SOLVE FOR X.

Automate Your Warehouse: Advancements In Lift Truck Technology

Presented by:

Dr. Kai Beckhaus, Head of Market Management Logistic Systems

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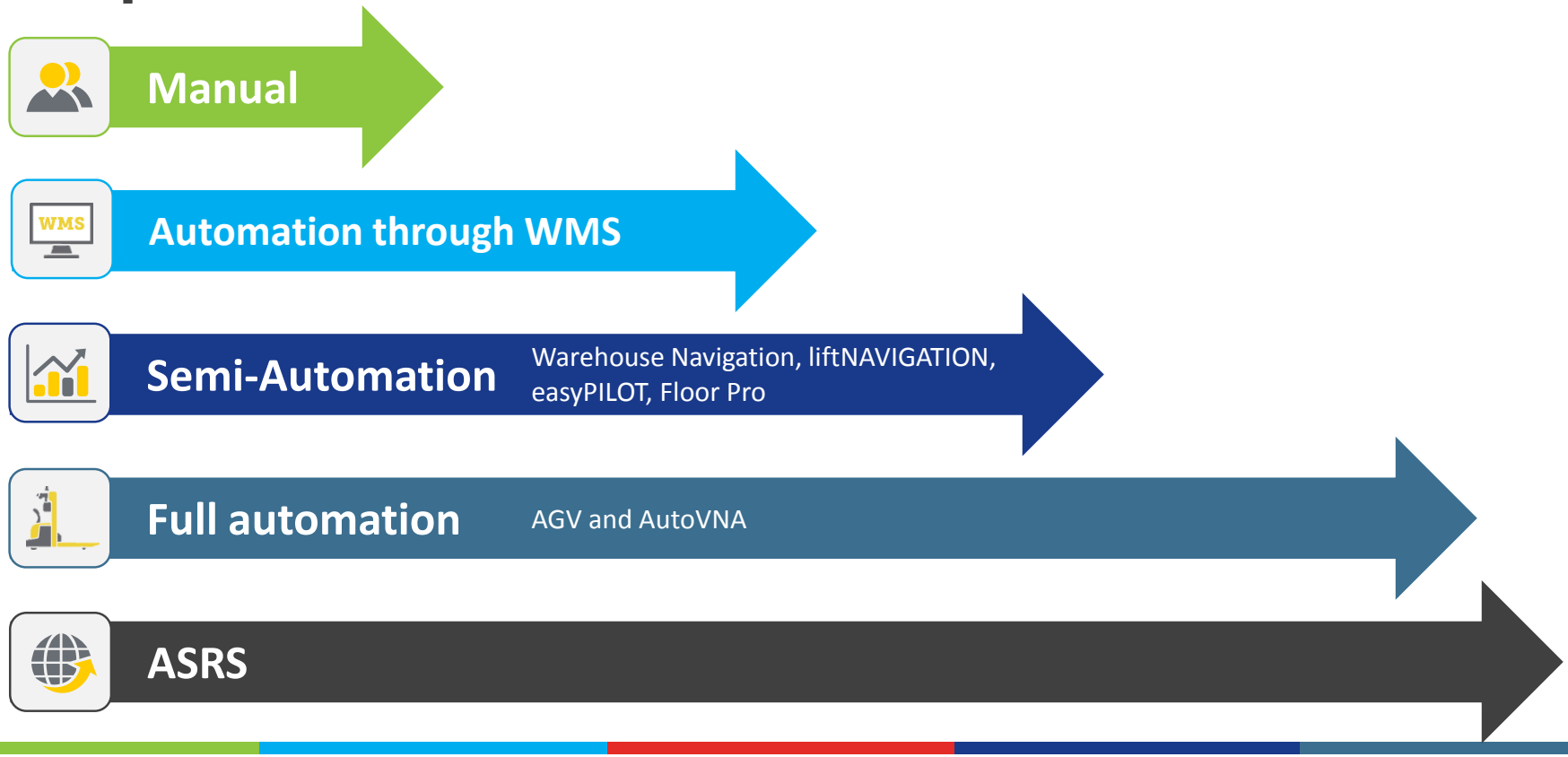
Step Wise Automation



Introduction

Jungheinrich

- Drawing on a balanced portfolio of material handling equipment, logistics systems and services, Jungheinrich offers its customers comprehensive solutions from a one-stop shop.
- Established 1953, global presence, approx. 15,000 employees, 3 billion euros in net sales.

