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Intelligent Vehicle Cockpit-driving Integration (Cockpit-driving-parking) Industry Report, 2024

Jan. 2024

Driving-parking integration, cockpit-parking integration and cockpit-driving integration

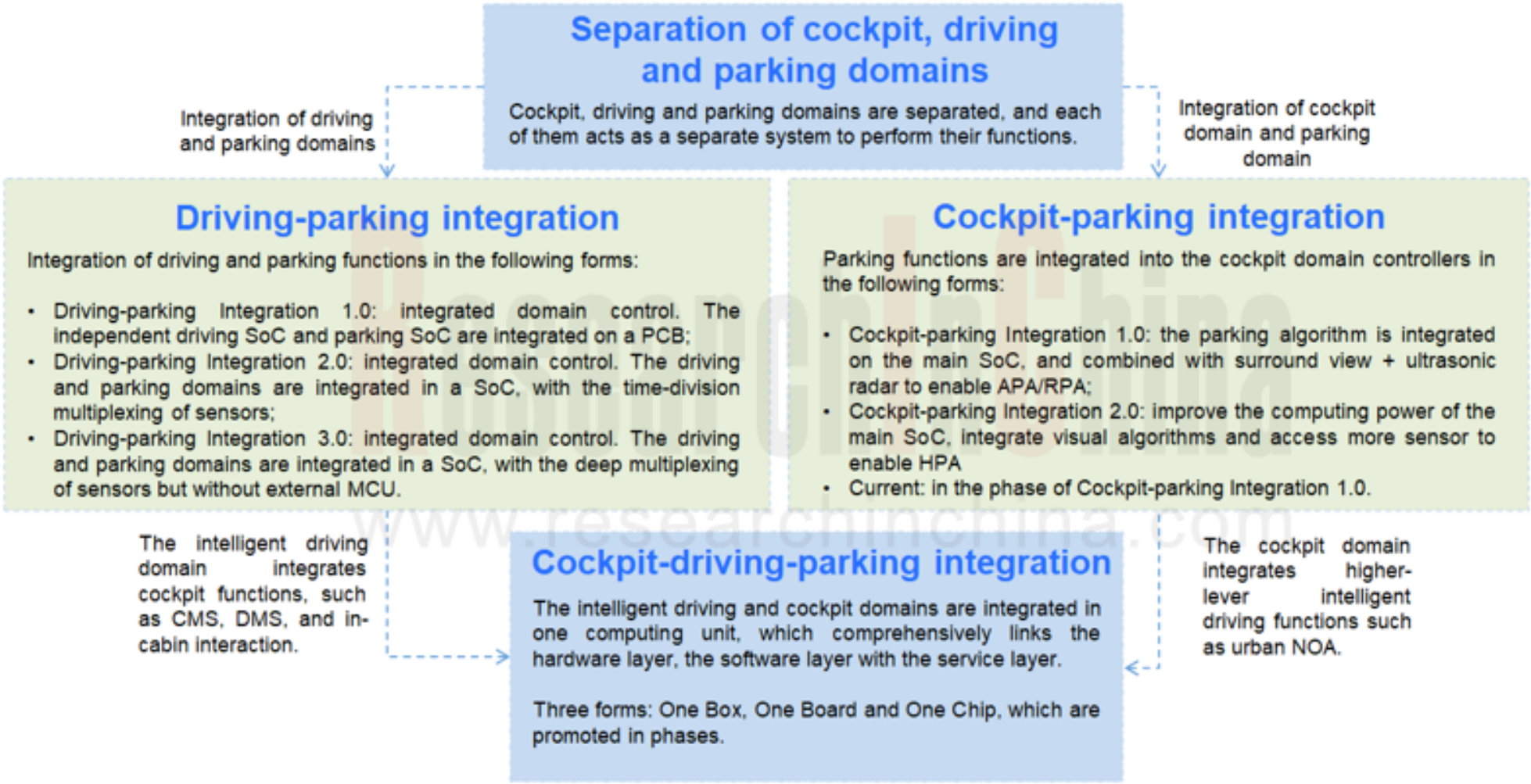
At present, EEA is developing from the distributed type to domain centralization and cross-domain fusion. The trend for internal and external integration of domain controllers, especially the integration of two core domains, intelligent driving domain and cockpit domain, becomes clearer. Against this background, three main integration forms come out: driving-parking integration, cockpit-parking integration and cockpit-driving integration.
Given this, ResearchInChina released the Intelligent Vehicle Cockpit-driving Integration (Cockpit-driving-parking) Industry Report, 2024, aiming to comprehensively comb through cockpit-driving-parking integration and summarize the development directions of the industry.

