

# Automatic Frame Positioning Through Mould Marks

Use case for Aerospace Industry

A wide-angle photograph of an Airbus aircraft manufacturing plant tarmac. In the center is a large white Airbus A350-1000 with 'AIRBUS' and 'A350-1000' printed on its side. To the left is a grey fighter jet. To the right is a white helicopter and a large grey Airbus A400M military transport aircraft. The background shows hangars and tall light poles under a clear blue sky.

# Airbus is a global leader in aeronautics, space and related services

Airbus, Airbus Defence and Space and Airbus Helicopters

**134K**

Total workforce

**€449bn**

Order book

**€59bn**

2022 revenue

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# Passion to create better ways to fly

## Airbus Commercial Aircraft (end 2022)

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**7,967**

Commercial Aircraft  
backlog

Annual press conference 2023

**79.1k**

Employees

**€41,4bn**

Annual revenue

**AIRBUS**

# The Airbus Family of versatile new-generation aircraft

## Single-aisle Family



**A321neo**



**A320neo**



**A319neo**



**A220-300**



**A220-100**

## Widebody Family



**A350-1000**



**A350-900**



**A330-900**



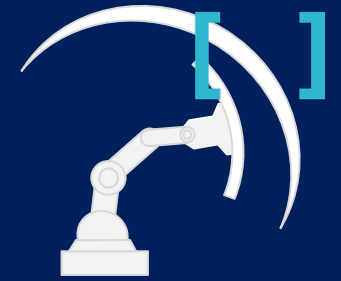
**A330-800**

# Dimensional Metrology at Airbus

Within Airbus, Dimensional Metrology can generally be grouped within two areas.

## 1. Manufacturing - Coordinate Geometry

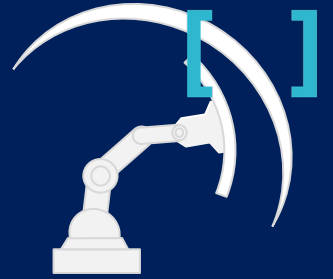
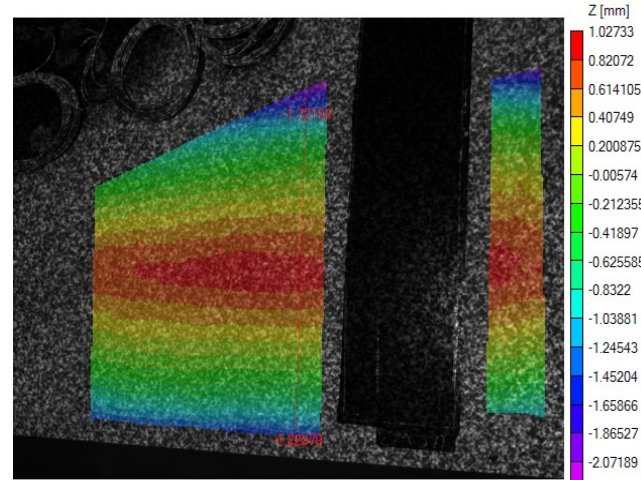
- Verification of assembly jigs and tooling.
  - 3 dof point measurements at ICY locations
- Verification of manufactured parts
  - Quality control of key dimensions and manufactured shape
- Used for accurate assembly of individual airframe components in the Final Assembly Line (FAL)
  - i.e. Wing to fuselage join up respecting the aerodynamic geometries.



