

SURCAR 2011

Modular Paint Box Concepts („Modshops“) in Comparison to Conventional Sequential Paint Lines

Dr. Hans Schumacher, Dürr Systems GmbH

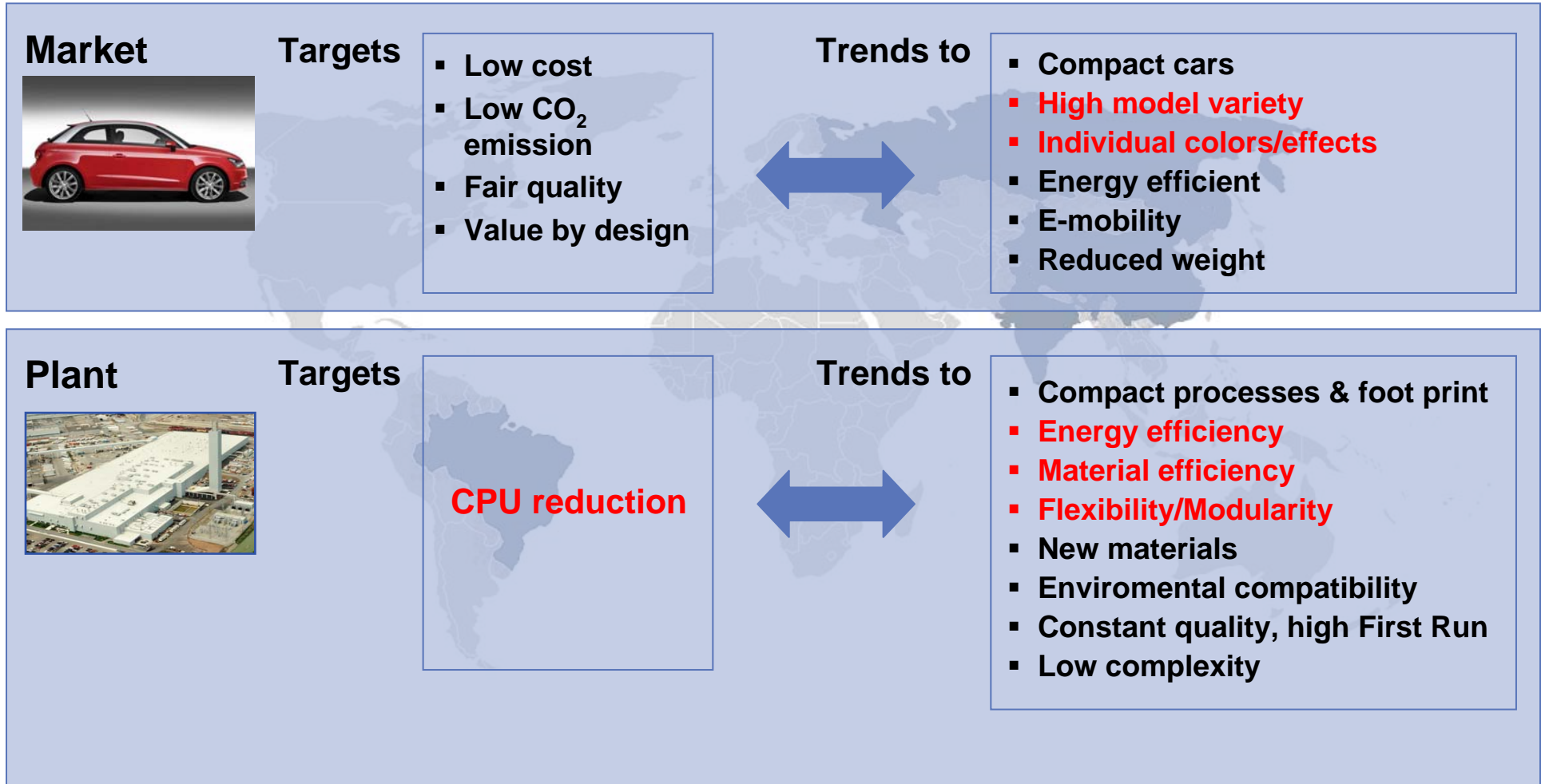
Cannes, 01.07.2011

Agenda

- **Line vs. box: a generic concept comparison**
- **Project example**
- **Conclusion**