Driving-parking integration: Since wide adoption in 2023, driving-parking integration solutions have been mounted on nearly 70 vehicle models of more than 30 manufacturers. According to the statistics of ResearchInChina, from January to November 2023 driving-parking integration solutions were installed in over 1.4 million vehicles in China, a like-on-like surge of 38.0%. The figure is expected to hit more than 3 million in 2025.

Cockpit-parking integration: In the stage of commercial exploration, high-compute chips such as Qualcomm 8155/8295, SiEngine Longying No.1 and SemiDrive X9SP have been the first to be used. On this basis, Bosch, Aptiv, Visteon, Desay SV, ECARX, Yuanfeng Technology and BICV, among others have launched cockpit-parking integration solutions, some of which have been designated by or mass-produced for OEMs for their models like Lynk & Co 08. During 2024-2025, cockpit-parking integration will find massive application in vehicles.

Cockpit-driving integration: The hardware foundation is basically in place. For example, NVIDIA Drive Thor and Qualcomm Snapdragon Ride Flex, with computing power up to 2000TOPS, enable the integration of intelligent driving and in-cabin algorithms on a single chip, and support isolation among multiple computing domains. Cockpit-driving integration has begun to be accelerated in the second half of 2023 and is expected to be mass-produced and applied in 2025.

Cockpit-driving-parking integration



Source: ResearchInChina

Driving-parking integration highlights "cost performance" and the market is further segmented

1. Driving-parking integration highlights "cost performance" and the market is further segmented.

Driving-parking integration means the original independent driving and parking controllers are integrated into a domain controller, lowering costs while supporting more and higher-level intelligent driving functions.

In recent two years, the booming driving-parking integration has attracted OEMs, Tier1 suppliers, intelligent driving companies, algorithm companies, software companies and chip companies to make layout. Two main reasons stand out: first, driven by cost, integrating driving and parking ECUs on the same domain controller can reduce a lot of hardware costs; second, as the demand for intelligence increases, driving-parking integration allows for computing resource sharing and deep sensor multiplexing, and improves intelligent driving experiences for users via unified OTA updates.

By computing power, driving-parking integration is roughly divided into three levels: low (5-10 TOPS), medium (10-100 TOPS), and high (100+ TOPS). In 2023, OEMs are in urgent need of cost reduction, so that Tier 1 suppliers of driving-parking integration have played the "ultimately cost-effective" card to facilitate market segmentation.

There are two main ways: first, they expand to low computing power (5-10TOPS) by squeezing chip computing power and working hard on algorithms; second, vendors who originally aimed at the high-end market above 200TOPS no longer “stack up” but strengthen algorithms and software technologies to balance the performance and cost of high-level driving-parking integration.

Classification of Driving-parking Integration (by Computing Power)

	Low Computing Power	Medium Computing Power		High Computing Power	
Computing Power	5-10 TOPS	10-20 TOPS	20-100 TOPS	100-200 TOPS	200+ TOPS
Sensors	1R5V, 5R5V, etc.	5R5V, 6R5V, etc.	5R10V, etc.	5R11V/10V/9V, etc.; low-weight maps, zero/few LiDARs	5R11V/12V + LiDAR/4D radar + HD maps
Driving Functions	L2 driving assistance	Mainly L2, scalable to entry-level highway NOA	Highway NOA	Highway NOA + Urban NOA (limited scenarios)	Enhanced highway NOA / Urban NOA (all scenarios)
Parking Functions	APA/RPA	Mainly APA/RPA, scalable to HPA	APA/RPA/HPA	APA/RPA/HPA, scalable to AVP	APA/RPA/HPA/AVP

Source: ResearchInChina

Haomo.AI released the 2nd-generation HPilot system

In October 2023, Haomo.AI released the 2nd-generation HPilot system, including three driving-parking integration solutions - HP170, HP370 and HP570, which cover high-, medium- and low-level scenarios and are scheduled to be mass-produced in 2024.

