

# L4 autonomous driving research: the industry enters a new development phase, "dimension reduction + cost reduction".

#### L3/L4 autonomous driving enjoys much greater policy support.

The development of L3/L4 autonomous driving needs both policy and technology support. Since 2022, China has given far greater policy support to high-level autonomous driving.

The Development Plan for New Energy Vehicle Industry (2021-2035) issued by the State Council indicates that "by 2025, L4 vehicles will be commercialized in limited areas and specific scenarios, and by 2035, L4 vehicles will find massive application."

On March 1, 2022, the national recommended standard GB/T 40429-2021 Taxonomy of Driving Automation for Vehicles came into force. In November 2022, the Ministry of Industry and Information Technology together with the Ministry of Public Security organized the drafting of Notice on Piloting Entry and Road Travel of Intelligent Connected Vehicles (Draft for Comments), suggesting piloting the entry of production-ready intelligent connected vehicles with autonomous driving functions (L3 and L4 in the GB/T 40429-2021 standard).

As concerns local governments, the Administrative Rules of Beijing Municipality for Autonomous Shuttles in the Pilot Areas Carrying out Intelligent Connected Vehicle Policies (Road Test and Demonstration Application) released in November 2022, is China's first policy to give the corresponding right of way in the form of coding to autonomous shuttles. In August 2022, the Regulation on the Administration of Intelligent Connected Vehicles in Shenzhen Special Economic Zone came into effect. It is China's first L3 autonomous driving regulation that highlights the first clear identification of accident responsibilities. As the knockout starts, L4 autonomous driving suppliers seek "cost reduction + dimension reduction", and the industry enters the phase of large-scale commercial application.

At present, the installation rate of autonomous driving functions in vehicles is on the rise, and L2/L2+ autonomous driving technology has been relatively mature. The competition in the market is white hot. To gain more competitive edges, OEMs and autonomous driving solution providers compete to enter the track of higher-level autonomous driving.

Yet high-level autonomous driving consumes more capital, and is unlikely to build a full commercial closed-loop in the short term. In October 2022, Argo AI, a star start-up specializing in L4 autonomous driving, declared bankruptcy due to the capital chain rupture, a result of the inability to attract further investments, as its backers Ford and Volkswagen decided to stop investing in it.

Despite ceasing to invest in Argo AI and turning the focus on L2+/L3 that is easier to implement, Ford is still optimistic about L4 autonomous driving, but chooses not to develop on its own. It would team up with L4 autonomous driving solution providers in the future.

The case of Argo AI shows the challenges faced by L4 autonomous driving suppliers in current stage. If they do not try to develop real commercial solutions, they may eventually be weeded out by the market under capital pressure. To run farther on L4 autonomous driving track, all major suppliers aim at the mass production OEM market of passenger cars and embark on "dimension reduction" application, while working hard on L4 technology.



**QCraft:** propose the dual engine strategy. On one hand, based on public road L4 autonomous driving software and hardware solutions, it makes continuous efforts to improve its technical competence; on the other hand, based on the mass production and large-scale application of autonomous driving for OEM market, it keeps expanding application scenarios.

In May 2022, QCraft introduced DBQ V4, an autonomous driving solution for passenger car OEM market. Supporting 1 to 5 LiDARs, 0 to 4 blind spot radars, 6 radars and 12 perception cameras, it enables 360-degree perception without missing blind spots and dead corners, and allows mutual redundancy between left and right. It also packs a customized traffic light recognition camera. The solution is expected to be mass produced and mounted on vehicles during 2023-2024.

DBQ V4 offers standard and high configuration versions. The high configuration version has all L4 autonomous driving functions. Compared with high configuration version, the standard version features a slightly lower configuration, but it can still enable 99% L4 autonomous driving capabilities. The DBQ V4 autonomous driving solution integrates full-stack autonomous driving software and hardware technologies independently developed by QCraft. The standard version with a reduced LiDAR configuration carries a computing platform with lower computing power, cutting down the mass production cost to about RMB10,000. The mass-produced solution for the OEM market also enables driving and parking integrated functions.

## **QCraft's Passenger Car OEM Autonomous Driving Solution DBQ V4**





**Cruise:** since 2021, it has worked to build Ultra Cruise intelligent driving system for GM. This solution is mainly mounted on the high-end vehicle models of GM and complements the Super Cruise system, helping GM to apply driving assistance technologies to all of its models.

Compared with Super Cruise, Ultra Cruise has added some new autonomous driving functions:

- Follow the internal navigation route and keep moving forward;
- Observe the speed limit
- Support automatic and on-demand lane change
- Support automatic left and right turns
- Support close object avoidance

# **Scenarios Covered by Ultra Cruise**





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In addition, the high cost is also a major obstacle to the implementation of L4 autonomous driving products. In particular, for cost-sensitive passenger cars, it is obvious that L4 autonomous driving that generally costs hundreds of thousands of yuan doesn't justify it. All suppliers therefore have begun to vigorously "cut down cost".

**Deeproute.ai:** in June 2022, Deeproute.ai launched DeepRoute-Driver 2.0, a low-cost L4 autonomous driving system worth USD10,000 (about RMB64,000). This solution carries 2 to 5 solid-state LiDARs and 8 cameras, Nvidia Orin high computing power automotive chip, integrated navigation and HD map, enabling high-level autonomous driving.

