Mapping the Future: Navigating LiDAR's Supply Chain, Market Dynamics, and Emerging Trends

Pierrick BOULAY – Senior Analyst
Lighting and ADAS systems
Yole Group

DVN LiDAR conference

Credits: Mercedes-Benz

YOLE Intelligence

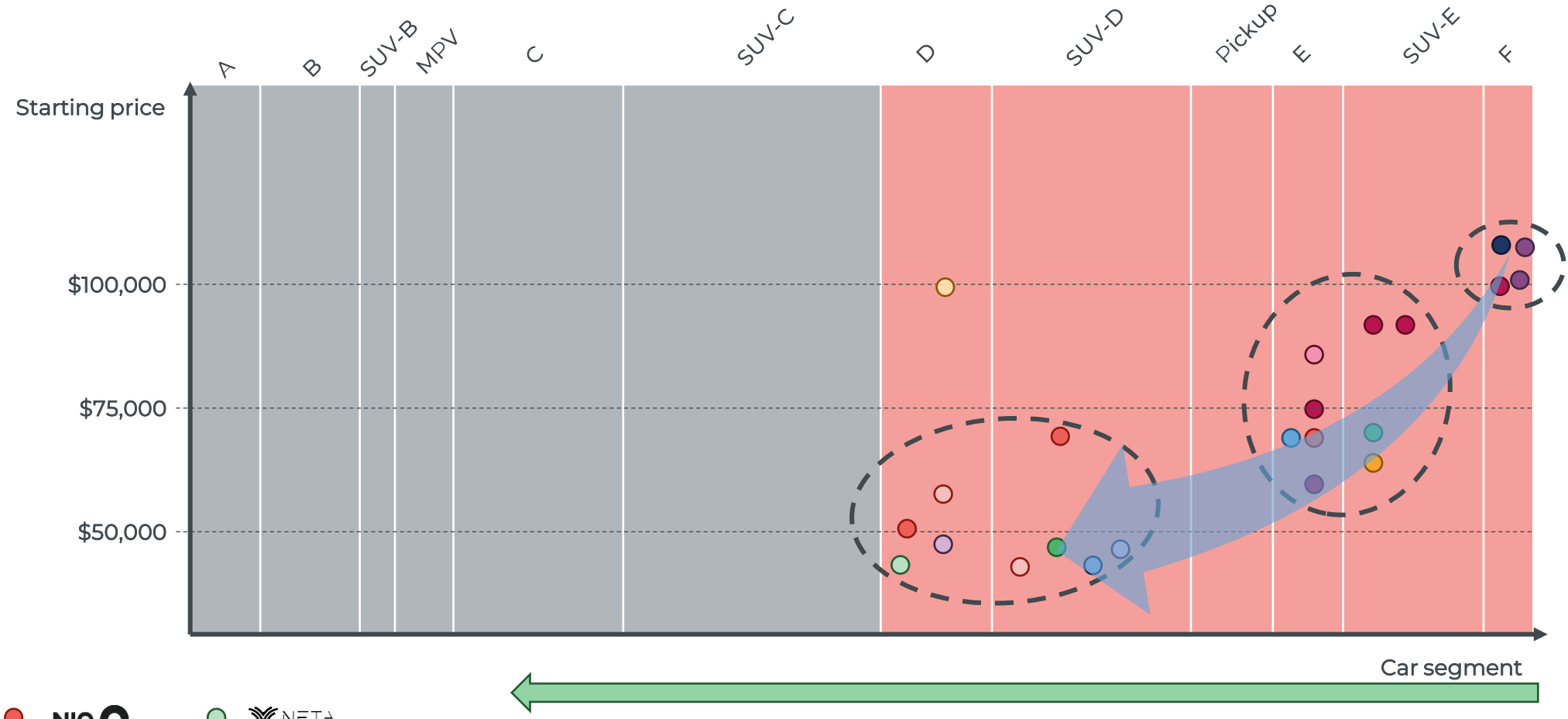
AGENDA

1. Market Dynamics
2. LiDAR ecosystem
3. Technology, Process, & Cost analysis
4. Key takeaways

MARKET DYNAMICS

Passenger car market: distribution of cars with LiDAR (2018-2022)

First cars with LiDAR were in the F-segment. In 2022, several cars with LiDAR are now in the D-segment, with a much lower price.



E-F segments are where ADAS innovations are initially introduced. Then, ADAS systems progressively spread into other segments.