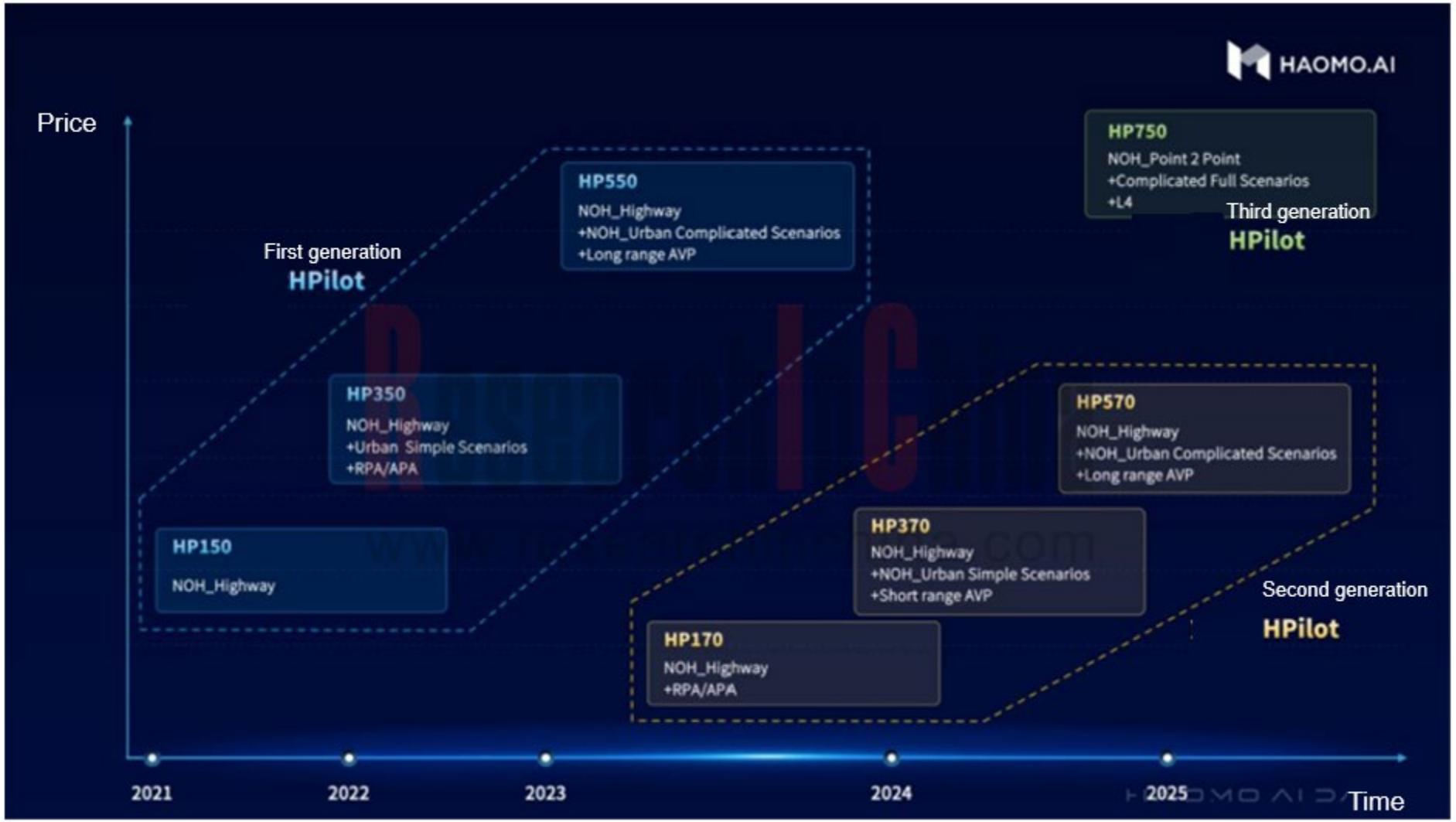
HP170: the RMB3,000 solution can meet the market demand for low-compute driving-parking integration solutions. The solution uses a non-map solution, features time-division multiplexing, and supports access to 5V2-5R sensors to enable urban NOA without maps.

