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# Leading Foreign OEMs' ADAS and Autonomous Driving Report, 2023

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# Global automakers evolve to software-defined vehicles by upgrading EEAs

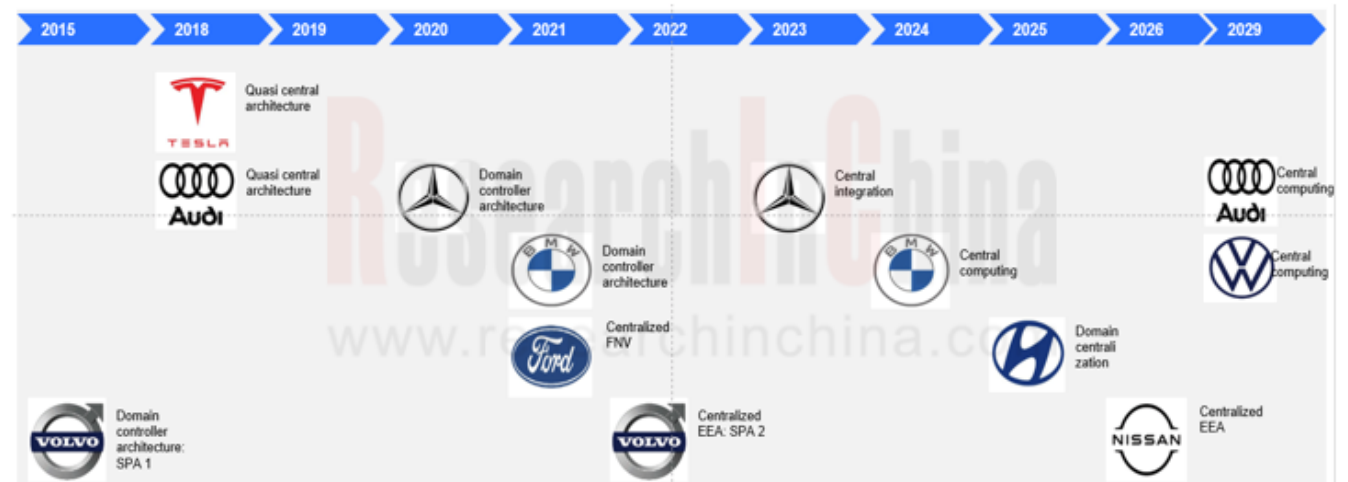
Centralized electronic/electrical architectures (EEA) act as the hardware foundation to realize software-defined vehicles. At present, leading foreign OEMs are aggressively deploying centralized EEA.

For example, Mercedes-Benz's newly developed electronic architecture uses a central processor (254TOPS) to replace the previous independent computing controllers, making data calculation and transmission faster and more stable. It will be installed in Mercedes-Benz E-Class, a model expected to be marketed in China in November 2023.

Hyundai Motor is developing domain centralized EEA to manage ever more electrical components by system efficiency. The domain centralized architecture divides main vehicle functions into four domains: comfort, driving, infotainment and ADAS, so as to ensure vehicles improve efficiency via OTA updates. Hyundai Motor Group plans to apply the domain centralized architecture to all its models worldwide by 2025.

Renault-Nissan-Mitsubishi Alliance is also developing a common centralized electronic and electrical architecture converging electronics hardware and software applications. By 2026, the next generation of models under the alliance will use this architecture. The alliance will also launch its first software-defined vehicle by 2025 to improve the full life cycle OTA performance of vehicles.

## Centralized EEA Deployment Planning of Leading Foreign OEMs



Source: ResearchInChina

# Leading foreign OEMs build core software capabilities by strengthening their software talent deployment

For the transition to software-defined vehicles, leading foreign OEMs have increased their investment in software and algorithm talents. In February 2023, Cariad, the software division of Volkswagen, announced that it would recruit more than 1,700 employees. Volkswagen itself and its subsidiary premium car brand Audi need 700 and 400 IT specialists respectively. In May 2023, Toyota announced that it would train 9,000 employees in-house by 2025, hoping to turn them into software developers. In May 2023, Nissan strengthened cooperation with KPIT Technologies, an Indian R&D company. Based on this partnership, KPIT Technologies plans to increase the number of its vehicle system software development experts working for Honda from 1,100 to a level close to 2,000 by 2030.

## Software Talent Deployment of Leading Foreign OEMs (Part)

OEM	Software Talent Planning
Mercedes-Benz	Mercedes-Benz plans to increase its software and other R&D personnel in China to 2,000 by the end of 2023, approximately doubling the number in 2020.
BMW	BMW's software development department has more than 8,000 software experts worldwide.
Audi	Audi offered about 400 new IT jobs in February 2023.
Volkswagen	In February 2023, Cariad, the software division of Volkswagen, announced that it would recruit more than 1,700 employees. Volkswagen itself and its subsidiary premium car brand Audi need 700 and 400 IT specialists respectively.
GM	GM has raised the salary of the technology department to the same level as that of large IT companies.
Volvo	Zenseact, an autonomous driving software development company of Volvo, has a team of about 700 people around the world.
Ford	Ford's wholly-owned autonomous driving subsidiary Latitude AI hires about 550 employees formerly of Argo AI across machine learning and robotics, cloud platforms, mapping, sensors and computing systems, test operations, systems and safety engineering.
Hyundai	In October 2022, Hyundai Motor planned to increase the number of software developers by 20% every year.

