Media Workshop

Digitalisation in Production and Logistics at Volkswagen

Thursday | 7 December 2017 | Wolfsburg

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Media Workshop

Digitalisation in Production and Logistics at Volkswagen

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09:15 am	Welcome by Stefan Loth, Plant Manager Wolfsburg
09:30 am	Presentation by Dr Martin Goede, Head of Technology Planning and Development of the Volkswagen brand
10:15 am	Short introduction of competence centre for technology and innovation by Steffen Jaensch and Dr Markus Buschmann
10:30 am	Project market "Digitalisation at Volkswagen you can touch and feel" 1. Digital way / energy efficiency 2. Vehicle identification and servicing materials positioning 3. Fully automatic vehicle commissioning 4. Human-robot collaboration • Automatic initial AdBlue® injection • Automatic mounting of coupling rod • Automatic mounting of alternator • Automatic side panel adhesive bonding 5. Vehicle body construction robot cell
12:00 noon	Discussion and light lunch
1:00 pm	End of the workshop

The Volkswagen brand is facing one of the biggest revolutions in its history: Computers, robots and the internet penetrate all areas of work and life. Our environment has changed dramatically and rapidly in recent years – socially, politically and technologically. And this trend continues: Digitalisation and the internet will revolutionise the automotive industry. However, not only the product will be affected, but vehicle production will also be transformed in the future.

"With our innovative developments in efficient manufacturing technologies, flexible servicing materials and intelligently networked digitalisation, we are shaping the most productive factories of the future", says Dr Martin Göde, Head of Technology Planning and Development of the Volkswagen brand.

Digitalisation is the start of a new industrial revolution – first we had the invention of the steam engine followed by traditional assembly line work and mechanisation. The next jump was the permeation of information technology in factories. Industry 4.0, considered the next development leap, now represents the fusion of production and IT. This involves intelligent networking of people, robots and IT systems across the entire industrial production value chain.

Faster information flows in production and logistics within the integrated production network increase Volkswagen's resource efficiency and productivity. Real-time networking promotes transparency and unlocks potential to shorten response times, increase flexibility and optimise processes.

The media workshop on digitalisation in Volkswagen production and logistics provides insight into the innovative power and collaboration between Development, Planning and Production. It furthermore gives a glimpse of human-robot collaboration, fully automatic vehicle commissioning and other future topics.

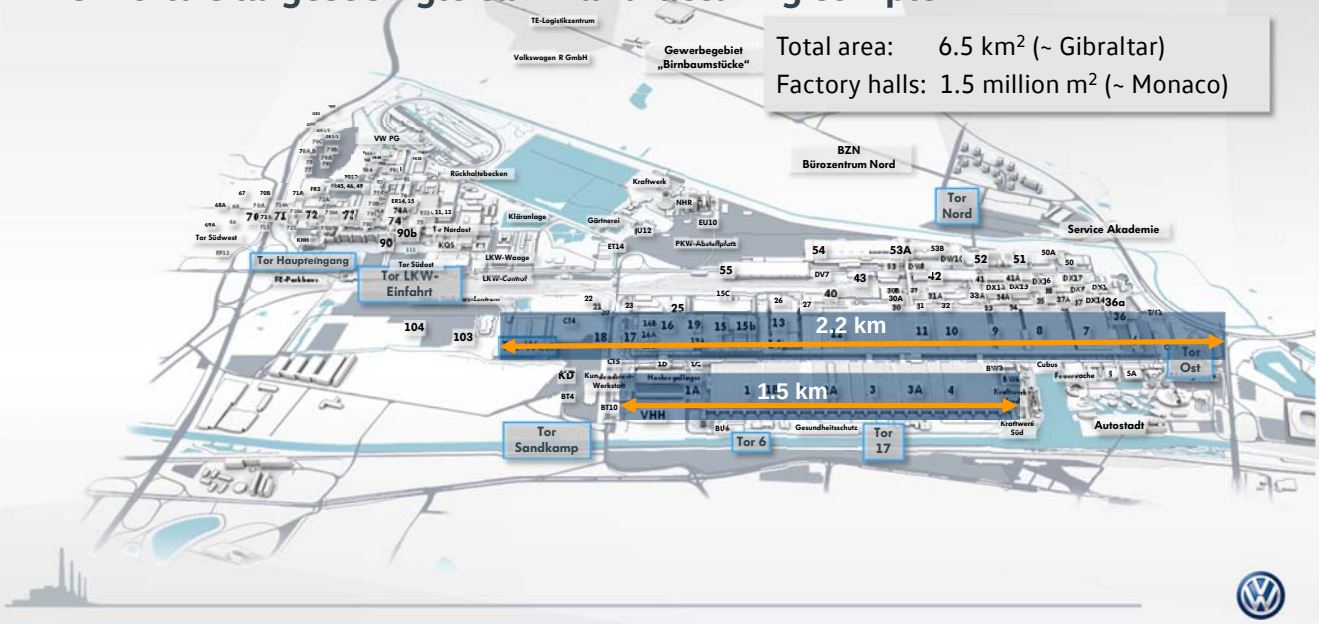
Welcome to Wolfsburg

Dr. Stefan Loth

Volkswagen

The Wolfsburg plant –
The world's largest single car-manufacturing complex

Total area: 6.5 km² (~ Gibraltar)
Factory halls: 1.5 million m² (~ Monaco)



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Significance of the Wolfsburg plant

Volkswagen AG
- Group Board of Management
- Group functions

Headcount: ~ 3,500

Wolfsburg plant
- Vehicle production (S1 and S2)
- Components production
- Services

Headcount: ~ 25,000

Volkswagen AG
- Brand Board of Management
- Research & development
- Procurement
- Sales
- Planning

Headcount: ~ 32,000

Companies
- Autostadt GmbH
- Auto Vision GmbH
- Sitech Sitz GmbH
- Other

AUTOSTADT

Total headcount: ~ 12,000

Total headcount: ~ 73,000

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August 24, 2017: 150 million Volkswagen brand vehicles

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22 September, 2017: 44,444,444 vehicles built at Wolfsburg plant

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Wolfsburg plant (2106) – Facts & figures

Production
~ 800,000 vehicles/year

Team
~ 20,000 employees

Vehicle models
4

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Model overview Wolfsburg plant