HP370: the RMB5,000 solution is involved with medium computing power. Based on TDA4 VH (30 TOPS), it supports 9V3-5R (two optional front corner radars) to enable highway NOH, urban memory driving and HPA.

HP570: the RMB8,000 solution enables urban NOH in all scenarios without maps. With optional 72TOPS and 100TOPS chips, standard 11V1R12U, and an optional LiDAR, it realizes such functions as non-map urban NOH, all-scenario parking assist, all-scenario intelligent obstacle avoidance, and cross-floor teaching-free HPA.

Zhang Kai, the president of Haomo.AI, said that the three passenger car driving assistance products of the 2nd-generation HPilot drag down price but improve performance, making medium- and high-level intelligent driving cheaper and easier to use. Compared with the first-generation HP550 (based on Qualcomm Snapdragon Ride with the computing power of 360TOPS, it can be connected to LiDAR, etc. to achieve urban NOA), HP570 reduces costs by two-thirds without compromising on performance.

HPilot system



Source: Haomo.AI

Multiple Suppliers Deploy "Cost-effective" Single-Soc Driving-Parking Integration

In addition, Tier 1 suppliers, such as Hong Jing Drive, iMotion, Freetech, and NavInfo, are sparing no effort to promote the "extremely cost-effective" products. Most of them make layout in the low-compute and low-to-mid-end markets to seize the dividend of large-scale application.

In February 2023, Freetech introduced a single-SOC low-compute driving-parking integration solution (based on TDA4M, 8TOPS, 5V5R configuration), with cost controlled within RMB3,000, including sensors, domain controllers, algorithms, etc.

By the end of 2023, Hong Jing Drive's driving-parking integration solution (time-division multiplexing) based on a single J3 chip from Horizon Robotics has been production-ready. With the computing power of 5TOPS, self-developed parking perception, and planning and control algorithms, it can be connected to 5R5V12U (supporting 8MP front view) to enable functions such as automatic lane change and large vehicle avoidance. The total cost of the solution amounts to RMB3,000.

Multiple Suppliers Deploy "Cost-effective" Single-SOC Driving-Parking Integration (Part)

Vendor	Solution	Launch Time	Chip	Computing Power (TOPS)	Sensors	Main Functions	Supported Models
iMotion	iDCMid	2022	1*TDA4VM	8	4R5V12U	L2 Driving Functions + Highway NOA + HPA	EXEED Lanyue, EXEED Lingyun, Dongfeng Aeolus M6
AutoBrain	Single-SoC Driving-parking Integration	Jan. 2022	1*TDA4	8-32	8MP Front View	L2-L2.5 + APA/HPA	Geely Livan 7
Yihang.AI	Single-SoC Driving-parking Integration Lite	Apr. 2023	1*TDA4VM	8	5R5V12U	L2 Functions (Scalable Highway NOA) + APA/RPA	Renault
ZongMu Technology	Amphiman3000	Jul. 2022	1*J3	5	5R5V12U	L2 Functions + APA/RPA	Designated by Changan
MAXIEYE	MAXIPILOT2.0	2022	1*TDA4VM	8	5R5V1D	L2 + Highway NOA + APA/RPA	GAC Trumpchi L2++ Project
Enjoy Move Technology	DCU3.0	2022	1*J3	5	5R5V12U	L2+ Driving Functions + HAPA	A Chinese automaker
Hong Jing Drive	Single-SoC Driving-parking Integration	Dec. 2022	1*J3	5	5R5V12U	L2 + Highway NOA + APA/RPA	A Chinese automaker
Freetech	Lightweight Driving-parking Integration	Q2 2023	1*TDA4VM	8	5V5R12U	L2 Functions + APA/RPA	-
NavInfo	Driving-parking Integration NOP Lite	Jan. 2023	1*J3	5	5V5R12U	Lightweight NOA+HPP	-
DJI	7V Vision-only Driving-parking Integration	2023	TDA4VH	32	7V1R	Highway NOA + HPA	Baojun Yunduo (Lingxi Version)