Dr. Kai Beckhaus

- University Diploma in Computer science and economics
- Doctoral degree in engineering
- Programmed the award winning and best seller MHE middleware “Logistics Interface”

Manual Operation

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VNA Assistance Systems

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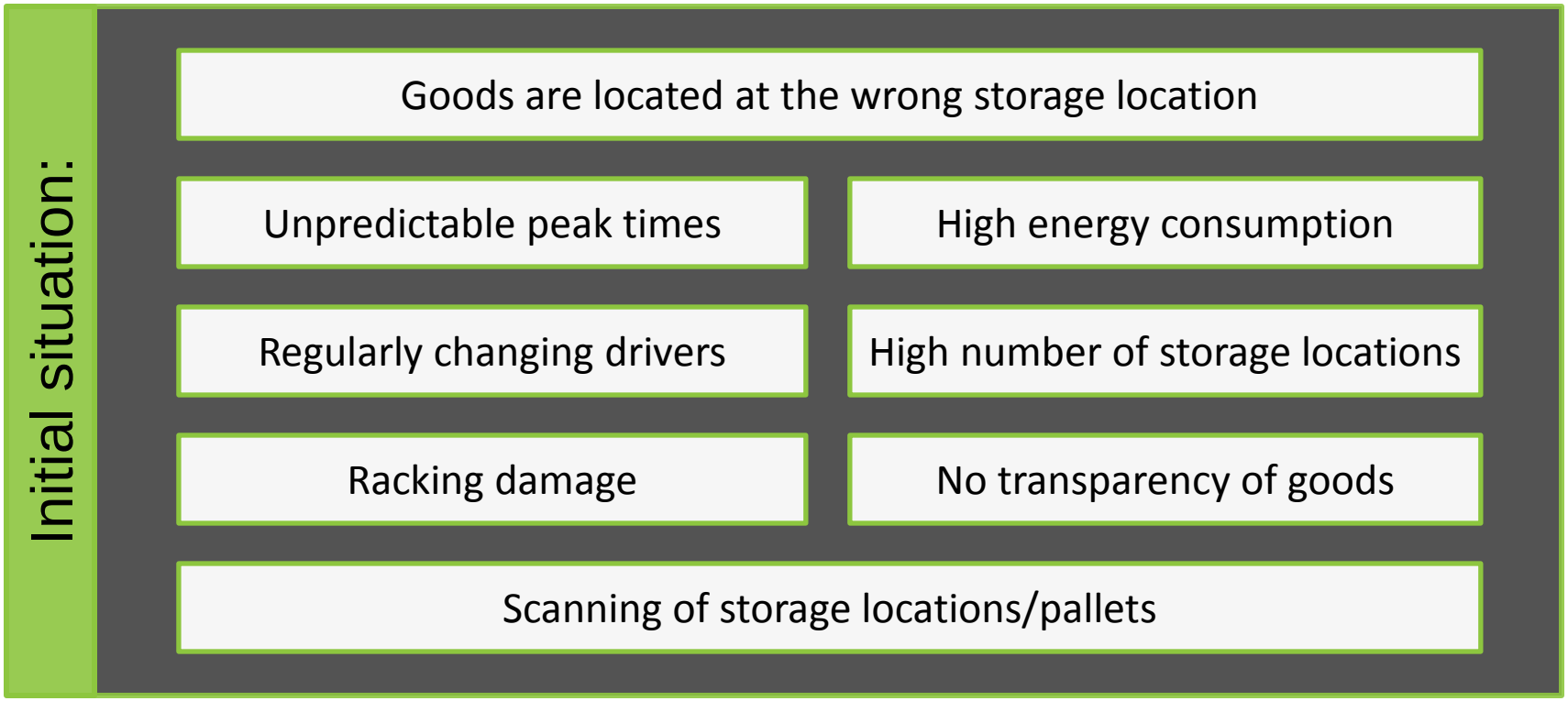
Typical challenges with manual operation that indicate need for assistance systems:



VNA Driving Assistance

- Operator gives impulse to start driving and lifting
- Truck travels semi-automatically to its destination
- Vehicle location via RFID in the floor

Typical Efficiency Increase by VNA Driving Assistance

25 %

20 %

15 %

10 %

Up to 25 %

Factors:

Positioning assistance

+ approx. 10 %

Positioning assistance with changing staff

+ approx. 5 %

No manual scans

+ approx. 5 % per Scan (x2)

VNA Driving Assistance – Calculation Example:

Efficiency Increase	10 %	20 %
Working cycles per year without warehouse navigation	40,000	40,000
Working cycles per year with warehouse navigation	44,000	48,000
Costs per working cycles without warehouse navigation	2.30 $	2.30 $
Costs per working cycles with warehouse navigation	2.10 $	1.92 $
Savings per Year	**7,731 $**	**16,791 $**

Video Warehouse Navigation

http://youtu.be/V09t42XLVS0

Video Warehouse Navigation

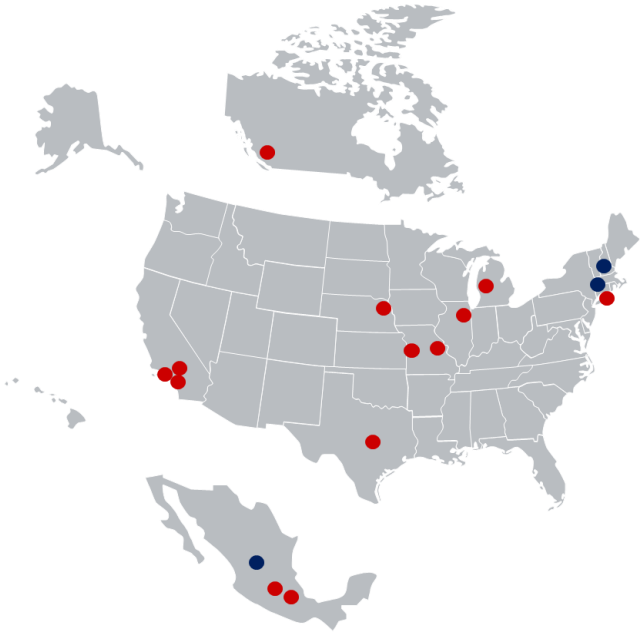
http://youtu.be/V09t42XLVS0

“Warehouse Navigation” References

Worldwide Project Figures (as of 12/2016)

