



# **Sustainable Assembly Systems: Ergonomic Optimization of Volkswagen Commercial Vehicles Production @ Assembly Engineering Conference 2016**

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Nutzfahrzeuge

# Contents

1. Challenges at Volkswagen Commercial Vehicles
2. General Procedure and Employee Participation
3. Implementation of Improvements
4. Ergonomic Design Process
5. Summary

# Challenges at VW Commercial Vehicles

## Length and Height in Comparison to Passenger Cars

1 → 2 → 3 → 4



## (1) Product Dimensions

- **Product Dimensions:**
  - Greater length and height of vehicles
  - More difficult accessibility
  - Increased proportion of overhead work
  - Parts are bigger in size and weight
  - More assembly tasks in car interior

- Product Lifecycle

- Plant Structures

# Challenges at VW Commercial Vehicles

1 → 2 → 3 → 4

## Part Dimensions

Wooden ground floor (ca. 20 kg)



Paint auxiliary fittings



## (2) Product Life Cycle

- Product Dimensions :
  - Greater length and height of vehicles
  - More difficult accessibility
  - Increased proportion of overhead work
  - Parts are bigger in size and weight
  - More assembly tasks in car interior

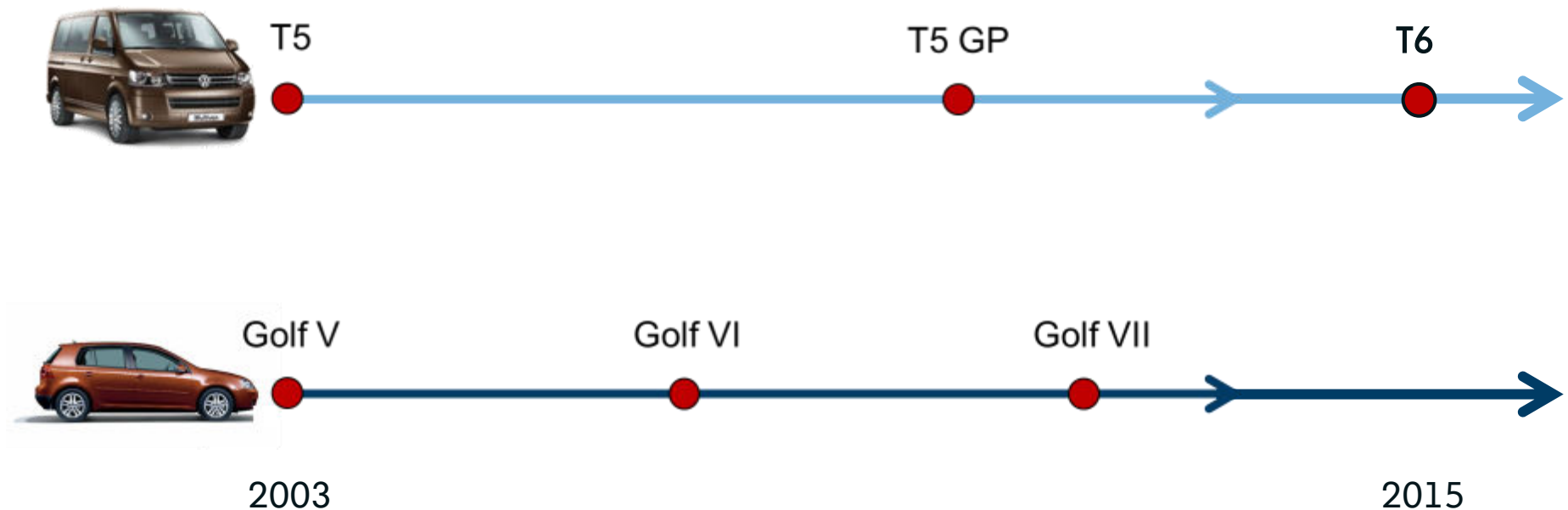
- Product Lifecycle

- Plant Structures

# Challenges at VW Commercial Vehicles

## Product Lifecycle in Comparison to Passenger Cars

1 → 2 → 3 → 4





## (3) Plant Structure

- Product Dimensions :
  - Greater length and height of vehicles
  - More difficult accessibility
  - Increased proportion of overhead work
  - Parts are bigger in size and weight
  - More assembly tasks in car interior