Source: ResearchInChina

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Chip vendors make a quick response to the urgent need for "cost reduction and efficiency improvement”

2. Chip vendors make a quick response to the urgent need for "cost reduction and efficiency improvement”.

To meet OEMs’ need for "lower costs and higher efficiency", driving-parking integration chip vendors have begun to adjust their product lines and have developed a series of new products. Typical companies are NVIDIA, Horizon Robotics, Black Sesame Technologies and TI.

NVIDIA: To help OEMs reduce costs, NVIDIA developed Orin-N, its next-generation chip which was first mounted on DENZA N7, a model launched in September 2023.

Orin-N is a low-power version of Orin X, with fewer CPUs and GPUs. With computing power of 84TOPS, it supports highway NOA, AVP and other functions.

Despite a little lower computing power than Orin X, Orin N can compare with Orin-X in development tools and data links. In development, automakers can transplant algorithms to make Orin-N compatibile with Orin X and other versions of Orin.

The mass production and installation of Orin-N caters to automakers who intend to reduce costs and improve efficiency. It is expected to be used in more models in the future. At present, Desay SV is developing an Orin-N-based driving-parking integration product on IPU02.

Journey 6

Horizon Robotics: J3, J5, J6 and other series of chips have been or will be launched one after another. Among them, J6 will be released in April 2024, supporting urban NOA in all scenarios. J6 series chips will cover low-, medium- and high-level intelligent driving.

The flagship version of J6 was first unveiled in November 2023, with computing power up to 560TOPS and the integration of CPU, BPU, GPU, and CU. It can not only be easier to deploy, but also improve the cost performance of the system. It supports full-stack computing tasks (such as perception, prediction, planning, control, and cockpit perception), 24 cameras with the maximum resolution of 18MP, and access to multiple types of sensors such as LiDAR and 4D radar.

J6's first partners include BYD, GAC, Bosch, Li Auto and Volkswagen Cariad.

Source: Horizon Robotics

Black Sesame Technologies creates the extremely cost-effective NOA

Black Sesame Technologies: it has launched Huashan Series chips for intelligent driving and Wudang Series chips for cross-domain computing.

Huashan Series contains three products: A1000L, A1000 and A1000 Pro, which are based on two self-developed IPs - NeuralIQ ISP (automotive image processor) and DynamAI NN (automotive low power consumption neural network accelerator). All of them have been mass-produced to satisfy L2-L3 intelligent driving.

Wudang Series C1200, launched in April 2023 and based on the 7nm process, uses the latest ARM A78AE+G78AE automotive CPU+GPU architecture. A single C1200 meets the requirements of cross-domain computing scenarios including CMS, driving-parking integration, vehicle computing, infotainment system, intelligent headlights, and in-cabin perception system.

In April 2023, Black Sesame Technologies indicated that based on A1000 Series, it had launched a cost-effective driving-parking integration intelligent driving domain controller solution supporting 10V (camera) NOA functions, with the BOM cost lower than RMB3,000.

Source: Black Sesame Technologies

Quite a few companies deploy cockpit-parking integration, and ECARX is a pioneer in application

3. Quite a few companies deploy cockpit-parking integration, and ECARX is a pioneer in application.

In 2023, while driving-parking integration became popular, cockpit-parking integration has been quietly emerging.

In addition to parking functions, cockpit-parking integration also integrates cockpit functions, and uses cockpit GPU resources to provide rendering capabilities for AVM and APA, so as to reduce costs and improve efficiency. Currently Bosch, Aptiv, Visteon, ECARX, Desay SV, Yuanfeng Technology, and BICV among others have launched cockpit-parking integration solutions.

