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# Autonomous Heavy Truck Industry Report, 2020-2021

## Autonomous heavy truck research: front runners first going public

Our Autonomous Heavy Truck Industry Report, 2020-2021 carries out research into highway scenario-oriented autonomous heavy truck industry, including OEMs and autonomous driving solution providers inside and outside China.

## Several autonomous heavy truck companies try to list their shares for financing.

The surging road freight volume and a widening gap in demand for truck drivers, promote the financing boom of self-driving heavy truck industry, and accelerate the R&D of related products and technology landing.

According to incomplete statistics, several autonomous heavy truck solution providers at home and abroad have closed a total of at least 16 funding rounds in the most recent year (August 2020 to August 2021). Examples include PlusAI and Inceptio Technology, two Chinese firms which have raised over USD800 million in all in their recent several funding rounds.

## Financing of Autonomous Heavy Truck Solution Providers, Aug. 2020-Aug. 2021

Time	Provider	Round	Amount
Aug. 2020	CiDi	A++	RMB100+ mln
Oct. 2020	Einride	-	USD10 mln
Oct. 2020	Pony.ai	C	USD400+ mln
Nov. 2020	TuSimple	E	USD350 mln
Nov. 2020	PlusAI	C	USD100 mln
Nov. 2020	Inceptio Technology	Equity financing	USD120 mln
Jan. 2021	CiDi	B	RMB400 mln
Feb. 2021	PlusAI	D	USD200 mln
Feb. 2021	Pony.ai	C+	USD100 mln
Mar. 2021	PlusAI	D+	USD220 mln
Apr. 2021	CiDi	B+	USD300 mln
May 2021	Einride	B	USD110 mln
May 2021	Hong Jing Drive	A	Nearly RMB100 mln
Jun. 2021	Kodiak Robotics	B	Unreleased
Jun. 2021	Waymo	-	RMB2.5 bn
Aug. 2021	Inceptio Technology	Round B equity financing	USD270 mln

Source: ResearchInChina

## Listing of Autonomous Heavy Truck Solution Providers

Time	Provider	Way of Listing	Listing Plan
Apr. 2021	TuSimple	Conventional ways	Having been listed on Nasdaq
May 2021	PlusAI	SPAC	To be listed on New York Stock Exchange this year
Jun. 2021	Embark	SPAC	To be listed on New York Stock Exchange this year
Jul. 2021	Aurora	SPAC	To be listed on Nasdaq this year

Source: ResearchInChina

In the meanwhile, some solution providers which suffered sustained losses, and high input and low output, have started resorting to IPO for raising more funds. On April 15, 2021, TuSimple went public on Nasdaq, becoming the world's first listed company in autonomous driving field. And then a few other autonomous heavy truck solution providers announced listing in the US as special purpose acquisition companies (SPAC).

***The LiDAR + camera + radar fusion solutions have become mainstream.***

Most providers adopt the LiDAR + camera + radar fusion solutions combined with HD map and high-precision positioning, which enable their heavy trucks to drive themselves. Some solution providers like Embark use hybrid LiDAR solutions, that is, the combination of solid-state and mechanical LiDARs enables omnidirectional depth perception of the surroundings of a vehicle.

The time that mainstream solution providers inside and outside China are expected to launch the technology is relatively consistent. In the case of loose policies, autonomous heavy trucks will come into service on highways between 2023 and 2024.

## L4 Heavy Truck Sensor Solutions and Launch Time

L4 Truck Sensor Solution Provider	Embark	Aurora	Kodiak Robotics	Einride
Sensor Solution	Solid state LiDAR*1 Mechanical LiDAR*2 Radar*3 Camera*8 HD map	FirstLight LiDAR*1 Mechanical LiDAR*5 Long-range 4D imaging radar Camera HD map	Luminar LiDAR*1 Hesai LiDAR*2 Radar*3 Camera*8 Sparse map	LiDAR*4 Radar*2 Camera*6 HD map
L4 heavy truck prototype	Peterbilt 579	Peterbilt 579	Kenworth T680	Einride Pod
L4 launch time	2024	2023	2023	2023
L4 Truck Sensor Solution Provider	TuSimple	PlusAI	Pony.ai	Inceptio Technology
Sensor Solution	LiDAR*3 Radar*6 Camera*9 HD map	LiDAR*1 Radar*5 Camera*8 HD map	LiDAR*2 Radar*3 Camera*6 HD map	LiDAR Radar Camera HD map
L4 heavy truck prototype	International LT Series	FAW Jiefang J7	FAW Jiefang J7	Sinotruk SITRAK
L4 launch time	2024	2023	2023	-

