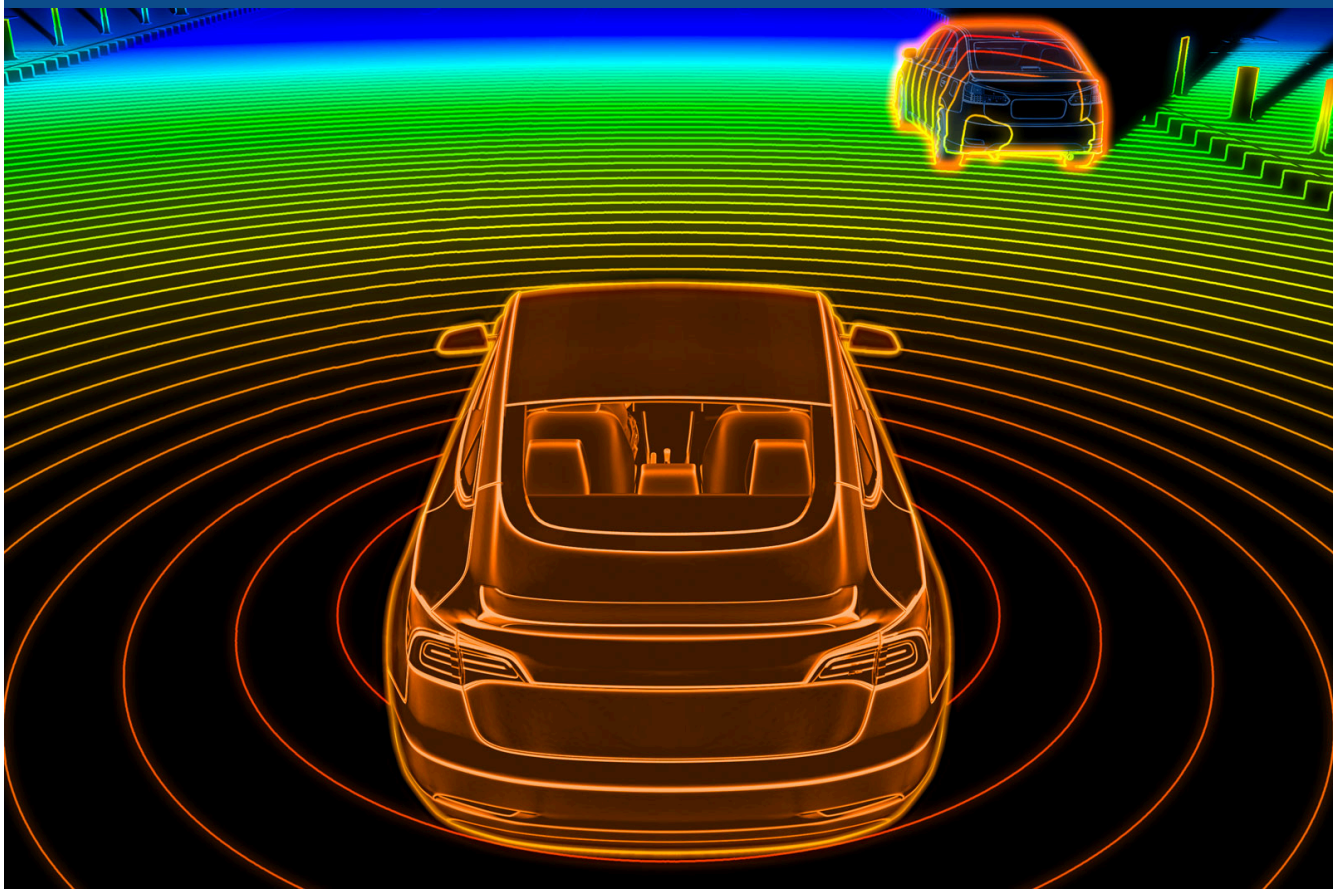
DVN

Sensing & Applications

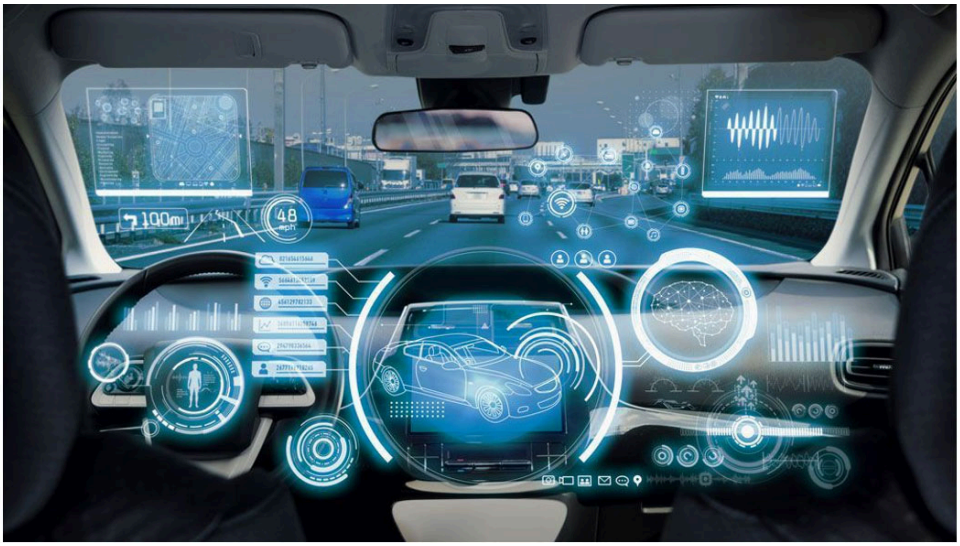
Monthly newsletter #2.2

FEBRUARY 12, 2025



EDITORIAL

DVN ADAS/AD Applications Newsletter #2.2 February 2025



CES was very busy in January, with the West Hall dedicated to automotive. We published a separate report including interviews with a number of companies and this month we will cover a few follow-up topics, including an interview with Magna on the topic of AEB.

You will find the report entitled "CES ADAS Report January 2025 – DVN" on our website.

Cost reduction for L2 ADAS was one key theme at CES as well as adding more features to the existing sensor set. Software defined vehicles move to a more general computing architecture and allow easier over-the-air updates that will allow new features (as they are developed) to