- Sites in operation > 430
- Trucks in operation > 1,400
- In 37 countries on 6 continents

- Trucks in operation N.A. > 40

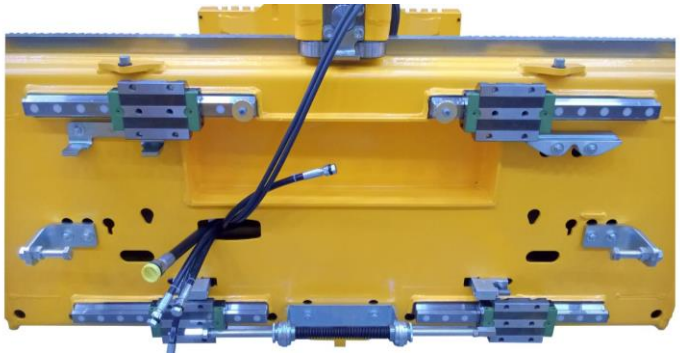


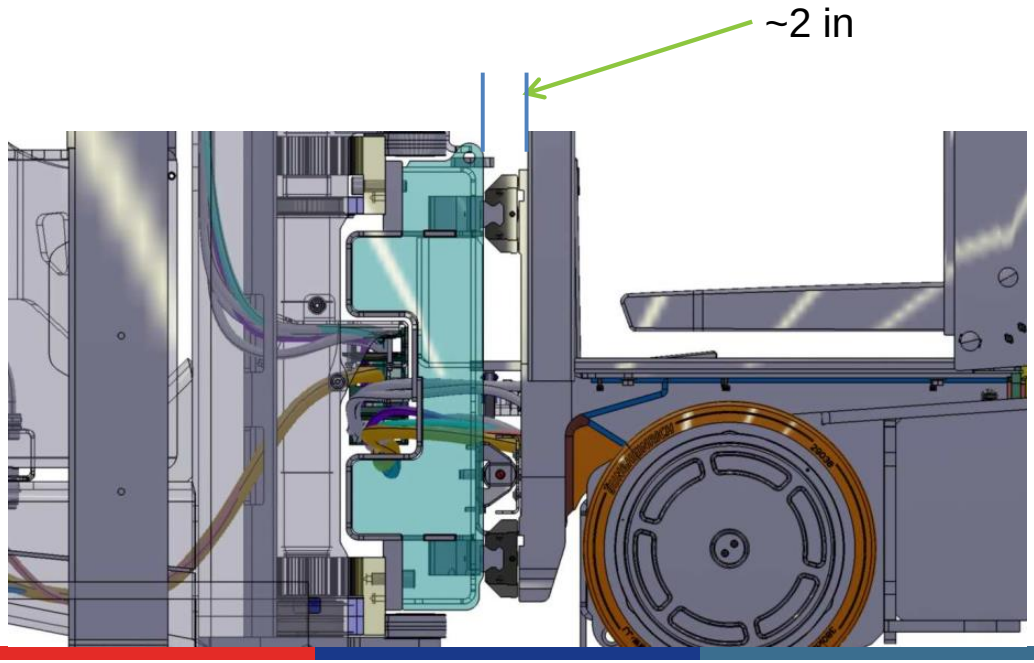
Are there any brand new trends in VNA assistance systems?

- First vendors tackle the top challenge of uneven floors.
- Trucks operating in heights above 55 ft handling 2,200 lbs require a super flat floor.
- ⇨ Newest technological trend is an innovative damping system to reduce mast movements to the side
- Increases safety and allows for higher driving speeds on uneven floors
- Reduce wear and tear on all components
- Opens new fields of application for VNA trucks