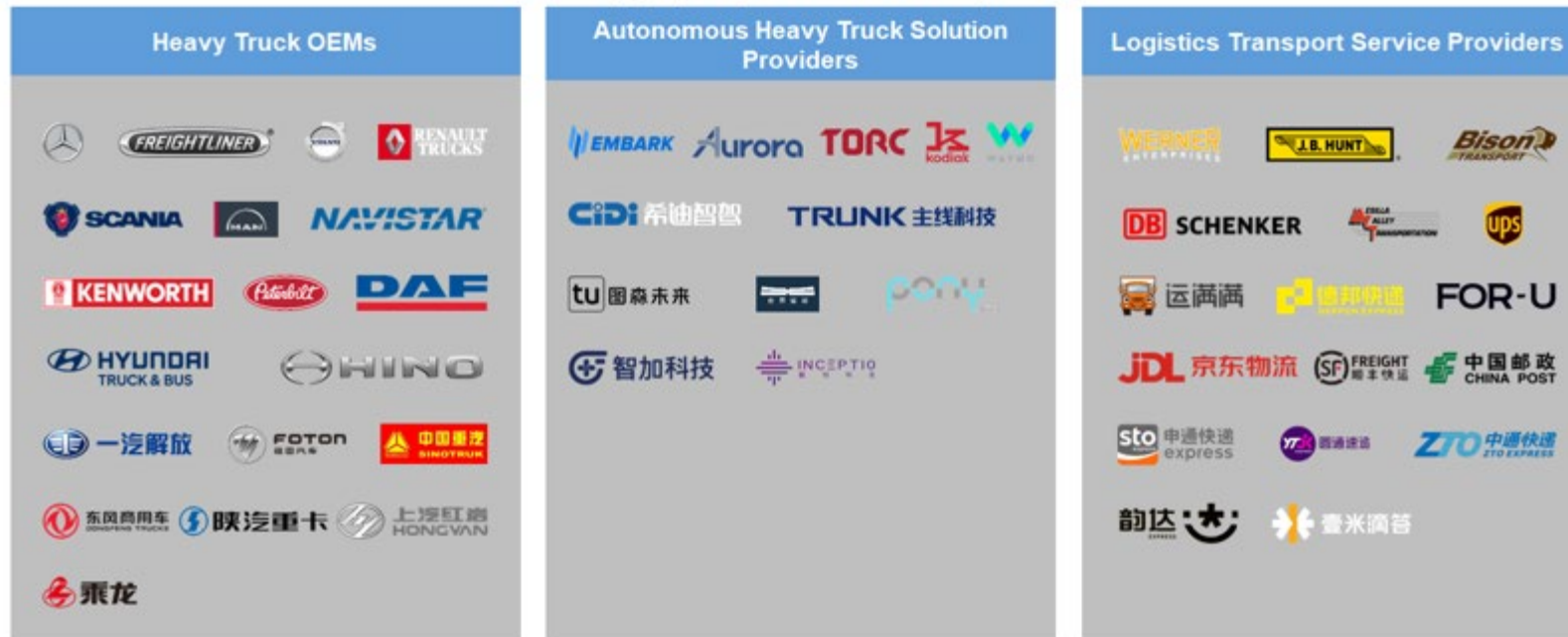
Source: ResearchInChina

## Cooperation modes of autonomous heavy truck industry

Quite a few heavy truck OEMs and logistics companies race to land on highway scenarios in addition to capital betting on autonomous heavy trucks. The highway transportation scenario-oriented autonomous heavy truck ecosystem accommodates autonomous heavy truck solution providers, heavy truck manufacturers and logistics transport service providers, which work together to propel commercialization of autonomous heavy trucks. As concerns research and development, solution providers and heavy truck manufacturers jointly develop L4 autonomous heavy trucks based on OEM or AM vehicle models. With regard to commercial operation, solution providers partner with logistics transport service providers on commercial operation and actual freight transport test of autonomous heavy trucks.

