Manufacturing Engineering
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From the Past to Manufacturing 4.0

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Purpose and Contents

Purpose of the Presentation

... is to give an overview of Airbus level of automation and technologies, and how to go forward.

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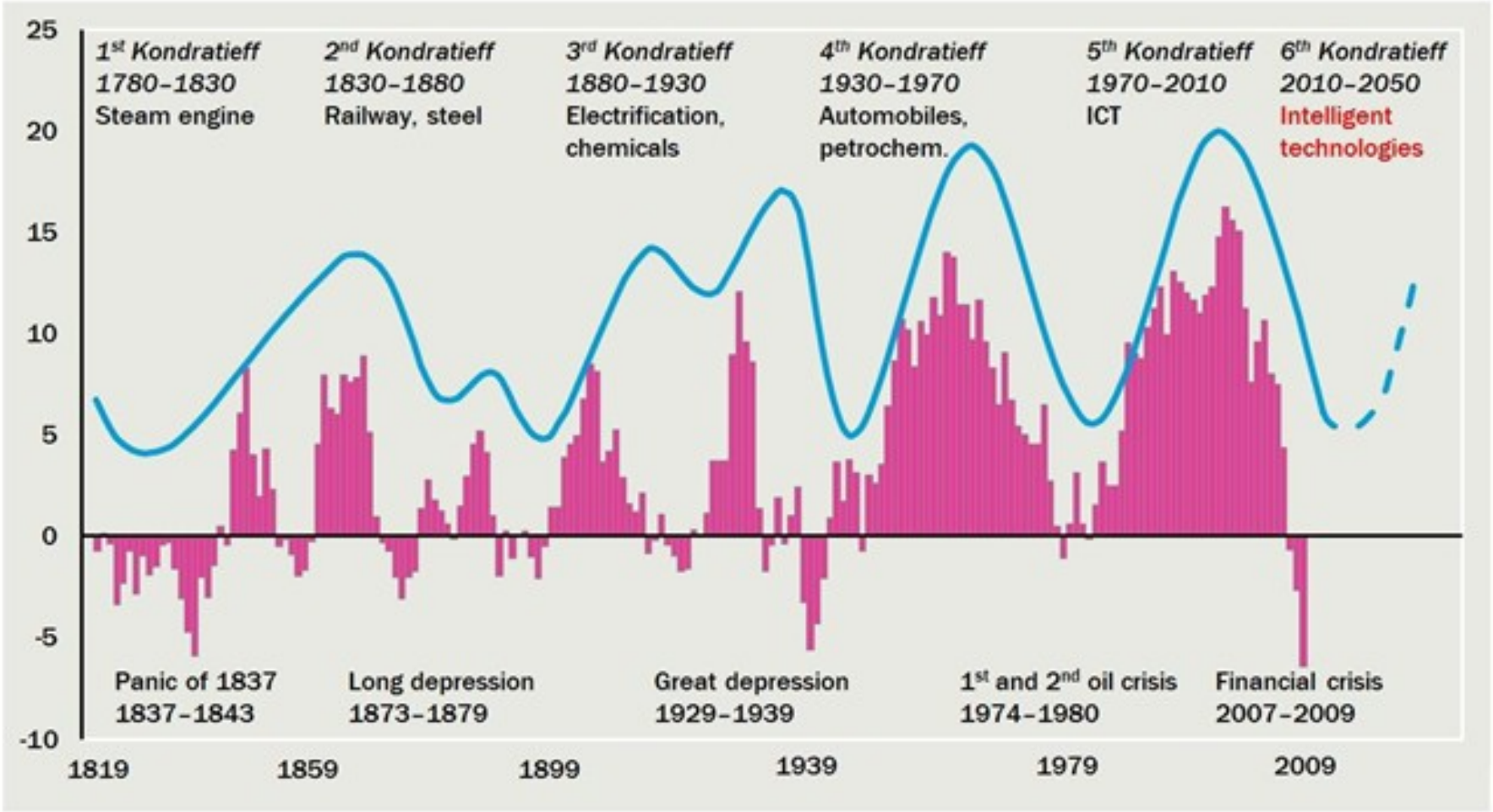
History of automation – The Kondratieff waves