# Dimensional Metrology at Airbus

## 2. Design and Testing – Strain and Deformation

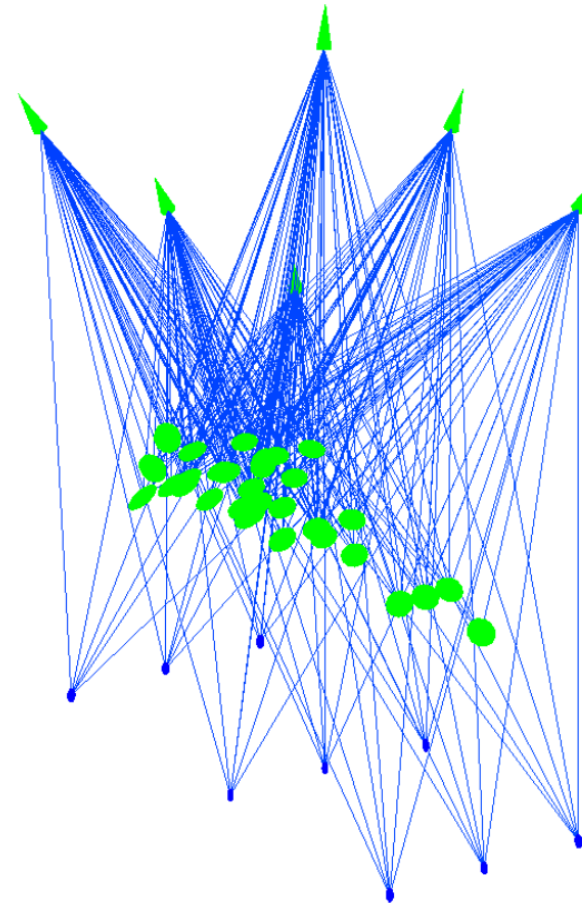
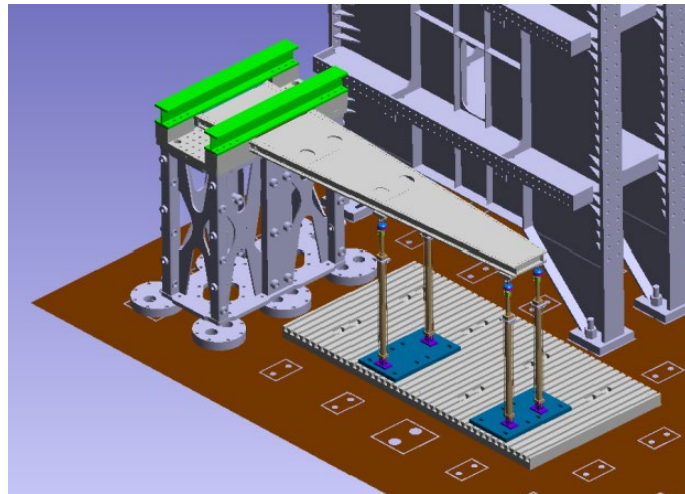
- Validation of numerical predictions
  - Structural Testing (Static and Fatigue).
- Displacement of airframe structures under simulated loading
  - Wing bend/twist or fuselage pressure etc.
- Performance of structures in Flight.
  - Aero elastic loads and deflected shapes.
- Measurement of Assembly stresses
  - Validation of design assumptions



# Dimensional Metrology at Airbus

## Current R&T metrology projects at Airbus

- Tool tracking
- Multiple target tracking
- Targetless photogrammetry & scanning
- Integrated embedded production metrology
- Smarter Testing - Advanced Metrology Techniques
- Integrated Multi-System Measurement
- Automatic frame positioning

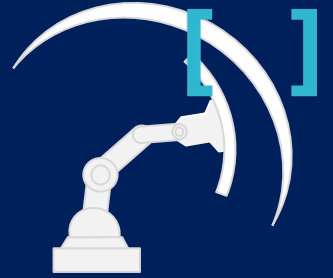


# Targeted Process

Frame positioning on a carbon fiber fuselage

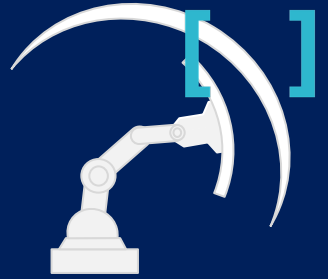
## Our Goals

- ▶ Limit the use of external references
- ▶ Reduce the tolerance stack
- ▶ Enable automation
- ▶ Adaptation to design changes

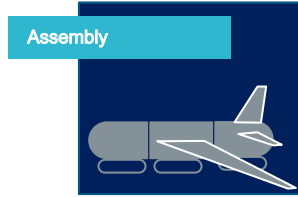


1. Targeted Process
2. Use Case Description
3. Techno Used
4. Tests Performed





# Targeted Process



Typical Aircraft manufacturing process could be simplified as.

**Part Manufacturing**

Highly automated processes  
 Carbon fiber laying up  
 Aluminum press forming  
 Elementary parts manufacturing

**Assembly**

Tooling based manual operation  
 Assembly from major components to final assembly lines

**System Installation**

Manual installation of systems and testing  
 Focus on reducing the work in progress

**Painting**

Manual & Automatic processes

1. **Targeted Process**
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# Targeted Process



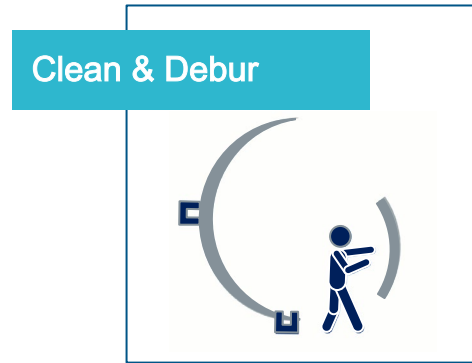
Typical Aircraft manufacturing process could be simplified as.