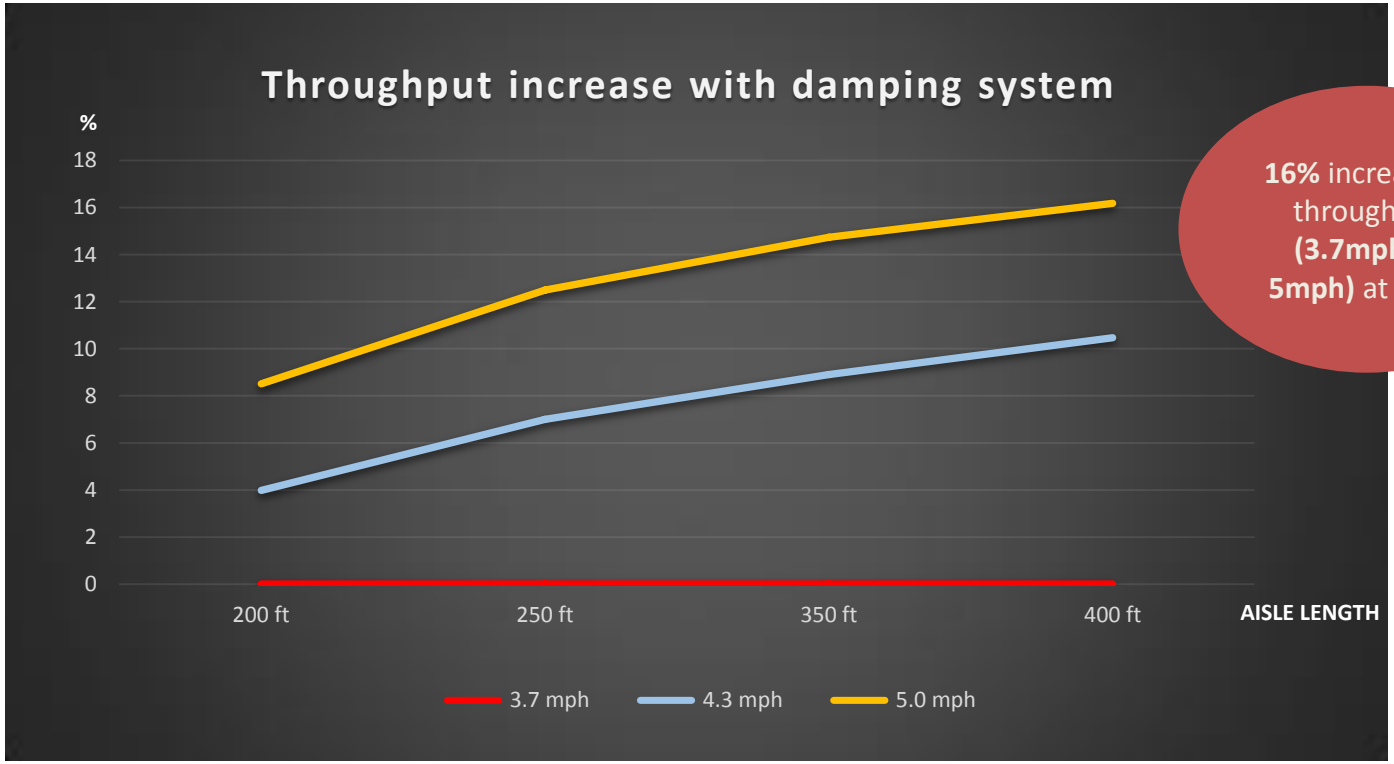
Example for a technical solution to the problem:

Hydraulic Compensation of Floor Unevenness



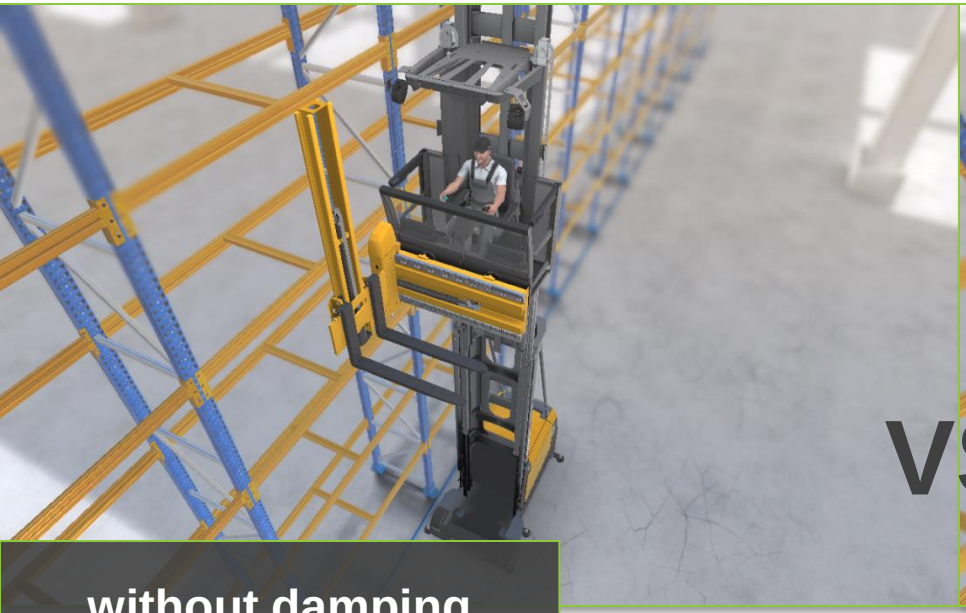


Higher throughput thanks to faster speed profiles.



How to read the graph: With floor unevenness and w/o damping system, speed needs to be capped at 3.7mph. The damping system allows travel @ 4.3 or 5mph, leading to the stated throughput increase. Calculations/measurements are based on 33 ft top-beam in a turret truck application.

