

Global and China Automotive LiDAR Industry Report, 2021

Apr.2021

STUDY GOAL AND OBJECTIVES

This report provides the industry executives with strategically significant competitor information, analysis, insight and projection on the competitive pattern and key companies in the industry, crucial to the development and implementation of effective business, marketing and R&D programs.

REPORT OBJECTIVES

- ◆ To establish a comprehensive, factual, annually updated and cost-effective information base on market size, competition patterns, market segments, goals and strategies of the leading players in the market, reviews and forecasts.
- ◆ To assist potential market entrants in evaluating prospective acquisition and joint venture candidates.
- ◆ To complement the organizations' internal competitor information gathering efforts with strategic analysis, data interpretation and insight.
- ◆ To suggest for concerned investors in line with the current development of this industry as well as the development tendency.
- ◆ To help company to succeed in a competitive market, and

METHODOLOGY

Both primary and secondary research methodologies were used in preparing this study. Initially, a comprehensive and exhaustive search of the literature on this industry was conducted. These sources included related books and journals, trade literature, marketing literature, other product/promotional literature, annual reports, security analyst reports, and other publications.

Subsequently, telephone interviews or email correspondence was conducted with marketing executives etc. Other sources included related magazines, academics, and consulting companies.

INFORMATION SOURCES

The primary information sources include Company Reports, and National Bureau of Statistics of China etc.

Abstract

At the 2021 Shanghai Auto Show, Huawei shocked all automakers and suppliers. Huawei has directly and indirectly supported more than 10,000 engineers in the R&D of intelligent automobiles. Except production, Huawei covers almost all of aspects required for digital transformation of automobiles: automotive perception and decision-making, network communications, electric drive, batteries, electric control, cloud-road networks outside vehicles, R&D and marketing.

Compared with the previous R&D investment involved with 1,000 persons (such as Baidu), Huawei's R&D team consisting of 10,000 persons has greatly accelerated the upgrade pace of intelligent networking of China's auto industry. When other countries around the world are still worrying about the pandemic, China will enter the era of leading the development of global automotive intelligent networking from 2021.

Take LiDAR installation as an example, the new models with LiDAR mainly come from domestic automakers.

New domestic models equipped with LiDAR

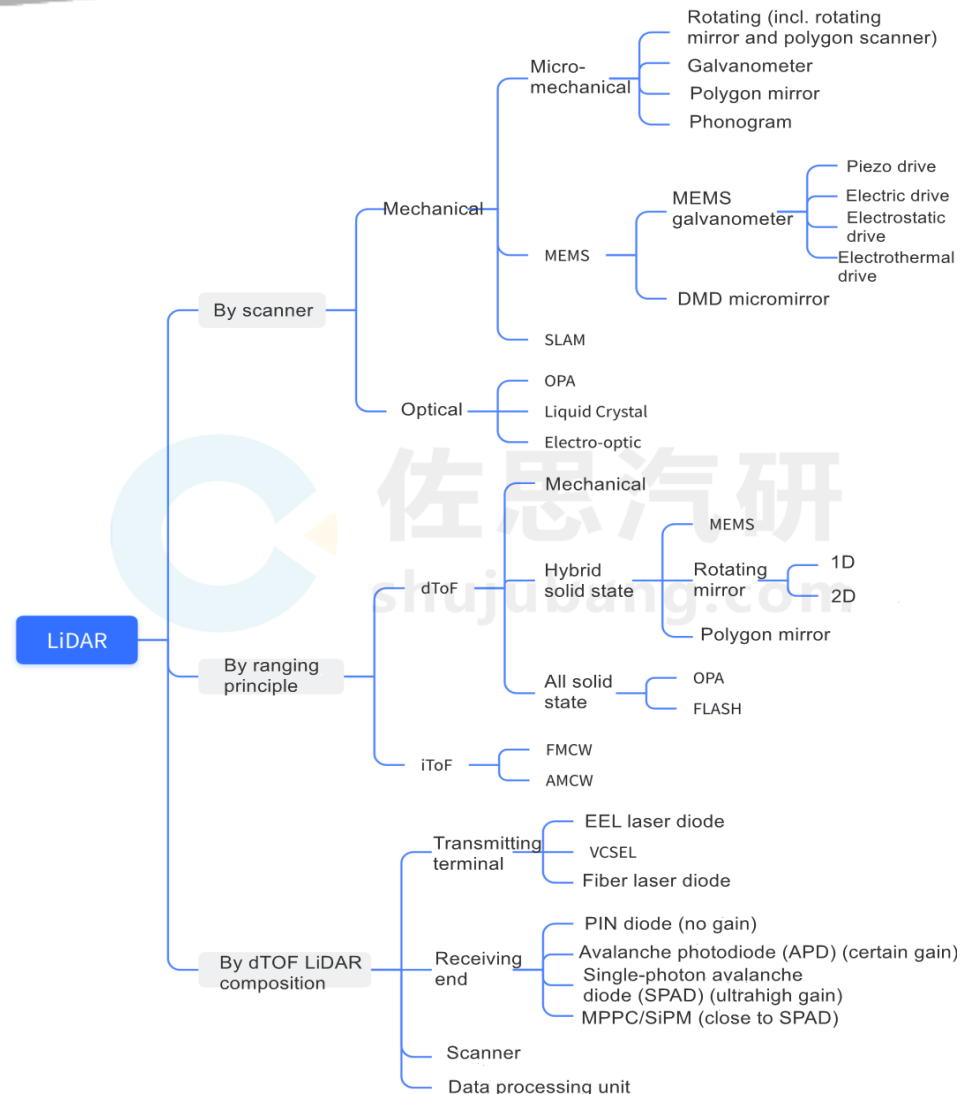
Automaker	Model	Launch Time	SOP plan	LiDAR Supplier	LiDAR Product	Sensor Configuration (Units)			
						LiDAR	Radar	Camera	Ultrasonic
NIO	ET7	Jan. 2021	2022Q1	Innovusion	Falcon	1	5	11	12
IMMOTORS	IM models	Jan. 2021	2022	Huawei (estimated)	96-channel	3	5	15	12
Great Wall Motor	Mocha	Jan. 2021	2022	IBEO	ibeoNEXT	3	8	7	12
SAIC R	ES33	Mar. 2021	2022H2	Luminar	Iris	1	2(4D)	12	12
Xiaopeng Motors	Xpeng P5	Apr. 2021	2021Q4	DJ Livox	Horiz	2	5	13	12
BAIC	ARCFOX αS Huawei HI Edition	Apr. 2021	2022	Huawei	96-channel	3	6	13	12
Changan Auto	Ark Architecture-based models	2021	2022	Huawei	96-channel	5	6	13	12