be deployed. This also allows for software subscription models for OEMs that can charge for additional features over the life of the vehicle.

Robotaxi services are becoming more common – Waymo, Zoox and VW were amongst the vendors showing platforms at CES. As the service is rolled out on a much broader basis, cost reduction of those platforms will be key. The VW ID.Buzz robotaxi, developed in partnership with Mobileye, uses 7 lidars, 13 cameras and 4 radars. Waymo was showing its cost reduced gen 6 platform at CES.

Don't forget our upcoming AEB workshop in Detroit, April 10th. We still have a few speaking opportunities and exhibit slots open, please contact me if you are interested.

Thank you,

Martin Booth

DVN USA Representative
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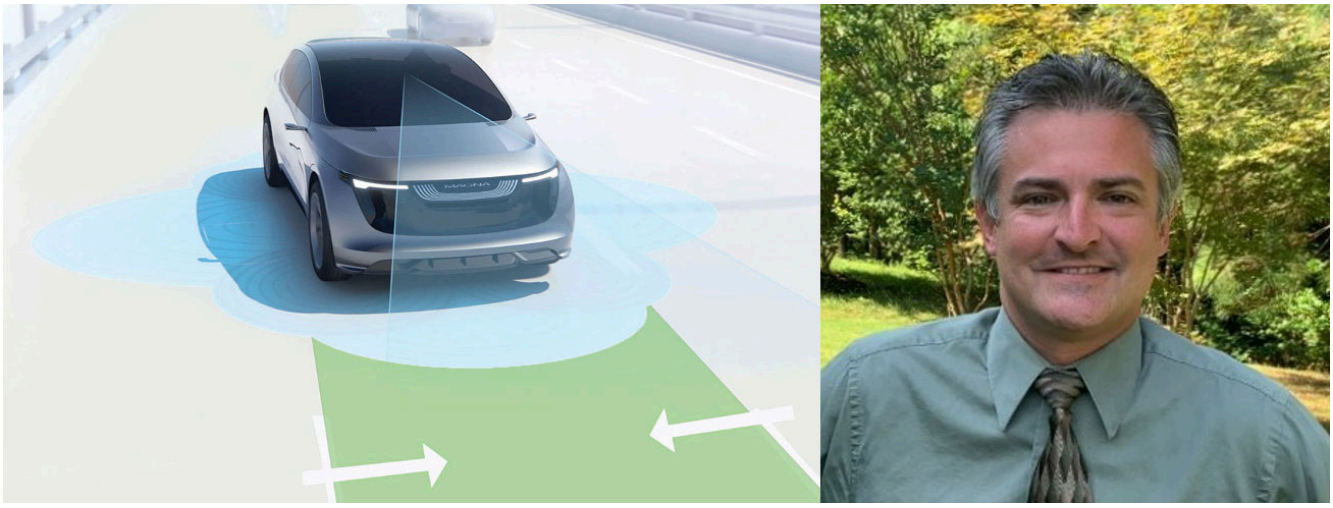
INTERVIEW