Segment 1

Golf A7: Ø 1,500 units/day

Golf SV: Ø 400 units/day

Segment 2

Tiguan: Ø 1,100 units/day

Touran: Ø 500 units/day

Production per day
~ 3,500 vehicles

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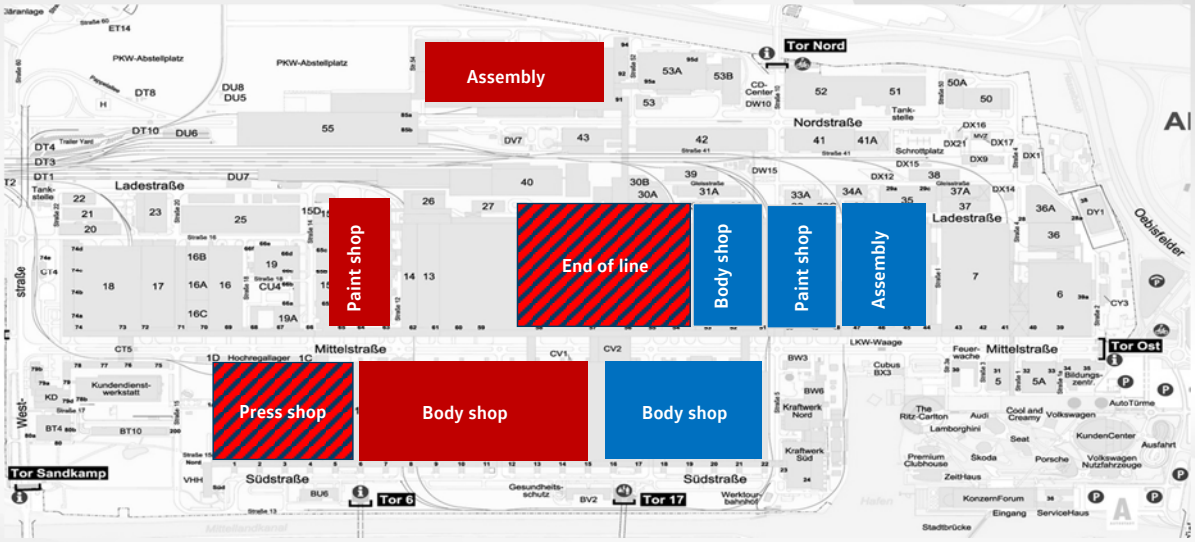
Wolfsburg plant - Structure



Segment 1 **Segment 2**

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New trends in vehicle production

Battery technology

CO_2 emissions

Automation

Climate change

Demography

Digitalization

Sustainability

Autonomous driving

E-mobility

Man-machine collaboration

Connected car

Industry 4.0

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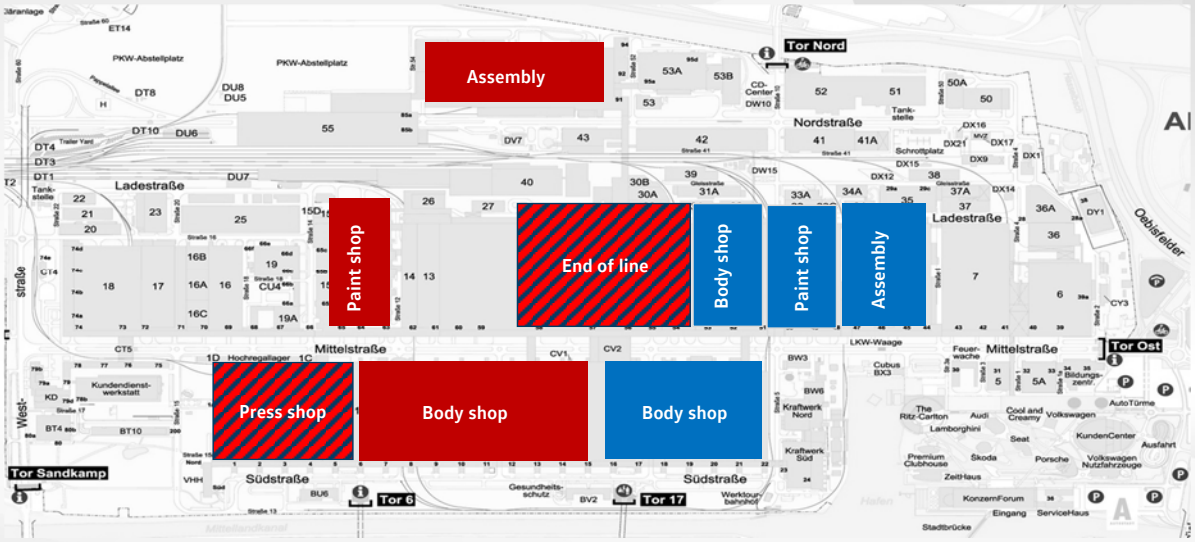
Wolfsburg plant - Structure



Segment 1 | Segment 2

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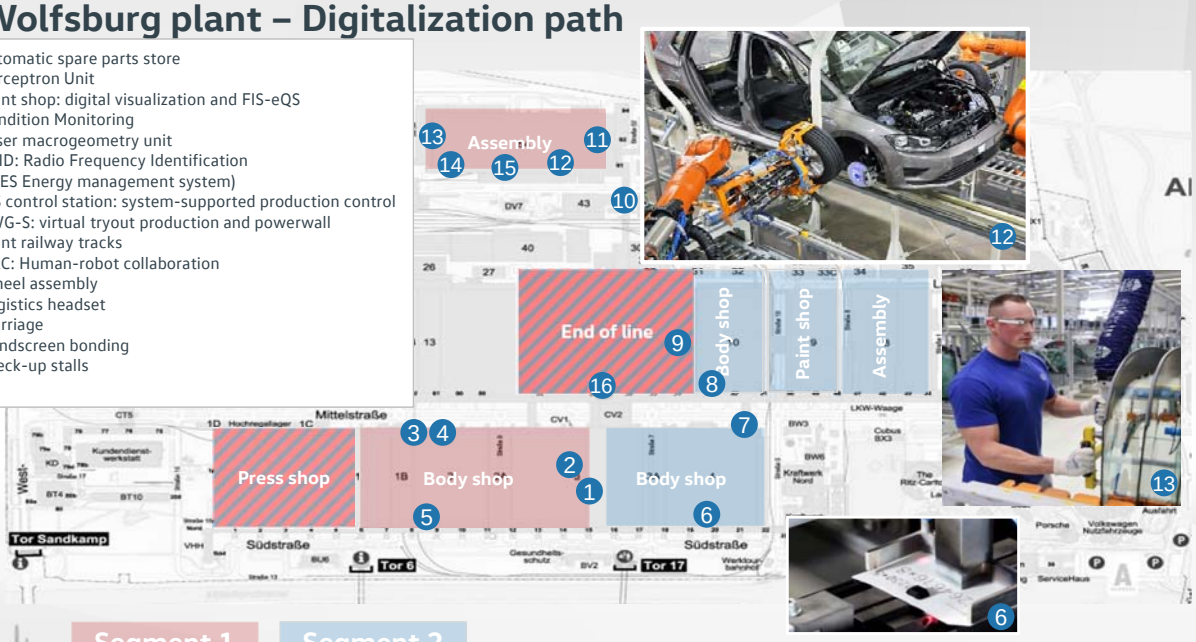
Wolfsburg plant – Digitalization path

1. automatic spare parts store
2. Perceptron Unit
3. Paint shop: digital visualization and FIS-eQS
4. Condition Monitoring
5. Laser macrogeometry unit
6. RFID: Radio Frequency Identification
7. EDES Energy management system)
8. FIS control station: system-supported production control
9. PWG-S: virtual tryout production and powerwall
10. Plant railway tracks
11. HRC: Human-robot collaboration
12. Wheel assembly
13. Logistics headset
14. Marriage
15. Windscreen bonding
16. check-up stalls



Segment 1 Segment 2

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Implementation at the Wolfsburg plant

Scientific enviroment/Brand	Site planning	Series production

Innovation

Need for innovation

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Thank you

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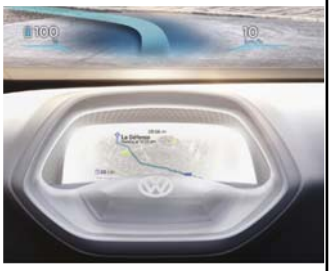