Automotive Market and Car Manufacturing

Global trends and targets



Sequential Paint Lines vs. Modular Paint Boxes

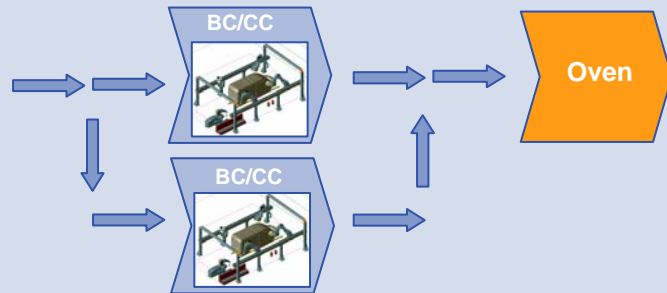
Generic concept comparison

Sequential Paint Line



- One sequential line of booths and ovens
- Body transfer by chain conveyor
- In each station and oven zone, only a part of the painting is processed
- Tracking or stop & go mode

Modular Paint Boxes



- Single stations (boxes) arranged in parallel
- Bodies fed in/out by adequate conveyors
- Painting task is maximized in each box
- Stop & go mode

JMC Nanchang



High variety of products to be processed

Passenger Car



- Capacity: 26 JPH
- Process: 3wet High Solid (solvent borne)
- Types: 4 Passenger
- Body size: 15 m² exterior surface area
- Colors: 2 Primer, 2 Monocoat, 6 BC / 1 CC
- Application: Interior/Exterior



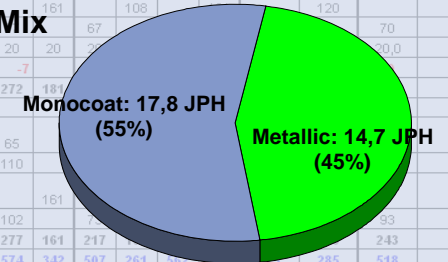
Van/Truck



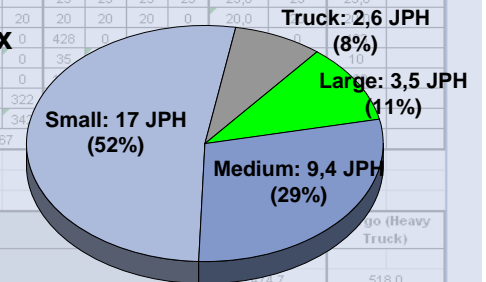
- Capacity: 32,5 JPH
- Process: 3wet High Solid (solvent borne)
- Types: 21 Van/Truck
- Body size min: 25 m² exterior surface area
- Body size max: 40 m² exterior surface area
- Colors: 2 Primer, 3 Monocoat, 5 BC / 1 CC
- Application: Cargo/Interior/Exterior