Video to Demonstrate the Technological Improvement

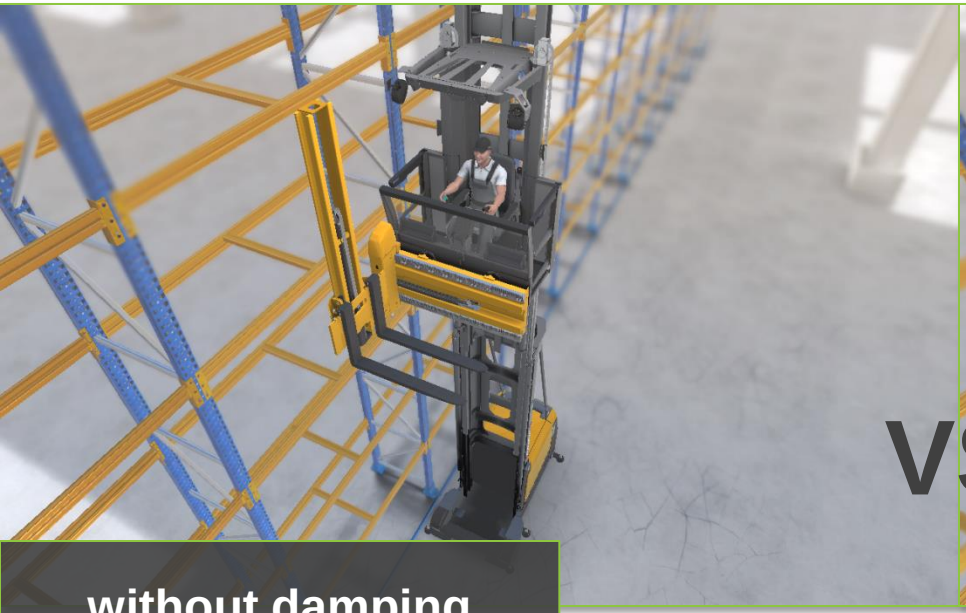


without damping

VS.

with damping

Video to Demonstrate the Technological Improvement



without damping

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Height Pre-Selection

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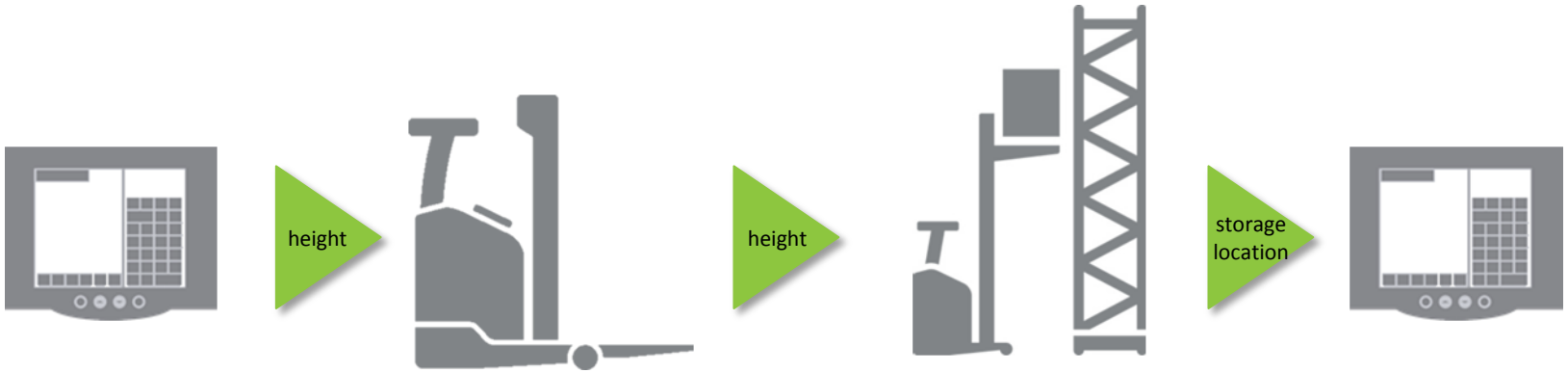
Typical challenges with manual operation that indicate need for assistance systems:

Health & Safety

- Goods are located at the wrong storage location
- Unpredictable peak times
- High energy consumption
- Regularly changing drivers
- High number of storage locations
- Racking damage
- No transparency of goods
- Scanning of storage locations/pallets

State of the Art Reach Truck Assistance System: Height Pre-Selection

- WMS connection: destination height transmitted to the reach truck control
- Lift stops semi-automatically at the correct fork height
- Confirmation of the storage location to the WMS



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Project Description

- adp Gauselmann GmbH, Germany
- ETV 312 reach truck
- Height pre-selection
- Logistics Interface connects to customer specific WMS

Key Benefits

- Increase in productivity
- More process safety
- More operator comfort and ergonomics