Source: Car segment classification from Marklines

MARKET DYNAMICS

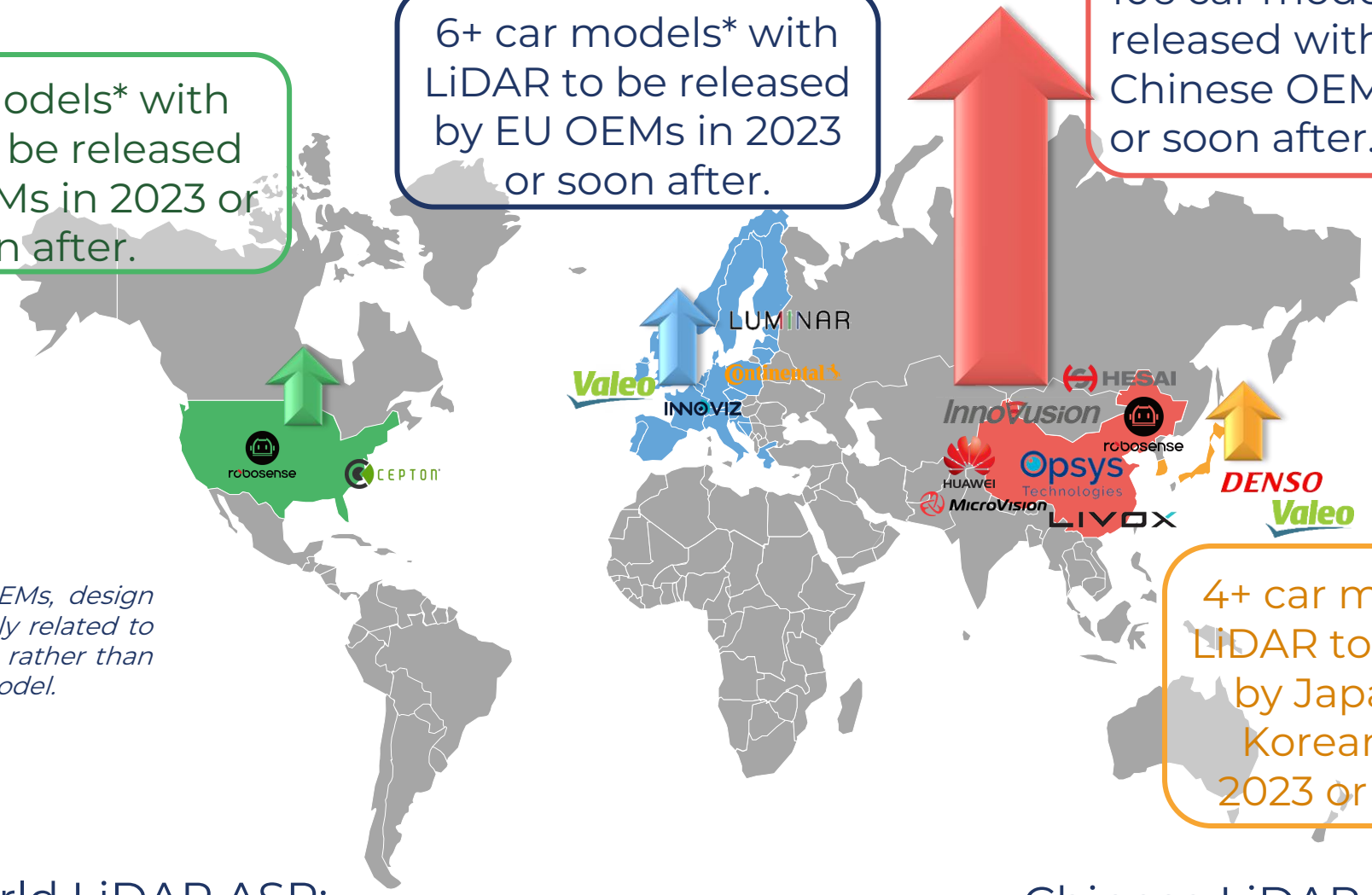
LiDAR market dynamics

There are two distinct LiDAR markets: China and the rest of the world (RoW).

3+ car models* with LiDAR to be released by US OEMs in 2023 or soon after.

6+ car models* with LiDAR to be released by EU OEMs in 2023 or soon after.

106 car models to be released with LiDAR by Chinese OEMs in 2023 or soon after.



4+ car models* with LiDAR to be released by Japanese and Korean OEMs in 2023 or soon after.