Color Mix



Body Mix

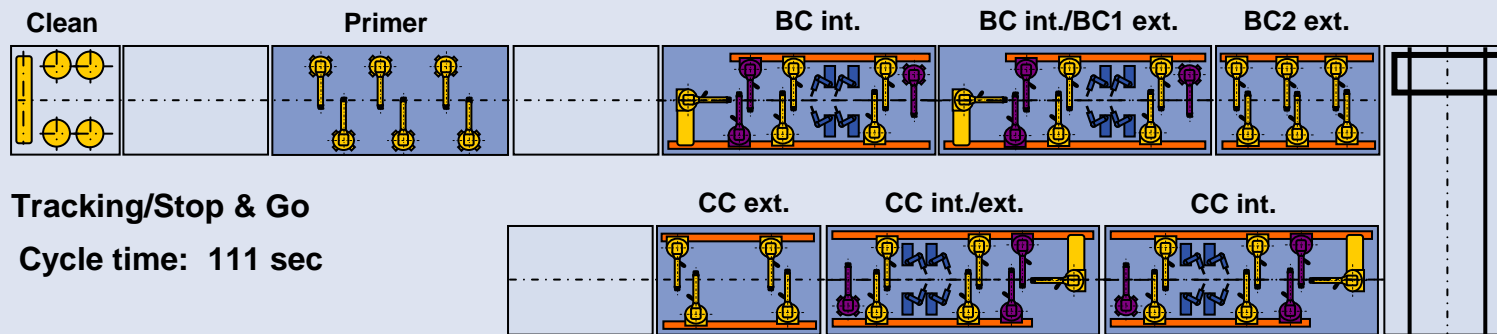


JMC Nanchang



Approach of a modular paint box concept for van/truck

Sequential Line Layout: 32,5 JPH

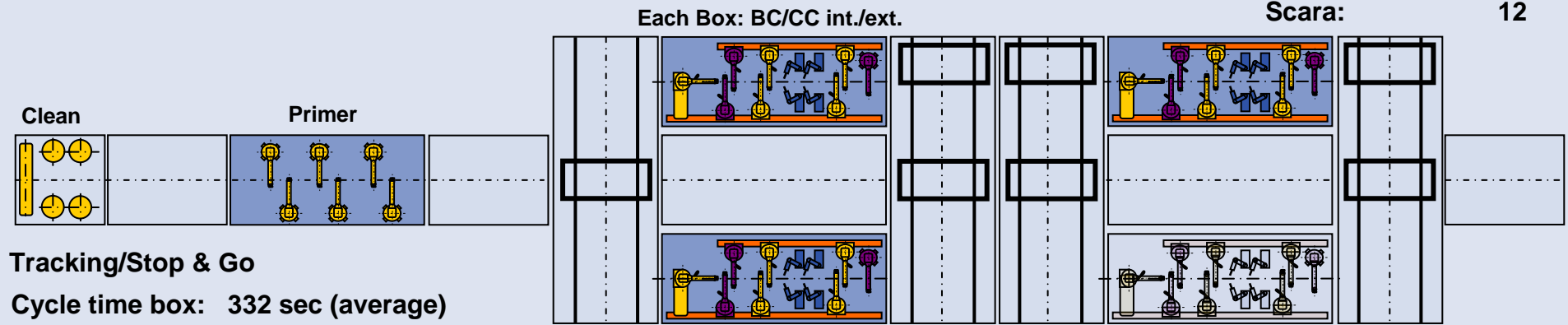


Scrubber length: 91 m
 Robots: 36
 Opener: 12
 Scara: 16

Tracking/Stop & Go

Cycle time: 111 sec

Modular Box Concept: 32,5 JPH



Scrubber length: 58 m
 Robots: 21
 Opener: 9
 Scara: 12

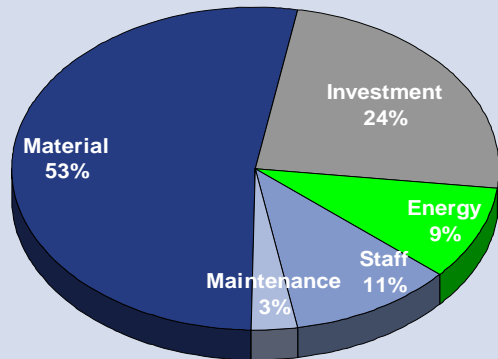
Tracking/Stop & Go

Cycle time box: 332 sec (average)

Future capacity extension

Saving evaluations box vs. line