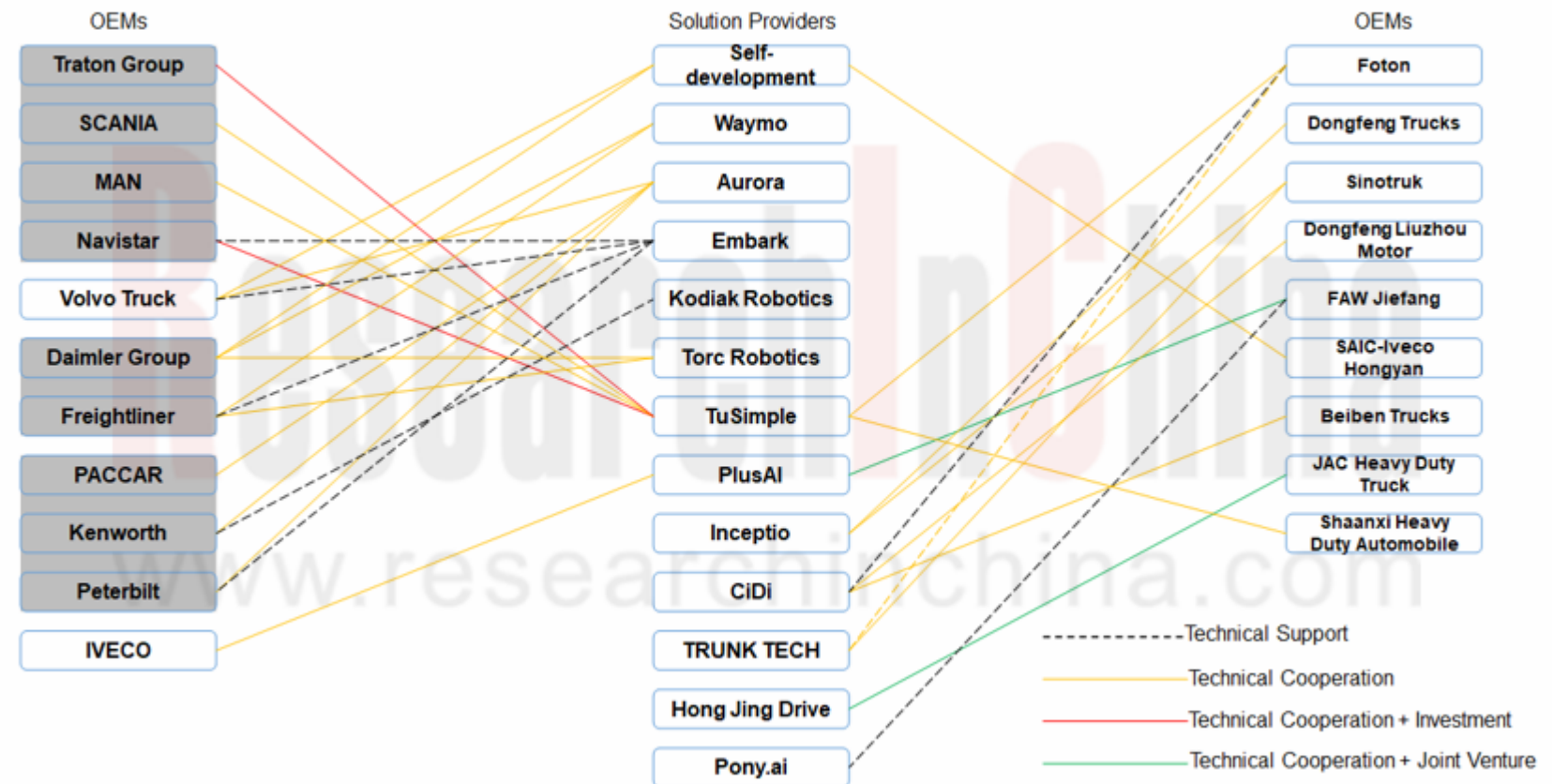
### Autonomous Heavy Duty Trucking Ecosystem

(highway transportation scenario oriented)



In terms of partnerships, autonomous heavy truck solution providers often team up with OEMs, co-developing L4 autonomous heavy trucks based on flagship models in OEM or AM market. Foreign autonomous heavy truck companies develop autonomous driving often under the leadership of their group companies, which means sub-brands of these group companies build technological cooperation with solution providers. For example, Traton under Volkswagen formed a global partnership with TuSimple to jointly develop L4 autonomous driving technology and apply to Volkswagen's brands like SCANIA and MAN.

## Partnerships between Heavy Truck OEMs and Solution Providers (Part)



Source: ResearchInChina

## ***Development trends of autonomous heavy trucks***

**Trend 1:** to achieve the goal of “emissions peak in 2030, carbon neutrality in 2060”, the power source of autonomous heavy trucks will shift from diesel to low or zero carbon energy like natural gas and hydrogen.

**Trend 2:** platooning technology is being reviewed. In January 2019, Daimler Trucks held a contrary opinion on platooning. After thousands of miles of testing, Daimler has come to the conclusion that truck platooning delivers low economic benefits and has natural defects such as needing a driver, so it will end development of the technology and turn to L4 autonomous heavy trucks. Also, what impacts the actual use of platooning will put on the normal traffic has yet to be verified in real road tests.

**In the short run, there will be certain barriers to large-scale commercial use of autonomous heavy trucks in China's business environment.**

The development goal of L4 autonomous heavy trucks is to remove driver and let vehicles complete logistics transport and delivery without needing a human driver to monitor. The most direct customers are logistics companies which operate their own fleets, such as JD, SF Express, YTO Express, STO Express, ZTO Express and YunDa Express. Such companies have much expectation of autonomous heavy trucks lowering their total cost of ownership (TCO), which will make autonomous heavy trucks a big market.

In China, truck drivers are generally self-employed and only 17% of them have their vehicles employed by companies or owned by fleets; 83% drive their own vehicles, according to the Survey Report on Employment of Truck Drivers in 2021 released by China Federation of Logistics & Purchasing (CFLP). The blossom of autonomous heavy trucks in China is still a long way off.

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