** For these OEMs, design wins are mostly related to a car platform rather than a dedicated model.*

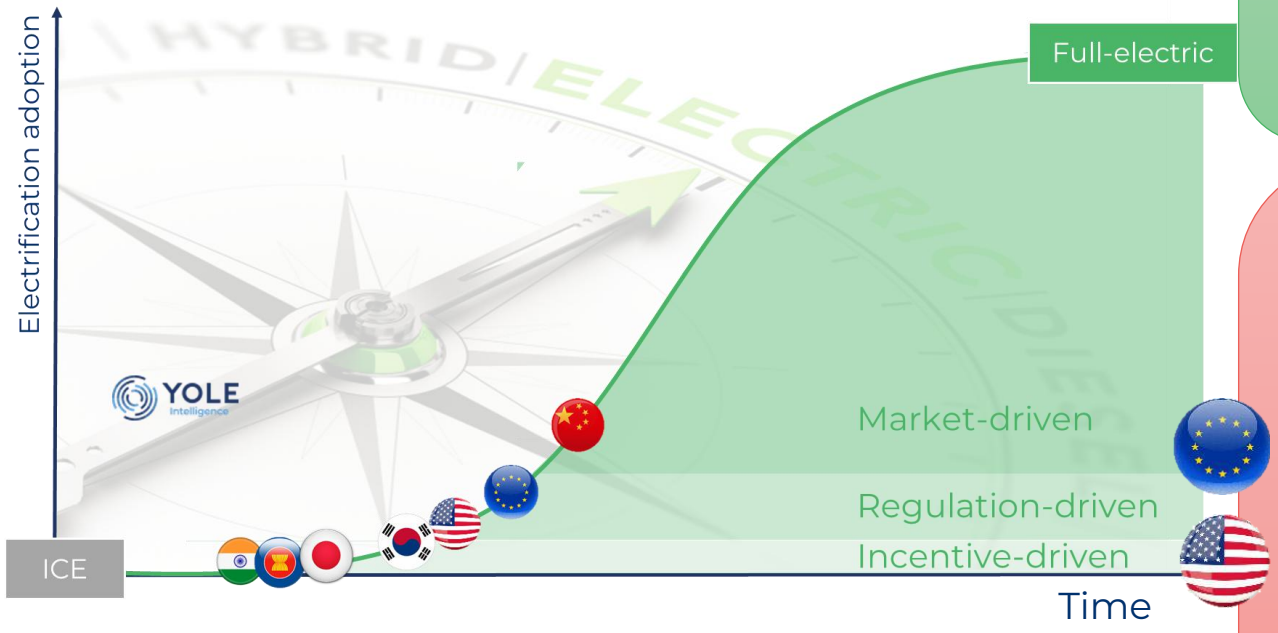
Rest of the world LiDAR ASP: ~$800-$1,000

Chinese LiDAR ASP: ~$600-$800

MARKET DYNAMICS

OEM choices: Electrification, automated driving, or both?

Chinese OEMs have already made the EV transition allowing them to integrate more automated driving features.



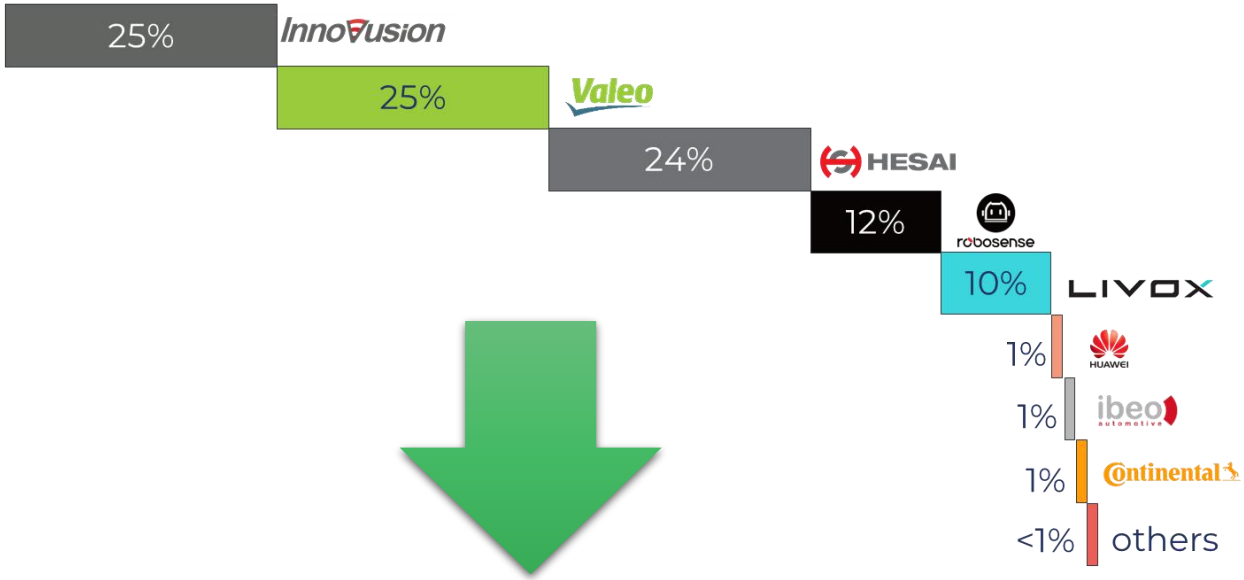
China's plan to invest in EV technologies started in the early 2000s. Between 2009 and 2022, the government poured over $29 billion into relevant subsidies and tax breaks to help local OEMs transition from ICE to EV. For a decade now, new OEMs have emerged as pure EV players. After the EV transition, they are now ready to push for automated driving.