- Product Lifecycle

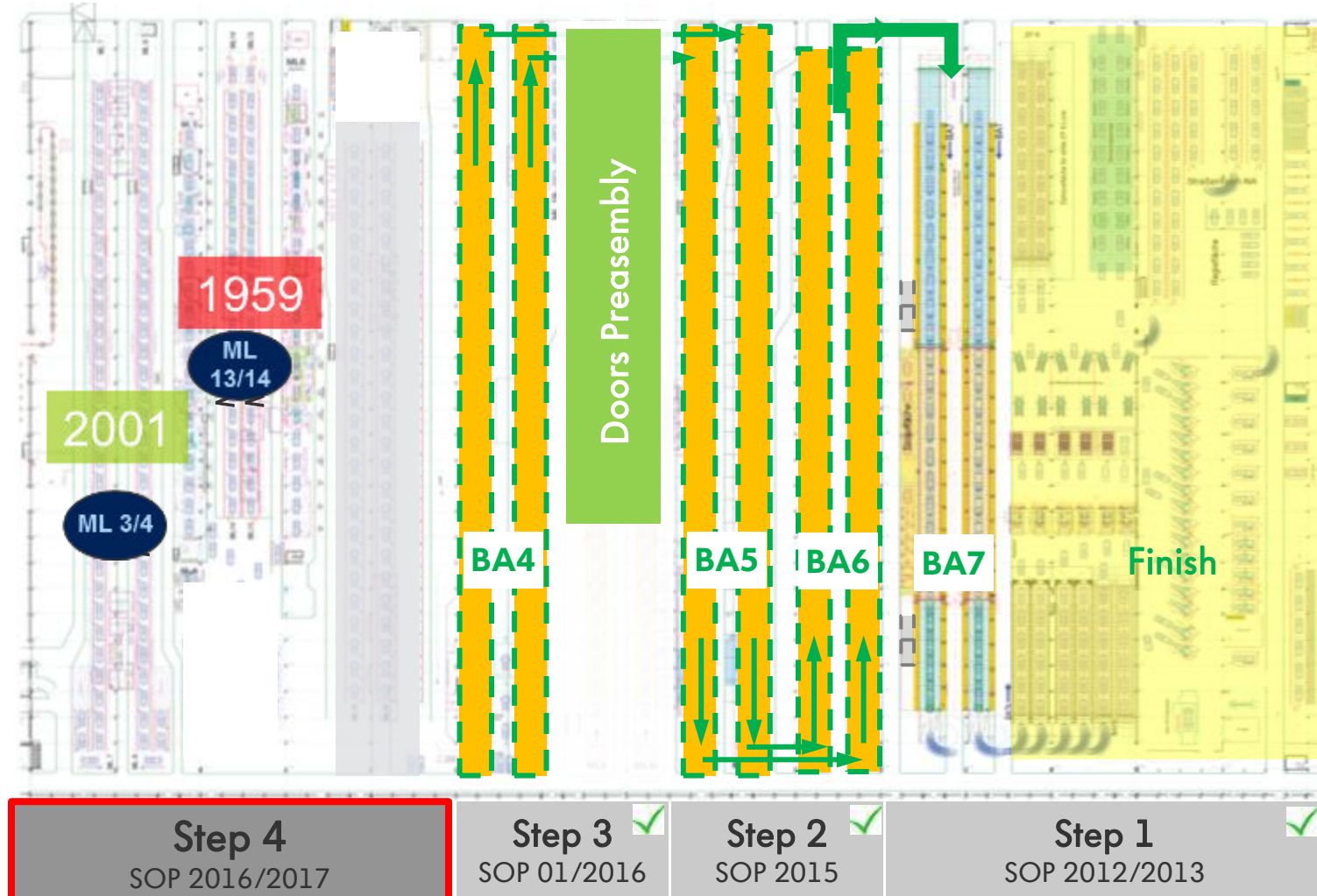
- Plant Structure



# Challenges at VW Commercial Vehicles

1 → 2 → 3 → 4

## Structure of Hannover Plant: NZM (New Sustainable