Cost per unit (CPU) in a typical paint shop



Energy: reduced booth ventilation

- Scrubber length per line/box concept: 91m/58m

➤ **Savings: 36%**

Investment: reduced amount of robots and booth length

- Number of robots per line/box concept: 64/42 ●
- Scrubber length per line/box concept: 91m/58m ●
- Ventilated booth length per line/box concept: 47m/140m ●
- Conveyor length & cross conveyors per line/box: 121m & 1 cc/118m & 4 cc ●

➤ **Savings: 31%**

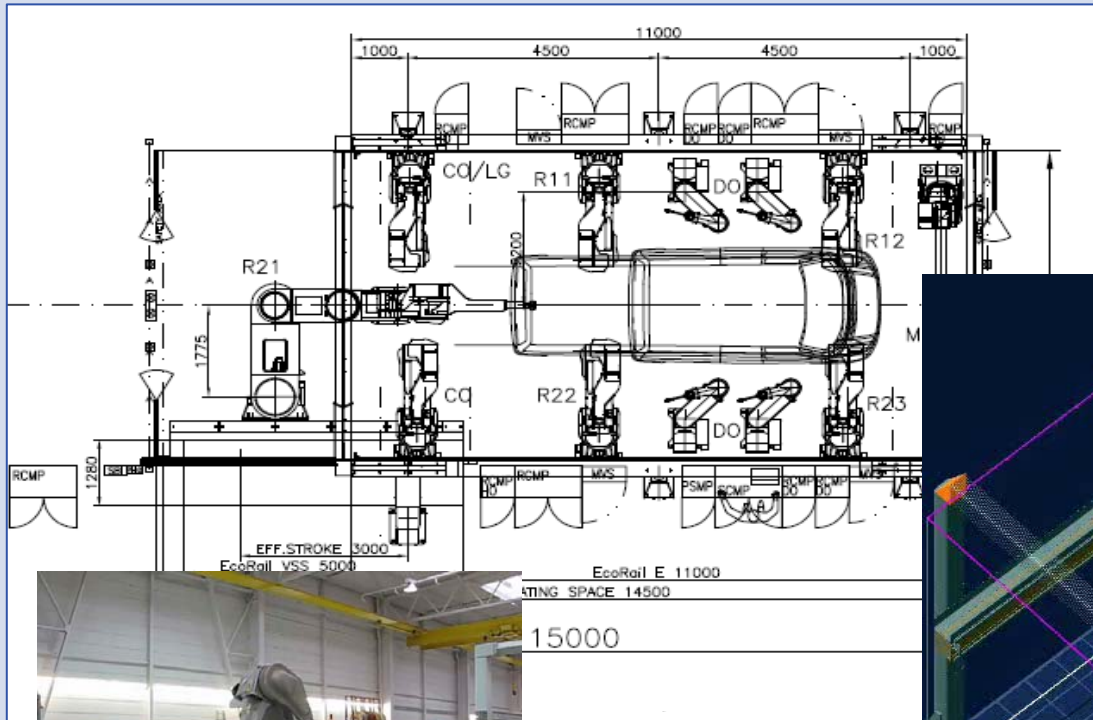
Material: reduced color change loss for monocoats