DVN Interview with Magna: December 2024 - Jeffrey McWilliams, Engineering Consultant



Jeffrey McWilliams is a seasoned professional in thermal sensing and automotive electronics, currently serving as Technical Sales, Thermal Sensing at Magna Electronics. He holds a Bachelor of Science in Electrical Engineering with a focus on analog microelectronics from the University of Michigan.

1. DVN: Can current RCCB cameras meet the specs for the NHTSA FMVSS 127 AEB regulation? Is SWIR an option? Will quantum dot allow IR cameras to reach a reasonable cost? Can a single (Forward) camera be used for level 2 and meet nighttime AEB specs or do we need a separate solution for this?

- Regular cameras, such as RCCB, are generally sufficient for the AEB component of FMVSS 127, but their adequacy for the PAEB part is uncertain. Compliance with FMVSS 127 is not the sole criterion; the system must also not pose an unreasonable risk to motor vehicle safety.
- For robust performance, these camera systems should ideally be supplemented by radar. Even with this supplementation, there may still be challenges at night, particularly with detecting stopped vehicles in traffic lanes that lack taillight illumination.
- SWIR technology's effectiveness for PAEB would necessitate active illumination. The primary issue is not SWIR itself but the active illumination systems required. To avoid interference from other light sources in the same wavelength, gating is necessary. Alternatives to SWIR exist, such as regular CMOS FPAs, which are sensitive in the NIR spectrum (<1000nm). Although the quantum efficiency diminishes with longer wavelengths, CMOS FPAs are a viable alternative. However, careful configuration of the illumination is required to ensure it meets eye-safe class 1 standards, a domain in which we hold patents
- A single forward-facing camera might suffice for level 2 automation and meet nighttime AEB specifications, but a more comprehensive solution, potentially involving supplementary radar and advanced illumination technologies, will likely be necessary to ensure robust performance and compliance with safety regulations.

2. DVN: Are LWIR Thermal cameras a better solution and if so what are the pros and cons? Can they achieve the costs required? How does power compare to other solutions?

- LWIR thermal cameras offer significant benefits in darkness for detecting objects with distinct heat signatures. However, they are not without drawbacks.
- The cost of LWIR thermal cameras in the automotive industry is a critical consideration. While the target is generally to reduce costs, the real issue is the cost of alternative solutions to comply with FMVSS 127, including the risk of recalls. Regular FPAs are inexpensive but may not perform adequately in darkness, potentially leading to inadvertent braking. Lidar solutions, although viable, are currently more expensive. Other active systems, such as gated imaging, present interesting options but may not yet match the cost-effectiveness of thermal cameras. As thermal camera volumes scale up, their costs are expected to decrease, especially with solutions optimized for augmenting AEB/PAEB systems to meet nighttime PAEB mandates. Our thermal product is specifically targeted for this purpose.
- One of the primary applications of thermal sensors is to meet pedestrian AEB requirements as standalone sensors. However, in practice, they serve as additional sensors that support the existing technology in the vehicle. This integration provides a more comprehensive and real-world aspect to the functional safety of the vehicle. By enhancing the capabilities of current ADAS systems, thermal sensors contribute to a more reliable and effective safety mechanism, ensuring better protection for pedestrians and other road users.
- In terms of power consumption, thermal cameras are passive sensors and thus have low power consumption. In contrast, active solutions, including imaging radar, consume more power than thermal cameras.