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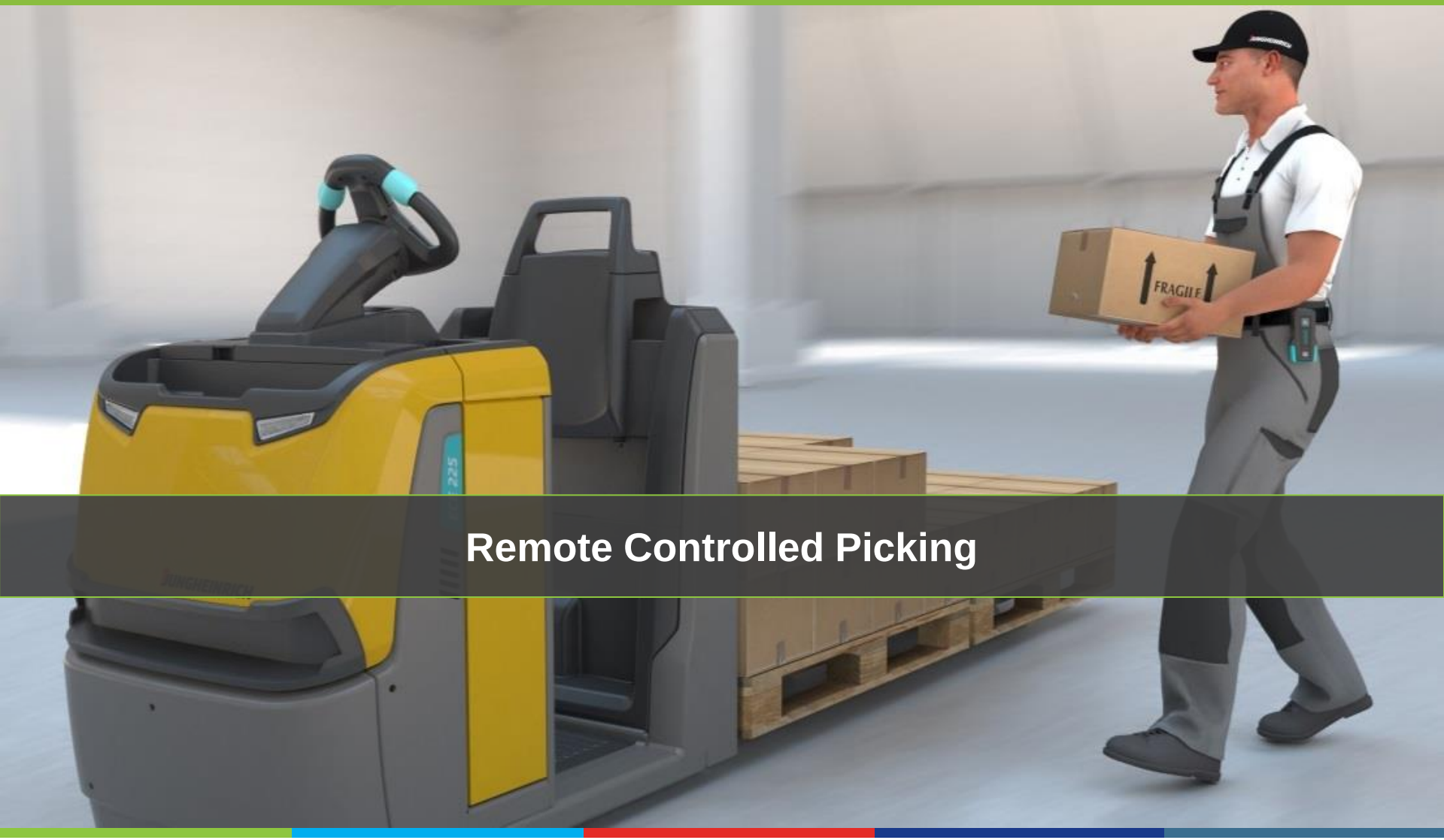

Remote Controlled Picking

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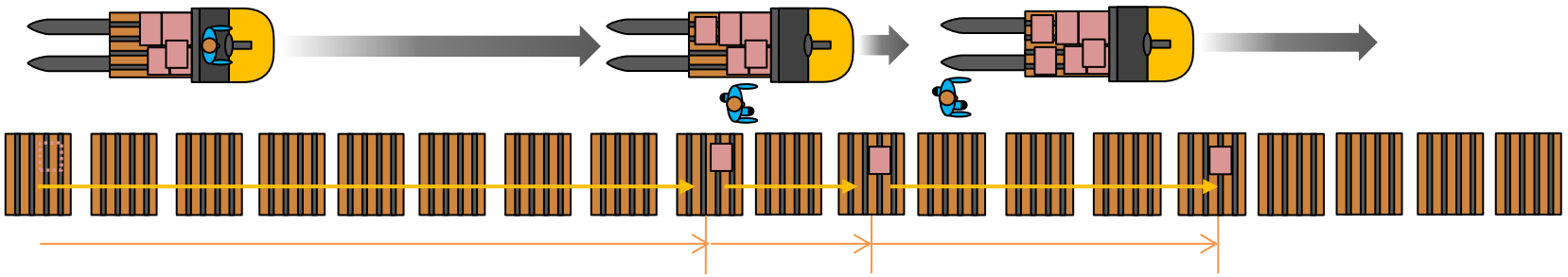
How can automation increase picking performance and workers' comfort?



Long distances.

Normal driving with ride-on operation

Short distances.

Side attached driving buttons

Middle distances.