Assembly)



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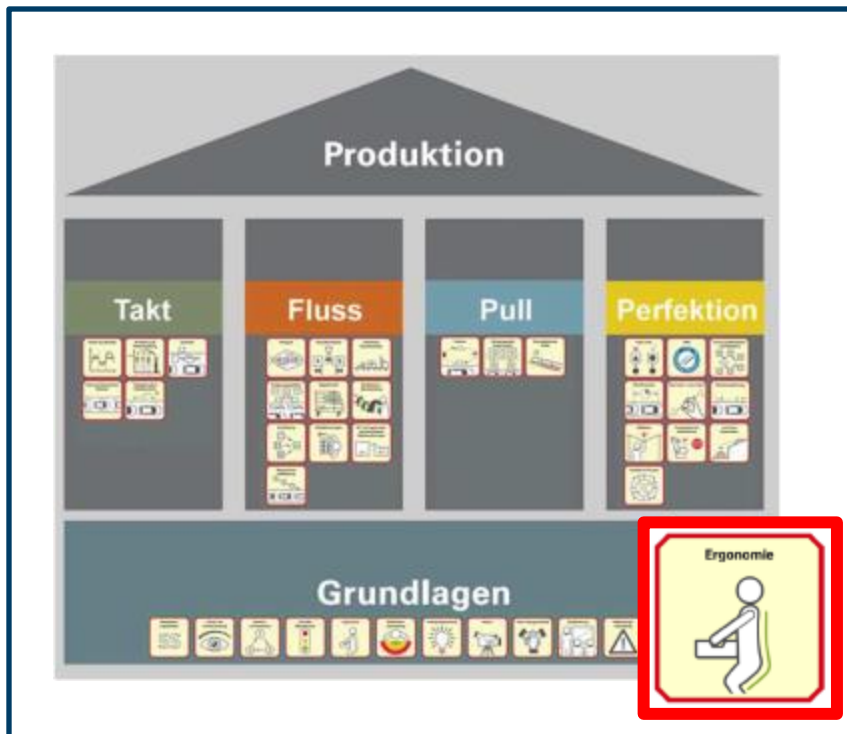
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# General Procedure at Hannover Plant