3. DVN: Is HD Radar an alternative option for this application, and what are the pros and cons of radar versus the other solutions proposed today?

- All sensors have their strengths and weaknesses. Magna believes that a complementary sensor suite, such as a combination of HD radars and thermal sensors, provides the best system-wide solution. HD radars show significant improvements over traditional radars and can meet almost all AEB cases. They excel at distinguishing small objects in all weather conditions, providing range and velocity information. Although identifying pedestrians near guardrails can be challenging for some HD radars, Magna has resolved this issue. Additionally, classifying nearly motionless pedestrians is difficult, but multi-modal systems, where thermal sensors augment radar data, can fully classify pedestrians.

4. DVN: LiDAR is still expensive – US/EU vendors might approach $500 in this timeframe and China vendors might be half of that – will that be a better approach for AEB systems?

- The question of whether LiDAR is a better approach for AEB systems should focus on the cost to comply with the regulation rather than a subjective definition of "better." LiDAR remains relatively expensive, with US/EU vendors pricing it around $500 and Chinese vendors potentially offering it at half the cost. In contrast, Thermal sensors can already achieve a price point significantly below $500 even in low volumes. Additionally, LiDAR, as an active system, consumes more power compared to thermal sensors. Therefore, considering both cost and power consumption, thermal sensors are likely a more cost-effective solution for AEB systems.

5. DVN: The AEB solution requires more than just the sensor of course – is the AI Component of the solution best in the camera/radar/lidar module or in central compute? What sort of processing is needed to achieve this (TOPS)?

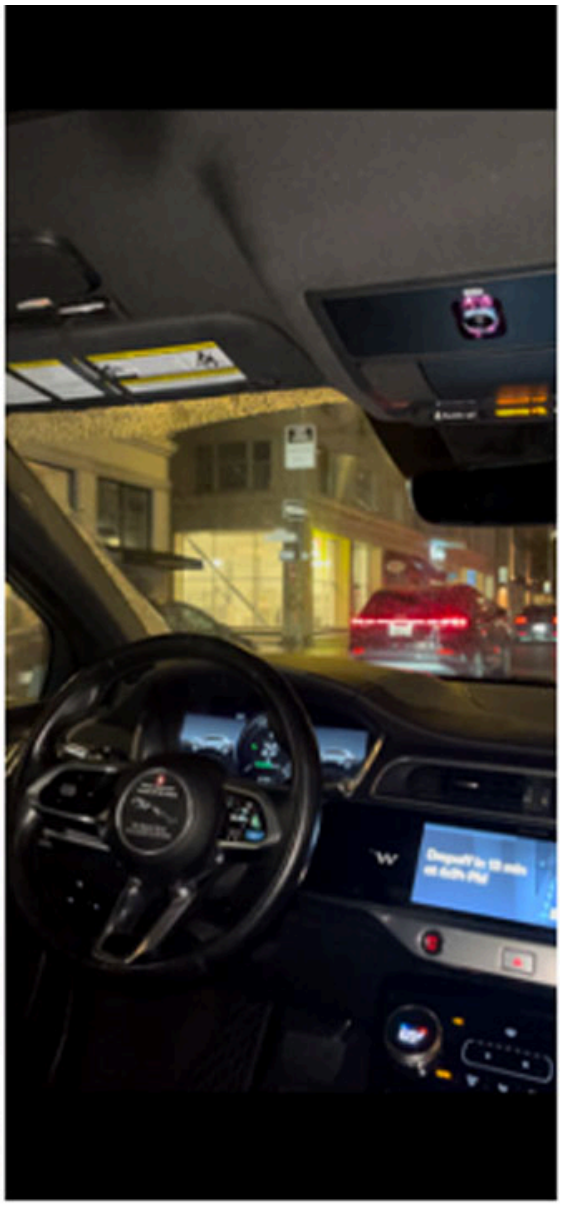
- The AEB solution requires more than just the sensor; it also necessitates a robust perception stack, which includes machine learning (ML) components. The placement of this perception stack—whether in the camera/radar/lidar module or in central compute—depends on various factors and the OEM's approach.
- The processing requirement, measured in TOPS (Tera Operations Per Second), is linked to sensor resolution but is not the only factor to consider. Thermal imaging can achieve PAEB with lower resolution compared to other imaging alternatives, while high-resolution radar currently has lower resolution. The specific compute requirements for high-resolution radar should be addressed by the radar team.