Remote control operation

- "to push the MHE forward"
- Full concentration on order picking process

Higher efficiency by semi-automation and relief for operators

Can the automation level increase through the Internet of Things?

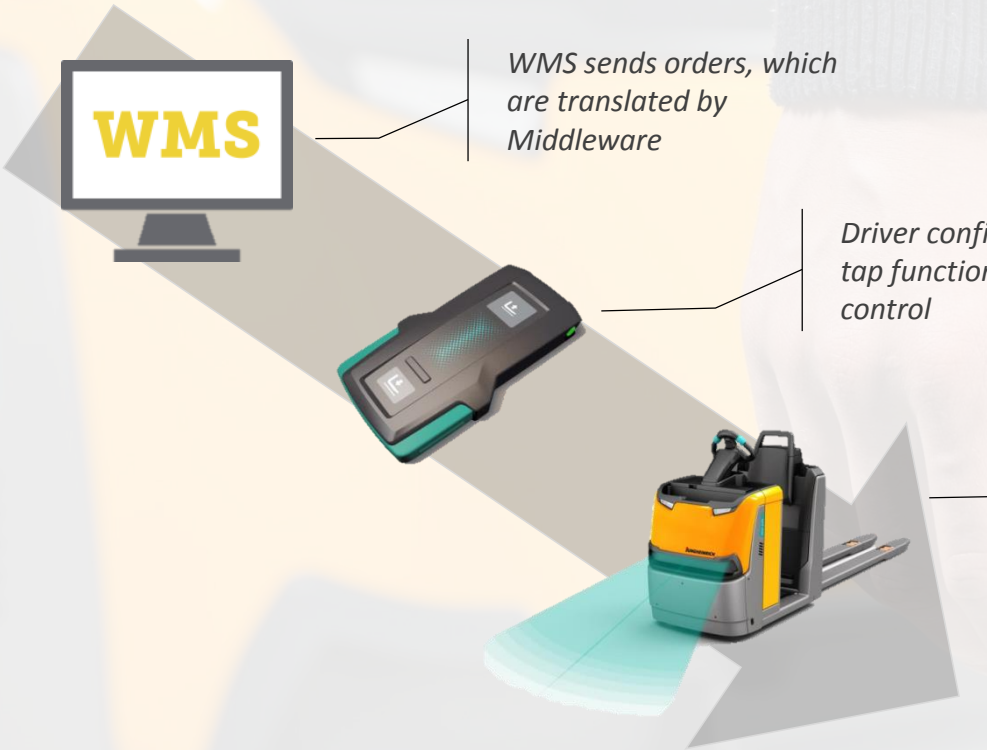
WMS connection of remote control

- Newest technology enables connection of remote control to a Warehouse-Management-System (WMS)
- Middleware as communication center between WMS and Pallet Truck

STEP 1: remote control (stand-alone)

STEP 2: WMS connection

Middleware for Center Rider/Remote Control



WMS sends orders, which are translated by Middleware

Driver confirms via double tap function of the remote control

Center Control Rider advances automatically to the right pick position

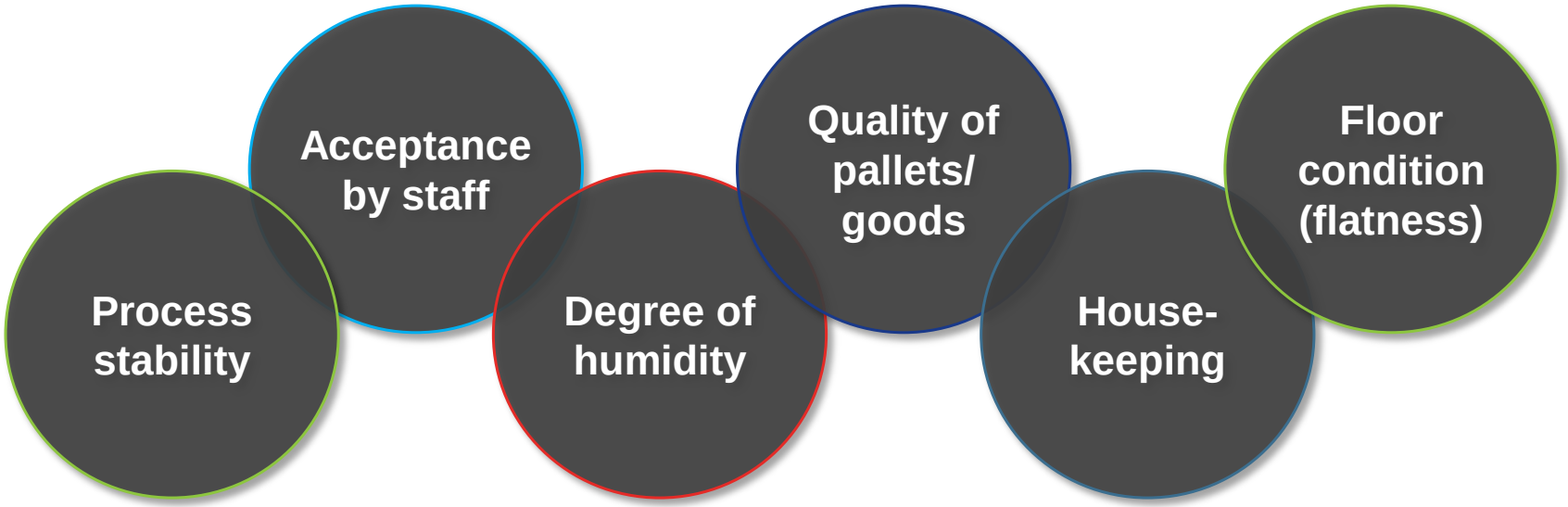
Remote Control – Efficiency Measurements*