## Ergonomics as Part of the Plant Strategy

1 → 2 → 3 → 4

### Volkswagen Production System



### Volkswagen „Fit for Future“ Programme

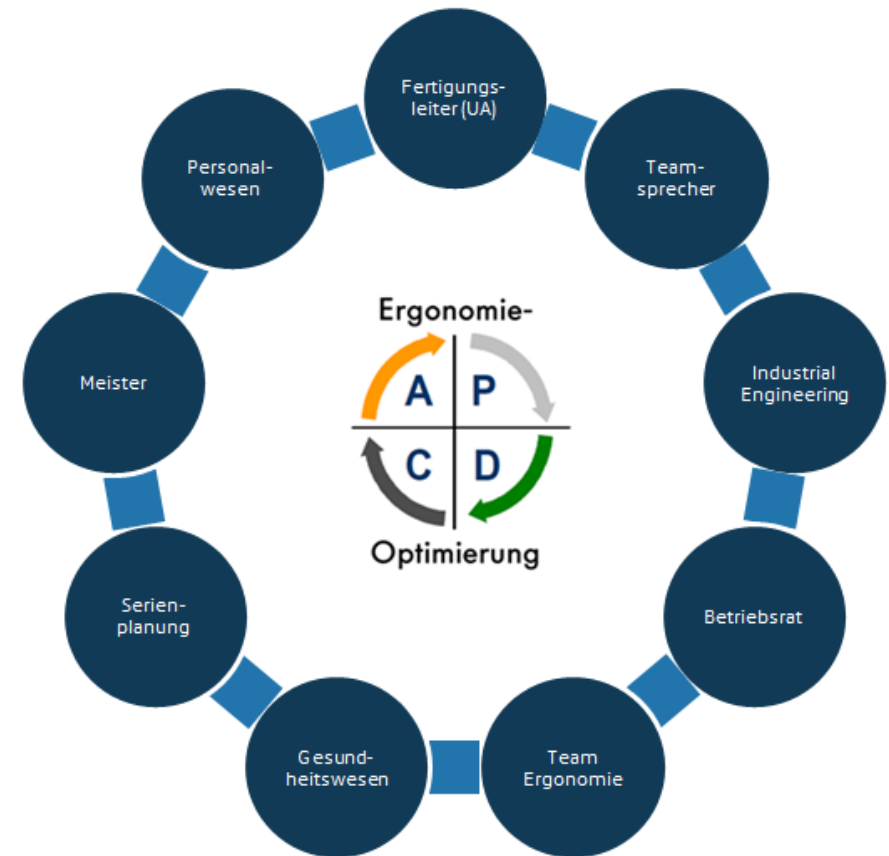


# General Procedure at Hannover Plant

## Employee Participation in „Review Teams“

1 → 2 → 3 → 4

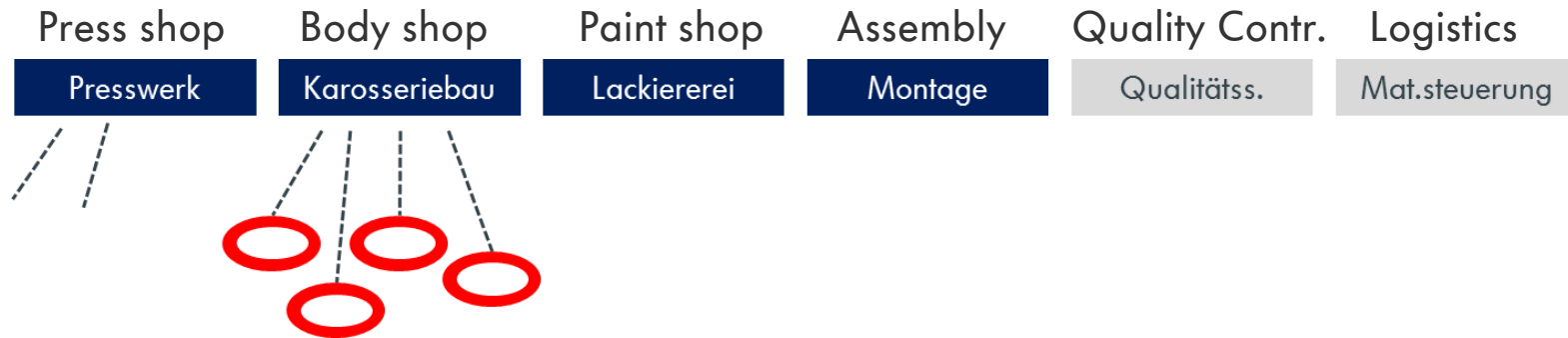
- Review Teams consists of representatives from different departments (Production, Planning, I.E., HR, Unions, etc.)
- Common generation and assessment of ideas for ergonomic improvements
- Systematic status tracking and continuous reporting to plant management



# General Procedure at Hannover Plant

1 → 2 → 3 → 4

## Reporting and Escalation Levels



Review Team

Improving ergonomics workplace design in 21 review teams across the entire commercial vehicle production process

Step	Activity	Level	Turnus
1	Cost center committee	Section Manager	Every 3 weeks
2	Ergonomics steering committee (all shops, all activities)	Plant Manager	Every 2 month
3	Live presentation of topics from Body, Paint and Assembly shop	Board Member	Every 6 weeks (1 example)

**Das nutzt.**

Werk Hannover




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# Implementation of Improvements

