

# LIDAR FOR AUTOMOTIVE AND INDUSTRIAL APPLICATIONS

## Market & Technology Report - August 2020

*LiDAR is facing headwinds and is looking for diversification.*

### WHAT'S NEW

- COVID-19 impact
- New LiDAR industrial applications
- Market technology split
- Chinese LiDAR companies
- Velodyne going public

### REPORT OBJECTIVES

- Provide market data on different LiDAR
- Key market metrics and dynamics
- Offer an application-related focus on key existing markets and the most promising emerging ones
- Furnish an analysis of the major technology trends
- Deliver a deep understanding of the LiDAR business value chain, infrastructure, and players
- Analyze the LiDAR supply chain with partnerships between OEMs, tier-1s and LiDAR manufacturers

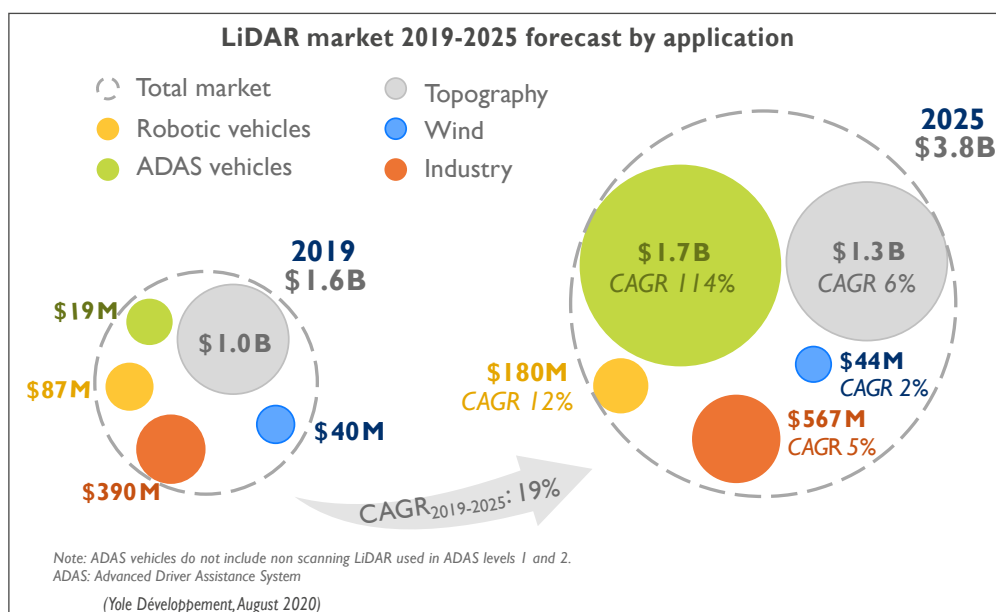
### INCREASING VOLUMES BUT DECREASING UNIT PRICES

Automotive applications are expected to be the main driver for LiDAR in the next five years, providing \$1.8B growth between 2019 and 2025. With several partnerships between LiDAR manufacturers and car manufacturers, Yole Développement (Yole) is expecting 3.2% of personal cars to adopt LiDAR by 2025. On the other hand, the impact of robotic cars on LiDAR will be more modest due to lower deployment of robotic cars than once expected. LiDAR for personal cars could also be jeopardized. The COVID-19 crisis is putting financial pressure on car manufacturers. Regulations imposing reduced carbon emissions are pushing investments towards electrification. Finally, the ambition of Tesla to rapidly achieve autonomous cars without LiDAR could make LiDAR less essential in coming years.

A new trend in the LiDAR business appeared a few years ago, which might dramatically

change the shape of LiDAR market, namely price drops. Velodyne has announced a plan to reach an average unit price of \$600 by 2024, from \$17,900 in 2017. Chinese LiDAR companies, which usually have LiDAR unit prices one-fifth of other companies and usually below \$1,000, are gaining market share and expanding their business. LiDAR with lower unit prices is expected to enter new industrial applications including factory, logistics and security. However, because of lower LiDAR unit prices, the industrial segment is expected to have moderate growth between 2019 and 2025, expanding from \$390M to \$567M.

*This comprehensive report covers market volume and value for applications in the automotive and industrial markets, broken down by several technologies, with deep analyses of players and supply chain.*



### LIDAR COULD BE ADOPTED BY MOST ROBOTS AND SMART FACILITIES

Since the 2005 DARPA (Defense Advanced Research Projects Agency) Grand Challenge, vehicles have been a major application of 3D real-time LiDAR. In 2017, Audi equipped some of its cars with the Valeo Scala, a long-range LiDAR. At the end of 2018, Waymo launched Waymo One, its robotaxi service equipped with its own mid-range and long-range LiDAR. Continental has announced short-range flash LiDAR for 2020. Aimed at Advanced Driver Assistance System (ADAS) cars, it could also equip robotaxis

