Valeo - a leader in ADAS with the only Automotive Laser Scanner in production
WAVE 1: SAFETY AND ACCIDENT REDUCTION
Active Safety comes as standard on most new vehicles
Valeo has booked €6bn+ of business on Active Safety

WAVE 2: LEVEL 2+ ADAS SYSTEMS
New businesses to be awarded all include L2+ functionality
Valeo has launched its first L2 system in 2020

WAVE 3: AUTOMATED DRIVING
New platforms from 2025 onwards are designed for AD
Valeo has contributed to the first L3 programs just being launched and offers the technology for L4
VALEO: LEADER IN PARKING, SAFETY & DRIVING AUTOMATION

30 years of innovation
15 world’s first in 10 years

1 in 4 new cars comes with Valeo ADAS technology

Broaderest perception portfolio in the industry

Making mobility safe &
more pleasant for everyone

Worldwide network of
engineers and production

>1 billion sensors shipped
>30 million systems/year
Privately Operated Vehicles (POV) Drive Market Growth

- Safety first: Vision Zero
- ADAS is accelerating
- Privately-operated vehicles will focus on Level 2+
- Affordability drives up penetration rates and generates volumes

Amount of L2/L2+ systems for POV to quadruple by 2025
SAE J3016™: LEVELS OF DRIVING AUTOMATION

<table>
<thead>
<tr>
<th>SAE LEVEL</th>
<th>ADAS</th>
<th>SAE LEVEL</th>
<th>AD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>1</td>
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<tr>
<td>2</td>
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<td>3</td>
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<td>4</td>
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<td>5</td>
<td></td>
</tr>
</tbody>
</table>

You are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering.

You must constantly supervise these support features: you must steer, brake or accelerate as needed to maintain safety.

You are not driving when these automated driving features are engaged – even if you are seated in « the driver’s seat ».

Liability passes to OEM

WITH L2+ ADAS THE DRIVER REMAINS RESPONSIBLE FOR THE DRIVING MATURITY FOR L4 REQUIRES VOLUMES WHICH ARE FOUND IN L2+
LIDAR IS A KEY ENABLER FOR SAFE AUTOMATED DRIVING

Valeo SCALA™ can detect:
- overhead objects
- road debris
- road markings
- offset static objects
LEVEL 3 SYSTEMS ARE ENTERING THE MARKET IN THE PRIVATELY OPERATED VEHICLES SEGMENT – ENABLED BY LIDAR

- Audi
- Mercedes • L3 in 2021
- Honda • L3 in 2021
- Lexus
- Great Wall • L3 in 2022
- Volvo • L3 in 2022
**LIDAR APPLICATIONS ACROSS VARIOUS MOBILITY SECTORS**

<table>
<thead>
<tr>
<th>Privately operated Vehicle</th>
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<td>Level 3</td>
<td>Level 4</td>
<td>Level 4</td>
<td>Level 4</td>
</tr>
</tbody>
</table>

- **FRONT**
- **SIDE**
- **REAR**

Two main sensor designs able to cover most needs across different sectors.

- **Long-range, >100° FoV, high resolution**
- **Short-range, 180° FoV, medium resolution**
The “AD Problem” is complex
- Market delays
- Raised sensing expectations

LiDAR “real” capabilities have limits
- Safety & availability trade-off
- All-conditions performance

Multiple usages drive LiDAR market
- Reference systems
- Delivery droids
- Robotaxis, robotrucks
- Private autonomous vehicles

Ongoing convergence between market expectations and technology capability
## The Challenge: Automotive Grade Technology

<table>
<thead>
<tr>
<th>Manufacturing</th>
<th>supplier management</th>
<th>process validation</th>
<th>end-of-line testing</th>
<th>process stability</th>
<th>traceability</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Validation</td>
<td>virtual testing</td>
<td>HiL / SiL</td>
<td>lab test test track</td>
<td>real world testing</td>
<td>all seasons worldwide</td>
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<tr>
<td>Development Process</td>
<td>requirement engineering</td>
<td>project management</td>
<td>SOTIF</td>
<td>functional safety</td>
<td>respect deadlines</td>
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<tr>
<td>Software Engineering</td>
<td>sensor control</td>
<td>service functions</td>
<td>calibration</td>
<td>point cloud</td>
<td>object identification</td>
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<tr>
<td>Sensor Design</td>
<td>mechanical robustness</td>
<td>EMC compliance</td>
<td>temperature range</td>
<td>durability</td>
<td>automotive components</td>
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<tr>
<td>Performance</td>
<td>perception range</td>
<td>field of view</td>
<td>resolution</td>
<td>accuracy</td>
<td>frame rate</td>
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<tr>
<td>Basic Requirements</td>
<td>cost</td>
<td>package size</td>
<td>vehicle integration</td>
<td>scalability</td>
<td>credibility</td>
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</tbody>
</table>