European and US OEMs are starting this transition with incentives and regulations pushing the transition from ICE to EV. This means that OEMs will face penalties or be unable to sell cars if they are not pure EVs. So, with the development of automated driving features, most OEMs have to make some choices as the transition will be associated with a high development cost. Few OEMs, like Mercedes, Volvo, and Cadillac, are developing both features, but this is limited to high-end vehicles at a high selling price.

MARKET DYNAMICS

2022 LiDAR market vs 2023 expectations

~225,000 LiDARs were shipped in passenger cars in 2022



Thanks to its partnership with Nio, with LiDAR mounted in series, Innovusion put more than 56,000 units on the road in 2022.

Hesai is directly entering the market in 3rd position thanks to partnerships with local OEMs.

Livox's market share was 10% in 2022, thanks to the XPeng P5. The future may not be bright as XPeng chose RoboSense for its following car models.

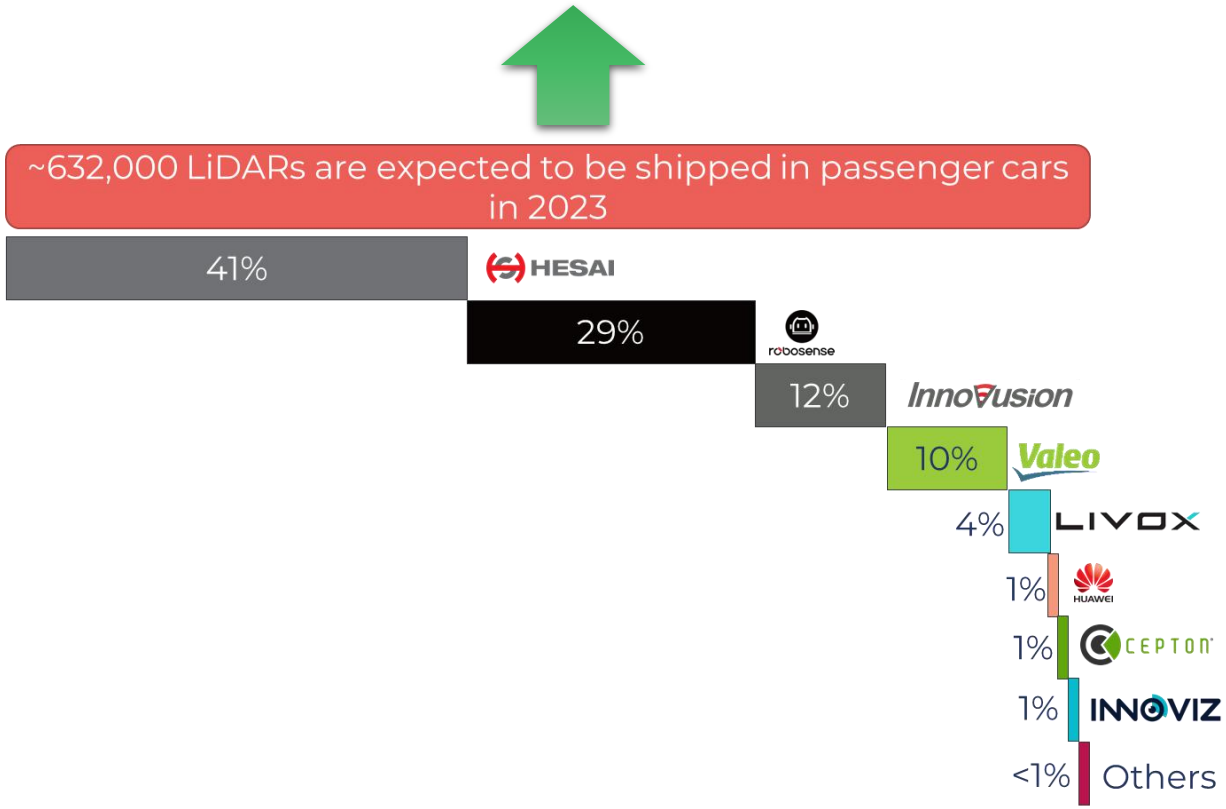
Hesai and Robosense could ship 70% of LiDAR implemented in passenger cars.