Digitization of manufacturing technologies for production of the future

Dr. Martin Goede, Volkswagen AG

Digitalisierung in der Produktion, 07. Dezember 2017, Wolfsburg

Volkswagen

Challenges for vehicle manufacturing of the future

Complexity increase of competition-relevant requirements

Model variety and drive variants

Demand of innovations through new competitors

Environmental awareness and sustainability

Complexity of partner and supplier networks

Complex and fast-paced software landscape

Big data as business model and data security

Intelligent equipment and production services

Generation change and customer needs

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Challenges for vehicle manufacturing of the future
Complexity increase of competition-relevant requirements

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Challenges for vehicle manufacturing of the future
E-mobility in volume segment

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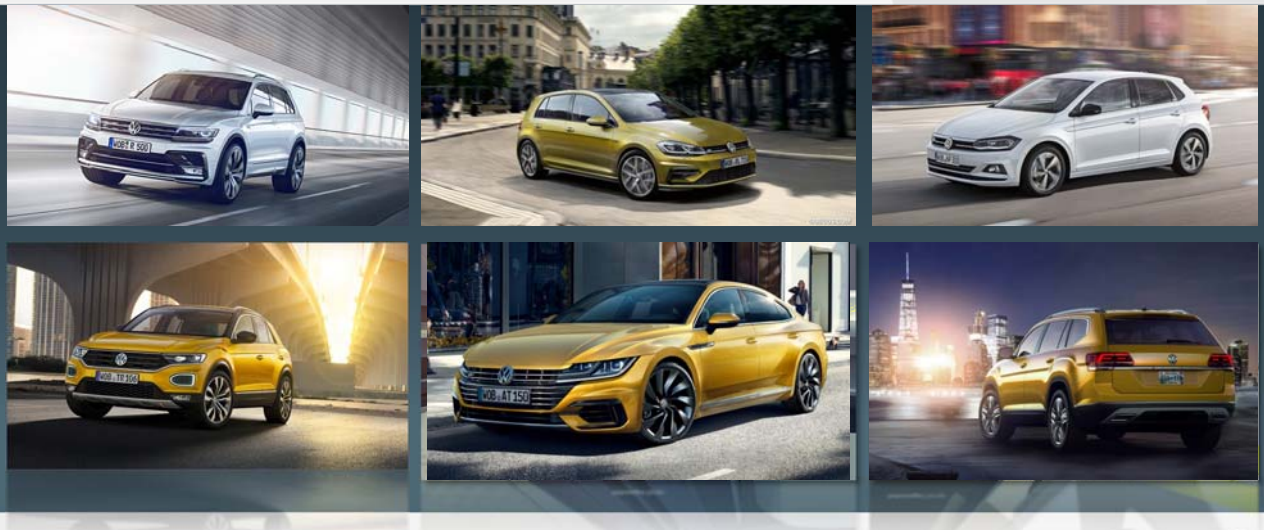
Product architecture today



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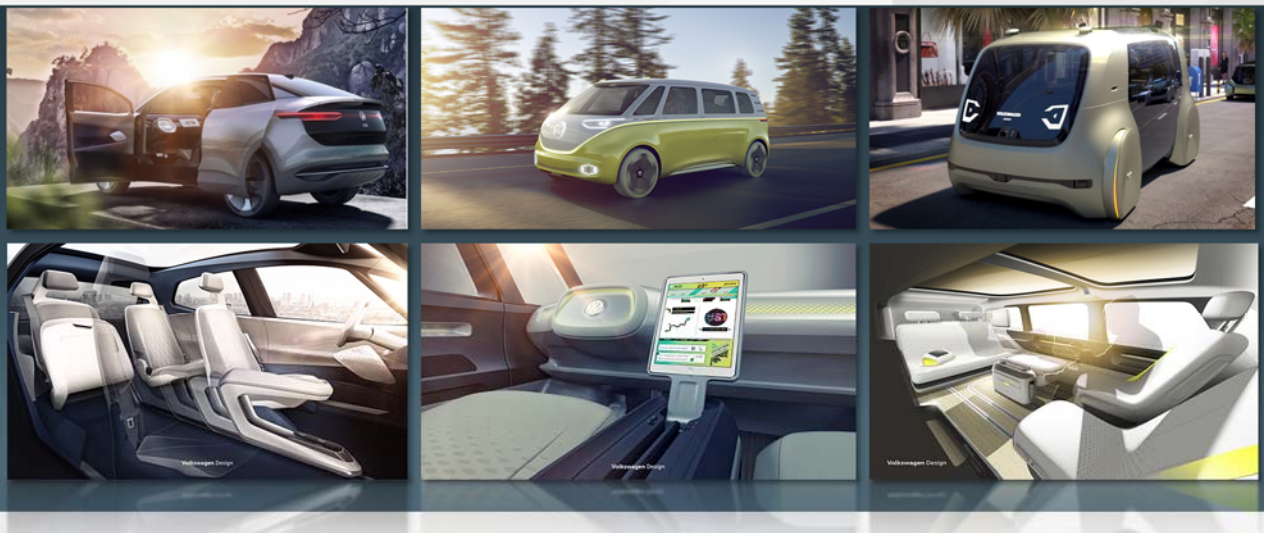
Product architecture of the future



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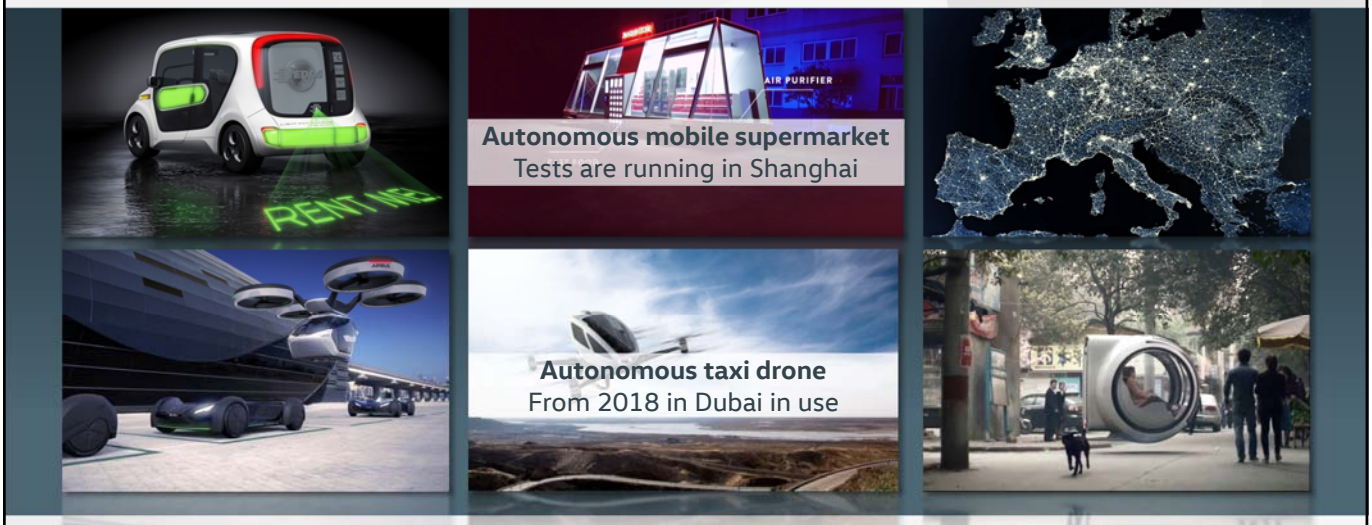
Product architecture of the future – next generation



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Challenges for vehicle manufacturing of the future

Change of added value

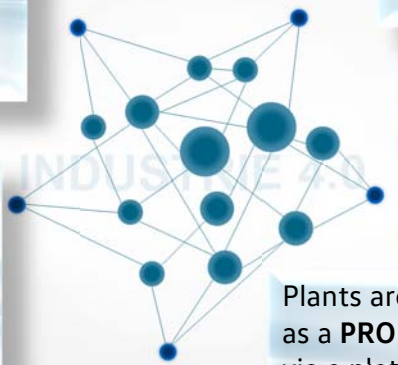
New technologies and higher customer requirements change the **PRODUCT.**


Innovative product design


Modular product design

Autonomically controlled **PROCESSES** for efficient production and logistics

Consistent optimization



Customers are involved as new **PLAYERS** in value creation and optimization.

