NATIONAL COMPOSITES CENTRE

REGULATORY BARRIERS ACROSS TO EFFICIENT VALIDATION AND CERTIFICATION OF COMPOSITES ACROSS SECTORS AND APPLICATIONS

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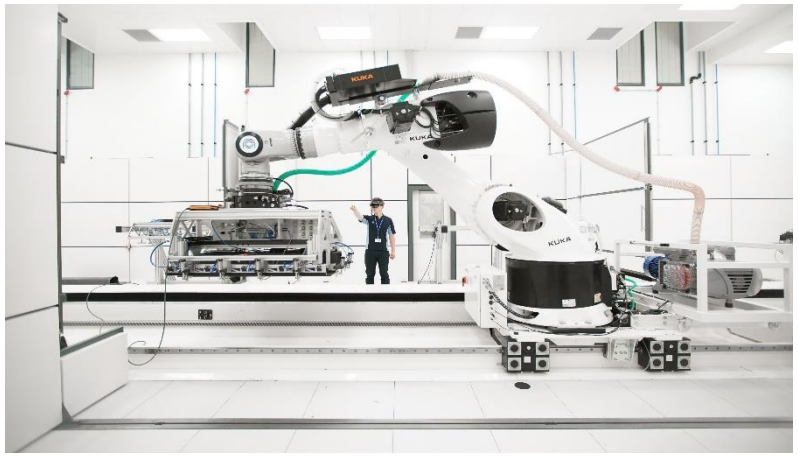
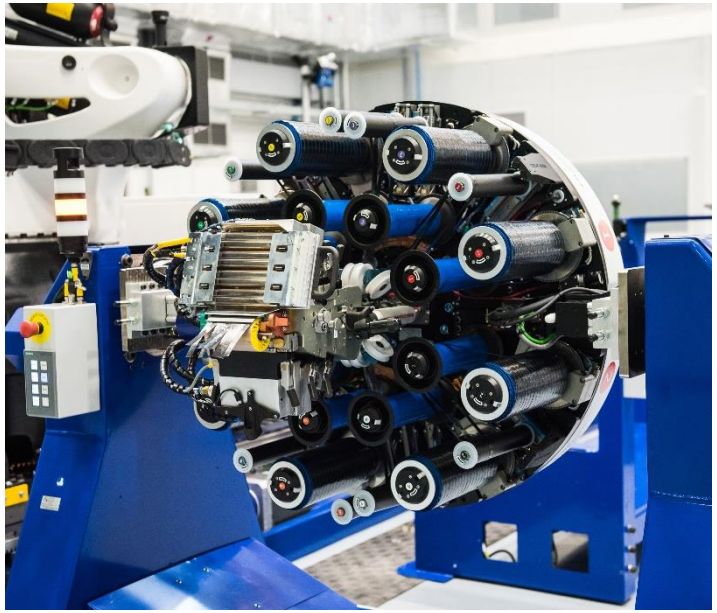


NCC - Europe's leading composite innovation capability



NATIONAL COMPOSITES CENTRE

Part of University of Bristol & the High Value Manufacturing Catapult

Seven centres of industrial innovation across 18 sites working together on the future of manufacturing in the UK.

