With SensePlanAct towards Vision Zero

Ralph Lauxmann, Senior Vice President Systems & Technology, Member of the Management Board, Continental Chassis & Safety Division
Continental Corporation
Overview

- Since 1871 with headquarters in Hanover, Germany
- Sales of €38.1 billion LTM¹
- 208,138 employees worldwide
- More than 300 locations in 53 countries

¹ Last Twelfth Months (October 2014 – September 2015)
Continental Corporation
Five Strong Divisions

Chassis & Safety
- Vehicle Dynamics
- Hydraulic Brake Systems
- Passive Safety & Sensorics
- Advanced Driver Assistance Systems (ADAS)

Powertrain
- Engine Systems
- Transmission
- Hybrid Electric Vehicle
- Sensors & Actuators
- Fuel & Exhaust Management

Interior
- Instrumentation & Driver HMI
- Infotainment & Connectivity
- Intelligent Transportation Systems
- Body & Security
- Commercial Vehicles & Aftermarket

Tires
- PLT, Original Equipment
- PLT, Repl. Business, EMEA
- PLT, Repl. Business, APAC
- Commercial Vehicle Tires
- Two Wheel Tires

ContiTech
- Air Spring Systems
- Benecke-Kaliko Group
- Compounding Technology
- Conveyor Belt Group
- Elastomer Coatings
- Fluid Technology
- Power Transmission Group
- Vibration Control

APAC: Asian Pacific American Coalition, EMEA: Europe, Middle East and Africa, PLT: Passenger and Light Truck Tires
Chassis & Safety Division
93 Locations in 20 Countries
Safe and Dynamic Driving

Towards VISION ZERO

ZERO ACCIDENTS
ZERO INJURIES
ZERO FATALITIES

Plan
Sense
Act
The Evolution of Vehicle Safety Technologies
Fatal Accidents in Germany 1953-2013*

* Federal Statistics Office, Germany (Destatis);
ABS - Anti-lock Brake System, ESC - Electronic Stability Control , EBA - Emergency Brake Assist, ACC - Adaptive Cruise Control, LDW - Lane Departure Warning
Crash Causation

95% of all road accidents involve some human error, in 76% of the cases the human is solely to blame

Misjudging, driving dynamics, weather: 50%

Distraction: 38%

39% of passenger vehicles and 26% of trucks do not activate brakes before a collision, some 40% more do not brake effectively

Underlying causes: alcohol, inexperience and tiredness

Status Quo of Vehicle Safety
“Safety Benefits” of ADAS

“ESC could save yearly up to 4,000 lives in Europe”
Institute for Transport Economics at University of Cologne, ESC Cost Benefit Study, 2007

“28% less rear-end collisions with personal injury”
Study by German Insurance Association, Demonstration von Notbrems- & Auffahrwarnsystemen, 2009

“8% less accidents when changing lanes on motorways”

“15% less deaths on European roads”
eIMPACT, Impact Assessment of Intelligent Vehicle Safety Systems, 2008
Safety for Everyone in North America
OEM Commitment: AEB Standard Fitment on All New Vehicles

› Ten major vehicle manufacturers have committed to making automatic emergency braking (AEB) a standard feature on all new vehicles built

http://www.nhtsa.gov/About+NHTSA/Press+Releases/nhtsa-iihs-commitment-on-aeb-09112015
AEB: Autonomous Emergency Braking, OEM: Original Equipment Manufacturer
Euro NCAP 2020 Roadmap
Overview

Occupant Protection
- Include 6y & 10y child dummy in front/side crash tests
- Seat belt reminder on rear seats demanded
- Far side tests for driver and front passenger
- Offset front impact protection in crash tests

AEB (C2C & VRU)
- Guidelines on safety critical HMI
- AEB for powered two-wheelers (motorcycles)
- AEB C2C
  - Angular Offset
  - Lateral Offset
  - Cut-In
- AEB VRU
  - Pedestrians & bicycles
  - Daylight & obscure lighting
- AEB Intersection
  - Crossing traffic
  - Turn into traffic
  - Oncoming

Lateral Assist
- Lane Keeping Assist (LKA) assessment
- Extend LKA-test including
  - Unintended road departure
  - Critical lane change
  - Head-on collisions (narrow off-set)

Speed & impaired Driving
- Update Speed Assistance (SAS) protocol to include
  - Traffic signs
  - Conditional speed limit
  - Digital map
- Reward for virtual co-pilot
  - Driver support technologies
  - Driver state monitoring
- Reward + Campaign for partial automated driving

AEB: Autonomous Emergency Braking
C2C: Car-to-Car, HMI: Human Machine Interface
NCAP: New Assessment Program
VRU: Vulnerable Road Users
Official Partner of the “Stop the Crash” Campaign
GLOBAL NCAP – 2015 until 2018

Divisions Tires and Chassis & Safety are Official Partner of the Global NCAP “Stop the Crash” Campaign together with other leading Automotive Suppliers

› **Targets:**
  Create awareness of leading crash avoidance technology in emerging markets
  Increase customer demand for vehicles to be equipped with these technologies

› **Technology focus:** ESC, AEB, Motorcycle ABS + Tire Pressure & Tread Depth

› **Campaign focus** are the emerging markets, focus of our own participation will be on markets that will integrate this cooperation into their own local activities

› **Timing:** Kick-off mid of Nov 2015 in Brazil, two technology demo events p.a.