Deeproute.ai says that in the future the cost of L4 autonomous driving could be lowered to less than RMB20,000 by cooperating with conventional OEMs for mass production and purchasing hardware equipment uniformly.

### Deeproute.ai's L4 Autonomous Driving OEM Solution **DeepRoute-Driver 2.0** Solid State Main Radar Equipped with NVIDIA DRIVE Orin Automotive Chip Surround View Camera 2-5 Solid State LiDARs Solid State Blind Spot Radar 8 Surround Surround **View Cameras** View Camera Solid State **Blind Spot Radar** Low Power Consumption **Computing Platform** Source: Deeproute.ai



In April 2022, Haomo.ai launched Little Magic Camel 2.0, a product priced RMB128,800 for a single vehicle. Haomo.ai can build RMB100,000 autonomous distribution vehicles, mainly because its autonomous distribution vehicles reuse its passenger car autonomous driving technologies, and cost less by virtue of passenger car supply chain advantages. In terms of hardware, Little Magic Camel 2.0 that bears an automotive perception kit and ICU 3.0, a computing platform with high computing power can cover all mediumand low-speed road scenarios and all road conditions on urban public roads.



Battle of the Scale of Autonomous Distribution Vehicles for End Logistics



# Technology reuse helps to expand multiple application scenarios for L4 autonomous driving systems

Affected by technology maturity and regulatory restrictions, L4 autonomous driving is available to relatively limited application scenarios in the short run. The main application scenarios include Robotaxi, autonomous delivery, autonomous shuttle, and autonomous logistics in (semi) closed scenarios.

For L4 autonomous driving is being piloted in application fields, the deployment scale is not large, and just with tweaks, L4 autonomous driving technology can be reused in different types of vehicles, so L4 suppliers rarely follow a single business line, and generally make multi-scenario deployments.

Global and China L4 Autonomous Driving and Start-ups Report, 2022 highlights the following:

- > L4 autonomous driving (policies, standards, regulations, etc.);
- L4 autonomous driving market (size, competitive landscape, etc.);
- Key technologies (algorithm, HD map and positioning, data closedloop, vehicle-road-cloud cooperation, redundancy, etc.) of L4 autonomous driving (major suppliers, technical solutions, etc.);
- Application scenarios (Robotaxi, autonomous shuttle, autonomous delivery, autonomous truck, etc.) of L4 autonomous driving (major suppliers, technical solutions, operation, etc.);
- > OEMs' layout and planning of L4 autonomous driving solutions;
- Major L4 technology suppliers (technical solution iterations, application and layout of L4 products, etc.).

Supplier	Robotaxi for Shared Mobility	Trunk Logistics	Autonomous Delivery	Autonomous Driving in (Semi) Closed Scenarios
Waymo	Layout: it has introduced robotaxi services in Phoenix, San Francisco and other places, and has begun charging for robotaxi rides in San Francisco. In October 2022, Waymo said that it will provide Waymo One service in Los Angeles; Partners: Jaguar, Renault-Nissan- Mitsubishi Alliance	Layout: "Waymo Via" combines all businesses from long- distance trucking to city transportation, and the automated transportation through large trucks + small trucks is piloted; Partners: Volvo, Chrysler, J.B. Hunt, etc.	Layout: it launched a pilot project with logistics giant UPS to use Chrysler Pacifica autonomous minivans to deliver parcels in Phoenix; Partner: UPS	/
Cruise	Layout: it has provided paid autonomous driving services in some areas of the San Francisco Bay Area; Origin vehicles will be mass-produced during 2022-2023 and planned to provide ride services in Dubai in 2023; Partner: Chevrolet	p <b>rch</b> earchin	Layout: Cruise partnered with Walmart to test out a delivery service using Cruise autonomous vehicles in Scottsdale, Arizona; Origin vehicles can act as grocery and food delivery vehicles off-peak; Partner: Walmart	Layout: Voyage acquired by Cruise in 2021, has operated low-speed robotaxi (with speed up to 25 mph) in a retirement community in San Jose; Partner: Ford
Baidu	Layout: it has made deployments in Beijing, Cangzhou, Changsha and other places. In 2022, it unveiled Apollo RT6, a new-generation Robotaxi expected to start trial operation in 2023; Apollo GO is expected to land in 30 cities in the next 3 years, with a fleet size of 3,000 vehicles; Partners: Hongqi, BAIC ARCFOX, etc.	Layout: in September 2021, DeepWay, an emerging truck maker strategically invested by Baidu, introduced Xingtu Gen 1, the first- generation intelligent new energy heavy truck which is planned to be spawned in 2023, with L3 functions, and will enable L4 autonomous driving via OTA updates in 2025. Partners:	Layout: during the epidemic, Baidu Apolong provided delivery services in Beijing and Suzhou; Udelv operated autonomous delivery services using Ford Transit urban cargo vans equipped with Apollo 3.5, in Silicon Valley; Partners: Ford, Meituan	Layout: Apolong autonomous minibus, with end- to-end low-speed autonomous driving capabilities, is applicable to such scenarios as parks, scenic spots, airports and resorts; in early 2021, it joined hands with Huangpu District of Guangzhou to build the world's first autonomous driving MaaS platform for diverse mobility;

Application Scenario Layout of Some L4 Autonomous Driving Suppliers



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