Innovusion could see its market share decrease as they only partnered with Nio.

Innoviz finally entering the market with BMW in the 7 series.

Cepton and Luminar still not delivering LiDAR.

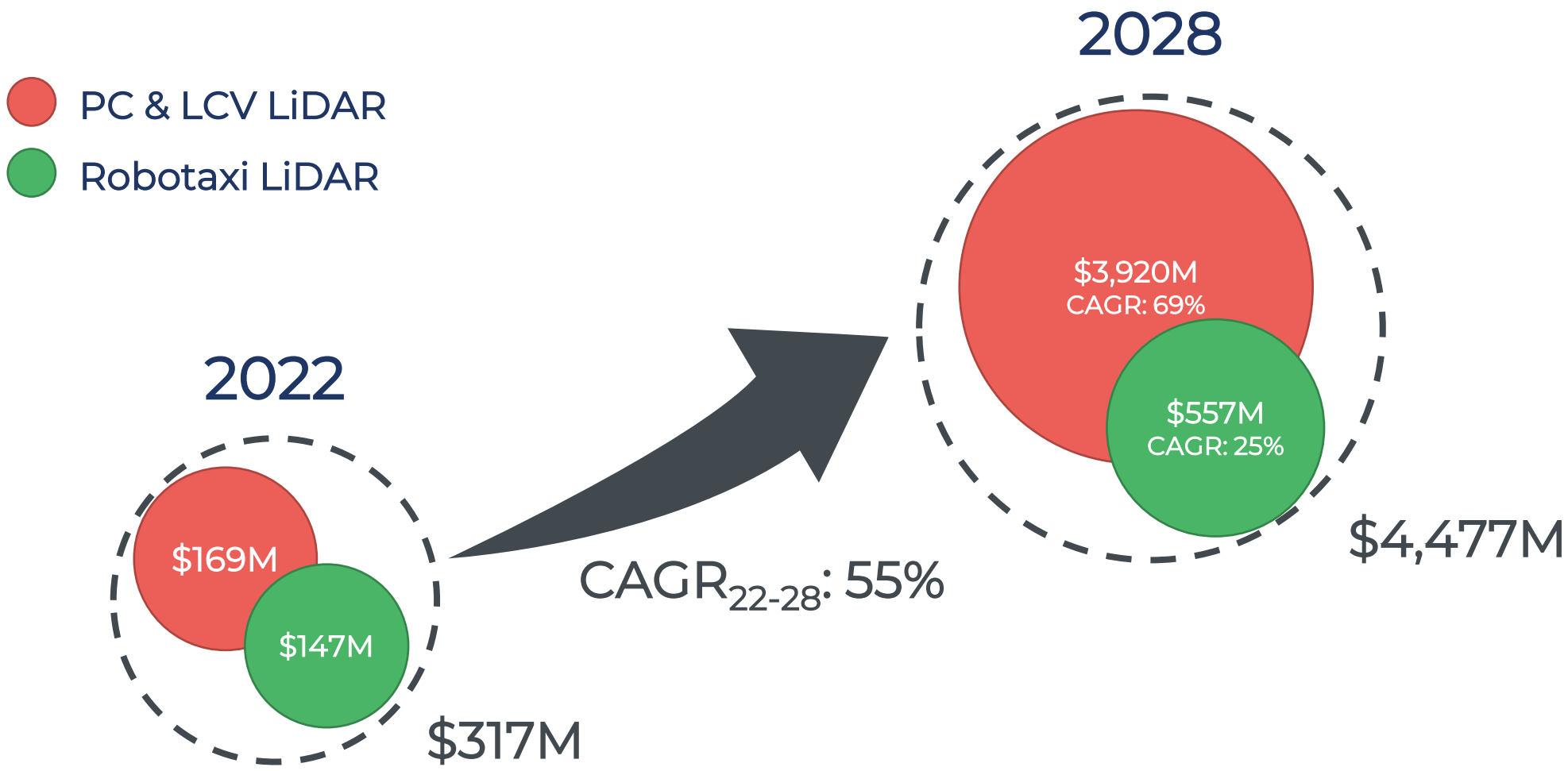
~632,000 LiDARs are expected to be shipped in passenger cars in 2023



MARKET DYNAMICS

Overview of PC & LCV and robotaxi markets

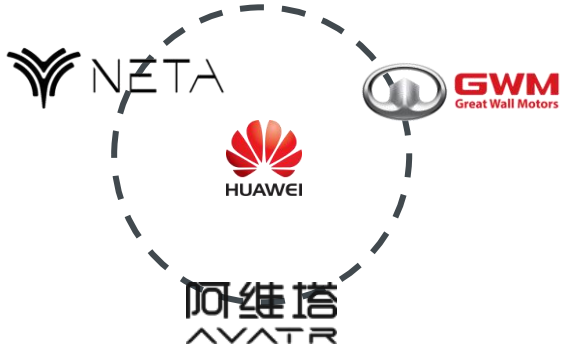
The LiDAR market for PC & LCV and robotaxis is expected to reach $4.5B in 2028 with a 55% CAGR from 2023.

