Trends in the Automotive Industry
Industry Trends

- Driving Safety
- Automated Driving
- Electric Mobility
- Digitalization
- Connectivity
Assisted to Automated Driving: The Safety Story
Traffic Fatalities

Still more than 1.2 Million traffic fatalities per year
In 2015, there were over 32,000 crashes and 35,000 fatalities in the United States.
Safety Technologies are the Main Drivers in Reducing the Number of Traffic Fatalities

Installation Rollout of Safety Technology / FMVSS Effectiveness

- 3 point seat belts
- NHTSA related improvements
- Electronic Stability Control
- Front Air Bags
- Side Air Bags

*Lives to be saved

Assisted & Automated Driving

* Fatality data beyond 2015 is hypothetical for illustrative purposes only
The Safety Basics
If a car assists you, or drives you automatically, it must:

- **SENSE**
  - IDENTIFY & INTERPRET

- **PLAN**
  - DECIDE & CONTROL

- **ACT**
  - EXECUTE

- **SURROUND MODELING**
- **MOTION PLANNING**
- **MOTION EXECUTION**
Automated Driving
Level 2 and beyond

Brain on
Level 0
Driver Only
Level 1
Assisted
Level 2
Partial Automation
Level 3
Conditional Automation
Level 4
High Automation
Level 5
Full Automation
Brain off

Level of automation terms acc. to SAE J 3016

Continental

Space for Sender Information
Confidential
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**Automated Driving Challenges..**

<table>
<thead>
<tr>
<th>Low sight</th>
<th>Pedestrians on the road</th>
<th>Merging lanes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sudden icy road</td>
<td>Animals</td>
<td>Tight lanes</td>
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<tr>
<td>Aquaplaning</td>
<td>Traffic light recognition</td>
<td>Toll stations etc.</td>
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<tr>
<td>Difficult lane markings</td>
<td>Lane change</td>
<td>Driver Take Over</td>
</tr>
<tr>
<td>Small stationary objects</td>
<td>System Failure</td>
<td>End of use case detection (system boundaries)</td>
</tr>
</tbody>
</table>

The list goes on…
Redundancy of sensor data will enable safe Highly Automated Driving

<table>
<thead>
<tr>
<th>Detection</th>
<th>Camera</th>
<th>RADAR</th>
<th>LiDAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color / Light</td>
<td>+</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Weather Robustness</td>
<td>0</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>Velocity Accuracy</td>
<td>-</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>Angle Resolution</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Object Contour</td>
<td>0</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Road Surface</td>
<td>0</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Range Accuracy</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Day vs Night</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Detection Reliability</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
High-Resolution 3D Flash LIDAR

Single laser pulse to illuminate all pixels per frame
Laser pulse return is focused through lens onto the 3D focal plane array

Imaging through obscuration

Camera

3D Flash LIDAR
Comprehensive Environment Model
Entire description of driving environment

Traffic Participants
Static Environment
Road Model
Traffic Control Info
Localization

Driving Functions
Highly Automated Driving @ Continental
On the road since 2011
Continental
Worldwide development of automated driving

Current testing regions worldwide
Vision Zero
Thank you for your attention!