Open Innovation

Use of **BIG DATA** to control business processes and new business cases


Data driven business models


Production as a service

Plants are organized and optimized as a **PRODUCTION NETWORK** via a platform.


Flexible product works

Value creation platform

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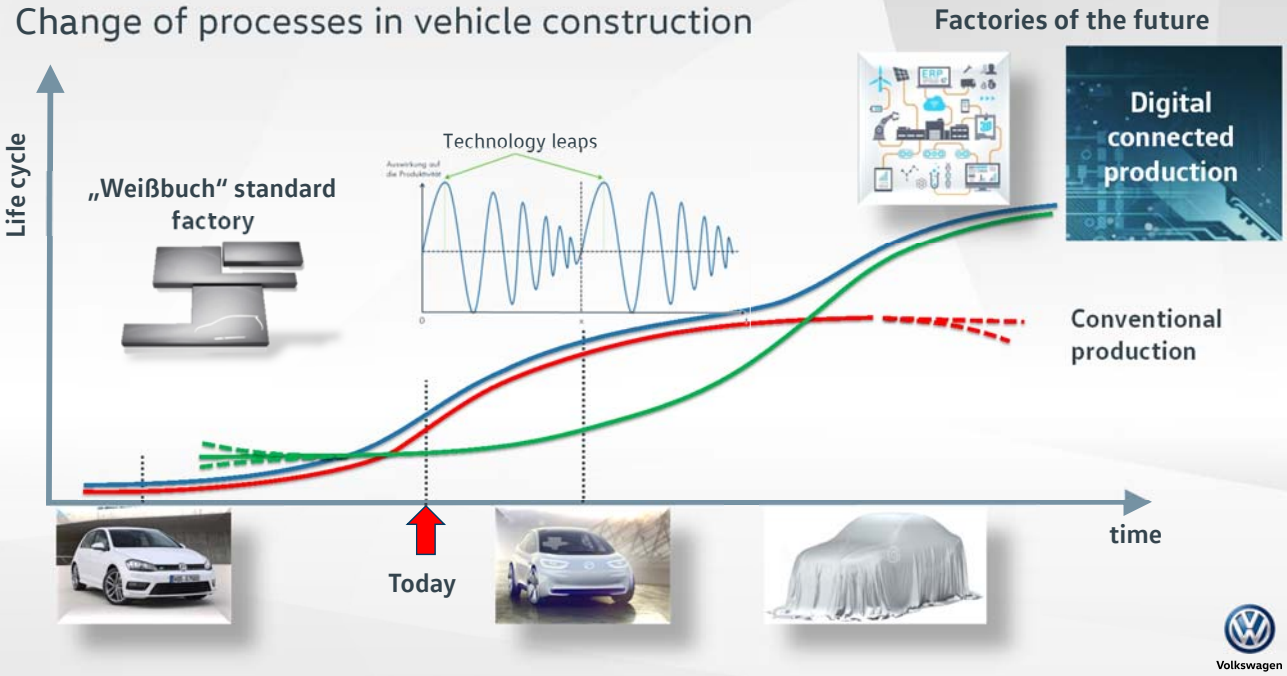
Digitally connected vehicle production of the future

Change of processes in vehicle construction



Digital connected Production at Volkswagen

Key factors

Digital Process Chain

Continuous data supply and use in the **production network** leads to efficient value chains.

Flexible Production

Modular manufacturing systems enable flexible, **agile production**.

Internet of Things

Self-optimizing systems, reduced integration effort and permanent information.

Human Empowerment

Digitally supported **decision processes** and coexistence of human and machine.

Big Data & Smart Analysis

Plant monitoring and **self-control** increase availability and reduce maintenance.

Artificial Intelligence

Independently operating systems, self-learning systems and assistants relieve the strain on people.

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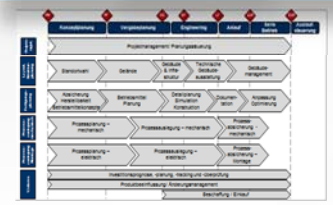
Key factors – Digital Process Chain

Consistent development, planning and production

Current Factory and planning processes (2016)

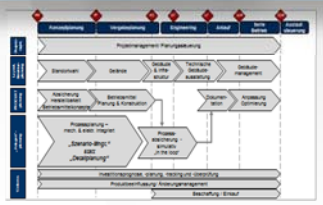


Disruptive change

Autonomous and **universally** usable systems of the future with **independent** implementation of the **production steps**.

→ **Scenario management** instead of **detailed layout and Plant planning** (including process simulation and flexibility, quality and cost assessment)

Factory and planning processes of the future (2025)



New processes require new planning systems

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Key factor Human Empowerment

Complexity control by digital assistants

Analogous

Computer-based

System supported

Connected

Mobile

Intuitive

We bring technology closer to the people.

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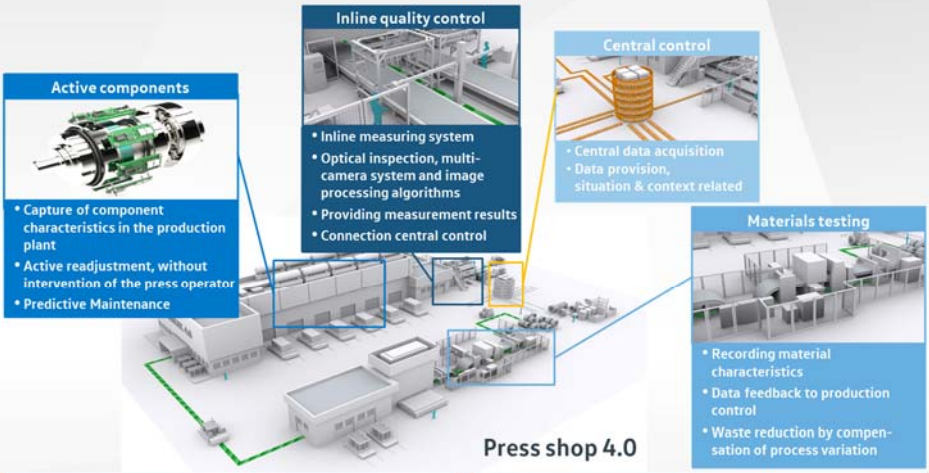
Key factor - Big Data und Smart Analysis

Performance increase through intelligent machines and systems



- Press shop with self-controlling processes by coupling innovative technologies
- More transparency and productivity

- Reduced machine downtime
- 100% testing
- Reduction waste

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Key factor – Artifical intelligence

Performance increase through intelligent software and machines

Smart Personal Assistent

Chatbots do simple tasks:

- Home-automation
- Task lists
- Opel: Test drive
- BMW: Home & Car

Automated Speech Recognition

Chatbots recognize natural language

- Use in schools / universities
- Control of software
- Convert error description into standard text