Source: ResearchInChina

# Leading foreign OEMs are exploring AI technology

At the same time, leading foreign OEMs are exploring AI technology, especially the application of generative AI in autonomous driving and cockpits, for movement towards intelligence.

In September 2023, Amazon Web Services (“AWS”) announced the BMW Group had chosen AWS as the preferred cloud provider for its automated driving platform. The BMW Group will develop its next-generation advanced driver assistance system (ADAS) using AWS to help innovate new features for its next generation of vehicles, the “Neue Klasse,” set to launch in 2025. The new cloud-based system will leverage BMW's pre-existing Cloud Data Hub on AWS, and will use AWS compute, generative artificial intelligence (generative AI), Internet of Things (IoT), machine learning, and storage capabilities to help accelerate the delivery of highly automated BMW vehicles.

Tesla is also exploring the application of generative AI technology. In April 2023, Tesla registered a new artificial intelligence startup named X.AI Corp, in Nevada. The company plans to launch a generative AI platform called "TruthGPT", an alternative to ChatGPT.

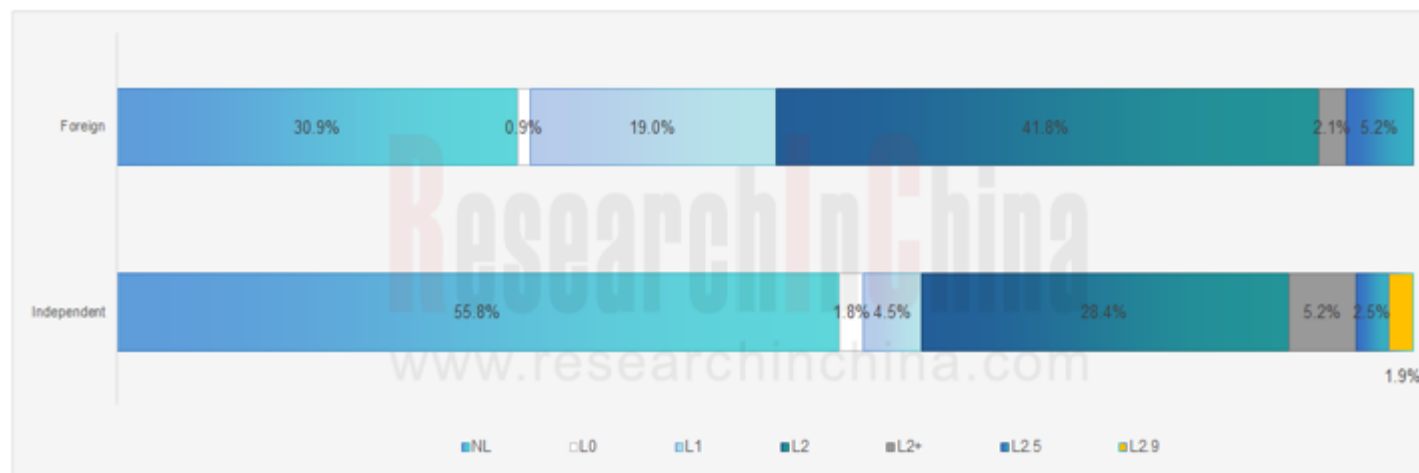
In the product development stage, generative AI can automatically generate new designs through existing planned training models, so that designers can improve these designs, thereby reducing labor costs and improving efficiency. In June 2023, Toyota Research Institute (TRI) unveiled a generative AI technique to help employees design car shapes faster. A designer can request, via text prompt, a suite of designs based on an initial prototype sketch with specific stylistic properties like “sleek,” “SUV-like,” and “modern”.

# Leading foreign OEMs will deploy ADAS functions in China

From January to June 2023, 9.256 million passenger cars were sold in China, of which 4.713 million units (down 3.5% from the same period last year), or 50.9% of the total (down 4.1 percentage points on a like-on-like basis), came from foreign brands. During the same period, 3.258 million foreign brand passenger cars in China were equipped with ADAS, jumping by 12.9% from the prior-year period and accounting for 61.8% of China's overall ADAS installations (down 5.4 percentage points compared with the same period of the previous year); the ADAS installation rate rose by 10 percentage points to 69.1%.

In terms of ADAS level, from January to June 2023, 1.972 million foreign brand vehicles were fitted with L2 ADAS, with the installation rate up to 41.8%; 246,000 foreign brand vehicles were installed with L2.5 ADAS, with the installation rate up to 5.2%.

## ADAS Installation Rate in Passenger Cars by OEM Type in China, Jan-Jun 2023



Source: ResearchInChina

Note: NL refers to models without any ADAS function.