- Color mix (monocoats): 55% (17,8 JPH)
- Robots per line concept: 16
- Robots per box concept: 8 (1,5 boxes)
- Color changes per h: 6 (each 15 ml/robot)
- Operation time: 24 h/d, 280 d/year

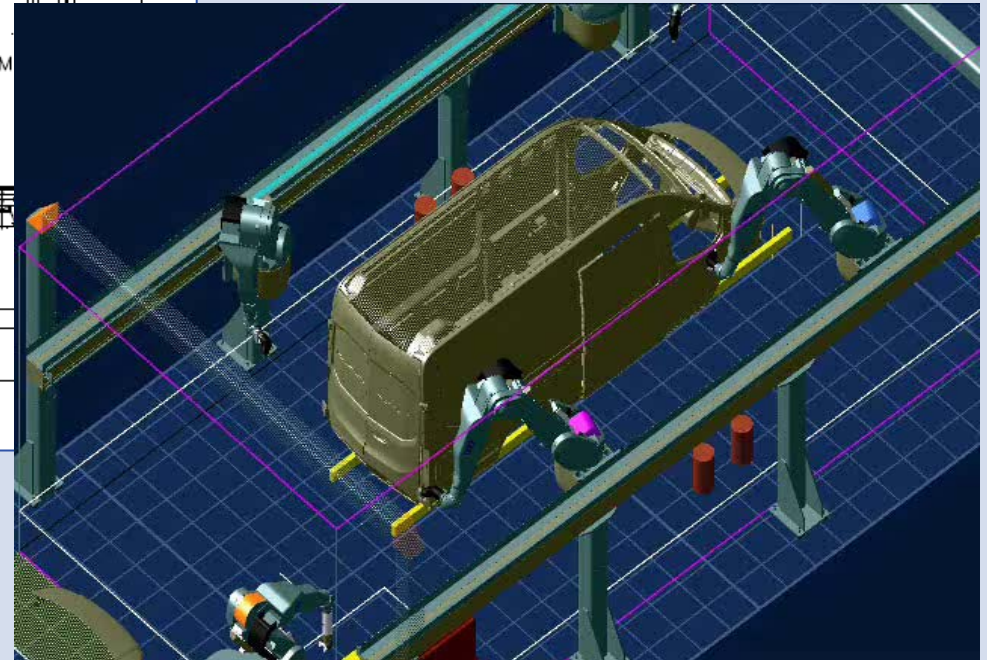
➤ **Savings: 4.838 l paint/year**

JMC Nanchang – Modular Paint Box

Interior and exterior application of BC and CC in the same box

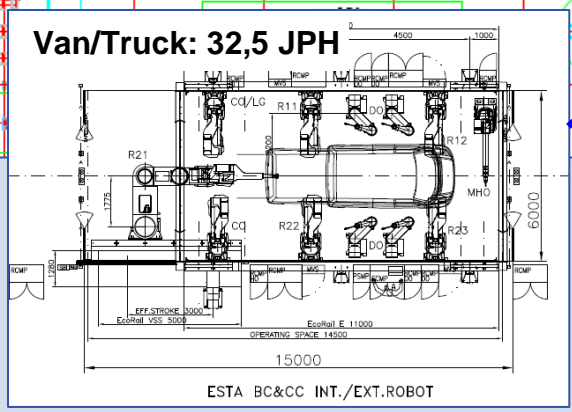
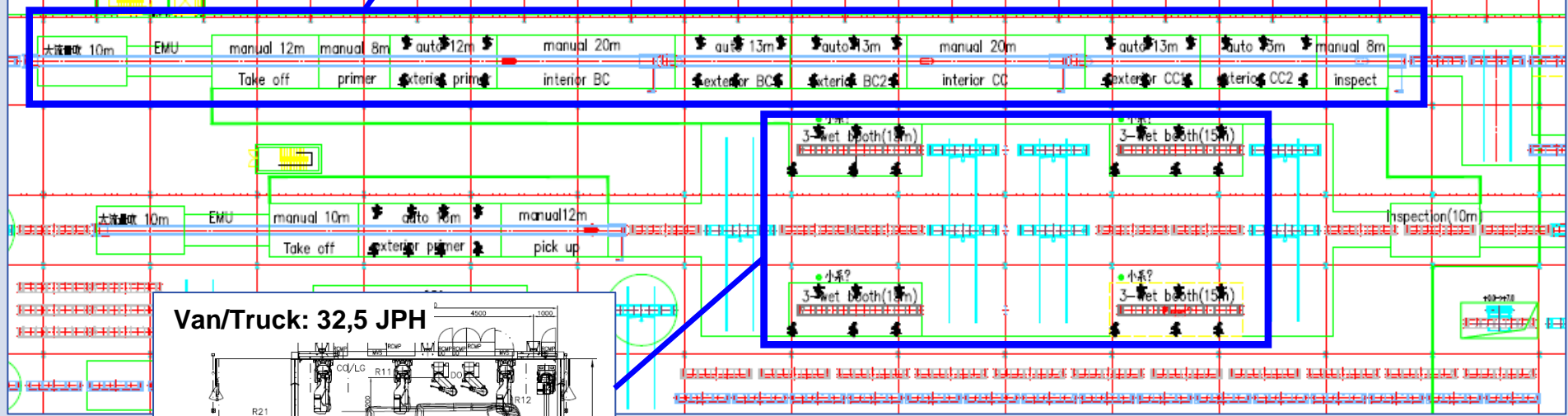
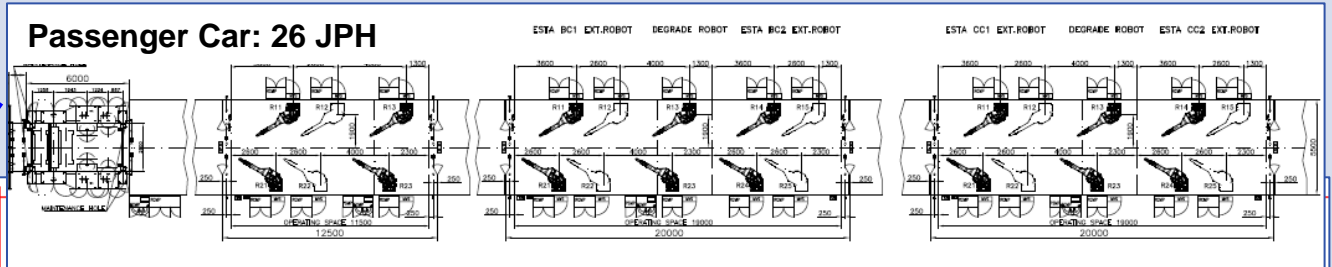