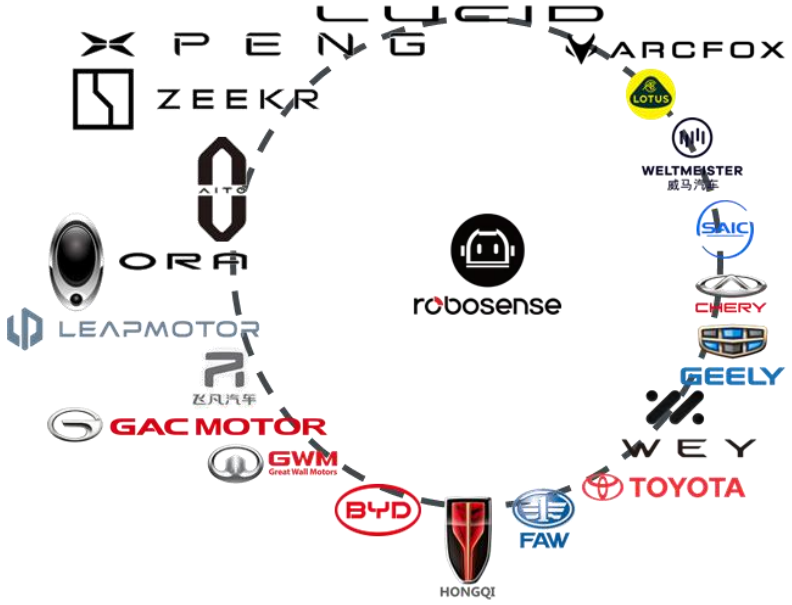


LIDAR ECOSYSTEM

Supply chain for passenger cars* - Focus on China (1/2)

Hesai and RoboSense are the two biggest Chinese LiDAR players. But the number of partnerships doesn't reflect the market reality.



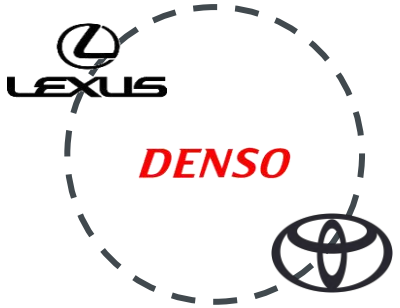


*Based on public information

LIDAR ECOSYSTEM

Supply chain for passenger cars* - Focus on the rest of the world (2/2)

Among other players, Valeo has the highest number of partnerships.



LIDAR ECOSYSTEM

Automotive LiDAR – Chinese landscape

Photodetectors

AGE OPTOELECTRONICS
YBPhotonics
amf ADVANCED MICRO FOUNDRY

ICs

FPGA

深圳市国微电子有限公司 SHENZHEN STATE MICROELECTRONICS CO.,LTD

SSMEC
(Shenzhen State Micro-electronics)

GOWIN
安路科技 ANLOGIC
华微电子 SINO-MICROELECTRONICS
云芯微电子 YUNCHIP

Amplifier

SGMICRO

ADC

北京时代民芯科技有限公司

MXTronics

ADAS Computing

Horizon Robotics
BLACK SESAME TECHNOLOGIES
blaize
HAILO Empowering Intelligence
行歌 SINGGO

LiDAR Systems

ABAX SENSING
Benewake
HESAI
LIVOX
HUAWEI
LSLIDAR
LiangDao
Tanway 探维
robosense
LuminWave
ZVISION

LiDAR Users

Automotive

XPENG
GAC MOTOR
FAW
autox
WEY
智行者 IDRIVERPLUS
WeRide 文远知行
HUMAN HORIZONS
LOTUS
AIWAYS
SAIC
AITO
ARCFOX
ZEEKR
WELTMEISTER 威马汽车
长安汽车 CHANGAN
JIDU
momenta
LEAPMOTOR
ORA
BYTON
xiaomi
ROX
Baidu 百度
GEELY
北京汽车 BAIC MOTOR
Alibaba Group 阿里巴巴集团