Accurate installation of aircraft parts



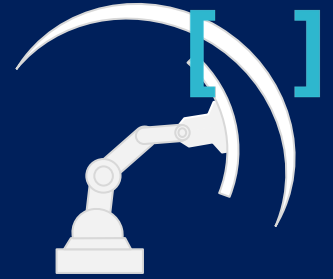
Holes performance for fasteners installation



Holes and Interface cleaning



Insertion and torquing of fasteners

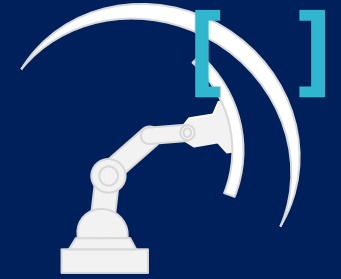


1. **Targeted Process**
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# Use Case Description



## Assembly Tooling Philosophies



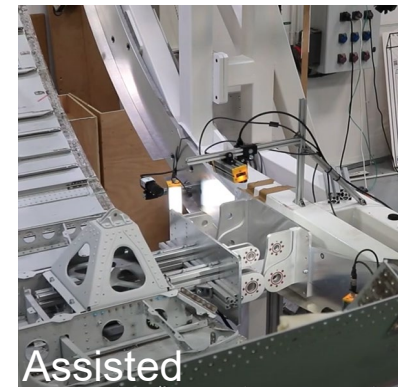
Jig As Master

Position driven by a fixed tooling  
Focus on simplicity and lead time reduction



Part As Master

Part positioned through its geometry, holes, faces, edges.  
Seeking NRC reduction and shop floor flexibility



Measurement Assisted

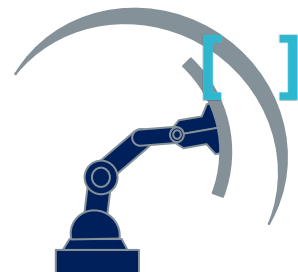
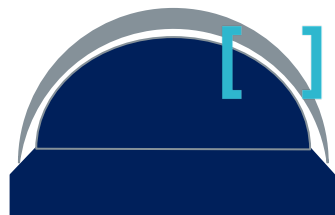
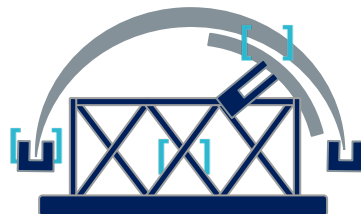
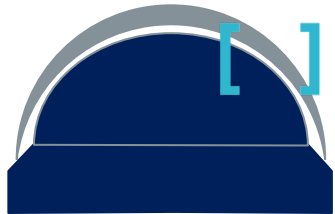
Position controlled by measurement systems.  
Resilient process against design changes improving accuracy

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# Use Case Description



Frame positioning on a carbon fiber fuselage



## Our Goals

- ▶ Limit the use of external references
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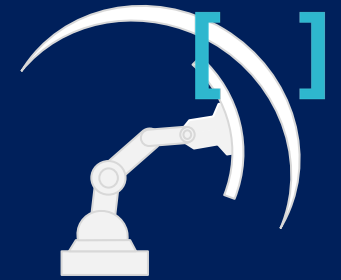
DANOBAT

ID E K O



AIRBUS

Airbus Amber



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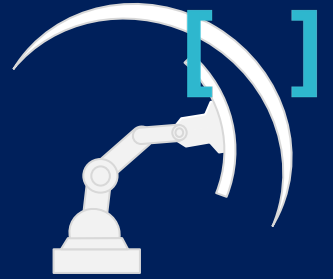
# Techno Used

Frame positioning on a carbon fiber fuselage



## Our Needs

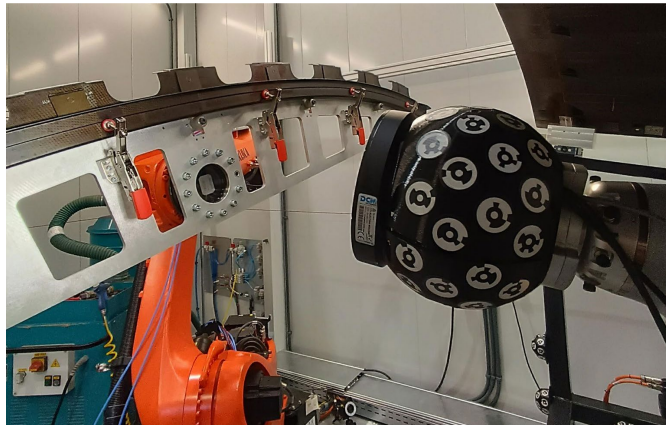
► Mould marks detection



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# Techno Used

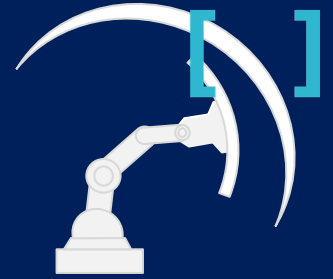
Frame positioning on a carbon fiber fuselage