Stringent standardization required to achieve predictable and robust results
### THE CHALLENGE: AUTOMOTIVE GRADE TECHNOLOGY

<table>
<thead>
<tr>
<th>Manufacturing</th>
<th>System Validation</th>
<th>Development Process</th>
<th>Software Engineering</th>
<th>Sensor Design</th>
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<tbody>
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<td>supplier management</td>
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<td>free space</td>
<td>road markings</td>
<td>noise suppression</td>
<td>static objects</td>
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<tr>
<td>virtual testing</td>
<td>HIL / SiL</td>
<td>lab test test track</td>
<td>pre processing</td>
<td>dynamic objects</td>
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<td>range estimation</td>
<td>blockage detection</td>
<td>end of line calibration</td>
<td>map matching</td>
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<td>interference suppression</td>
<td>rain spray detection</td>
<td>online calibration</td>
<td>accuracy</td>
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<td></td>
<td>heating &amp; cleaning control</td>
<td>OTA capability</td>
<td>misalignment detection</td>
<td>scalability</td>
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Stringent standardization required to achieve predictable and robust results
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<th>Performance</th>
<th>Manufacturing</th>
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<tbody>
<tr>
<td>statistical model</td>
<td>virtual testing</td>
<td>HiL / SiL</td>
<td>lab test</td>
<td>real world</td>
<td>all seasons</td>
<td>supplier management</td>
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<td>scenario database</td>
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<td>test track</td>
<td>testing</td>
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<td>end-of-line testing</td>
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<td>ground truth extraction</td>
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<td></td>
<td>process stability</td>
</tr>
<tr>
<td>data management</td>
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Stringent standardization required to achieve predictable and robust results
## THE BENEFITS: AUTOMOTIVE GRADE PRODUCT & PROCESS

### Reliable Product
- Over environmental conditions
- Over personal vehicle lifetime
- Built-in service functions to maximize availability
- Compliant with safety requirements and various stringent qualifications

### Reliable Production
- Stable industrial setup
- Secured large scale capacity
- Robust supply chain

### Reliable Teams
- Stable and competent base
- Worldwide footprint
- Able to support solving use case across mobility sectors

### Reliable Prices
- Design to cost to address automotive business constraints
- Driven by personal vehicles volumes
  - Production on large scale assembly lines

---

**Scalable solutions available for the whole transportation industry**
VALEO SCALA™ 3D LASER SCANNER

Launch of 2\textsuperscript{nd} generation in 2021

Over 125,000 SCALA™ on the road worldwide

Optimized for privately operated vehicle use cases

Fully compliant with automotive requirements

World’s only automotive grade 3D lidar since 2017
## VALEO LIDAR PORTFOLIO

<table>
<thead>
<tr>
<th>SCALA™ Gen. 2</th>
<th>Near-field Lidar (NFL)</th>
<th>Mobility Kits</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Up to 200 meter range (car)</td>
<td>- Up to 30 meter range (car)</td>
<td>- Sensors, SW Tools, Functions</td>
</tr>
<tr>
<td>- 133 x 10° field of view</td>
<td>- 100 x 80° field of view</td>
<td>- Automotive grade quality</td>
</tr>
<tr>
<td>- Up to 0.125° horizontal resolution</td>
<td>- 0.4 x 0.4° resolution</td>
<td>- Easy to Use (plug &amp; play)</td>
</tr>
<tr>
<td>- 16 vertical planes</td>
<td>- iToF Flash lidar</td>
<td>- Flexible configurations</td>
</tr>
<tr>
<td>- 25 Hz update rate</td>
<td>- 25 Hz update rate</td>
<td>- Raw Data output</td>
</tr>
<tr>
<td>- 107 x 94 x 65 mm</td>
<td>- 60 x 91 x 47 mm</td>
<td>- Open interfaces</td>
</tr>
<tr>
<td>- Point cloud or Object interface</td>
<td>- Point cloud interface</td>
<td>- From single parts to thousands</td>
</tr>
</tbody>
</table>

<< €900 at volume  \< €200 at volume

The right lidar solution for applications across automotive and mobility sectors

Contact: cda.valeo-mobilitykits.mailbox@valeo.com
CARS IN 2025+ WILL BE DESIGNED FOR AUTONOMY

OEMs are significantly changing the E/E architecture

- **DECENTRAL**
  - Intelligent sensors
  - Heavy wiring
  - Flexibility

- **DOMAIN + ZONE**
  - Synergies
  - Computing cluster
  - Service Orientation

Opportunities for Valeo in different Products

- Interior Interface Module
- Domain Controllers
- Zonal Controllers
- Connectivity Module