Laser Sources

EEL

HITRONICS
O-Net Technologies
Accelink
FOCUSLIGHT Never stop exploring

VCSEL

华芯半导体 SINOSEMIC
EVERBRIGHT
VERTILITE

Fiber laser

HITRONICS
bwt

Optical Elements

MEMS Scanners

ZhiSENSOR
WIO TECH 微奥科技
Xijing Technology

Optical Systems

HITRONICS
舜宇光学科技(集团)有限公司 SUNNY OPTICAL TECHNOLOGY(GROUP)CO.,LTD
水晶光电 科技触点·观知未来
CASTECH 福晶科技
Zhejiang Crystal-Optech

ADC: Analog Digital Converter
EEL: Edge-Emitting Laser
FPGA: Field-Programmable Gate Array
IC: Integrated Circuit
IR: Infrared
MEMS: Micro-Electro-Mechanical System
OPA: Optical Phased Array
VCSEL: Vertical Cavity Surface-Emitting Laser

TECHNOLOGY, PROCESS, & COST ANALYSIS

Examples of LiDAR teardowns

InnoVusion

Texas Instruments · VISHAY · AMD XILINX · NXP · onsemi

robosense

Texas Instruments · BROADCOM · AMD XILINX · onsemi · ANALOG DEVICES · MICROCHIP

Valeo

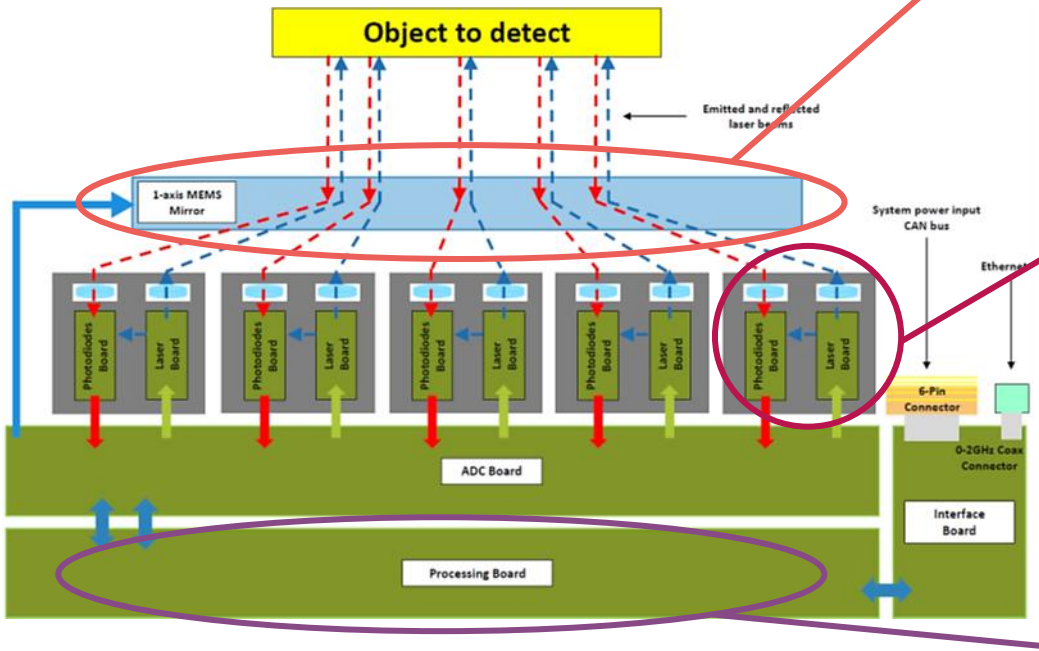
Texas Instruments · Micron · AMD XILINX · NXP · muRata

TECHNOLOGY, PROCESS, & COST ANALYSIS

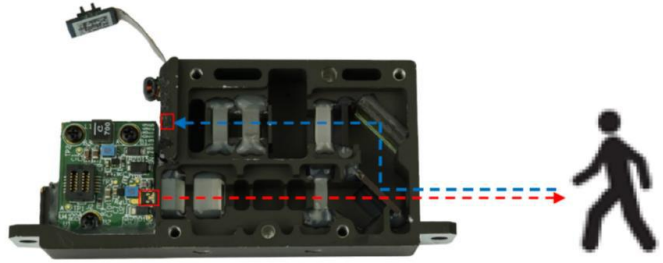
Teardown of RoboSense's RS-LIDAR-M1 (sample version)

The RoboSense M1 was the first MEMS-based LiDAR to be embedded in a car. The LiDAR also embeds SiPM as receivers instead of the APDs traditionally used by other manufacturers.