The 6th Kondratieff stay for

- ***Global network***
- ***Big data***
- ***Life sciences***
- ***Artificial intelligence***
- ***Robotic***
- ***Bionic***

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History of drivers in automation for assembly manufacturing at AIRBUS

1970 - 1985: At low rates assembly technologies were driven by manual work. In comparison to other industries the production rates and the repeatability part-to-part is low. First implementation of automation was done with heavy duty machines. The processes automated were drilling / fastening.

1985 -1995: Restriction accessibilities led to less automation in fuselage. Open structures boxes, shells were automated. Semi-automatic machines were implemented.

1995 - 2005 Automation only done partially e.g. AROCS [**A**utomatic **R**iveting **o**f **C**losed **S**tructures] in BRE for Flaps

2005 - 2015 Further improvements, especially with increasing rates, improve effectivity

2015 – now Integrate complex systems in structure assembly “Automation @ Step Change”. Reduced lead time and with a look on ergonomics leads to development of light and modular automation

Automation was implemented in the past mainly for drilling / fastening with heavy duty machines for open structures. To reduce RC-hours, increase flexibility and reduce cost of non quality

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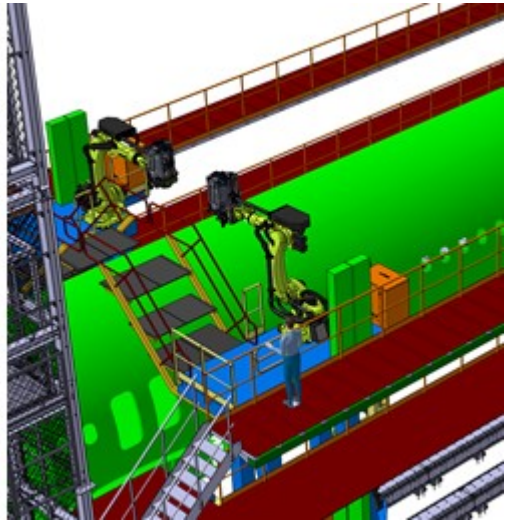
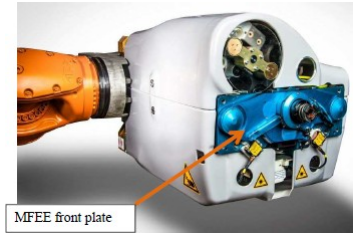
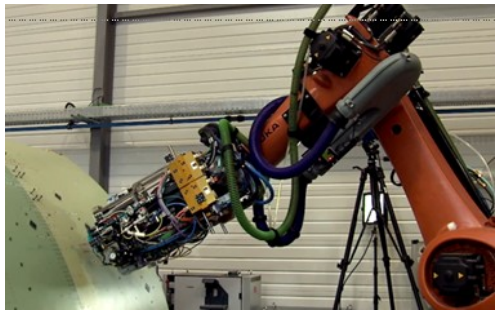
Automation @ Step Change single aisle, AIRBUS Hamburg – Robotic drilling and fastening of orbital joints







- KUKA robot + Alema drilling and fastening end effector for app. 6 800 holes/aircraft
- Automatic referencing
- One-shot drilling and fastener insertion
- No drilling jigs
- App. 50% recurring cost / workload reduction
- Better ergonomic situation for employees