On April 14, Xpeng's third mass production car, the P5, was launched. The biggest highlight is that it is equipped with two DJI Livox LiDARs, which can realize the NGP function on urban roads. Following NIO ET7, Great Wall Mocha, IM and SAIC ES33, P5 is another new model equipped with LiDAR.

On April 17, the ARCFOX Alpha S Huawei HI equipped with three Huawei's 96-channel LiDARs (installed on the center and both sides of the front) was officially unveiled; later, Changan's model based on the Ark architecture will also be equipped with Huawei's LiDAR.

The second model of Lixiang will also be equipped with LiDAR.

After years of development, automotive LiDAR technology roadmaps and products have been quite diversified. ResearchInChina has sorted out classification and composition of LiDAR, as shown in the figure below.



Early, LiDAR was mainly used in Robotaxi, Robotruck, Robobus, low-speed autonomous driving and roadside perception, etc. in small scale. The extensive application of LiDAR depends on the passenger car market.

As L4 technical solutions are gradually applied to L2-L3 models, LiDAR has been installed widely. LiDAR is currently available on production cars, and is mainly used to enhance ADAS functions and make new cars more appealing.

So far, domestic OEMs prefer to adopt hybrid solid-state LiDAR (including rotating mirror, prism, MEMS) solutions, mainly because:

First, it is easier to reduce the costs of hybrid solid-state LiDAR than mechanical LiDAR. Compared with pure solid-state (OPA, Flash) LiDAR, hybrid solid-state LiDAR technology is relatively mature and easier to commercialize.

Second, the Rotating Mirror Solution (represented by Valeo) is the first technical solution that meets National Automotive Standards and the performance requirements of automakers, and can be supplied in batches with controllable costs.

Xpeng P5 is equipped with two LiDARs (installed on both sides of the front bumper) from DJI Livox Horiz (customized version), which use the dual prism scanning solution, with the maximum detection distance of 150m (@10% reflectivity), the lateral field of view of 120 degrees, the angular resolution of $0.16^{\circ} \times 0.2^{\circ}$, and the point cloud density equivalent to 144-channel LiDAR.

Xpeng Livox LiDAR uses 905nm wavelength at the transmitting side, APD at the receiving side, and double prism at the scanning side, namely Risley prism universal pointing system, with a unique non-repetitive scanning method.