Neural Machine Translation

Detection and translation of different languages

- Loss of communication limits
- Cultures are approaching

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Key factor – Artifical intelligence

Performance increase through intelligent software and machines

Classic construction	Optimisazion by simulation	Automated design
		
Design according to the experience of the designer	Design according to simulation loops	Design and construction according to genetic algorithms, production by 3D printing
• Weight: ↑	• Weight: →	• Weight: ↓
• Cost: ↑	• Cost: ↗	• Cost: ↓

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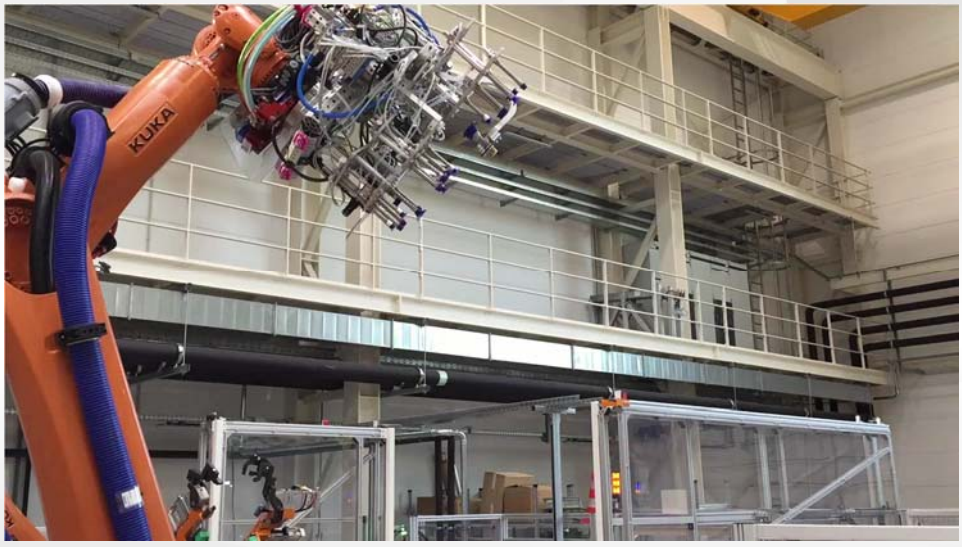
Key factor – Flexible production (Gripper)



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Concept "moving screwing module" for flow operation (VW Tiguan) - Volkswagen Osnabrück

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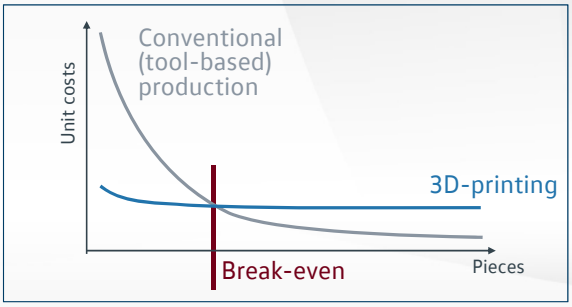
Potentials of new production technologies
Generative production of tools and components

1 Extended design freedom

- Advanced design options
- Functionalization

2 Individualisation and variant variety

- Individualization
- Complexity



3 Accelerated development cycles / Time-to-market

There are high potentials for the automotive industry

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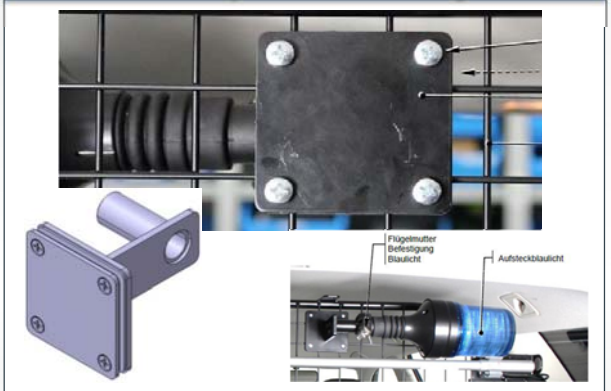
Potentials of new production technologies
Generative production of plastic components

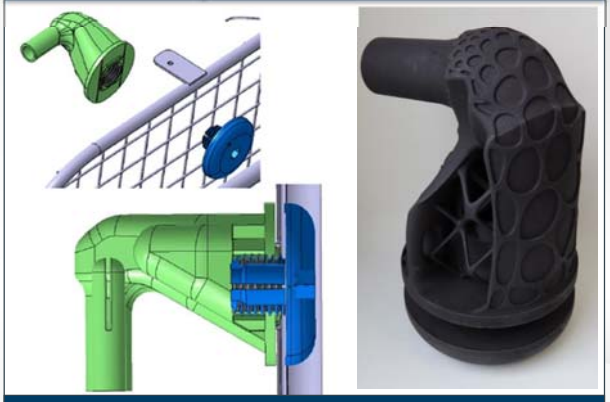
Series production today



Flashing blue light holder, Duplicate part R-GmbH
Weight: 687 Gramm (steel)

Small batch: < 500 Units/Year

Series production tomorrow



Flashing blue light holder, 3D printing, SLS-method
Weight: 137 Gramm (plastic PA12)

Small batch: < 500 Units/Year

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3D-Printing „Vision 2025“

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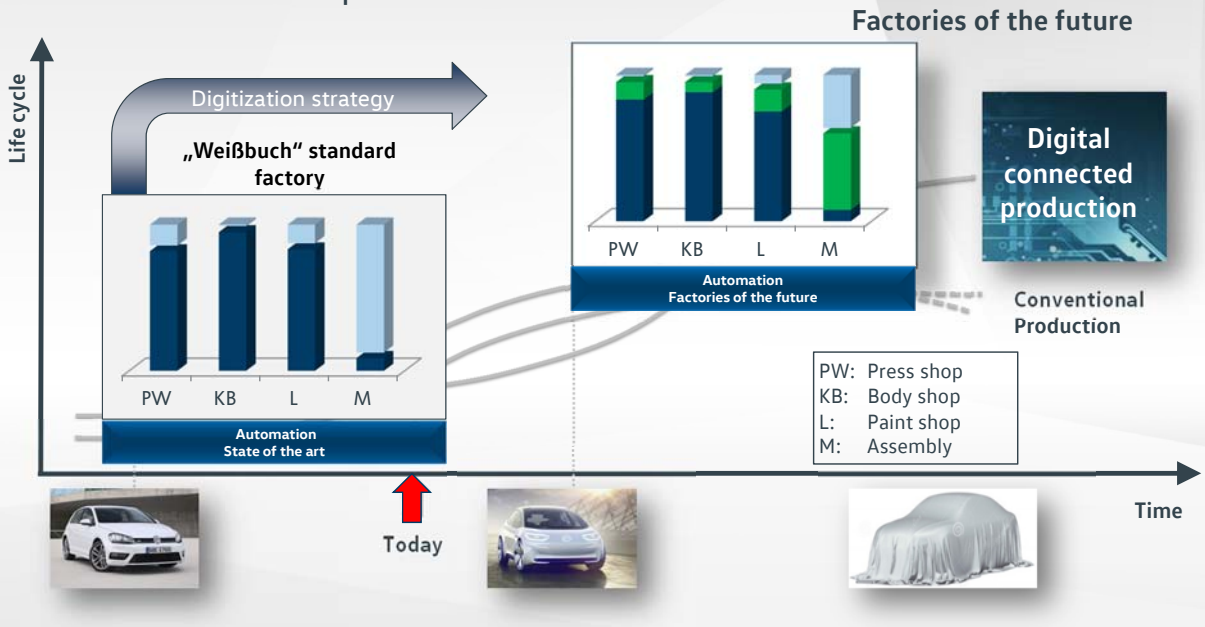
Efficient production and factory automation

Automation in vehicle production



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Efficient volume production technologies in factories of the future

Conclusions

- Intensive transformation of products
- Significant Technology push
- Increase of Complexity

- Improving economic and ecologic efficiency
- Digitalization of entire Process Chain

- New Dimension of Innovation implementation
- New Dimension of Collaboration networks

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Digitization of manufacturing technologies
for production of the future

Thanks for your attention!

