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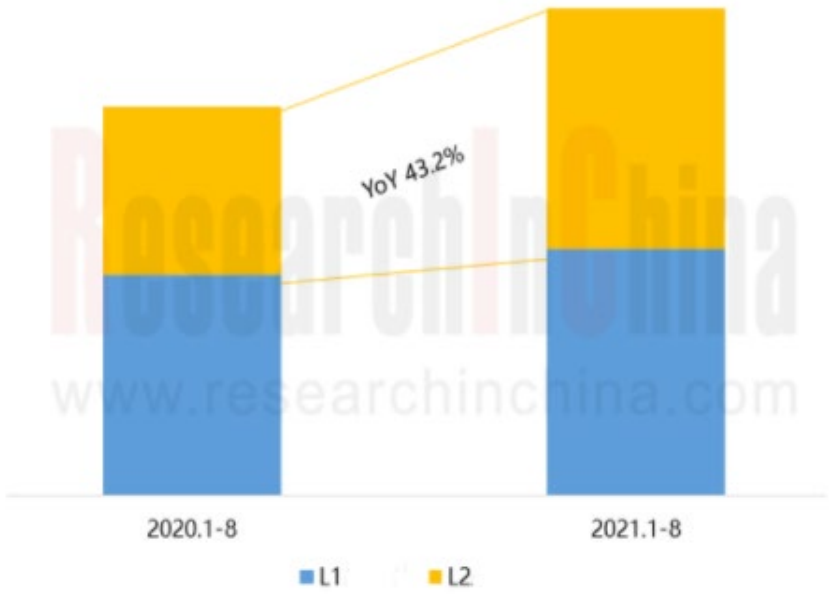
Joint Venture Passenger Car Brands' ADAS and Autonomous Driving Research Report, 2021

Dec.2021

Installations of L2 ADAS

In the first eight months of 2021, 3.87 million passenger cars of joint venture brands in China were equipped with ADAS, a like-on-like jump of 25.4%, with the installation rate up to 49.0%, up 4.9 percentage points. Wherein, the installations and installation rate of L2 ADAS increased by 43.2% and 5.1 percentage points from the same period of the previous year, separately.

Installations of L1-L2 ADAS in Joint Venture Brand Passenger Cars in China, 2020-2021 (Jan.-Aug.)



Source: ResearchInChina

Competitive Pattern of Joint Venture Brands in L2 ADAS

Toyota leads L2 ADAS market.

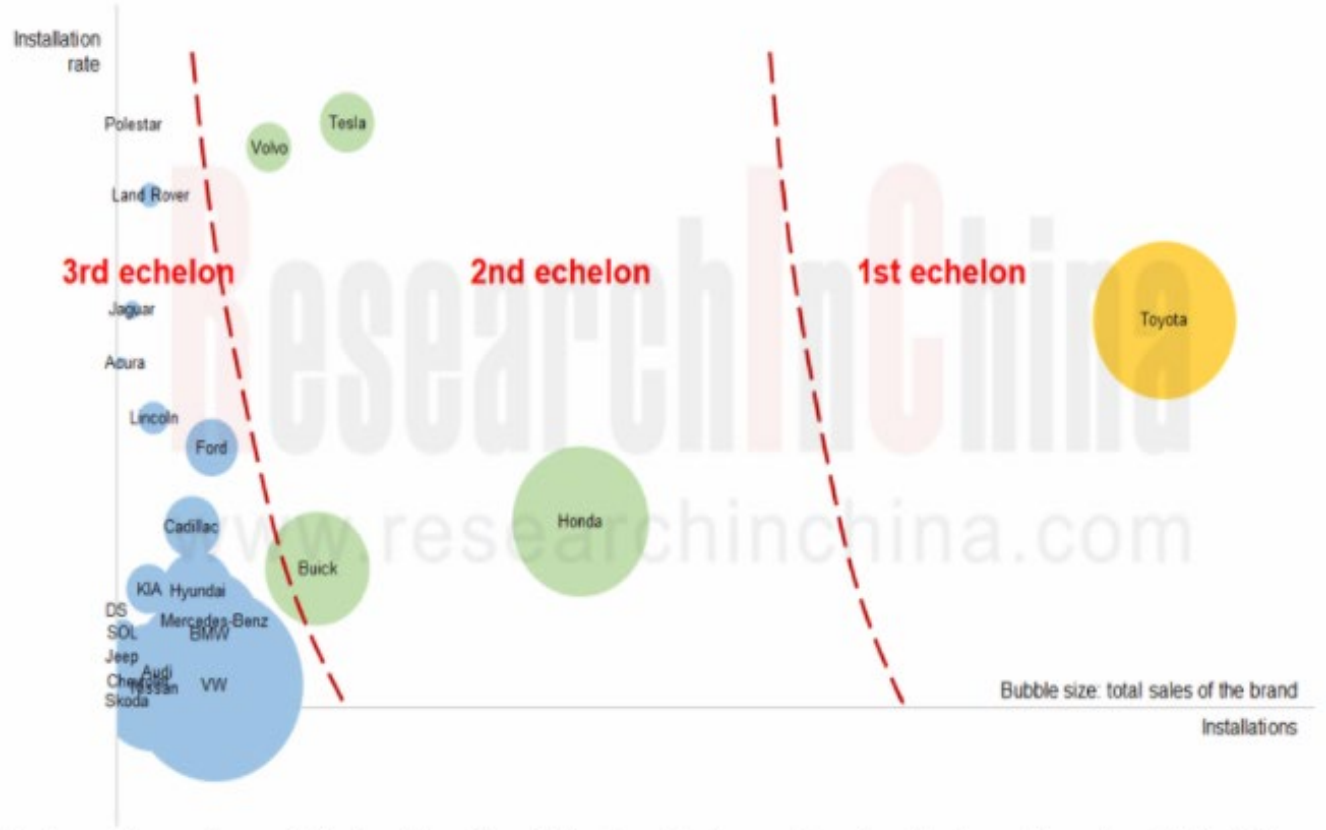
In the joint venture brands' L2 ADAS market, Toyota is only first-echelon player, with the system installations far higher than its peers; Honda, Buick, Volvo and Tesla are in the second echelon.

