Challenges To The Future of Mobility

Jeff Klei, President North America, Continental
Center for Advanced Automotive Technology Conference
May 6, 2016

www.continental-corporation.com
## Continental Corporation
### Five strong divisions

<table>
<thead>
<tr>
<th><strong>Chassis &amp; Safety</strong></th>
<th><strong>Powertrain</strong></th>
<th><strong>Interior</strong></th>
<th><strong>Tires</strong></th>
<th><strong>ContiTech</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Dynamics</td>
<td>Engine Systems</td>
<td>Instrumentation &amp; Driver HMI</td>
<td>PLT, Original Equipment</td>
<td>Air Spring Systems</td>
</tr>
<tr>
<td></td>
<td>Fuel &amp; Exhaust Management</td>
<td>Commercial Vehicles &amp; Aftermarket</td>
<td>Commercial Vehicle Tires</td>
<td>Elastomer Coatings</td>
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<td>Two Wheel Tires</td>
<td>Fluid Technology</td>
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<td>Power Transmission Group</td>
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<td></td>
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<td></td>
<td></td>
<td>Vibration Control</td>
</tr>
</tbody>
</table>

*PLT – Passenger and Light Truck Tires*
We Shape the Megatrends in the Automotive Industry: Safety, Environment, Information, Affordable Cars

Doing more.
For safe mobility.

Doing more.
For intelligent driving.

Doing more.
For clean power.

Doing more.
For global mobility.
Global Industry Mega Trends

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**Social Megatrends**

**Urbanization**

- Urban population: ~9.7 bn. (2050)
- Urban population: ~10 bn. (2060)

- Rural population: ~2.8 bn. (1950)
- Rural population: ~10 bn. (2060)

Population in billion inhabitants:
- 1950: ~2.8 bn., ~70%
- 2015: ~7.2 bn., ~46%
- 2050: ~9.7 bn., ~34%
- 2060: ~10 bn., ~70%
Rising sea level by...
~13 ft. / 4m at +2°C: affects over 100 mio. people
~23 ft. / 7m at +4°C: affects over 500 mio. people

Source: http://burnanenergyjournal.com
Social Mega Trends
New Dimension of Driving

Annual Global Light Vehicle Production 2000-2020 in millions of vehicles

Average Annual Growth

Europe -
North America -
South America -
Asia\Pacific -
Africa -

2001  2003  2005  2007  2009  2011  2013  FC11+1 B2017 B2019
55    59    64    69    58    77    84    87

+2,9%
+3,1%
~101

Annual Global Light Vehicle Production 2000-2020 in millions of vehicles

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7
Over 1.2 million die in traffic accidents every year. An additional 50 million are injured.

<table>
<thead>
<tr>
<th>Region</th>
<th>Fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Americas</td>
<td>142,252</td>
</tr>
<tr>
<td>Africa</td>
<td>232,768</td>
</tr>
<tr>
<td>Eastern Mediterranean</td>
<td>175,668</td>
</tr>
<tr>
<td>Europe &amp; Russia</td>
<td>285,020</td>
</tr>
<tr>
<td>South East Asia</td>
<td>278,321</td>
</tr>
<tr>
<td>Western Pacific</td>
<td>232,768</td>
</tr>
</tbody>
</table>


1) Data (except as otherwise noted) is from NHTSA report DOT HS 812 032 "Traffic Safety Facts 2012" | 2) 2013 data is a NHTSA “Early Estimate” | 3) Data prior to 1966 is based on historical NHTSA and FHWA Data
"Vision Zero“ is Possible
Traffic Accidents Belong In A Museum!