6. DVN: Will the AEB system be a separate domain, or will it always be part of the L2 or L3 driving system?

- The AEB system, mandated by FMVSS 127 for all light vehicles starting in September 2029, is not dependent on any SAE classification for L2, L3, or L4 driving systems. While some may include AEB within Advanced Driver Assistance Systems (ADAS), AEB/PAEB functions are typically hidden from the driver until triggered by an event. Therefore, it is not appropriate to bundle them with ADAS or any level of Automated Driving Systems (ADS). However, all ADS systems will also need to comply with FMVSS 127.
- Functional partitioning and system design depend on the OEM's preference and implementation. AEB and ADAS (including L2+/L3) are related features derived from inputs originating from a common set of sensors and are likely implemented on common hardware. It is unlikely that AEB will occupy a distinct "domain" separate from other driving assistance functions. However, safety analysis will be required to demonstrate the robustness and integrity of AEB independently from these other features.

SPECIAL REPORT

DVN Special Report – Waymo Test Ride



I recently took a test ride with Waymo to see how close Robotaxi service is to prime time. There are hundreds of Waymo Jaguar iPaces running around San Francisco and a few other cities in the USA, and they are currently providing over 100K rides per week.

I picked deliberately challenging conditions for this test - a dark and rainy evening, with lots of traffic and road closures along the route – from the Palace Hotel to Macy's Union Square, which would have been about a 15 min walk and is less than a mile, but a bit longer when you have to navigate the one-way streets in a car.

The Waymo app is very easy to download and use. The first problem was the car would not pick me up outside the hotel, rather I had to walk ½ a block down the street to the pickup point on a perpendicular street that the app sent me to.

I stood at a different spot on the street, but that was no problem for the iPace, it recognized where I was and pulled over right next to me. The car then had to make 3 right turns in light traffic to head to Market Street – and drove very smoothly. But once it went over Market, it should have made a left turn on Geary to head directly to Union Square – but it tried to avoid traffic (that was stopped to make the left turn) and missed the turn.

It proceeded up Kearney to make the next possible left, but then for some inexplicable reason, it paused to make the next left (to get back on route) and because there were pedestrians in the intersection it decided to go straight rather than wait. You can see the objects the car sees and the expected route on a monitor in the center console. The car then failed to make the next few left turns for various reasons (such as buses in the left turn lane) and eventually, about a mile off course, it did a right-right-right turn to head back towards Geary. The driving was still quite smooth and the car did a good job of avoiding double parked delivery vans, if sometimes making a bit jerky maneuvers.

However, it then took a premature left for no apparent reason and ended back on the wrong side of Union Square. Eventually, I hit the “pull over” button, and the car “said” it was going to pull over, but in the traffic, it took almost 10 more minutes to find a good place to let me out (a block away from my original destination). An Uber driver would have been able to navigate this route much more efficiently, and also been able to find a place to pull-over more efficiently.

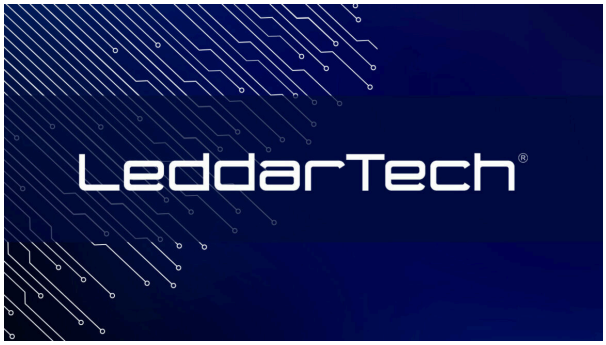
So the summary is, yes, the car can drive quite well, but route planning in challenging, busy city conditions still seems to need some improvement. Overall, this has the potential to rapidly replace taxi services with drivers and I think that it will continue to scale out in more cities over the next few years. There is a link to a video of the entire ride below if you are interested.