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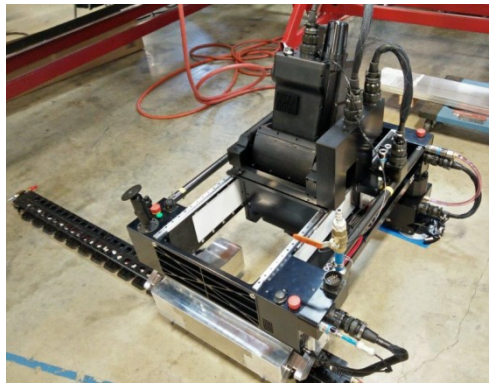
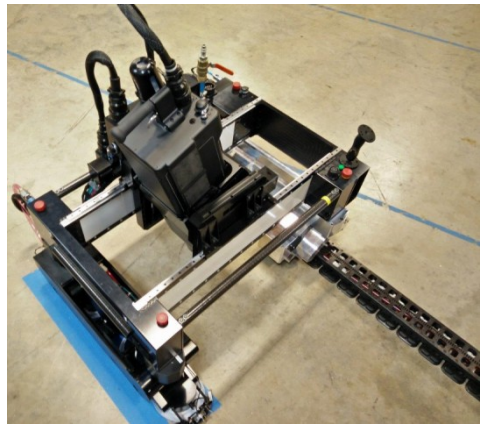
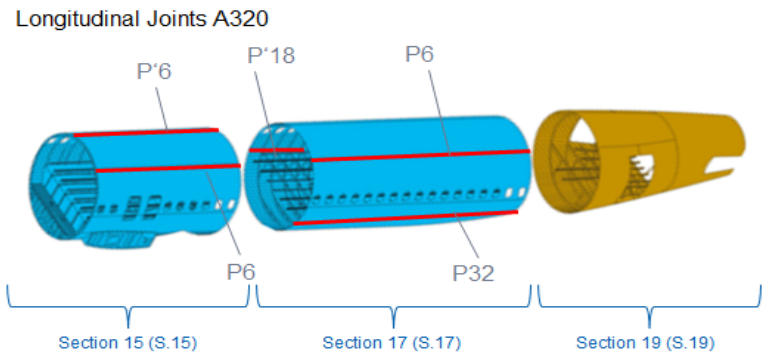
Automation @ Step Change Single Aisle, AIRBUS Hamburg – Automated drilling with flextrack of longitudinal joints







- Flextrack drilling system (LFT 3.0)
- Automated referencing and one-shot drilling for app. 6500 holes/aircraft
- No drilling jigs
- App. 30% recurring cost / workload reduction
- Better ergonomic situation for employees

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Painting – As is situation of the process in the paint booth

1. • cleaning and degreasing
2. • masking
3. • manual application of CPC *
4. • drying / evaporation time
5. • Quality check
6. • manual rework (if required)
7. • demasking

* CPC: Corrosion Preventative Compounds

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Painting – The vision

We'll create partly automated solutions inside and outside the fuselage that …

- respects any changes regarding demographic transition phases in future (demographic aging, lack of specialists)
- will improve ergonomics, health and safety as well as environmental aspects
- allows to develop and qualify worker to another level
- are able to work collaborative with a employee or at least in parallel
- are modular and extendable
- are mountable without any additional means (lightweight)
- are flexible regarding its application (multiple use cases)
- will be mounted in an early stage and travel through all process steps
- will contribute to Industry 4.0 and digitalization
- will influence future design changes in a positive way (design to manufacturing ⇨ design to automation)

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Painting – The vision

The journey will start with CPC application inside the fuselage and will be followed ...

- by CPC application from outside
- will be developed in future for sealant application
- cleaning operations, painting, drilling, riveting etc.

The mission ...