DJI Livox Biprism Scanning Solution

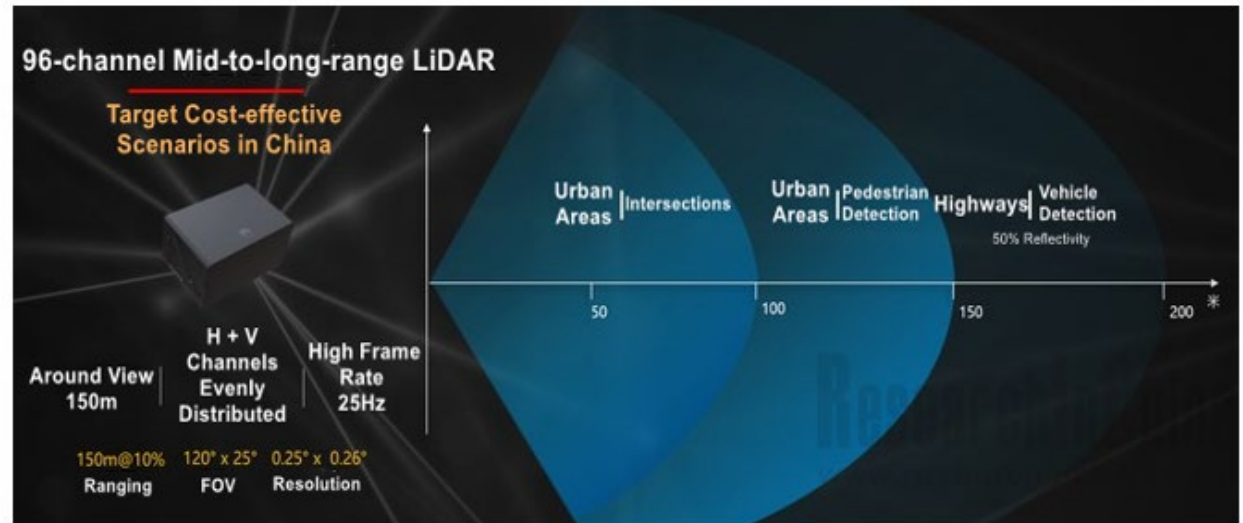


ARCFOX Alpha S Huawei HI is the first model equipped with Huawei's three 96-channel LiDARs on the center and both sides of the front. Released in December 2020, the LiDAR has the maximum detection distance of 150m (@10% reflectivity), the field of view of 120°×25°, and the resolution of 0.25°×0.26°.

Combined with other sensors (6 radars, and 13 cameras and 12 ultrasonic radars), the LiDARs can achieve 360° coverage.

Huawei's 96-channel LiDAR

Huawei deploys long, medium and short-range LiDARs with a rotating mirror scanning architecture. Like Valeo Scala 1, Scala 2, the LiDARs comply with National Automotive Standards and are available on cars.



Valeo's Rotating Mirror Solution Disassembly



In addition to Huawei and Valeo, Innovusion and Luminar adopt similar technical solutions which however exploit two-axis rotating mirror scanning. They will soon conduct mass production for NIO ET7 and SAIC R ES33.

SAIC R ES33 Equipped with Luminar 1550nm Iris LiDAR

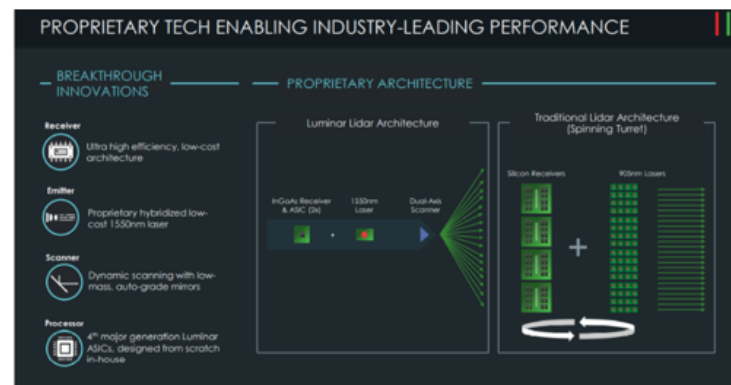


Source: SAIC R

Luminar LiDAR features unique technical advantages: 1550nm wavelength (mainstream: 905nm) at the transmitting side, the low-cost InGaAs detector at the receiving side, self-made fourth-generation custom ASIC chips, and a 2D rotating mirror scanning method.