EcoRP L153, flexible 9-axis van painter



Opener not shown

JMC Nanchang – Overall Layout



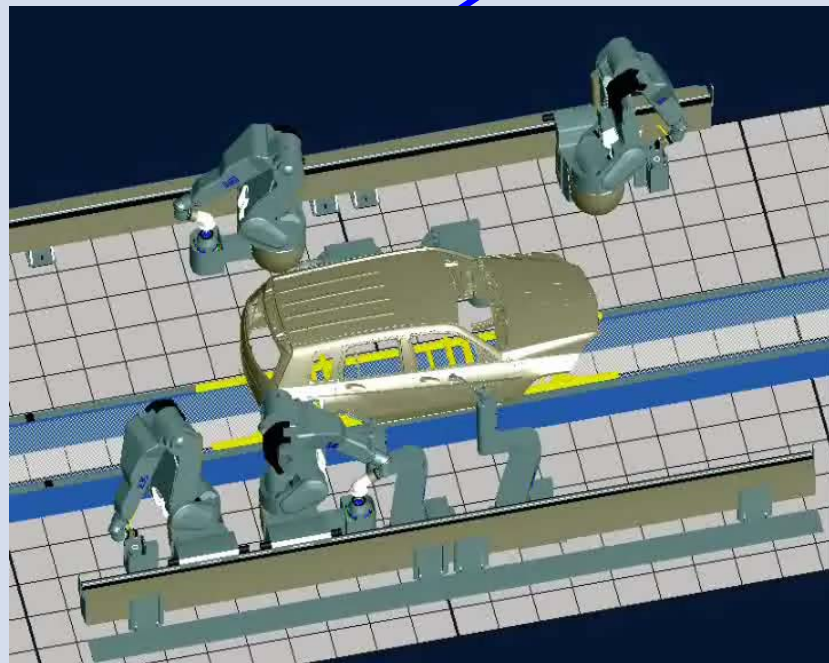
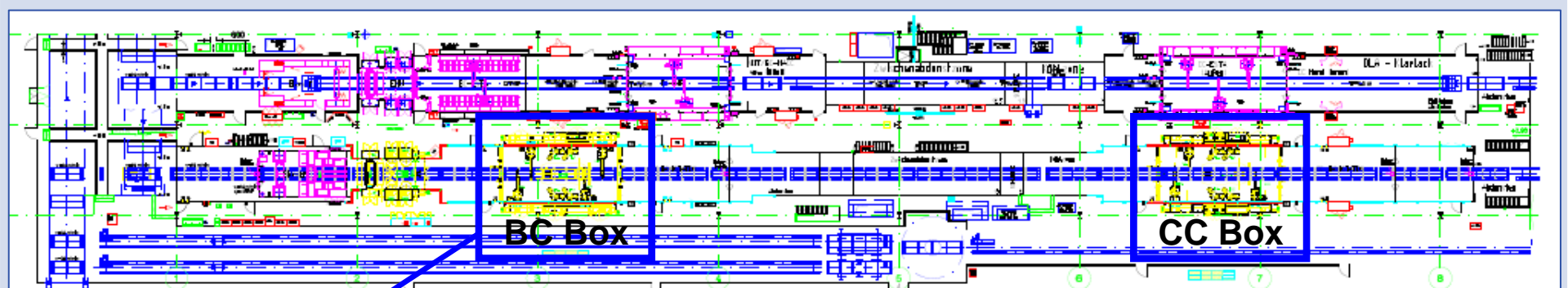
SOP 08.2011

Boosting the efficiency by using both concepts

Mercedes-Benz Bremen



Paint shop extension



- 2 new boxes for special colors in an existing (conventional) paint shop
- Stop & go, cycle time 5 to 9 Minutes
- Waterborne basecoat, 2K solvent clear coat
- Only 2 robots *EcoRP L133* with *EcoBell3 C* are painting the complete interiors and exteriors
- 4 scara openers (*EcoRP L130*) and 2 hood/trunk openers (*EcoRP L133*) for opening and closing
- SOP 1.2011

Key Enablers

Flexible and simple application products for efficient box painting

EcoBell3 C (Compact electrodes)



EcoBell3 C for interior and exterior painting of waterborne material

EcoBell2 HX (High flexibility)



High spray pattern flexibility necessary for interior and exterior application

Summary

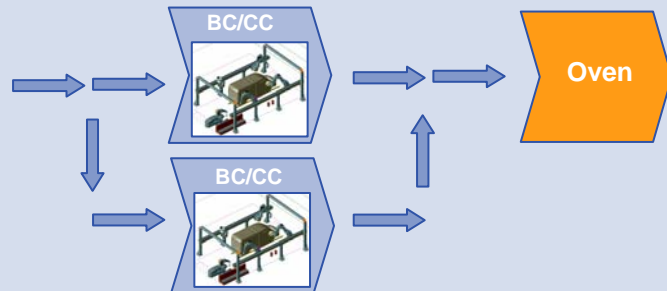
Sequential paint lines vs. modular paint boxes

Sequential Line Layout



- Low model variety
- Constant cycle time
- Process specific application

Modular Paint Box



- High model variety
- Model specific cycle time
- Easy adaption for production volume changes
- Efficient application of special colors
- High flexibility for future situations
- Temporary use as a teach box
- Same flexible application for all processes necessary

Actual References: Porsche Zuffenhausen, Mercedes-Benz Bremen, JMC Nanchang

Conclusion

- **The box concept is an additional layout option to improve the efficiency in case of high production variety**
- **Sequential lines are convenient for mass production**