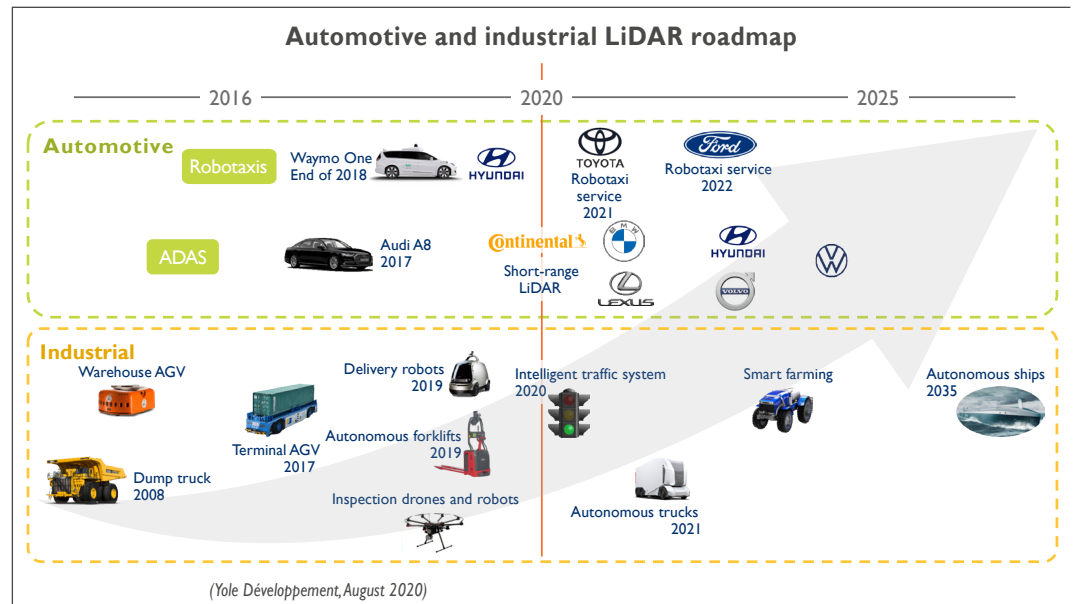
or even industrial platforms. Other LiDAR manufacturers that have partnership with car manufacturers, such as Innoviz, Velodyne and Luminar, are targeting long-range applications.

Industrial applications of LiDAR have a longer history, with topographic applications dating from 1970s. This business is well-established and operated by large companies. Mining applications started to develop in 2008 with Komatsu and Caterpillar offering autonomous dump trucks. Their positions as solution and

service providers have helped them operate these fleets. Recently many new industrial applications are emerging for LiDAR and include warehouse automated guided vehicles (AGVs), terminal AGVs, delivery robots and drones, autonomous forklifts, inspection robots and drones, intelligent traffic

systems, security and soon to come autonomous trucks and smart farming.

The report analyses the various automotive and industrial LiDAR applications with their particular timings and dynamics.



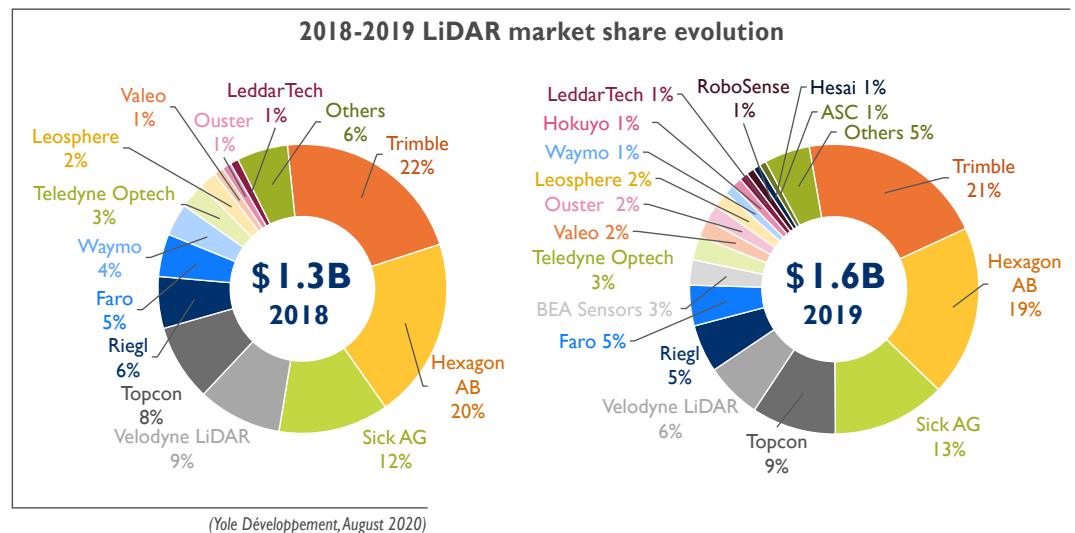
### THE LIDAR LANDSCAPE IS SHIFTING. WHO WILL HOLD ON?

The LiDAR landscape is shifting. Unit prices have been dropping and are expected to drop further in coming years. This will ease LiDAR adoption in new applications, either automotive or industrial. On the other hand, to fulfill these new applications, new LiDAR models are needed with more dedicated specifications. This particularly unstable situation is shaping the strategy of several key players.