Dr. Martin Goede, Volkswagen AG

Medienworkshop Digitalisierung in der Produktion, 07. Dezember 2017, Wolfsburg

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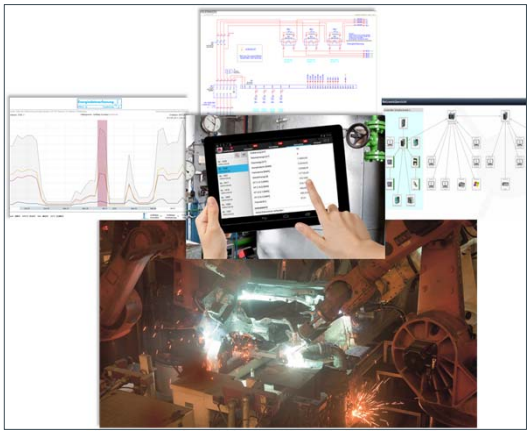
Digital way

Motivation – goals – benefit

The aim is to unlock potential from the advancement of information technologies to increase productivity in vehicle production:

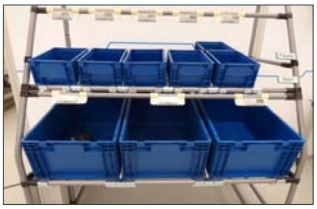
- Support maintenance processes through digital tools
- Increase manufacturing efficiency through digitally supported processes
- Reduce data handling effort through intelligent interfaces



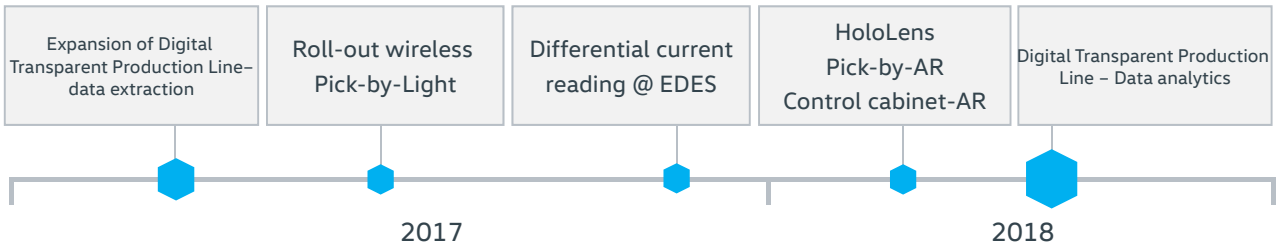
Tablets are used as a maintenance tool

Approach

The digital way maps opportunities for improvement in various manufacturing and manufacturing-related processes. Linking worker guidance to the Arbeitsplan system prevents maintaining duplicate sets of identical data. The wireless pick-by-light shelf reduces investment costs through the intelligent use of new technologies borrowed from the consumer sector. The Digital Transparent Production Line project demonstrates how line failures can be prevented (predictive maintenance) and how augmented reality can help to eliminate failures quickly. Workers or maintenance technicians can be provided with relevant information much more effectively through the use of tablets or data glasses (HoloLens).



Timeline

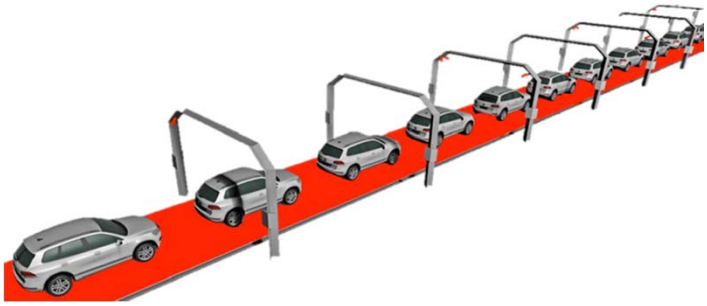


Vehicle identification and servicing materials positioning

Motivation – goals – benefit

The aim is to establish new identification and positioning technologies for vehicle identification, servicing materials positioning and
construction status documentation (BZD)

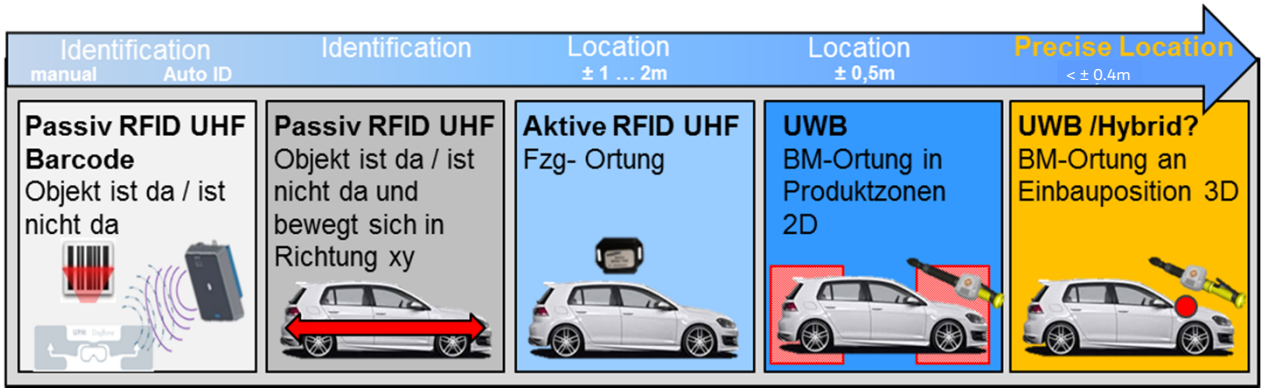
- Position-dependent tool activation/deactivation
- Monitoring and documentation of process sequences and results



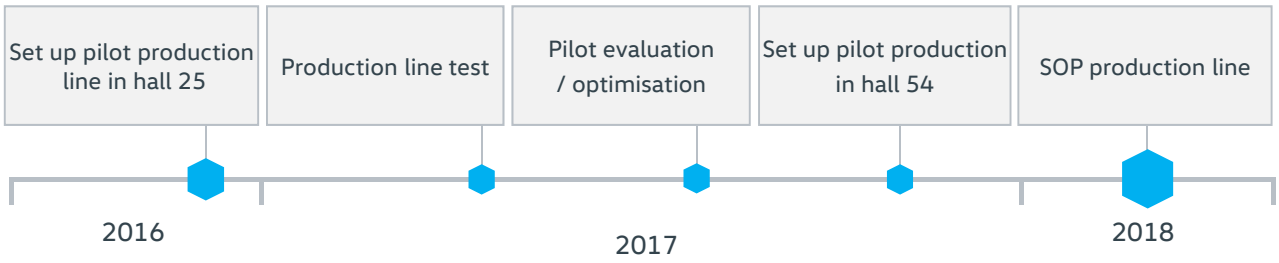
Illumination of the production line

Approach

Linking vehicle identification and position with exact servicing materials positioning in real time enables the definition of more precise work areas relative to the moving vehicle. Different technologies and hybrid solutions are tested, with a currently achievable tolerance radius of 0.3–0.4 metres.