https://youtu.be/4UC8QZLGXjs

ADAS/AD APPLICATIONS - BUSINESS NEWSBITES

ADAS/AD Business – News Bites

Hexagon Introduces cloud based ADAS Software Testing
Hexagon introduced its VTDx cloud based system to train, test and validate ADAS software. Physics based simulation is used to model the environment and thousands of test cases can be generated and run automatically against the “software under test”. Continuous integration and testing can significantly speed up releases and improve the quality of the release, which will be especially critical for SDVs.



LeddarTech and Texas Instruments collaborate on cost effective ADAS solutions. First OEM Design Win for LeddarVision ADAS Solution
Using the TI TDA4V processor, LeddarTech is offering up to a 40% cost reduction and 2x performance increase over existing systems. Early fusion is the key to improved performance on object detect and recognition as well as optimized algorithms for the TI processor.

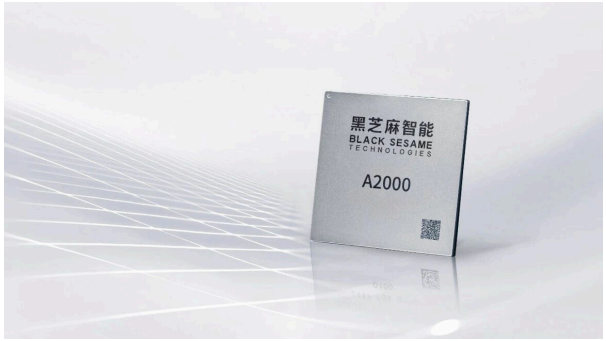
LeddarTech Announces First OEM Design Win for LeddarVision ADAS Solution:
The customer is one of the world's leading commercial vehicle OEMs (original equipment manufacturers) has selected LeddarTech as the fusion and perception software supplier for their advanced driver assistance system (ADAS) program for 2028 model year vehicles.

BMW boosts ADAS capability with help from Qualcomm
Increased processing power from the Qualcomm Snapdragon Ride processors allow BMW to offer a better understanding of road conditions and smoother lane changes on its upcoming Neue Klasse models. AWS was used to help develop the software, collecting data from thousands of kilometers of driving and validating the quality of the data and allowing multiple partners to collaoborate on the development in the cloud.

Qualcomm and Hyundai Mobis Power Next Generation ADAS and Digital Cockpit solutions
This is another example of a single SoC being used to power both the IVI/Cockpit and ADAS systems in a vehicle, using Mobis's software and systems capability to deliver enhanced performance, safety and efficiency.

Visinex closes Y100M funding round
Horizon Robotics has been quite successful in China at selling AI processors into the L2/L2+ ADAS Market. There are a number of other start-ups targeting this market, including Visinex that is developing Vision+AI SoCs. The base SoC offers 24 TOPS performance and supports up to 7 cameras and driving/parking algorithms. An enhanced version offers 40 TOPS performance and supports “Commute” NOA. The first systems using this processor are expected to go to production at the end of 2025.

Smart and DeepRoute.ai Partnership
Smart (a Mercedes/Geely JV) and DeepRoute.ai are co-developing autonomous driving solutions, including handling complex cases such as roundabouts, sharp turns, narrow congested lanes and unmarked lanes. DeepRoute has raised more than $500M of funding since 2019 and has also partnered with other major Chinese automakers including DongFeng. Its software has focused on power efficiency and is also targeting the European market.