Opportunities for Valeo in different Products
CDA PRODUCTS AND SERVICES | ADAPTED TO CUSTOMER NEEDS

- **Solutions**: Cross-Domain Solutions and Digital Services
- **Systems**: Turn-key System integration. Regional teams with transversal competence
- **Software**: Software-as-a-Product, e.g. ADAS/AD functional platforms
- **Components**: Industrial Product Lines with global footprint

- Vision Sensors
- Ranging Sensors
- Domain Controller
- Telematics
- Head Up Display
- Instrument Cluster
- Interior Radar
- Driver Monitoring Camera
- Interior Radar
Automotive grade quality is key for any automated driving application

Automotive quality is not easily achieved and requires hard work and above all experience

The world’s only truly automotive grade 3D lidar comes from Valeo

Valeo lidar solutions cover the key needs across different mobility sectors
A Leader in ADAS

Most comprehensive sensor portfolio in the industry

Scalable system platforms with re-usable hardware and software modules

1. 1 in 4 new vehicles already come with a Valeo ADAS system

2. >11bn€ Order Intake over the past 3 years

3. 1st Stand-Alone Level 2 based on camera-only technology

4. 1st AI Driver Monitoring with driver distraction & drowsiness detection

22,100 Employees
18 Countries
7,000 Research & Development
3,900 System & Software

2019 Figures
## LIDAR APPLICATIONS ACROSS VARIOUS MOBILITY SECTORS

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**FRONT**

- **Short-range, 180° FoV, medium resolution**
- **Long-range, >100° FoV, high resolution**

**SIDE**

- Two main sensor designs able to cover most needs across different sectors

---

*VALEO RESERVED*
Driverless Vehicles focus on Commercial Services

- Transportation of people and goods will first adopt L4 automation
- Automation becomes a business case, rather than a customer feature
- Uncertainty of regulatory and liability frameworks slows broad deployment

“Tier-1 suppliers like Valeo are also helping us get up and going.”
(John Krafcik at IAA 2019)
Platforms Generate Economies of Scale

**INTERIOR COCOON**  
Driver and cabin monitoring

**EXTERIOR COCOON**  
Perception and Situational Awareness

Valeo supports both pillars with our platforms for Automated, Connected, UX solutions
Powerful SOCs move the goalposts

- Silicon integration pushes chipmakers up the value chain
- We have built successful co-operations in the ADAS and Connectivity space
- We provide the broadest sensor portfolio in the market complemented by SW stacks

Established players in the western hemisphere... ... agile ecosystem / favourable government

Valeo has built global partnerships and local presence to add value as an integrator
Addressing New Value Spaces:
Smart Mobility is More Than Cars

- CES 2020 Demos:
  - eDeliver4U with Meituan
  - Mobility kit with TwinsWheel
- Cooperation with shuttle-makers
- Expand into cyber-services, localization, smart infrastructure etc.
30 YEARS OF VALEO INNOVATION IN ADAS

- Ultrasonic Parking Aid 1991
- Mirror-integrated Rain Sensor 1995
- Lane-Departure Warning 2004
- Multi-beam Radar 2006
- Cross Traffic Alert 2009
- Rear Camera w/ distance overlay 2006
- S-camera Surround View 2009
- Parking Aid w/ flankguard 2011
- Seamless Top View 2010
- Perpendicular & Braking Park Assist 2010
- 3D Surround View w/ obj. detection 2015
- Multi-function Front Camera 2015
- Hidden ultrasonic installation 2015
- Parking Domain ECU 2016
- Park Assist w/ remote option 2016
- Parking Aid & Park Assist 2017
- Map-based Park Assist 2015
- 5-camera Surround View 2009
- Seamless Top View 2010
- Cross Traffic Alert 2009
- Rear Camera w/ obj. detection 2013
- Invisible Trailer rear view 2019
- Laser Scanner w/ increased vFoV 2020
- Front Camera w/ 100° lens 2020
- Camera Design for high resolution 2021
- New ultrasonic Sensor Interface 2021
- New vision/fusion based features 2021
- 3D Surround View w/ obj. detection 2015
- Vision-only L2 driving function 2019
- Invisible Trailer rear view 2019
- Camera Design for high resolution 2021
- New Ultrasonic Sensor Interface 2021
- 3D Surround View w/ obj. detection 2015
- Vision-only L2 driving function 2019
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THIS IS JUST THE BEGINNING

1 billion ADAS sensors in the last 30 years, another billion in the next 5 years

Source: Valeo market estimation