## Categories of Improvements

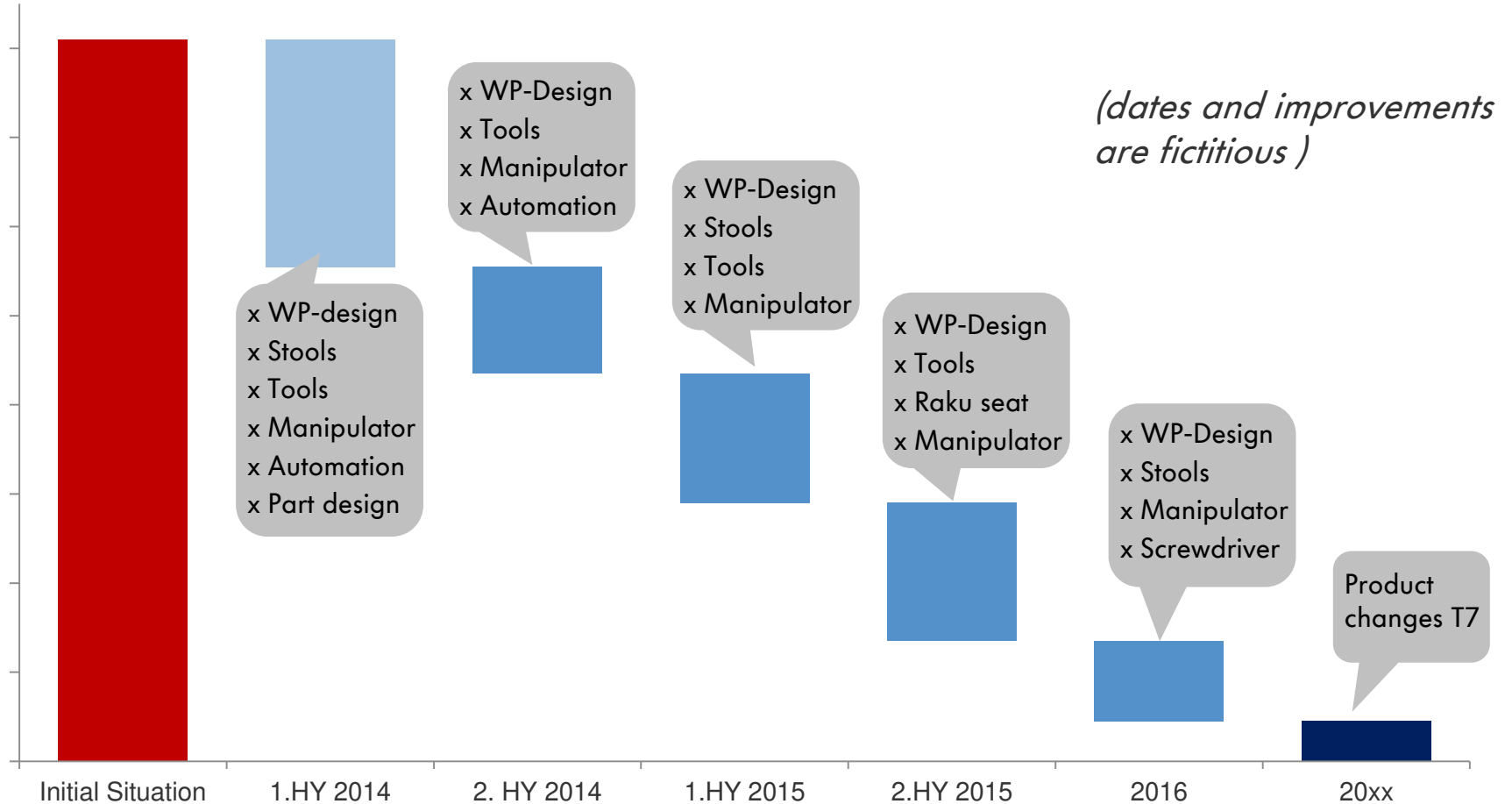
- increasing costs, complexity, timely effort*
- 
1. Work organization:
    - 1.1 Workplace design (working height, platforms, racks, trolleys, etc.)
    - 1.2 Process design (change of sequence, line balancing, optimization)
  2. Technical improvements:
    - 2.1 Lightweight stool
    - 2.2 Raku seat
    - 2.3 Tools & Fixtures
    - 2.4 Manipulator & Balancer
    - 2.5 Automatic Tools / Screwdrivers
    - 2.6 Full Automation
  3. Product design:
    - 3.1 Parts & Design changes