Luminar's Iris LiDAR based on this architecture has a detection distance of up to 250m (@5% reflectivity), and can detect dark objects on the road beyond 250m, with the resolution of up to 300PPD and the angular resolution of $120^{\circ} \times 30^{\circ}$. At the same time, it has low costs. The price of IRIS for L2 advanced assisted driving is US\$500; for L4/L5 autonomous driving, it is less than US\$1,000.

Luminar's Core LiDAR Technology

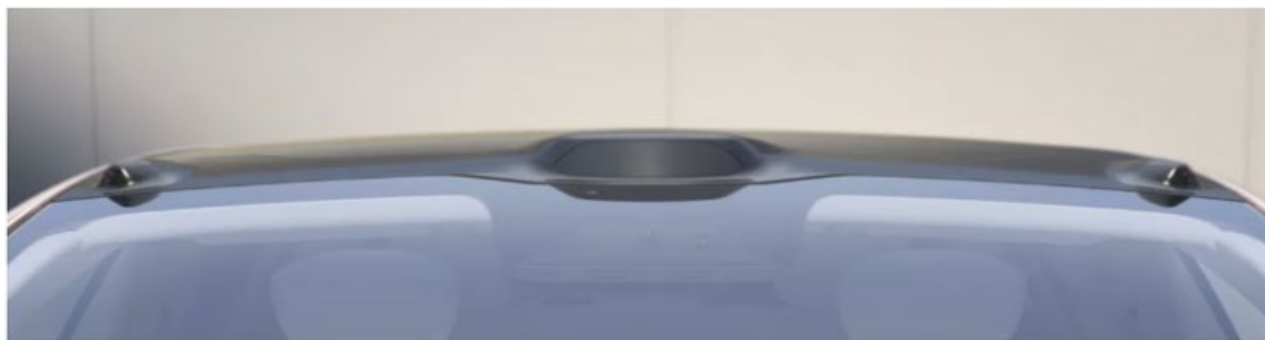


Source: Luminar

Innovusion and Luminar are alike in technology path. Both use 1550nm wavelength, fiber laser, and dual-axis rotating mirror scanning solution.

In January 2021, NIO ET7 was released, equipped with Innovusion's Falcon LiDAR. It will be mass-produced in 2022Q1.

NIO ET7 Equipped with Innovusion 1550nm Falcon LiDAR



Ultra-long Range High Resolution LiDAR

1.550nm | Horizontal FOV: 120° | Max. Resolution: 0.06°×0.06° | Max. Detection Range: 500m

Source: NIO

In addition, RoboSense's MEMS LiDAR -- RS-LiDAR-M1 will soon be carried on Lucid Air. RoboSense released the RS-LiDAR-M1 SOP in January 2021, and will start mass production and delivery of the designated project in 2021Q2.

This product adopts RoboSense's patented MEMS technology, with the farthest detection distance of 200m ([150m@10%](#)), the field of view of 120°x25°, and the resolution of 0.2°x0.2°. In addition to RoboSense, players using MEMS technical solution include Innoviz, AEye, Pioneer, HESAI, Leishen Intelligent Systems, Zvision, etc. The third-generation product of Valeo's is also based on MEMS technology.

Innoviz's InnovizOne will be installed on the new BMW iX in 2021; Valeo MEMS is expected to see mass production around 2022.

Company	Product	FOV	Angular Resolution	Max. Detection Range
Innoviz	InnovizPro	73°*20°	0.15°*0.3°	150m
Innoviz	InnovizOne	120°*25°	0.1°*0.1°	250m
Innoviz	InnovizTwo	100°*20°	0.1°*0.2°	250m
RoboSense	RS-LiDAR-M1	120°*20°	0.1°*0.25°	200m
Hesai Technology	Pandar GT 3.0	60°*20°	0.035 (5Hz)	300m (10%)
Pioneer	LMM-1860-S	60°*30°	-	37m
Pioneer	LMM-1830-M	30°*15°	-	73m
Pioneer	LMM-1815-T	15°*7.5°	-	180m
Blickfeld	Cube Range	15°*10°	0.18°*0.18°	150m (10%)
AEye	AE200	120°*45°	0.1°*0.1°	200m (10%)
AEye	4Sight M	60°*30°	0.1°*0.1°	205m (10%)
LeiShen Intelligent	LS20D	120°*20°	0.25°*0.1°	200m
LeiShen Intelligent	LS21G	120°*25°	0.15°*0.1°/0.075°*0.05°	200m
ZVISION	ML-X	60°*20°	0.1°	200m (10%)
ZVISION	ML-30s	140°*70°	0.05°	20-55m

1. Overview of LiDAR

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