Safety technology in motor vehicles vs. road fatalities
Development in USA

No. of road fatalities in 1,000

Source: KBA
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Impact on the Automotive Industry
Automotive Industry
Megatrends as Innovation Drivers

› Efficiency
  › EV/HEV
  › 48 Volt
  › Start-Stop
  › Exhaust Aftertreatment
  › Fuel Injection Systems
  › Engine components
  › Lightweight components

› Safety
  › Automated Driving
    › Driver Assistance System:
      — Blind spot detection
      — Lane keeping assist
      — Emergency brake assist
    › Tires

› Information Management
  › eHorizon
  › Intelligent Transportation System
  › Networking Vehicles and Intelligent Infrastructure
  › Mobility Solutions inside and outside the vehicle
Social Mega Trends
Traditional Business Models Are Being Tested

- Uber vs. Taxi
- Airbnb vs. Hotel Industry
- Car2Go vs. Auto Rental
- Booking vs. Travel Agencies
- Amazon vs. Brick & Mortar
- Delivery Hero vs. Delivery Service
New Entrants into the Industry

...plus others yet to come
GM - New Car Sharing Business Models

$500mio. Investment “Service Provider”

$1bn. Acquisition “AD Know How & IP”

Car Sharing Service Pilot program

New York City Car Sharing Service

(1) Autonomous Driving
(3) By End of 2017
(2) Michigan and Israel
(4) SAE Level 4 – highway, up to 50k veh p.a.
Automated Driving – A Roadmap to Zero Accidents
When we talk about DRIVING, we talk about ...

The absolute basis for the introduction of Automated Driving is ...

Driving Safety
“It’s really hard to design products by focus groups. A lot of times, people don’t know what they want until you show it to them.”

The Three Pillars of Automated Driving
More safety, comfort and efficiency

Safety
› Less accidents
› Convenient ride

Comfort
› Personal mobility
› Private space
› Freedom of time utilization

Efficiency
› Smooth traffic flow, less fuel consumption
Levels of Automated Driving
Evolution of AD driving functions

- **Level 0**: Driver Only
- **Level 1**: Assisted
- **Level 2**: Partial Automation
- **Level 3**: Conditional Automation
- **Level 4**: High Automation
- **Level 5**: Full Automation

Driver only: Chauffeur
Assistant: Companion
Pilot: Chauffeur

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FULLY AUTOMATED
- Monitoring of the system not required
- Driver does not need to be able to take over the driving task
Example: Highway driving up to 130 km/h

HIGHLY AUTOMATED
- Monitoring of the system not required
- Driver needs to be able to take over the driving task with lead time
Example: Stop-and-go (highway)

PARTIALLY AUTOMATED
- Monitoring of the system required
- Driver needs to be able to take over the driving task at any moment
Example: Stop-and-go up to 30 km/h
Continental – “In the Automated Driver’s Seat!”
Working Together
Continental is the Systems Integrator

Connected Vehicle

System integration, vehicle systems and components
Data compression and data security
Processing large amounts of data
High precision and cloud-based digital map data
Our Taxi to the Future has Started Already
Driver assistants help us while we drive
Joint Activities for Corporate Success
Technology Leadership Towards Automated Driving

- Stereo Camera
- Short / Long Range Radar
- Flash-Lidar
- Surround View
- Domain Control Unit
- Powertrain Management
- Antenna Module
- Car2x - MK2xPro
- Backend Services
- Fail Operational Brake
- Driver awareness
- Driver HMI
- Software - Continental
- Elektrobit - Software

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Historical Highlights of Automated Driving

DARPA Urban Challenge

DARPA Grand Challenge: In 2007, the driverless Chevy Tahoe "Boss" was the first to cross the finishing line, assisted by Continental technology.

Using a USB stick the team had just five minutes to configure ten high-performance computers so that the route could be calculated.
Learning through Highly Automated Driving Systems

Now Testing on Three Continents

First automotive supplier to receive AD testing license

Cross-country tours completed in 2012

Production sensors and actuation systems included

> 65,000 miles

2nd Generation with redundant safety architecture
Where are the Challenges?
It’s more than just technology that drives automation

Legislative & Regulatory action
Industry Standards
Auto Insurance
Cyber Security & Privacy
Consumer Acceptance & Trust
Infrastructure
Societal Impacts
Thank you for your attention!