Velodyne, inventor of the 3D real-time LiDAR in 2005, has decided to go public in Q3 2020. It has developed a strategic partnership for manufacturing with Nikon in Japan and Fabrinet in Thailand. It has acquired Mapper.ai for software development. Its strategy is to significantly reduce the LiDAR unit price to ease adoption and to release smaller and easier-to-use LiDAR.

In parallel, several Chinese LiDAR manufacturers are continuing their growth and expanding their portfolio. Hesai has more than 600 employees, Robosense more than 500, and Leishen more than 250. This has to be compared with Velodyne's 450 employees. Chinese LiDAR manufacturers do not only benefit from lower LiDAR unit prices but also from the numerous projects in China related to autonomous driving and logistics. The first autonomous port terminal happened in Qingdao, China, in 2017. Smart cities, autonomous mining equipment, and delivery robots are all happening in China.

Chinese LiDAR manufacturers are not the only ones benefiting from the growth in LiDAR market. Ouster, a California company specialized in industrial LiDAR, offers a wide range of products,



with almost 50 reference designs, based on robust technology employing VCSEL and SPAD. Their business has also started to become significant in the past year.

*The report presents market shares in automotive and industrial applications, private investment analysis, business model analysis, partnerships, and players technological positioning.*

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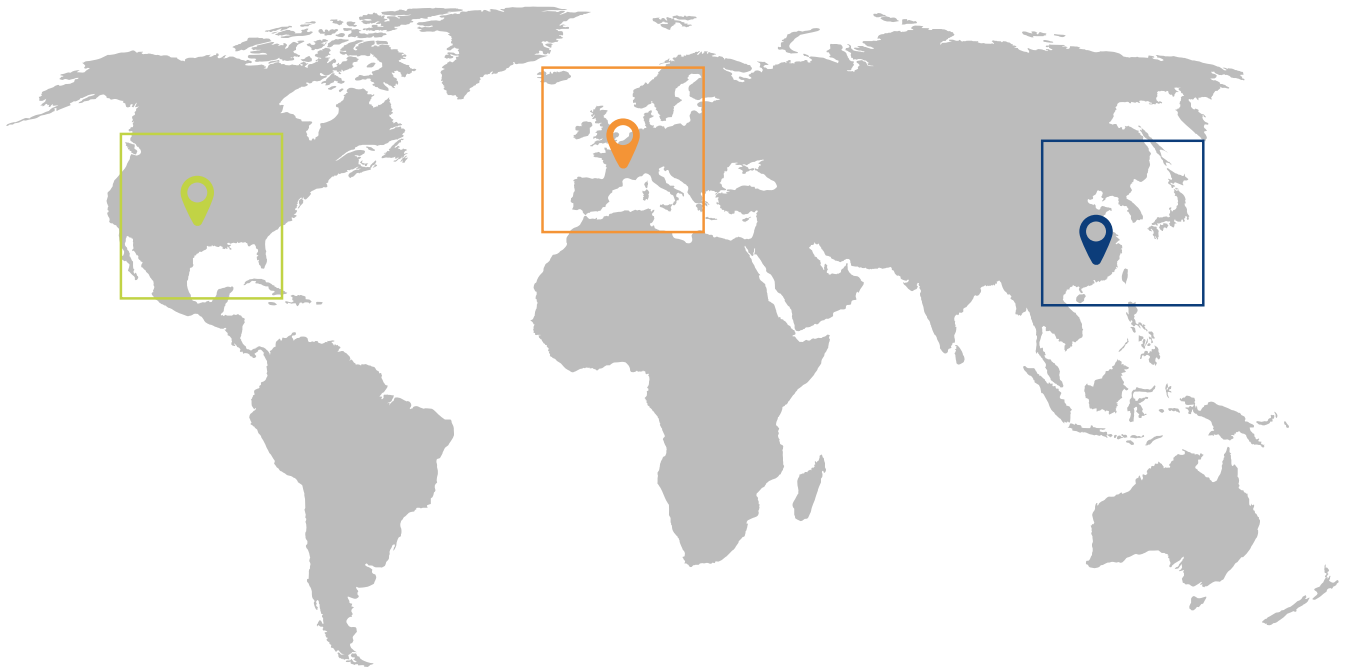
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## ABOUT YOLE DEVELOPPEMENT

Founded in 1998, Yole Développement (Yole) has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services, reverse engineering and reverse costing services. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 120 collaborators worldwide covering MEMS and Image Sensors, Compound Semiconductors, RF Electronics, Solid-state Lighting, Displays, Software, Optoelectronics, Microfluidics & Medical, Advanced Packaging, Manufacturing, Power Electronics, Batteries & Energy Management and Memory.

The “More than Moore” market research, technology and strategy consulting company Yole Développement, along with its partners System Plus Consulting, PISEO and Blumorpho, supports industrial companies, investors and R&D organizations worldwide to help them understand markets and follow technology trends to grow their business.

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