Bristol Composites Institute

CIMComp EPSRC Future Composites Manufacturing Research Hub

NMIS National Manufacturing Institute Scotland

The University Of Sheffield. AMRC Advanced Manufacturing Research Centre

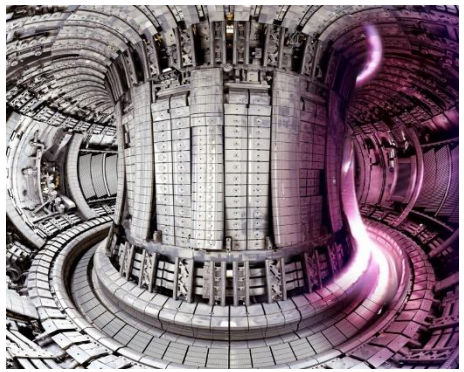
cpi

mtc Manufacturing Technology Centre

NUCLEAR AMRC

WMG THE UNIVERSITY OF WARWICK

Composites enabling the Net Zero Transformation: More variety

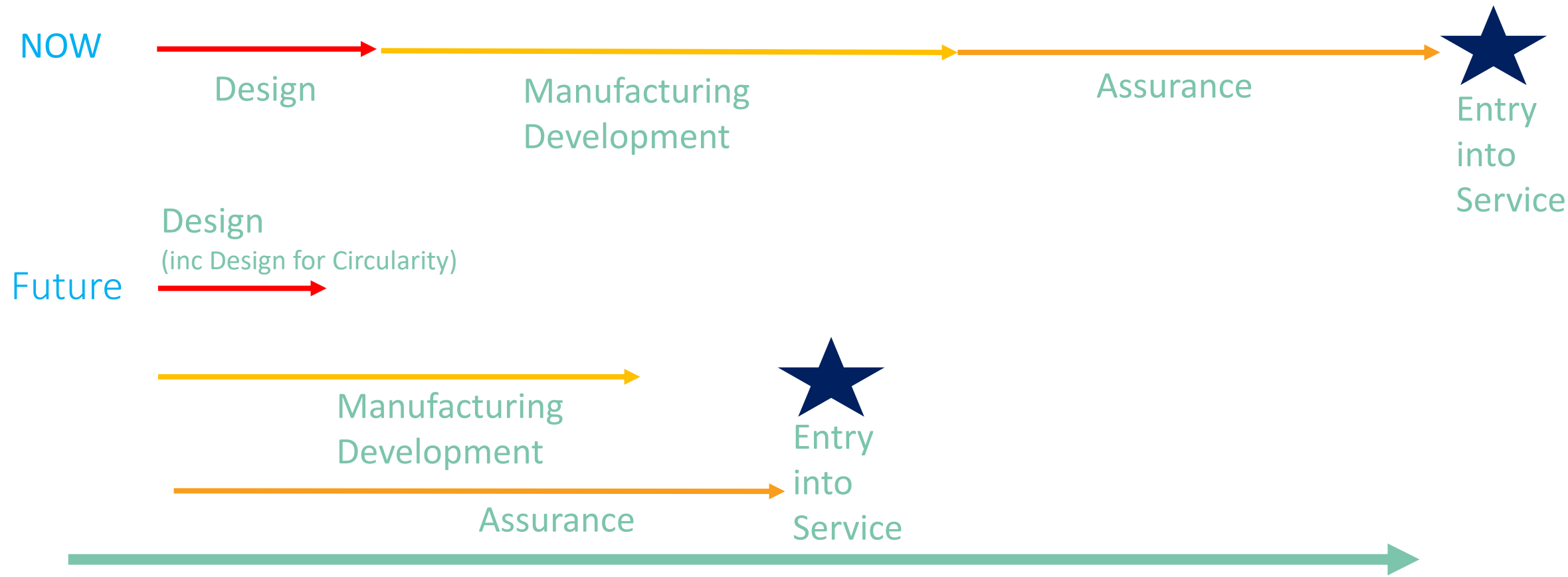


‘Net Zero requires transformational technology to deliver a step change in product and system level performance – composites can enable this transformation’

- **Light-weighting** to **accelerate zero emissions mobility (electric, H2)**
- **Storage and distribution** technology to **enable hydrogen**
- **Performance step-change** to **scale wind energy**
- **Zero emission aircraft** to achieve **‘jet zero’**
- **Energy efficient infrastructure** and **buildings**
- **High temperature, lightweight** materials to **unlock nuclear**

Source: https://compositesuk.co.uk/leadership-forum/uk-composites-strategy

The need to move beyond the Systems Engineering ‘Vee’



Regulations and composite materials

- **Regulations** pose different challenges in different sectors
  - **Composites across sectors**
    - Higher upfront engineering burden than other materials
    - Variability in manufacturing /lack of understanding drive **high safety factors**
  - **Specific to Civil Aerospace**
    - Pyramid of tests. Well understood, but costly and time consuming
    - Low product cycles (next programme's EIS in 2040?)
    - Limited introduction of in-service data into next generation → Slow changes in regulations
  - **Outside of traditional civil aerospace**
    - Use cases for systems are hugely variable and can vary from project to project driving project specific requirements (NOT CAPTURED BY REGULATIONS!)
    - Speedy product cycles
    - Significantly lower capacity to invest in R&D and fundamental knowledge
    - LCA not really understood and more critical than in aerospace
    - Lack of standards when certifying across certifying bodies
    - Similar challenges across sectors regulated differently

