Neue und integrierte aktive Chassis Systeme
für zukünftige Fahrzeugkonzepte

12.06.2018 | Kristof Polmans
thyssenkrupp Steering
NTB Technologietag

engineering. tomorrow. together.
12. April 2018 | NTB
Technologietag 2018 |
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Kristof Polmans

Digitalisation @ Thyssenkrupp
thyssenkrupp Steering within the tk Enterprise

 thyssenkrupp
 159’000 Employees, 41.5 billion Euro/anno

Components
Technology

Elevator

Industrial Sol.

Material Services

Steel, Europe

Automotive

~70% of sales

Steering

Damper

Automotive Systems

Camshafts

Spring & Stabilizers

Industry

~30% of sales

Forged Technologies

Elevator Industrial Sol.

Components Technology

Employees, 41.5 billion Euro/anno

159’000

Elevator Industrial Sol.

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Neue und integrierte aktive Chassis Systeme für zukünftige Fahrzeugkonzepte

Kristof Polmans

Products: Steering Systems & Components

> 8,500 Employees worldwide

4 Tech Centers

18 Manufacturing Sites
Serving a diverse customer portfolio

From premium ...  ... to volume ...  ... to emerging OEMs ...  ... and further applications

Mercedes-Benz  BMW  RENAULT NISSAN  Tesla  BAIC Group  DANA

Audi  JAGUAR  Land Rover  Ford  Volkswagen  BEELY  STIHL

HYUNDAI  MAZDA  HONDA  Brose Technik für Automobilen  Husqvarna

Full wheel-to-wheel product portfolio for different customer groups
thyssenkrupp Presta Steering – current product Portfolio

Cold Forging

Steering Column

Steering Gear

Column EPS
Development Steps to Presta 4.0
From Cold Forging to Software Development
Required competence fields for development of mechatronic steering systems
With very strong interactions!
Need for new processes and tools
System V-Engineering and global standardised connected tools

System Know-How
Testing and Competences do not stop at physical system boundaries

Very strong interaction on vehicle level
Development Steps to Presta 4.0
From Cold Forging to Software Development
The car of tomorrow will be electrified, connected and autonomous
Digitalization conquers automotive

New car concepts centered around “self-driving systems”
Future Mobility vs Today
Trends offer challenges and opportunities

Steer-by-wire

Motion Control
Future Automated Vehicle Concepts Architecture

Integrated Vehicle Dynamics Control (iVDC)

stronger interaction of systems

- Steering
- Suspension
- E-Brake
- E-Drivetrain

Interface to automated driving

Sensing & Cognition
Data fusion
Environmental representation
Vehicle motion control
Chassis domain integration

To stay in long-term Tier 1 position we have to build up systems integration know-how for all chassis domains.

On chassis components level this higher level systems know-how is an enabler to strengthen technology leadership.
Why is Motion Control Know-how Important?
Motivation & Customer Benefit

Trend towards integrated chassis solutions

Increased chassis system complexity with Domain ECU

Shifting value added & USPs to software functionality

*Advanced Driver Assistance Systems
16 | 12. April 2018 | NTB Technologietag 2018 | Neue und integrierte aktive Chassis Systeme für zukünftige Fahrzeugkonzepte | Kristof Polmans
today more than 100 Mio lines of codes in car,
predicted to increase exponentially
to more than 200 bn by 2030.

Source: Delphi (2017)
Long-term Product Vision Towards Motion Specialist
Increasing System Integration

2017
Advanced components provider

2019
Advanced systems provider & integrator (for new entry & smaller OEMs)

2021
Integrated chassis systems provider electrified & autonomous

2025+
Rolling chassis platform provider electrified & autonomous

aspired long-term vision

f
longitudinal
lateral
vertical
To prove safety with 95% confidence:

8 Billion km of road testing

100 vehicles 24/7 for 225 years

Source: Automotive IQ (2018)
When?

Impact on business?

Competition?

...?

What?

How fast?

Disruptive Solutions?

New business models?

Politics / Legislation?

Increased Complexity!
Very high uncertainty and increased complexity

Speed and Agility

New Methods and Tools
Product Research and Development
Traditional test and development support tool chain

**Simulation**
- Limited correlation
- No system integration

**Test Bench**

**Target Vehicle**
- Not Flexible
- No modularity
Product Research and Development
Agile test and development tools

Driving Simulator with Steering HIL

Modular Research Platform

Modular Research Platform

- Fully flexible drive train concept
- EPS or SbW
- Rear wheel steering
- Single wheel steering concepts
- Inboard or outboard brakes
- Active suspension
- Adjustable suspension kinematics
- ....

AGILITY - test functionality of new HW / systems on vehicle level asap

COMPLEXITY - Integrated Chassis controls development
Example 1: Development of alternative steering functions
MRP offers full flexibility to test interaction with different architectures
Example 1:

Development of alternative steering functions

MRP offers full flexibility to test interaction with different architectures.

BMW X5 on VDA
Example 2: Single Wheel Steering Concepts
MRP offers full structural and packaging freedom to integrate new steering concepts
Example 2: Single Wheel Steering Concepts

MRP offers full structural and packaging freedom to integrate new steering concepts.
Driving Simulators as Agile Development Tools for Steering
Steering HIL Integration into driving simulators

Static Driving Simulator

Dynamic Driving Simulator

Simulations and modeling for agile development and testing
Integration of Steering HIL Testing in static driving simulator

Driving Simulator tests with actual Steering System HW and SW in the Loop
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Driving Simulator tests with actual Steering System HW and SW in the Loop
Driving Innovations and increased System Complexity and Integration imposes new Challenges
"If I had asked people what they wanted, the would have said faster horses"

Henry Ford
There’s no chance that the iPhone is going to get any significant market share. No chance.

Steve Ballmer
Hierarchische-Struktur  vs. Netzwerk /Start-up-Struktur

Organisation
Fail fast and cheap. Fail often. Fail in a way that doesn’t kill you.

Seth Godin

Development Tools and Processes
CULTURE EATS STRATEGY FOR BREAKFAST

Culture and Mindset
Vielen Dank!

Kristof Polmans
Head of Technology & Innovation
kristof.polmans@thyssenkrupp.com

engineering. tomorrow. together.

thyssenkrupp