# Leading foreign OEMs have made deployments for providing advanced intelligent driving assistance functions in the future

**In 2023H2**, Mercedes-Benz will first launch its DRIVE Pilot feature in China. By then, Mercedes-Benz cars equipped with this function can drive from point to point on highways and urban expressways across the country.

**Starting from 2024**, SAIC-GM will provide the Chinese market with NOA and HPA on highways and urban public roads.

**Tesla is** also vigorously deploying its autonomous driving business in China, hoping to introduce its FSD solution in China (expected in 2024). In August 2023, Tesla planned to establish a local operation team of around 20 people to implement its FSD solution into the Chinese market. Tesla also tried to set up a data labeling team consisting of about 100 people in China to prepare for training the FSD algorithm.

**Leading foreign OEMs are open to cooperation in China and shore up their weak spots.**

Faced with the rising passenger car sales of Chinese local OEMs and intelligence competition from them, leading foreign OEMs have become more open in layout and cooperation in China, decentralizing power to their R&D teams in China and exchanging capital for technology to shore up their weak spots.

**First**, leading foreign OEMs, including BMW, Volkswagen and Hyundai Motor, have given their R&D teams in China more authority. In addition, Toyota and Nissan have put forward the idea of feeding back technologies in China to the world.

# R&D Authority Adjustment of Some Leading Foreign OEMs in China

R&D Authority Adjustment of Some Leading Foreign OEMs in China

OEM	Authority of R&D Team in China	Technology Application in China
BMW	<ul style="list-style-type: none"> <li>In the global R&amp;D network, only China has the competency to develop vehicles throughout entire process except Germany.</li> <li>Chinese R&amp;D team takes a deep part in design, development, testing and verification of the innovative battery-electric car BMW i5 made in China.</li> <li>Chinese R&amp;D team plays a crucial role in many key tasks for BMW's next-generation models.</li> <li>In April 2023, BMW Group appointed Dr. Robert Kahlenberg as Senior Vice President of BMW Research &amp; Development China, who is fully responsible for R&amp;D activities in China.</li> </ul>	Application in China
Volkswagen	<ul style="list-style-type: none"> <li>Chinese R&amp;D team can dispose its own budget and conduct development in China from 2023, including independent R&amp;D, application in the Chinese market and cooperation with local suppliers.</li> </ul>	Application in China
Hyundai	<ul style="list-style-type: none"> <li>In 2021, Hyundai Motor established Advanced &amp; Digital R&amp;D Center China in Shanghai in 2021, which is responsible for R&amp;D of forward-looking technologies at an earlier stage. This facility focuses on studying new technologies in 5 to 10 years. The R&amp;D results will be applied to the R&amp;D center in Yantai and even around the world.</li> </ul>	Technologies in China fed back to the world
Toyota	<ul style="list-style-type: none"> <li>Starting from 2023, Toyota will build a self-circulating R&amp;D system for intelligent and new energy vehicles based in China, and may expand Chinese R&amp;D to the world.</li> <li>In April 2023, the global CTO of Toyota Motor Corporation stated that Toyota's China team can directly decide on all affairs in China.</li> <li>In July 2023, Toyota renamed its R&amp;D base in China "Toyota China Technology R&amp;D Center" as "Toyota Intelligent Electric Vehicle R&amp;D Center (China) Co., Ltd."</li> </ul>	Technologies in China fed back to the world

Source: ResearchInChina

# Leading foreign OEMs have begun to quicken their pace of mass-producing intelligent driving

**Second**, since the second half of 2023 many leading foreign OEMs have begun to quicken their pace of mass-producing intelligent driving to gain greater competitive edges by cooperating with Chinese brands.

In July 2023, Volkswagen acquired a 4.99% stake in Xpeng for USD700 million. In terms of R&D, Xpeng will provide technologies such as vehicle platforms, intelligent cockpits and intelligent driving software, while Volkswagen is mainly responsible for the interior and exterior design of bodies and models.

In August 2023, Nissan intended to cooperate with Dongfeng Motor, and use the S BEV platform in Dongfeng Motor's "Quantum Intelligent Electric Architecture" (launched in April 2023) for R&D and production. The new quantum architecture will be equipped with 800V high-voltage fast charging technology, enabling a cruising range of more than 1,200 kilometers, and supporting shared battery swapping.

In September 2023, Hyundai Motor Group announced that it would strengthen cooperation with BAIC Group in new energy vehicles, and the models in their cooperative project were in the development and testing stage.

According to LatePost Auto, Huang Chang, CTO of Horizon Robotics, will join the joint venture between Horizon Robotics and Volkswagen with some senior R&D personnel from Horizon Robotics. The joint venture will use the intelligent driving solutions and algorithm training platform of Horizon Robotics to provide Volkswagen with driving assistance functions including highway NOA. With the help of local ADAS suppliers in China, leading foreign OEMs will narrow the gap with Chinese local OEMs in intelligent driving functions in the next 2 or 3 years.



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## Definition of ADAS Functions

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