- to build up an aircraft factory, supported by flexible light weight robots

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Painting – Facts and figures of the system

- Install 3 robots in the cargo area
- Working in parallel on a rail system
- Scan the section and create the paint path
- 250 t € savings p.a.
- Enable for additional applications
- Higher qualification for employees
- Worker does no longer work under full protection, in non ergonomic conditions

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Painting – Additional projects based on the same robot system (multiple use cases)

Floor panel installation

Collar swaging

- drilling
- marking
- material positioning
- window installation
- glue brackets

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Painting – The mission gets reality: Surface Protection Centre

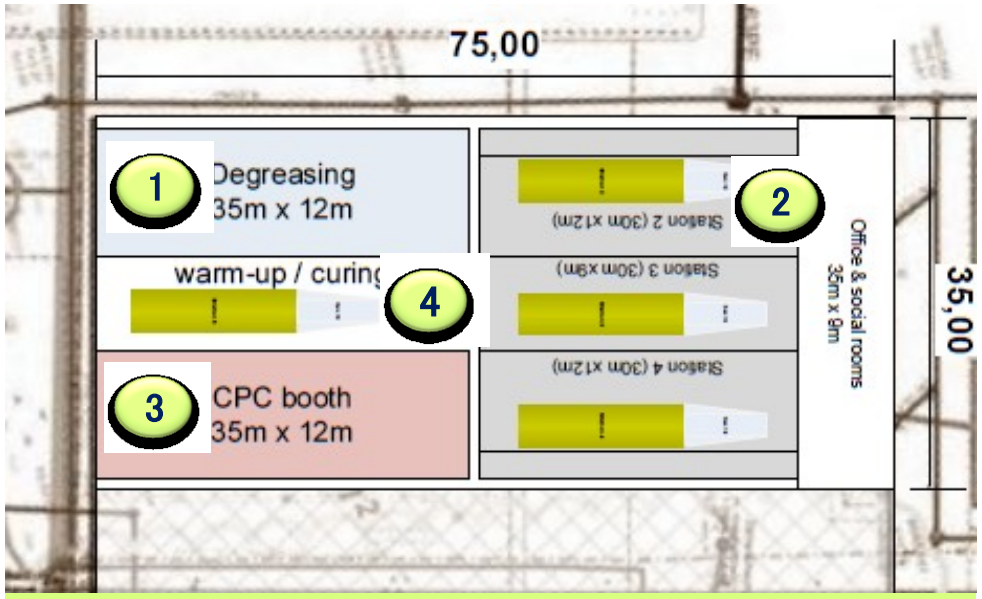
PROCESS IMPROVEMENTS

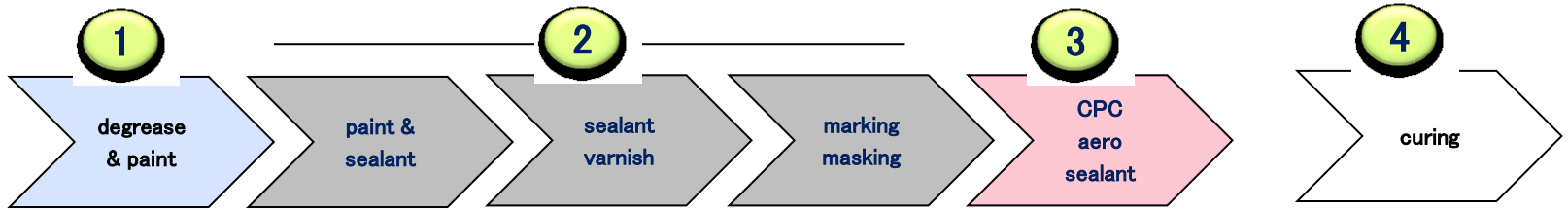
A **Hangar humidity** control system for the whole SP-Center area → in line with REACH

B **Integration of robotic and flow line concept**
→reduction of workload
→elimination of red ergonomic areas
→independent takting process

C **Lead time + operating cost reduction**
→ from 6 to 5 shifts, each shift on 1 station/booth
→ lower maintenance costs

D **Vision 2030** conformity
→ reduction of emission etc.





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Build the future for robots at AIRBUS

Create visions

Robots can support to create the daily work easier for employees

See the different use cases

Analyse the as is situation

Find solutions

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