Traditional materials are favoured

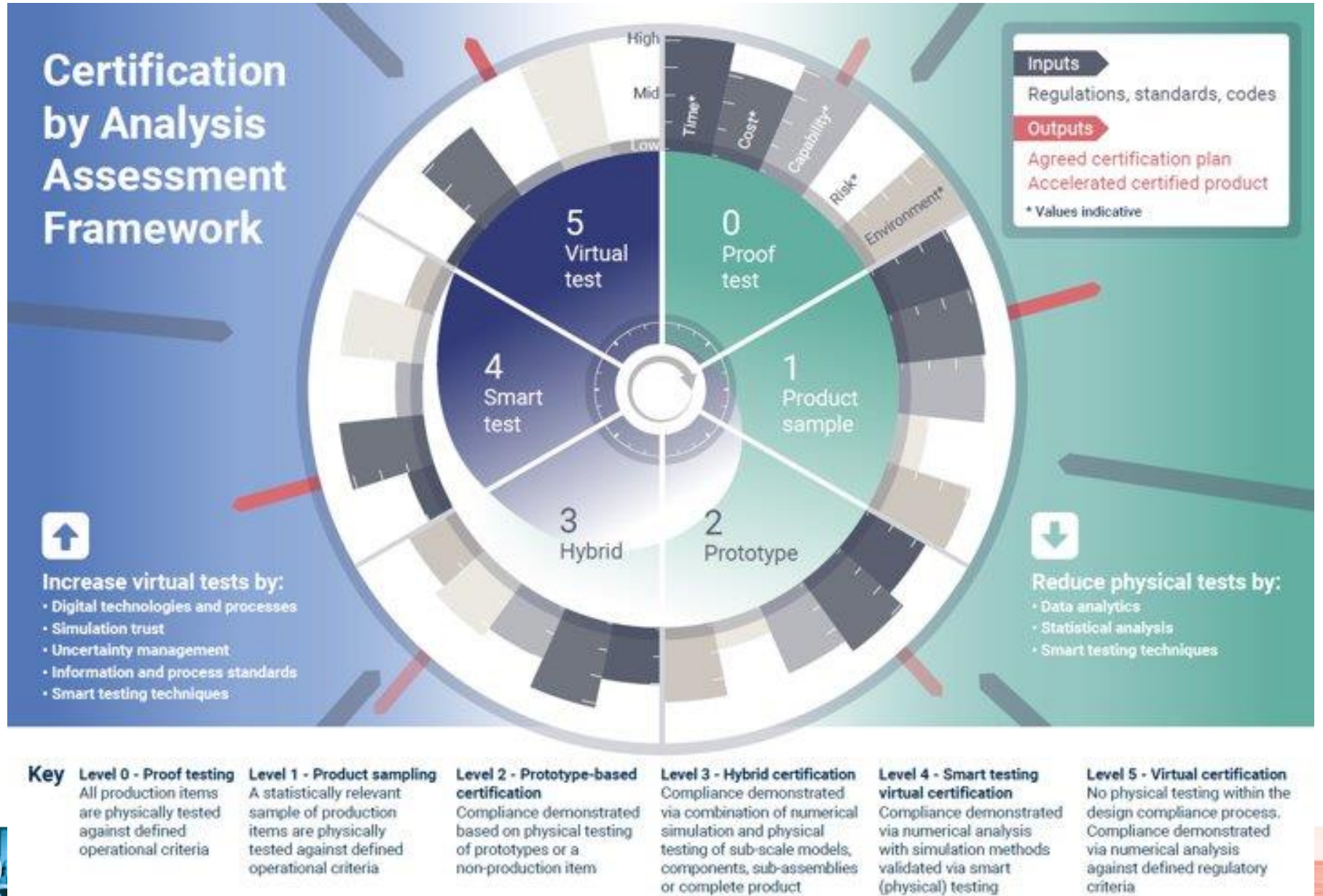
Cross-sectoral challenge: Accelerating Certification, improving regulations

END GOAL: To make composites as easy to adopt in product design and manufacture as metals and plastics

- **Regulations**
  - Conservative, Out-of-date, slow to change, don't capture functional requirements
- Concurrent engineering
- Digital Twin and Thread to gain **confidence** in every step of the development cycle
  - Data Capturing and analytics
    - **In-process monitoring** → As-manufactured models
    - **In-service monitoring** → Realistic requirements
  - **Performance modelling from as-designed to as-manufactured**
  - Reduction of knock-down factors
- **Faster certification cycles**
- More **agile regulations (up-to-date)**

Towards Product Certification by Analysis (CbA)