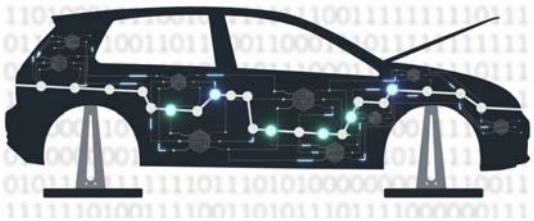
Timeline



Fully automatic vehicle commissioning

Motivation – goals – benefit

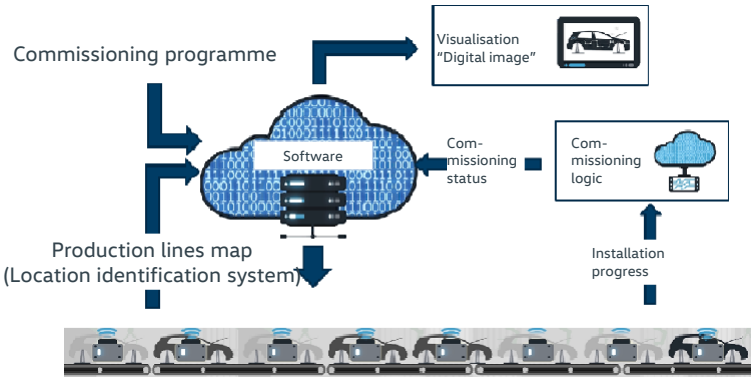
The Volkswagen product offensive brings with it the upcoming challenges of both an increase in the volume of data and the number of electronic devices in each individual vehicle, which increase the amount of time required for vehicle commissioning.



- Sustainable
- Utilisation of unused areas
- Reduced production steps
- Increased direct run rate
- Phased introduction

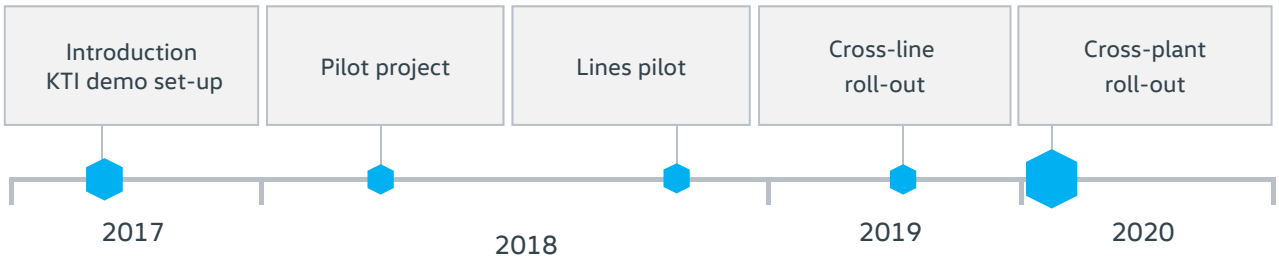
Approach

The aim is to be able to put the control units in operation at any time with location-independent and fully automatic commissioning. By doing so, it will be possible to react quickly and with flexibility to future challenges.



System diagram of fully automatic vehicle commissioning

Timeline

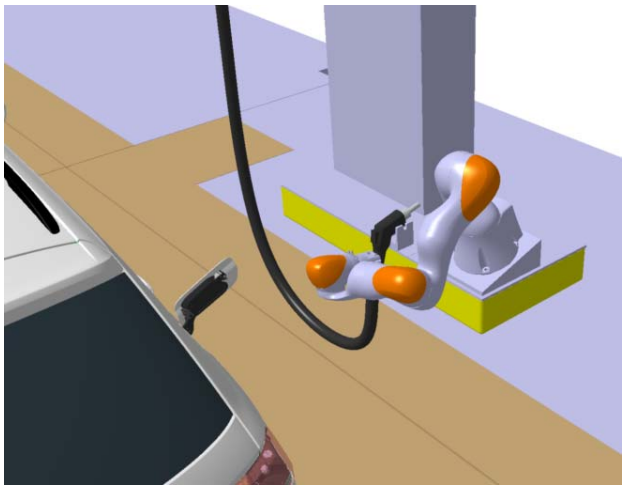


Human-robot collaboration urea filling

Motivation – goals – benefit

The aim is to implement a project for human-robot collaboration (HRC) in filling technology.

- Unlock flexibility, ergonomics and productivity potential
- Partial automation of handling the filling adaptor



Filling console with lightweight robot

Approach

The AdBlue filling adapter is guided by a lightweight robot right up to the tank flap cup. The operator then adjusts the injection adapter and starts the refuelling process.

Through the robot's sensitivity, the tolerance is adjusted during refuelling without the use of additional sensors.

After the refuelling process is finished, the robot removes the adapter and returns to its basic position.

Adaptation of the AdBlue filling adapte for use with a lightweight robot

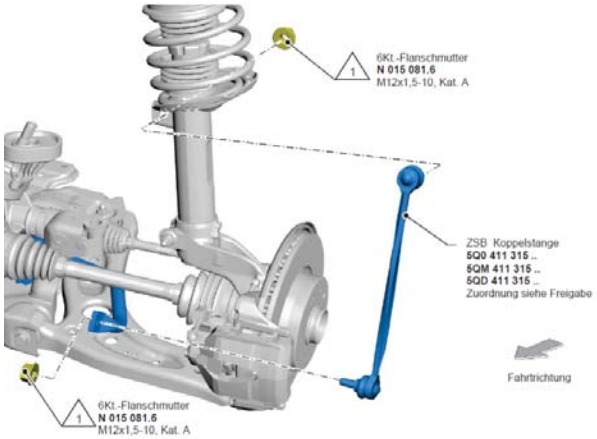
Timeline

Mounting coupling rod in the VM subframe

Motivation – goals – benefit

The aim is to implement additional projects for human-robot collaboration (HRC) in assembly.

- Unlock flexibility, ergonomics and productivity potential
- Use of light-way robots for mounting requiring documentation



Approach

The coupling rod is automatically mounted using a lightweight robot. Through the robot's sensitivity, the tolerance is adjusted without the use of additional sensors.

Timeline

Set up pilot production line in hall 25	Production line test	Determination of biomechanical limits	Set-up production line in hall 54	SOP production line

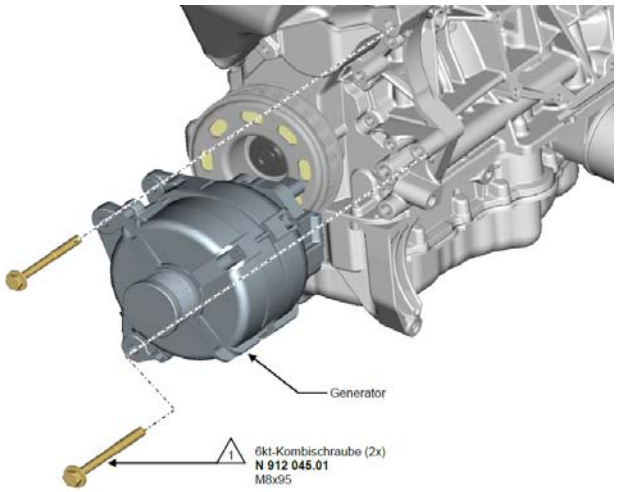
2017 2018

Automation of alternator mounting in the ML2/3 engine line

Motivation – goals – benefit

The aim is to implement additional projects for human-robot collaboration (HRC) in assembly.