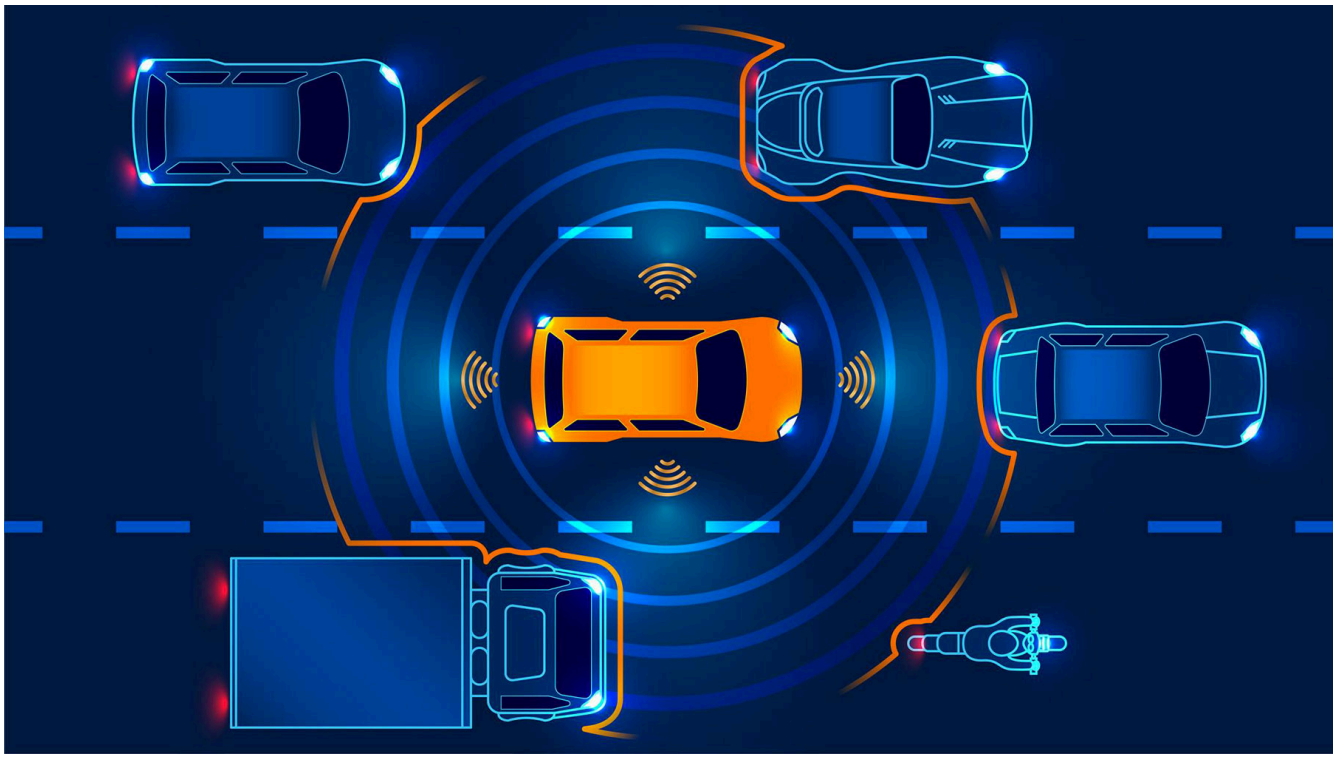


Micron and Black Sesame launch new ADAS Solutions
Black Sesame, based in Wuhan, develops AI chips and was funded by SAIC, Tencent, Bosch, Dongfeng, Nio, Geely and others. Customers include JAC, FAW Dongfeng, Baidu and JICA. Their latest A2000 chip is developed for Urban Autopilot and interfaces to Micron’s automotive grade LPDDR5 memory. The China SoC developers are continuing to gain share in their local market for ADAS solutions and Black Sesame is already one of the larger players here. For the first 6 months of 2024 they did 180M RMB in revenue (Approx $25M).

Horizon Robotics and iMotion form Strategic Partnership
Horizon’s Journey 6 SoC is already designed into 100 vehicle models for ADAS functions and is projected to ship over 1 million units by the end of 2025. iMotion develops front camera systems and “intelligent driving” domain controllers as well as the software for ADAS.

ADAS/AD DEPLOYMENT - NEWSBITES

AD NewsBites



L2 Blue Cruise Deployment @ Ford
Ford provided an update on its L2 Blue Cruise deployments during its recent earnings call. Almost 700,000 vehicles are now in operation with over 300M hands-free miles driven. Pricing was recently reduced. Ford is still developing L3 capability internally (for highway pilot) but is also looking at 3rd party solutions.