Cockpit-parking Integration Products and Solutions (Part)

Company	Product and Solution	Integration Mode	Launch Time
Bosch	Cockpit-parking Integration 1.0	Basic cockpit functions (based on 8155) + APA/RPA	Planned in 2024
	Cockpit-parking Integration 2.0	Based on Cockpit-parking Integration 1.0, it integrates visual perception algorithms in SOCs and implements functional safety control on MCUs.	Planned in 2024
Aptiv	Next-generation High-performance Intelligent Cockpit Platform	Based on Qualcomm 8295, it supports cross-domain fusion and can be expanded to realize cockpit-parking integration functions.	SOP in China in Q3 2023
Visteon	4th-generation Cockpit Domain Controller	Equipped with SiEngine Longying No.1, it supports 7 displays and enables cockpit-parking integration functions.	2023
	4th-generation Cockpit Domain Controller	Equipped with Qualcomm 8295, it supports 7 displays and enables cockpit-parking integration functions.	2023
Desay SV	4th-generation Cockpit Domain Controller: G9PH	Based on Qualcomm 8295, it has cockpit-parking integration capabilities.	2022
	Extended Version of 4th-generation Cockpit Domain Controller: G9SH	Based on Qualcomm 8255, it has cockpit-parking integration capabilities.	Oct. 2023
	Intelligent Cockpit Domain Control Platform: DS06C	Based on SemiDrive X9SP, it has cockpit-parking integration capabilities.	Apr. 2023
ECARX	Antora 1000 Pro	With two SiEngine Longying No.1 chips, it has cockpit-parking integration capabilities.	First installed in Lynk & Co 08 in 2023
BDStar Intelligent & Connected Vehicle Technology (BICV)	Cockpit-parking Integration Solution	Based on Qualcomm 8155, it allows for integration of the original parking domain controller into the intelligent cockpit domain controller, and integrates the cockpit SOC and the parking SOC into the same core board, hereby enabling inter-domain communication/on-chip communication, multi-modal perception fusion and so on.	Released in Sept. 2023
	Intelligent Parking Assist (IPA) Domain Controller	Based on Horizon Robotics J3, it enables isolation of software and hardware, and integration of visual perception, voice recognition, lip language capture, karaoke without microphone, cockpit-parking fusion, and APA. Commercialization has started.	Released in Aug. 2022

Source: ResearchInChina

Antora 1000 Pro

ECARX is strategically invested by Geely. In September, 2023, ECARX first installed Antora 1000 Pro computing platform on Lynk & Co 08. Launched in March 2023, this platform is ECARX's first cockpit-parking integration computing platform. It integrates two Longying No.1 chips, with NPU compute up to 16TOPS. It can provide L2 driving assistance, automated parking assist (APA), remote parking assist (RPA) and other functions while supporting cockpit entertainment interaction.

Antora 1000 Pro, an equivalent of Qualcomm 8155, features 200K DMIPS CPU, 1800G FLOPS GPU, up to 16TOPS (INT8) NPU, and SE-LINK customized by SiEngine.

ECARX's Cockpit-parking Integration Computing Platform: Antora 1000Pro

Hardware	• CPU: 200K DMIPS • GPU:1800 G FLOPS • NPU:16TOPS int 8 • LPDDR5:32GB • SE-LINK: Customed by SiEngine
Core Functions	• APA/RPA • 8 screens displaying different contents • LPDDR5 cameras
Supported Models	• Lynk & Co 08

Source: ECARX

Performance Comparison between Main Computing Modules/Platforms in ECARX's Intelligent Cockpit

	Time	Process	CPU	GPU	Application
E01	2018	12nm	14.4K	20.4K	Old Lynk & Co 01/02/03
E02	2020	14nm	6.2K	8.2G	
Antora 1000 (E4)	2023	7nm	100K	900G	Lynk & Co 06
Antora 1000Pro (2*E4)			200K	1800G	Lynk & Co 08
Makalu (E5)	2023	7nm	394K	10.1 T	Smart BEV (2024)