› **Plan 2016/2017:** Malaysia, Mexico, India, China

[www.stopthecrash.org](http://www.stopthecrash.org)
Our Core Competencies along the Chain of Effects
If a Car Assists you or Drives you Automatically, it has to...

Sense its environment & vehicle's current state...
Plan its actions...
Act using the car's actuators and control systems!

Division Chassis & Safety
Public
9 November 2015
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SensePlanAct
Integrated Active & Passive Safety Technologies for each Stage

Sense
Selected product technologies
for vehicle status and vehicle environment sensing
## ADAS Product Segments 1/2

### Radar

**Functions:**
- Adaptive Cruise Control
- Emergency Brake Assist
- Forward Collision Warning
- Blind Spot Detection
- Lane Change Assist
- Rear Cross Traffic Alert

**Products:**
- Long Range Radar LRR (77GHz)
- Short Range Radar SRR (24GHz)

### Camera

**Functions:**
- Intelligent Headlamp Control
- Lane Departure Warning
- Lane Keeping Support
- Traffic Sign Assist
- Forward Collision Warning
- Emergency Brake Assist
- Road Profile Estimation

**Products:**
- Mono Camera
- Stereo Camera

### Lidar

**Functions:**
- Emergency Brake Assist - City
- Emergency Brake Assist - Urban
- Emergency Brake Assist - Pedestrian
- Crash Imminent Braking

**Products:**
- Short Range Lidar Sensor
- Multi Function Camera with Lidar
ADAS Product Segments 2/2

Surround View

Functions:
› 2D Surround View
› 3D Bowl Surround View
› Automated Parking
› Trailer Reversing
› Auto Trailer Hitching
› Object/Pedestrian Detection with Warning
› Blind Spot Warning
› Lane Departure Warning

Products:
› Surround View Camera
› Surround View ECU

Rear View

Functions:
› Parking Support (Warning)
› Trailer Reversing
› Auto Trailer Hitching
› Object/Pedestrian Detection with Warning
› Blind Spot Warning

Products:
› Intelligent Rear View Camera

Mirror Replacement

Functions:
› Object Detection with Warning
› Blind Spot Warning
› Lane Detection

Products:
› Mirror Camera
› Mirror Camera - Truck
Sense – Advanced Driver Assistance Systems
From Basic to Complex Scenarios; from Single to Networked Systems
SensePlanAct
Integrated Active & Passive Safety Technologies for each Stage

Plan
Selected product technologies for action planning and selection
Plan – Further Development of Passive Safety towards Vision Zero

Applications

› Front, side, rear, driving dynamics, PreCrash and roll over sensing

› Pedestrian protection

ACU: Airbag Control Unit, gSAT: Crash Satellite, PPS: Pedestrian Protection System, pSAT: Pressure Satellite, SCU: Safety Control Unit, SDCU: Safety Domain Control Unit, SPEED: Safety Platform for Efficient & Economical Design
SensePlanAct
Integrated Active & Passive Safety Technologies for each Stage

Act
Selected product technologies for action implementation.
ESC responds within milliseconds and stabilizes the vehicle through wheel-specific brake intervention and adjustment of the engine torque.
Advanced Driver Assistance Systems

Market Drivers

Increasing Installation Rate

Consumer Ratings & Legislation

Increasing Automation

Technology Migration

Full Automation

Conditional/High Automation

Partial Automation

Assisted

Time

Division Chassis & Safety
Public

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Growth Opportunities in the Automotive Group

Complexity Challenge

In total:

- more than 170 Sensors
- up to 90 ECUs
- more than 150 Actuators

Growing complexity in all domains and additionally:

- ECUs² interact via bus systems
- Functions are distributed over several ECUs²
- Different (black-box) SW¹-Moduls, also from 3rd parties
- Vehicle system is connected to the outside world

¹ Software, ² Electronic Control Unit
Advanced Driver Assistance Systems as Fall-Back Level and Enabler for Highly Automated Driving
Automated Driving Roadmap – Market Launch
C&S Hardware & Architecture Generations / Goals

Goal: L4 Highways
L3 Enhanced Highways
L3 Highways
L2 Highways

2016
2018
2020
2022
2025
2030

Goal: L5 parking (restricted areas)
L2 parking (trained)
L2 parking (remote)
L2 parking (in car)

2016
2020
2022

NCAP: New Car Assessment Program

L2: Partial Automation
L3: Conditional Automation
L4: High Automation
L5: Full Automation

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Visual Range 0-300m
Is this really enough?
Growth Opportunities

Large Scale Application of Elektrobits Competencies

supports many customers...

...with many components

Powerful HW and SW functions

Application of Elektrobits competency in SW management, integration and Industrialization on a large scale
Multiple Sources of Synergies From The Combination Elektrobit to Strengthen Continental’s Capabilities in all Relevant Areas

Software Driven Component Business
› OEMs increasingly ask for software integration for ECUs

Software Integration Business
› Increasing number of electronic components have to interact in the future and make software integration decisive for future success

Multimedia & Infotainment Business
› Complexity of infotainment solutions increases through rising number of functionalities based on different operating systems; therefore highly flexible network solutions needed

Software as Product
› Certain OEMs with lack of scale or scope increasingly ask for software solutions

Synergies From Efficiency Gains
› High order intake in Chassis & Safety’s business unit ADAS creates bottlenecks which can be better addressed by rising number of highly skilled software engineers