Block diagram



MEMS mirror



Optical module with both emitter and receiver

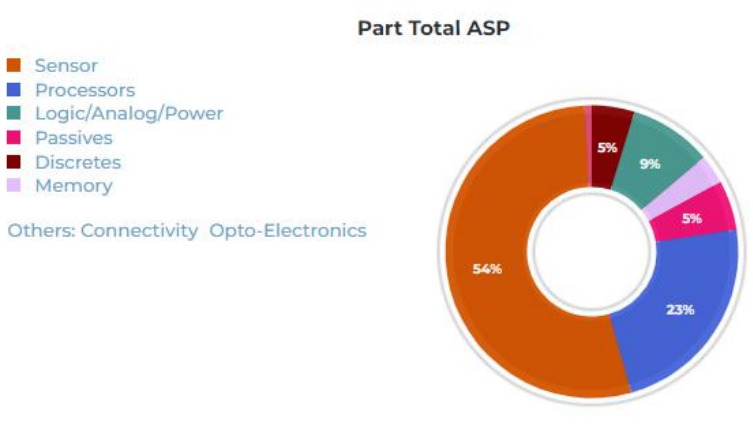
Xilinx XA Zynq UltraScale+

TECHNOLOGY, PROCESS, & COST ANALYSIS

Teardown analysis leading to cost estimation

InnoVusion

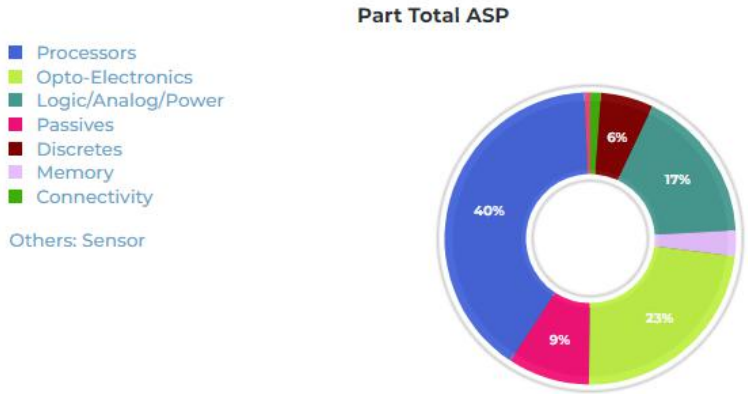
Series version from Nio ET7



Total BOM cost
316

robosense

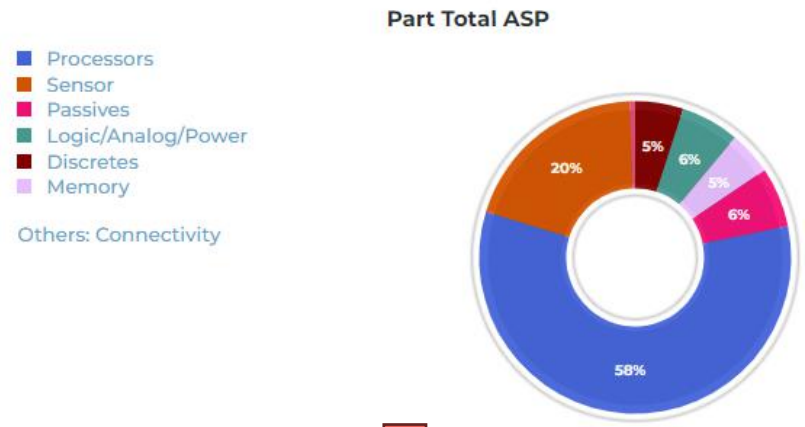
Series version on-going
Based on sample version



Total BOM cost
179

Valeo

Series version from Mercedes S-Class



Total BOM cost
100 (reference)

~X3.2

~X1.8

KEY TAKEAWAYS

- In 2022, we are now at a crossroads as passenger cars and robotaxis markets generated almost the same revenue: $169M for passenger cars and $163M for robotaxis.

- The LiDAR market is taking off:
  - 150+ design wins monitored between 2018 and 2025.
  - ~120 cars with LiDAR to be released between 2023 and 2025.
  - >100 cars will be released by Chinese OEMs.

- Strong Chinese relations between OEMs and LiDAR suppliers but when we look at the device level, most of the devices are manufactured by EU or US companies (TI, NXP, Onsemi, Osram, Xilinx…)
  - Local device manufacturers are growing, especially regarding computing and light sources.

THANK YOU FOR YOUR ATTENTION

If you have any questions, feel free to contact me by email: pierrick.boulay@yolegroup.com

This presentation was based on the following reports:

LiDAR for automotive 2023

Computing and AI for automotive 2023