•Toyota's installations of L2 ADAS approached 700,000 units, driven by its hot-selling models like Corolla, Levin, RAV4 and Avalon, nearly 400,000 units more than the runner-up Honda. In terms of sensor solution, Toyota's L2 ADAS adopted 1R1V and 3R1V solutions, over 90% of which were 1R1V;

•Volvo boasted a L2 ADAS installation of 95.6% and mainly used 1R1V and 3R1V solutions, of which 1R1V swept over 80%;

•The third-echelon players, Ford and Volkswagen have the potential to leap to the second echelon.

Competitive Pattern of Joint Venture Brands in L2 ADAS, Jan.-Aug. 2021



Note: Brands not listed in the third echelon also include: Mazda, Infiniti and Peugeot.

Source: ResearchInChina

L3 ADAS of Honda

L3 ADAS of Honda and Mercedes-Benz has been approved for use in cars legally introduced on roads in their local markets.

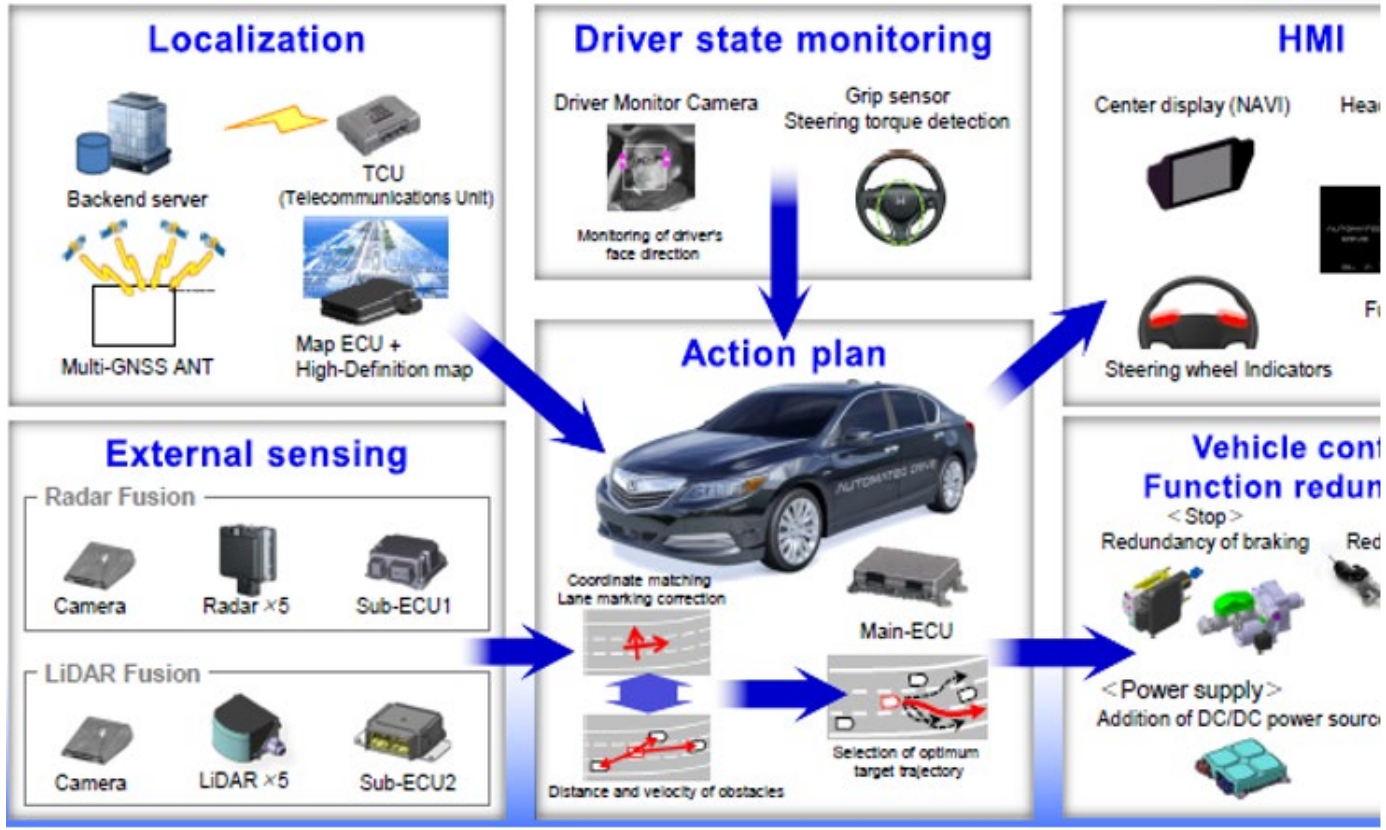
In March 2021, Honda introduced Honda SENSING Elite, a L3 automated driving system first mounted on Honda Legend, the world's first L3 model legally introduced on roads. This L3 system employs the following sensor solution:

•1 set of front view stereo cameras
•4 surround view cameras
•5 LiDARs (Valeo's second-generation SCALA LiDARs, 16-channel)
•5 radars

The sensor layout is shown below.

L3 ADAS of Honda

The composition of Honda SENSING Elite is as follows.

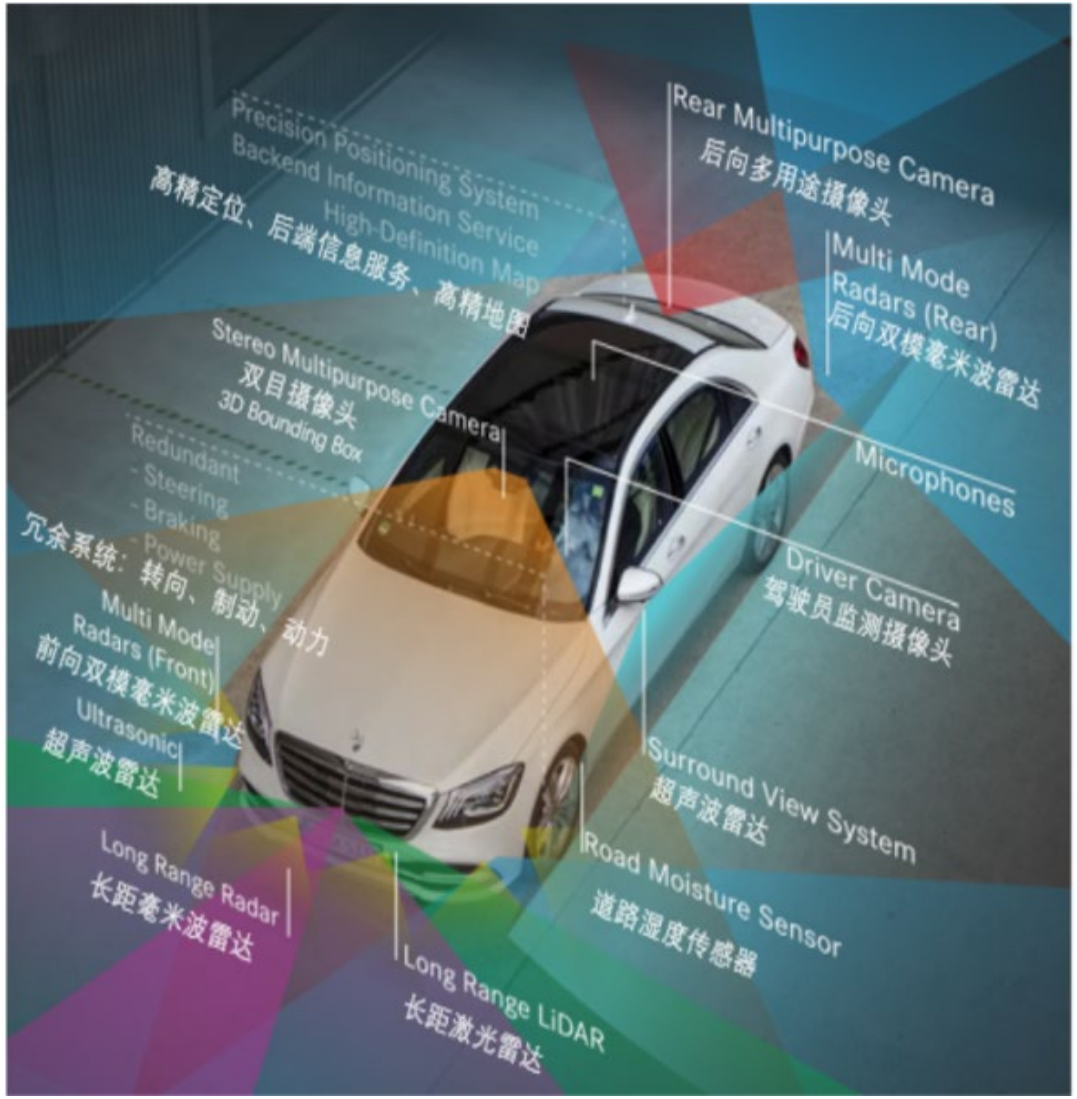


Honda Legend, the world's first L3 autonomous model legally running on roads, is only available in Japan. Just 100 units have been launched on market for rental, not sold. The MRRP of JPY11 million (approximately RMB660,000) refers to only deposit. There is still no effective way for ordinary users to access L3 automated driving.

L3 ADAS of Mercedes-Benz

In December 2021, Mercedes-Benz DRIVE PILOT, a L3 autonomous driving system captured the approval for driving on roads from the German Federal Motor Transport Authority (KBA). This L3 system mounted on Mercedes-Benz EQS or S-Class will become available on market in 2022, which means ordinary users will use L3 autonomous driving function on 13,000km highways in Germany as early as the second half of 2022.

The sensor solution for Mercedes-Benz DRIVE PILOT is as follows:
- 1 LiDAR
- 4 angular radars
- 1 long-range forward radar
- 1 set of front view stereo cameras
- 4 surround view cameras
- 12 ultrasonic radars
- 1 wheel camera (working together with the rain sensor on the windshield to perceive whether it is rainy or not)
- 1 rear multi-purpose camera
- HD map
- Driver camera



Technical Regulation UN-R157 and L4 Autonomous Driving

The KBA has granted approval for Mercedes-Benz's mass-production and sales of L3 autonomous cars on the basis of the technical regulation UN-R157, a UN Regulation on uniform provisions concerning the approval of vehicles with Regards to Automated Lane Keeping Systems, which was passed at World Forum for Harmonization of Vehicle Regulations of United Nations Economic Commission for Europe.

UN-R157 defines ALKS:

- ALKS is a system than controls the lateral and longitudinal movement of the vehicle in the lane for extended periods without further driver command;
- Limit to passenger cars (M1 vehicles);
- Limit to operational speed to 60 km/h maximum.

According to UN-R157 regulation, Mercedes-Benz DRIVE PILOT specifies that there is 10 seconds for the driver to disengage after sending the transition demand, a milestone in the history of "full disengagement of autonomous vehicle drivers".

UN-R157, the world's first binding international regulation on SAE L3 automation, has entered into force on January 22, 2021. Noticeably, the contracting states include states of the EU, UK, Japan, Korea and Australia. UN-R157 will provide reliable guidelines for automakers to develop L3 autonomous driving functions in major global markets.

GM and Ford among others will achieve L4 autonomous driving in 2022 at the earliest.

Volkswagen, GM, Ford and the likes develop L4 autonomous driving technologies by establishing subsidiaries or investing technology firms. They plan to first implement commercial L4 in online ride-hailing and logistics distribution.

Volkswagen will develop a new software platform in 2025 to support L4 autonomous driving, through its software subsidiary CARIAD (formerly known as Car.Software). In addition to CARIAD, Volkswagen and its investee Argo AI partnered and plan to achieve fully autonomous driving in 2025.

Cruise Origin, a fourth-generation L4 self-driving car co-launched by GM and its subsidiary Cruise, eliminates the steering wheel, accelerator and brake pedals and features layout of two bench seats that face inward. The car is projected to be spawned at Detroit-Hamtramck Assembly Plant starting in 2022.

In October 2020, Ford and Argo AI together unveiled a fourth-generation self-driving test vehicle refitted from Ford Escape Hybrid. They plan launch of the commercial autonomous service for online ride-hailing and logistics distribution in 2022.

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