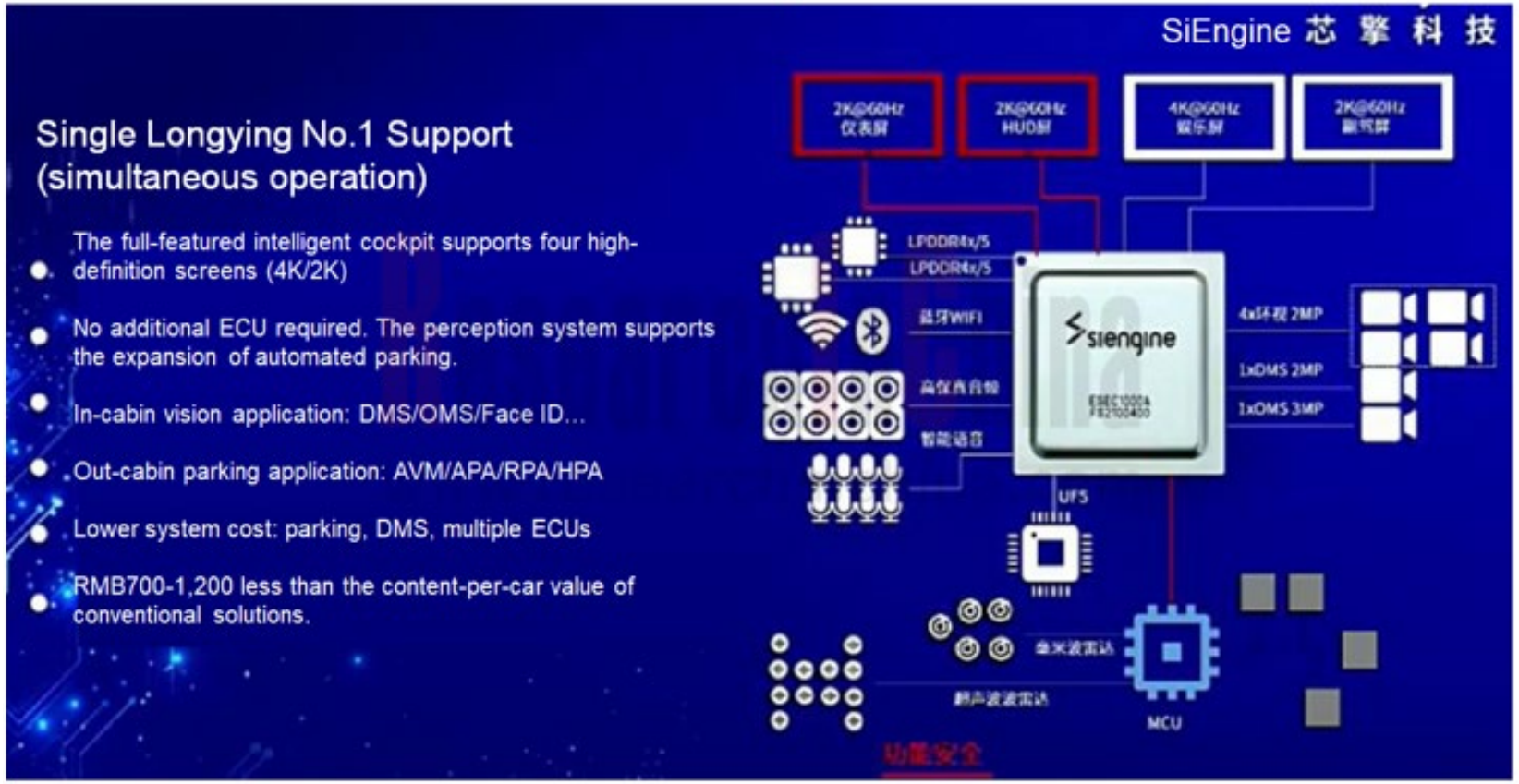
Source: ResearchInChina

Longying No.1

Established in 2018, SiEngine is a joint venture between ECARX and ARM China. Longying No.1 used in Antora 1000 Pro was developed by SiEngine independently and released in March 2023, as the first 7nm automotive chip in China. It has built in 8 CPU cores, 14 GPU cores, an 8TOPS (INT8) programmable NPU, an ASIL-D security island, and a high-performance encryption and decryption engine. It supports 7 4K/2K different independent screens and 12 2/3MP cameras.

