, Valeo presence was sprinkled all over CES. They commanded a major outside space for demonstration of their autonomous-car developments, though the demonstration was made difficult by very heavy rain and wind on the day we visited.



Valeo technology also figured heavily in the Navya AutonomCab, claimed to be the world's first robo-taxicab. It's a fully- electric, driverless vehicle equipped with seven Valeo SCALA® laser scanners—they are said by Valeo to be the first mass-produced lidar scanner on the market designed specifically for cars.

Elsewhere at the show was the Valeo Virtual World, where attendees could strap on a set of goggles, stretch out, and experience an immersive simulation of Valeo's view of the future.

Varroc

Varroc's suite, our first stop of the whole show, was a festival of light and magic on the 25th storey, with an expansive view of Las Vegas being drenched by a giant rainstorm, the first in 112 days. Inside, it seemed like every surface in the main room was covered with intriguing lighting technology. Specially-modified, experimental and demonstration versions of production and prototype headlamps and rear lamps, multifunction lamps with novel functions and innovative appearance, fascinating sets of taillamps with quasi-holographic appearance of red diamonds seeming to float in space (and a variant of the same technology creating a luxurious depth effect with minimal actual depth and affordable cost). Tail lamps that look perfectly black—like a switched-off smartphone—when unlit, yet light up with brilliant coloured light. Perhaps most impressive of all (though it's difficult to pick favourites) was a very fancy set of taillamps that looked and lit like OLEDs, but based on inexpensive LED technology, and with a few tricks OLEDs can't do (multiple colours from one surface, for example). There was a mini-scale car showing vehicle-to-pedestrian lighting ideas, a micro-LED message screen on the rear bumper, and dynamic billboards on the side, which could be used for advertising, to show EV state of charge, to call out a taxi or rideshare passenger by name, or any of numerous other uses. And an innovative way of customising the appearance of a headlamp for different vehicle options or trim levels without expensive, slow unique tooling.

In the second room was another collection of headlamps and components showing off Varroc's talents in engineering, design, and packaging. All-in-one multifunction lamps incorporating radar and lidar units, cameras, and other sensors are the coming thing; just think of the cost and hassle savings in wiring harnesses alone!. What's more, there was an advanced virtual-reality setup providing an immersive virtual world wherein it's easy and fun to scrutinise headlamps from any angle, explode them to examine the components, and drive at night with different kinds of lights; that last capability really showed the differences in resolution and response from different ways of implementing ADB. The photo here shows DVN Chief Editor Daniel Stern trying out the VR setup.

And in the corridor outside the suite was a live-action demonstration of the fruit borne of Varroc's coöperative work with Bright Way Vision. That Israeli firm's innovative slice-view gated technology readily sees through fog and rain to deliver clear, sharp, highly-detailed, easily-recolourised augmented vision for drivers, and the hardware is readily integrated into compact Varroc lights.

ZF

ZF showed off their innovations for making autonomous driving possible and dependable. ZF's ProAI control module, coöperatively developed with Nvidia and equipped with artificial intelligence capabilities, has progressed from last year's concept to a production-ready system this year. Using a test vehicle fitted with the technology and a comprehensive sensor set, ZF presented a modular, scalable hardware and software architecture for highly and fully automated driving applications. The ZF booth featured a sit-in simulator so show attendees could get a sample of ZF's idea of what tomorrow's car will be like, as well as a variety of display screens with interactive explanations of how ZF technology facilitates ADAS today and AVs tomorrow.

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