Ioki provides software for Swiss Autonomous Driving Project
Ioki, a Deutsche Bahn company, is providing software for an autonomous driving project in Zurich, to connect rural areas to public transport. The project is using Nissan vehicles with WeRide's AV software than can be booked on an app developed by Ioki, which also provides the route planning for the vehicles. The pilot phase starts in the spring of 2025.

GM Provides Guidance on Super Cruise adoption

On the GM Q4 24 earnings call, Mary Barra said that ending Cruise robotaxi development will lead to approximately $1B a year savings. The team has been refocused to passenger car ADAS development and the L2+ Super Cruise system is rolling out on more models in 2025. GM claims 60% of its 360K customers who purchased it use it regularly and they expect the fleet to double in size in 2025. The system is offered with a 3 year trial on some models and at the end of the trial about 20% of owners signed up for the continuing subscription at $25 per month. GM aims to approach $2B in annual revenue from Super Cruise within 5 years.

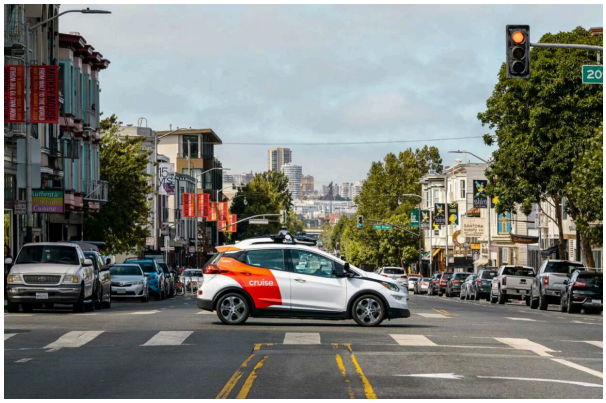
Tesla provides robotaxi update

Tesla provided an update on its autonomous driving efforts during the Q4 ’24 earnings call. FSD was significantly enhanced by adding the “cortex” training cluster in Austin which will consist of more than 100,000 Nvidia H100/H200 boards. Accumulated capex spend on AI reached $5B. Robotaxi service is planned to be launched in Austin TX in June. Tesla already has cars driving around unsupervised in its factories in California from line-end to their parking spots.

User experience seems to validate major improvements in the latest release of FSD, but going from supervised to unsupervised operation is still a major leap, if for no other reason than achieving validation and regulatory requirements. Elon has been consistently optimistic in his timelines but for sure they are making progress towards this goal.

Continental announces partnership for driverless trucks

Continental is working with Aurora and Nvidia to deliver a level 4 autonomous truck solution for mass production in 2027. The platform will run Nvidia’s DriveOS running on the DRIVE Thor compute platform. Aurora is close to launching driverless operations and is closing its safety test cases and final validation. Aurora plans to start driving in April 2025 between Dallas and Houston using prototypes of the Continental hardware.



Cruise lays off half its staff
As the GM integration continues, Cruise has laid off around half its staff (around 1000 people). NHTSA also closed its evaluation of Cruise's automated driving system after the safety recall and no more operations remain on public roads.

NHTSA upgrading probe into Ford BlueCruise™
NHSTA announced it is upgrading a probe (to do engineering analysis) into 129K Ford vehicles after collisions involving BlueCruise hands-free driving technology. In fatal collisions last year, Ford Mustang Mach-Es travelling at over 70mph on highways during nighttime conditions hit stationary vehicles. AEB in high-speed night-time conditions is challenging for camera only based systems and this is another example of the sort of problems that auto makers can face.

Other News Bites

- US regulators escalated their investigation into Tesla's smart summon feature after a number of crashes.
- Waymo announced plans to bring robotaxi trials to 10 new cities in 2025, including Las Vegas and San Diego.
- Uber announced a partnership with Nvidia to help build AI models
- Rivian announced an upgrade to its hands-free driver assistance in 2025 with eyes-off coming in 2026.
- Pony.ai secured a license to start testing on Beijing highways without drivers.
- HPI released a research report showing 57% of UK motorists were concerned with lack of control in self-driving cars. Fully autonomous vehicles could be on UK roads by 2026 and public attitudes are starting to shift as more drivers gain experience with AEB, ACC and other ADAS technologies.