- Between 12.7 % and 30 % productivity improvement
- Elimination of walking distances increases efficiency
- Reduced energy consumption per pick of approx. 16% per pick

* source: Theo Egberts (2016): Pick by tap (f+h 9/2016)

…requirements for full automation…



Discussion:
Automatic vs. autonomous trucks

AGV

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Project Description

AGV

- AVO Werke, Germany
- Replacement of the manual transport system with AGVs
- 3 x vertical order pickers EKS 210a
- Transport control software Traffic Manager

Key Benefits

- Increased efficiency and productivity
- Elimination of transport damage
- Cost savings
- 100 % recipe tracking

Can AGVs operate in Very Narrow Aisles?

AutoVNA

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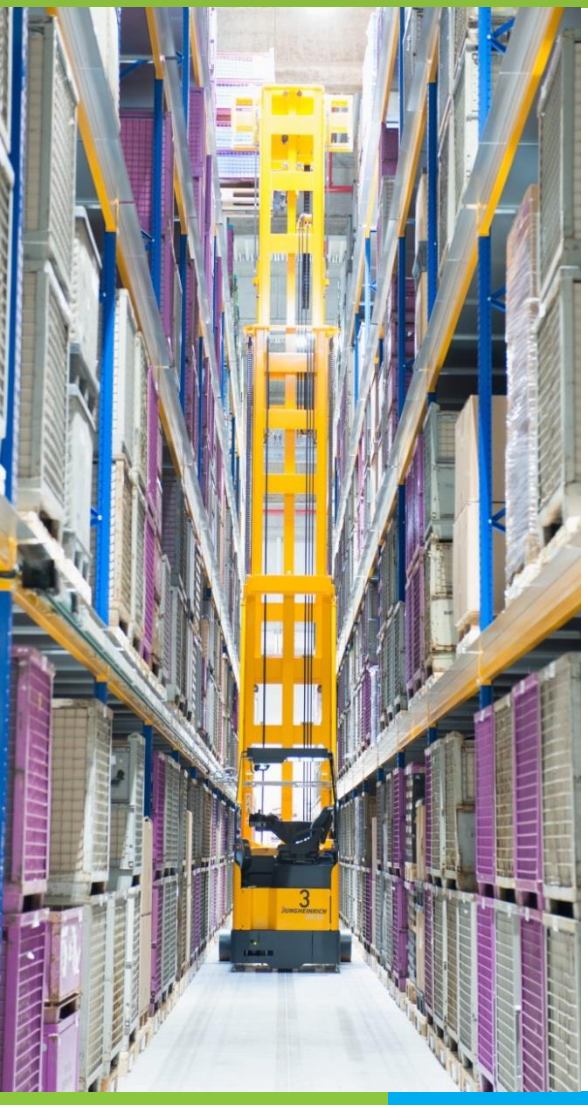


Project Description

AutoVNA

- Coko-Werk GmbH & Co. KG, Germany
- JH Warehouse Control System (WCS)
- Automation of narrow aisle warehouse
- 3 x high-rack stacker ETX 515a

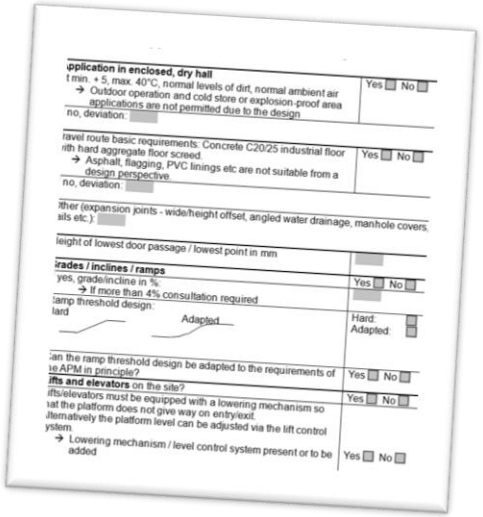
Key Benefits

- Efficiency boost
- Reduced energy consumption
- Increased overall availability
- Reduced wear

What's the next step, if requirements are fulfilled?

Which data makes an enquiry a good one?

- Floor spec., grades / inclines / ramps
- Environment, temperature, humidity etc.
- Floor layout, travel routes, lifts/elevators, door clearance, stations (height, spaces, rack space, …)
- Transported materials, overhangs, load unit details
- Transport matrix, working hours / shifts (incl. breaks), peaks
- Way of order generation, interfaces to software or stationary hardware like sensors, PLCs, fire doors
- …



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