Certification by Analysis Levels



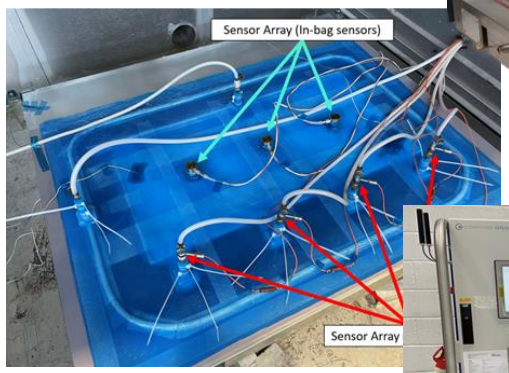
Right Every Time Resin Infusion

Exploiting the Digital Twin for Self-Adaptive Control and Knowledge Codification

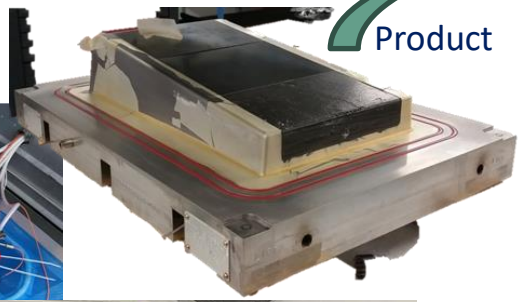
Physical World

Real Time Data

Digital World



Process Flow Sensors

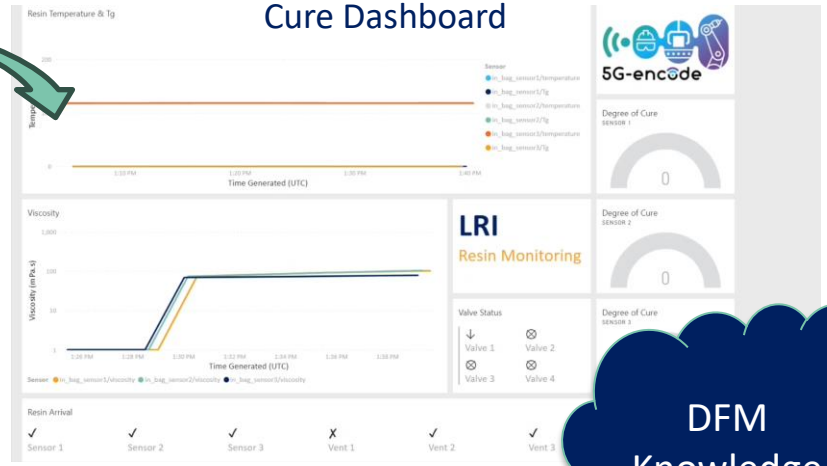


Product

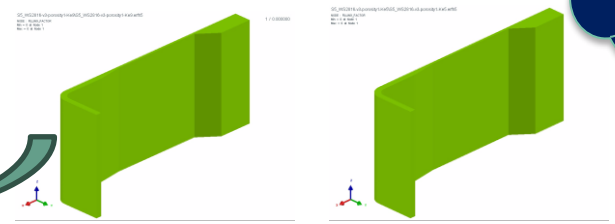
Injection Control Systems

5G
WIFI
IT
IOT
Cloud
HPC
AI

Cure Dashboard

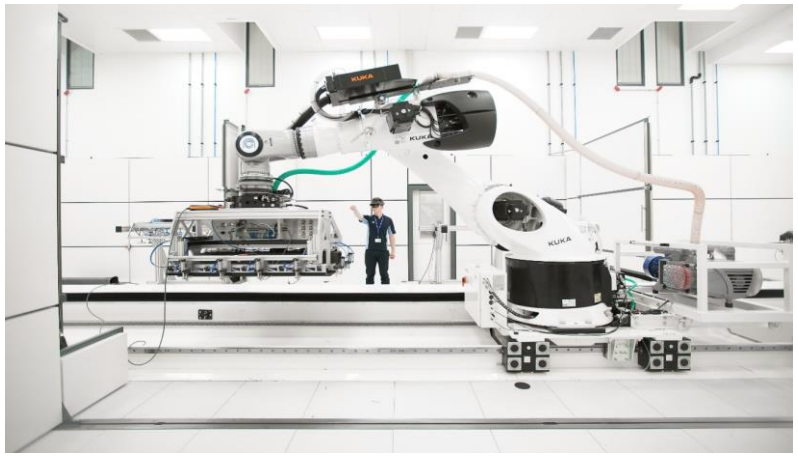


DFM Knowledge



Predictive Flow Control Models

Real time Insights and Feedback



Thank you

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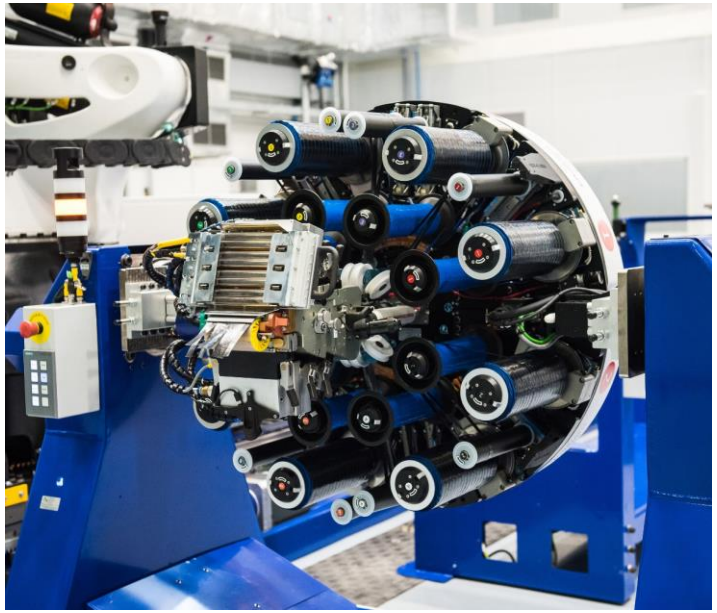

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