# Implementation of Improvements

## Definition of „Ergonomic improvement path“

1 → 2 → 3 → 4

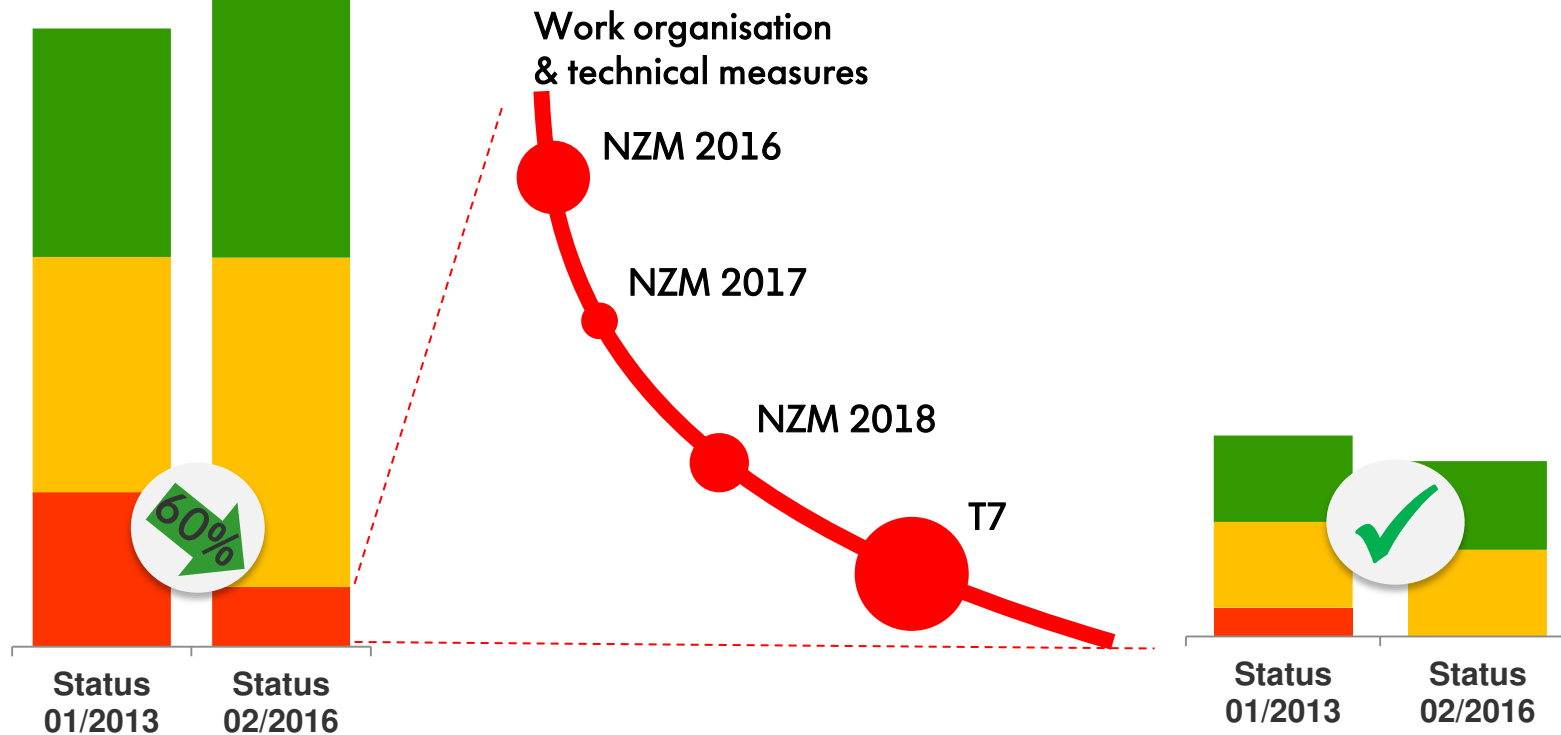


# Status quo



T6

Amarok



# Example: Press shop

1 → 2 → 3 → 4

## (1) Roof frame

Before



- 3 parts at a time (total weight > 3 kg)
- Ergonomically bad picking height
- Deep bending while placing
- 2 workers (left/right)



35 Pts.

After



- Decoupling of worker from press cycle time
- No manual load handling
- Packaging is now possible with one worker



12 Pts.

- 23 Pts.