- Unlock flexibility, ergonomics and productivity potential
- First use of lightweight robots for mounting requiring documentation



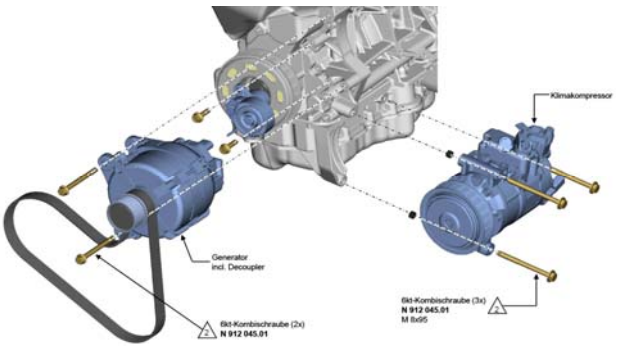
PDM extract of alternator mounting

Approach

Using a lightweight robot, the alternator is automatically mounted including the final tightening.

Through the robot's sensitivity, the tolerance is adjusted without the use of additional sensors.

As part of the pilot application in the Competence Centre for technology and innovation (KTI), in addition to the alternator, the air conditioner compressor and the tensioning roller are also mounted by robots to prove technical feasibility.



PDM extract of mounting the alternator, air conditioner compressor and tensioning roller

Timeline

Set up pilot production line in hall 25	Production line test	Determination of biomechanical limits	Set-up production line in hall 54	SOP production line

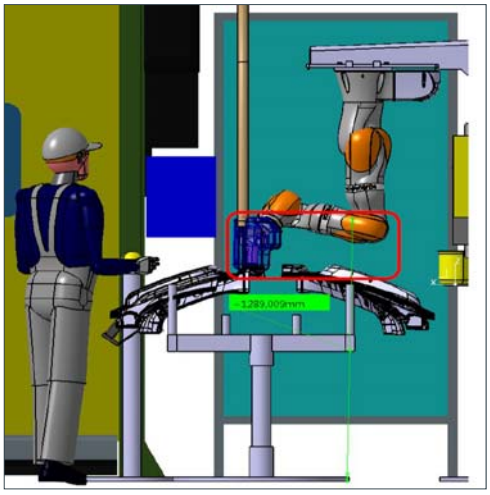
2017

HRC adhesive bonding side panel, inside, rear

Motivation – goals – benefit

The aim is to implement the pilot project for human-robot collaboration (HRC) in body construction.

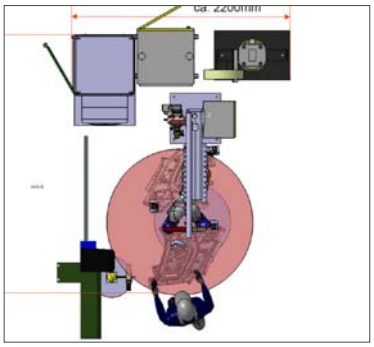
- Raising awareness of HRC among workers
- Unlock flexibility, ergonomics and productivity potential
- Development of new technologies
- Consistent adhesion seam quality
- “No rework”

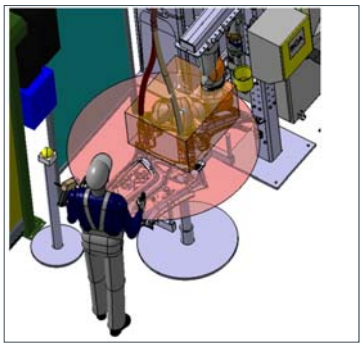


Hall 25, field B38

Approach

The adhesive is to be applied automatically using an HRC robot. By doing so, there is less stress on the employee and there is no direct exposure to the adhesive. The challenges include the development of a safe glue nozzle and the interaction of the adhesive hose with the robot.





Timeline

Set up pilot production line in hall 25	Feasibility study / Test phase	Lessons learned Biomechanical strength measurement	Principle suitability achieved	Start integration in production line

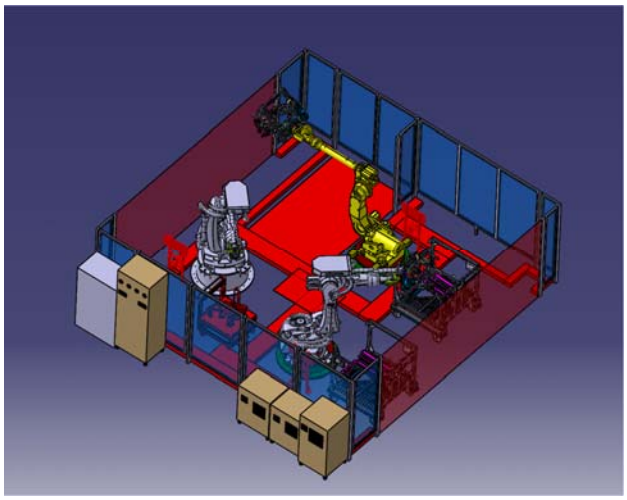
2017 2018+

Vehicle body construction robot cell

Motivation – goals – benefit

The variety of components and technologies available in body construction requires robust processes in manufacturing plants. The factory's economic efficiency is ensured by an extensive testing phase under real conditions.
Possible topic clusters include:

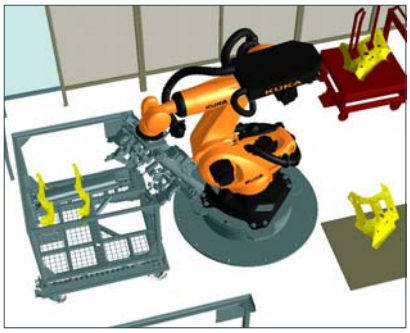
- Test field for technologies/components
- Test runs of VASS/robot standards
- Firmware version compatibility

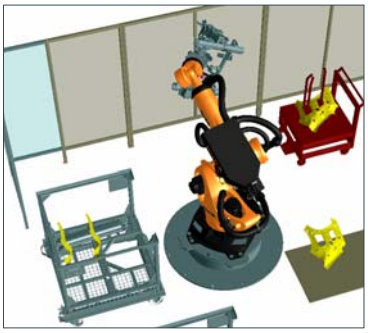


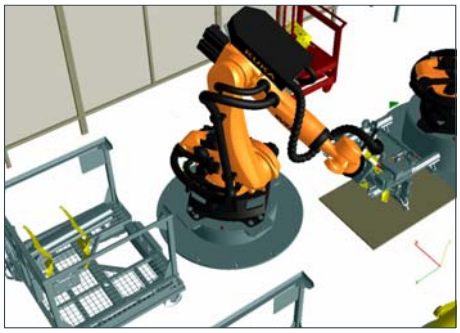
Hall 25 robot test cell

Approach

In addition to the analysis of problems in the field, establishing a flexibly expandable body construction test cell enables in particular deliberately instigating fault patterns. The result is a reduction in commissioning times and downtimes of running production plants.







Timeline

2015	2016	2017
Conception/ Robot cell technology selection	Qualification of 3D camera systems on Fanuc robot	Completion of full commissioning of the robot cell
Set up and commissioning in hall 25	Condition-based maintenance Energy data capture	