Based on a single Longying No.1 chip, SiEngine has developed a cockpit-parking integration solution to bolster a full-featured intelligent cockpit with four 4K/2K screens, without additional ECU and perception system for automated parking expansions such as RPA/HPA. Compared with conventional solutions, this solution can save RMB700-1,200.

Cockpit-parking Integration Solution with a Single Longying No.1 Chip



Source: SiEngine Technology

Cockpit-driving integration takes the fast road, and is expected to go into mass production in 2025

4. Cockpit-driving integration takes the fast road, and is expected to go into mass production in 2025.

Cockpit-driving integration means the cockpit and intelligent driving domains are integrated into a high-performance computing unit to support both intelligent driving and intelligent cockpit functions simultaneously. It is considered the future development direction.
So far, NVIDIA, Qualcomm and Black Sesame Technologies among others have launched high-compute chips to support computing across intelligent driving and intelligent cockpit domains.

NVIDIA: with computing power up to 2000TOPS, a single Drive Thor chip fuses intelligent driving and in-cabin algorithms, and supports isolation among multiple computing domains. It is scheduled to be mass-produced for ZEEKR in 2025. At CES 2024, Li Auto indicated that it will use DRIVE Thor.

Qualcomm: With computing power up to 2000TOPS, a single Snapdragon Ride Flex (8775) SoC supports multi-domain fusion computing of cockpit and autonomous driving. At present, ThunderX, Megatronix and Autolink World are developing cockpit-driving integration products and solutions based on this platform.

Since the second half of 2023, the pace of development and application of cockpit-driving integration have quickened, and Baidu, ThunderX, Autolink World, Bosch and Aptiv have launched single-SoC cockpit-driving integration products or solutions. This will favor the rapid adoption of cockpit-driving integration, which is expected to be applied on a large scale after 2025.

In October 2023, **Baidu** launched Apollo Robo-Cabin, a cockpit-driving integration intelligent computing platform based on a Qualcomm cockpit chip (compatible with Qualcomm 8295, 8255 and 8775). With software and chip integrated, this platform also enables basic intelligent driving functions and cockpit capabilities, including AEB and LCC. The primary version of the solution has been first available in models like Geely Galaxy E8 and Jiyue 01. In addition, Baidu has cooperated with Hangsheng Electronics to build a new generation of cockpit-driving integration products scheduled to be launched in Q3 2024.

In November 2023, **ThunderX** unveiled RazorDCX Tarkine, a single-SoC cockpit-driving integration solution. Based on Qualcomm Snapdragon Ride Flex, it supports a through-type long 8K screen. Coupled with an all-scenario, immersive and full 3D interface, it enables 360° surround view, driver monitoring, gaming, audio and video entertainment, interconnection and other cockpit functions. It also supports automated parking, L2++ highway and urban intelligent driving functions.

Autolink World, Aptiv and Bosch

In January 2024, **Autolink World** launched its latest cockpit-driving integration domain controller based on Qualcomm Snapdragon Ride Flex. A single SoC can realize L2+ intelligent driving functions such as highway NOA, HPA, and camera monitoring system (CMS). This product will be mounted on the next-generation models of Neta Auto.

In January 2024, **Aptiv** launched its first cockpit-driving-parking integration system based on a single SoC - Cross-domain Fusion Computing Platform. Based on a domestic chip and Wind River software, it covers three domains: intelligent cockpit, intelligent driving assistance and automated parking, and can simultaneously support multiple functions such as multi-screen interaction, online video, navigation and voice assistants, lane line and traffic light recognition, parking space and obstacle perception.

At the core of the new vehicle computer unveiled by Bosch in January 2024 – called the cockpit & ADAS integration platform – is a single SoC, which processes a variety of functions from the two domains of infotainment and driver assistance simultaneously. This includes, for example, automated parking and lane detection, paired with smart, personalized navigation and voice assistance.

Bosch's cockpit & ADAS integration platform controls all the domains in modern vehicles with a single SoC

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Contact

Beijing Headquarters

TEL: 13718845418
Email: report@researchinchina.com

Website: ResearchInChina

WeChat: Zuosiqiche

Chengdu Branch

TEL: 028-68738514
FAX: 028-86930659

zuosiqiche