# Example: Body shop

## (2) Hood assembly und adjustment

1 → 2 → 3 → 4

Before



- Hood fixture has to be lifted manually (7,5 kg)
- Red workplace for 8 workers



72Pts.



35 Pts.

- 37 Pts.

After



- Fixture with gas spring. Lifting force < 30 N
- Strong reduction of asymmetric shoulder strain

# Example: Paint shop

1 → 2 → 3 → 4

## (3) Optimization glueing of interior rear view mirror

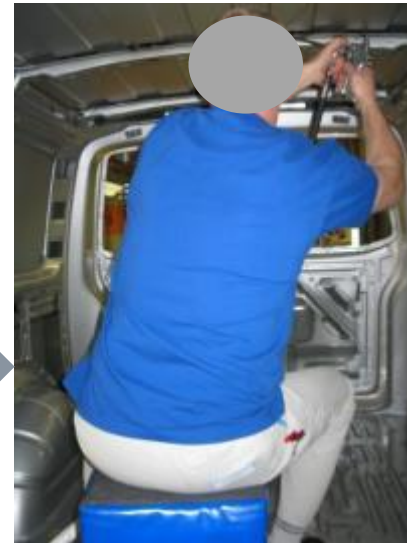
Before



- Rework for glueing the interior mirror
- Deep bending, standing posture or crouching
- Red workplace for 2 workers



After



- Sitting on lightweight stool
- Reduction of rework through optimization of the glueing station and workplace

# Example: Assembly shop

## (4) EC-screwdriver for seat belts

1 → 2 → 3 → 4

Before



73 Pts.



48 Pts.

- 25 Pts.



- Screw seat belts with power screwdriver (pistol grip) and manually tightening with wrench
- Screws have to be documented on data card

- Screws are tightened with the EC-screwdriver, no manual tightening and documentation
- Increased productivity, double handling avoided

**Das nutzt.**

*Werk Hannover*



**Nutzfahrzeuge**



# Example: Assembly shop

## (5) Door preassembly

1 → 2 → 3 → 4

Before



- Doors were fixed at the vehicle
- Ergonomic problems due to restricted accessibility in many assembly stations

After



- Doors are now separated in a pre-assembly line, and reassembled to the car later in the process



# Example: Assembly shop

## (7) Lightweight stool for interior tasks

Before



55 Pts.

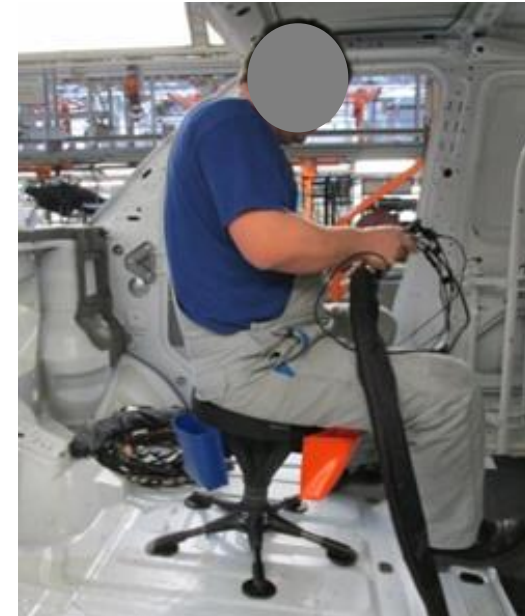


48 Pts.

- 7 Pts.

- Stool placed in the vehicle, multiple pick & place actions with asymmetric load handling (> 5 kg)
- Red workplace for 5 workers

After



- Lightweight stool 2,5 Kg
- Reducction of manual load handling > 50%
- High acceptance by workers