## Our Needs

- Mould marks detection
- Position Calculation

Airbus Amber



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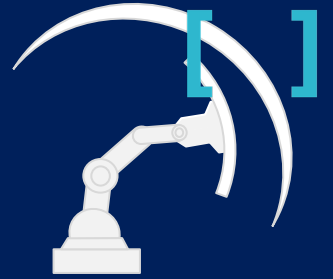
# Techno Used

Frame positioning on a carbon fiber fuselage



## Our Needs

- Mould marks detection
- Position Calculation
- Gripping Tooling



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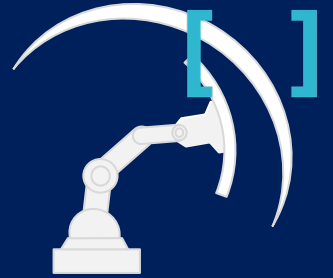
# Techno Used

Frame positioning on a carbon fiber fuselage



## Our Needs

- Mould marks detection
- Position Calculation
- Gripping Tooling
- Position Control



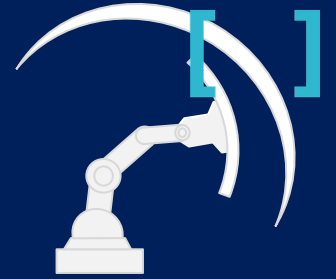
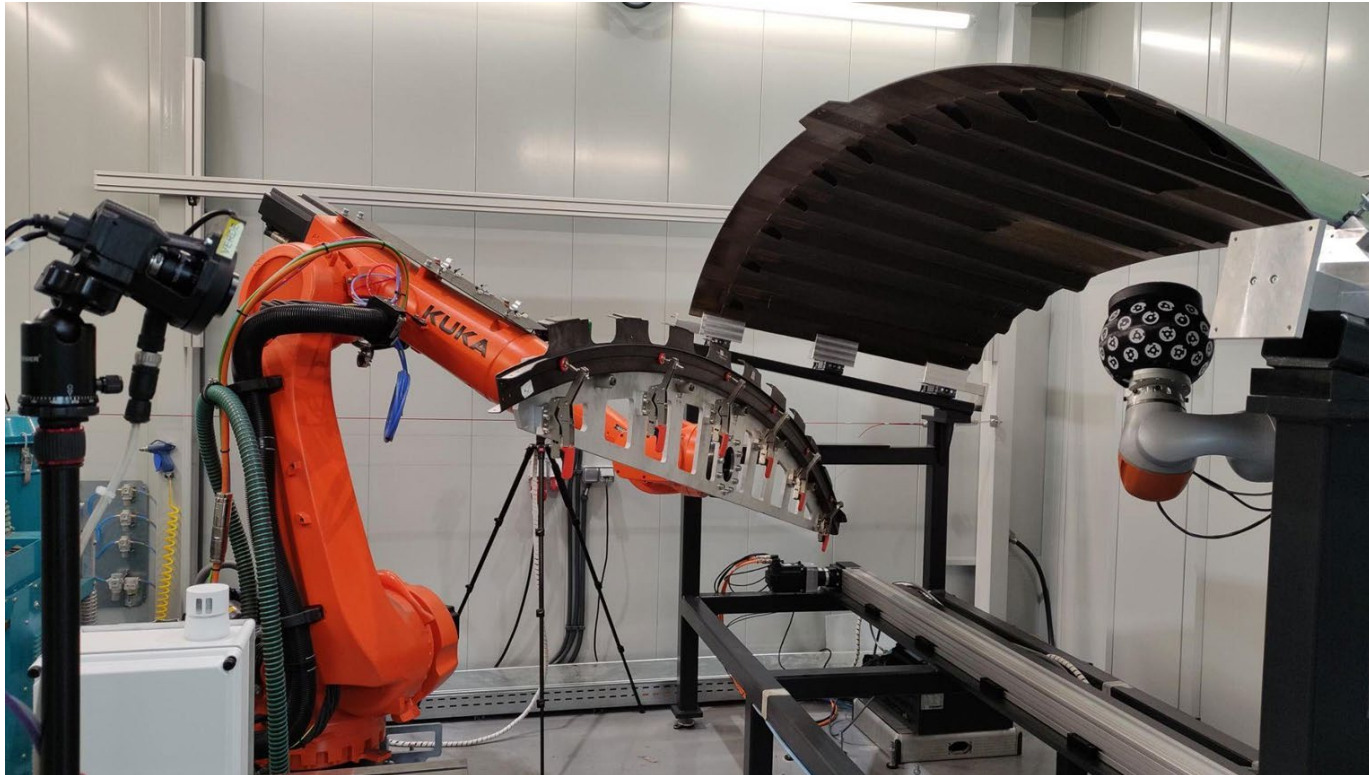
1. Targeted Process
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# Tests Performed



Frame positioning on a carbon fiber fuselage



1. Targeted Process
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**AIRBUS**

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# Thank you

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