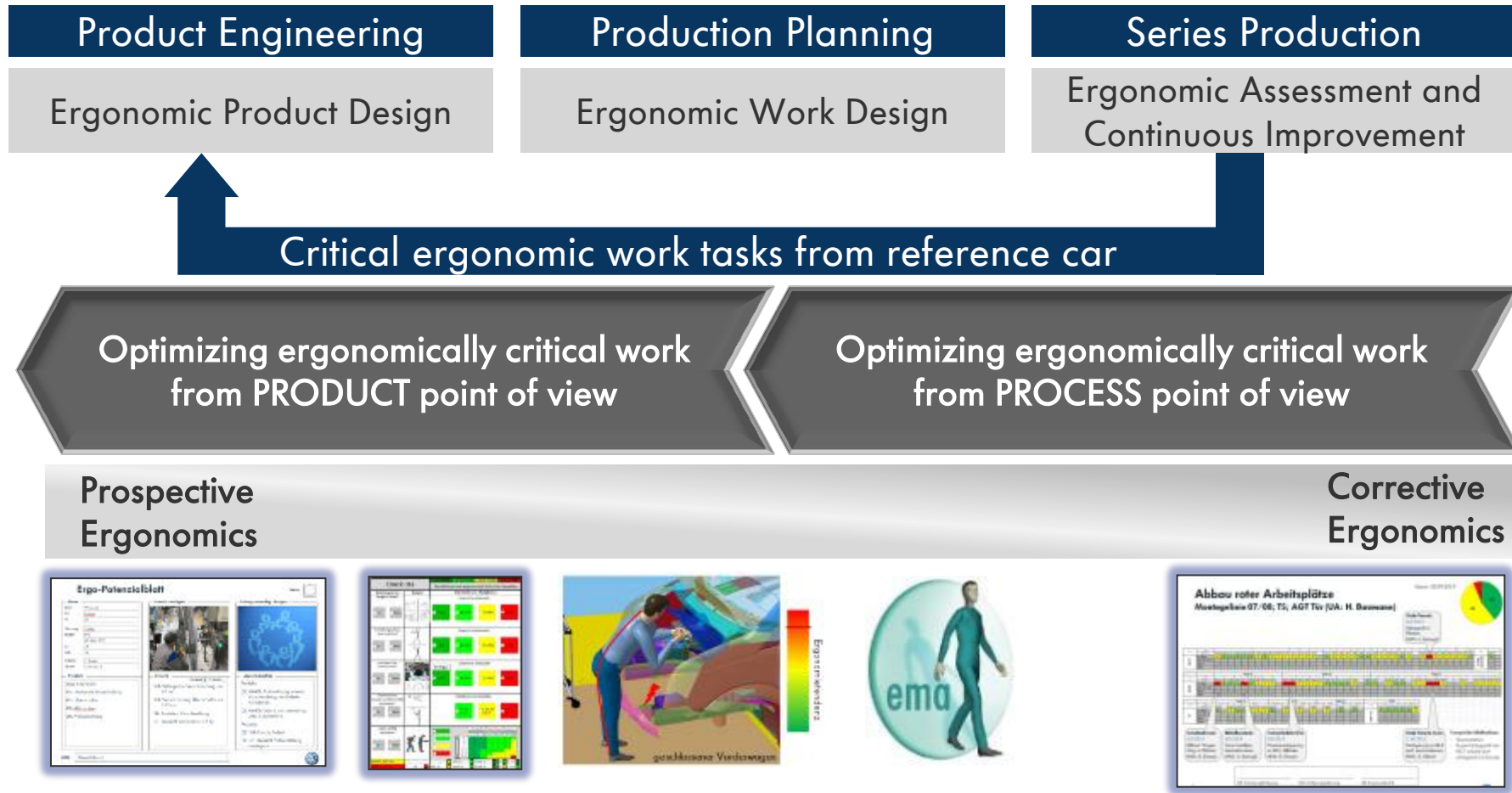
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# Ergonomic Design Process

## General (Future) Procedure

1 → 2 → 3 → 4



# Summary

- Ergonomic challenges in commercial vehicles production due to greater dimensions of body and parts and prolonged lifecycle
- Systematic approach is based on plant strategy and includes comprehensive risk assessment and status tracking
- Participation of employees (Review Teams) and reporting to plant management (Escalation Levels) is key for success
- In future more efforts should be concentrated on prospective ergonomic design at product and production process level

# ERGONOMIE IM PRODUKTIONSSYSTEM



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*(Video 90 s)*



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