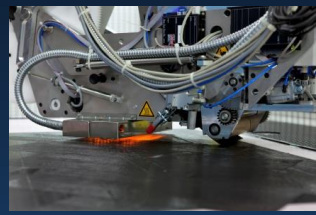
Airborne







Digital Manufacturing of Composites
Marcus Kremers - CTO

Airborne Group

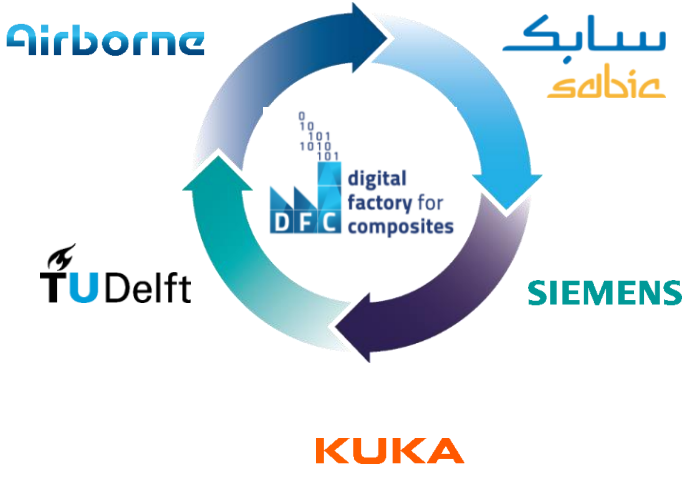
Airborne Composites Automation

Founded in 1995

Facilities in the Netherlands, Spain and UK

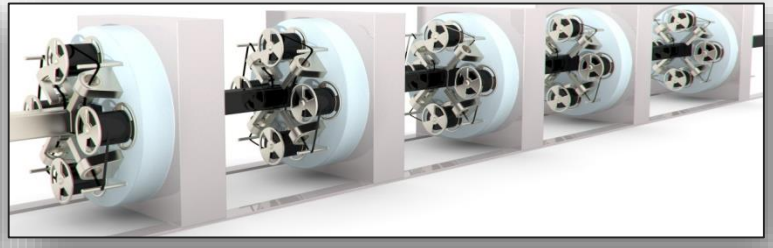
Driven by a strong vision and entrepreneurial spirit
>20 years of composite heritage

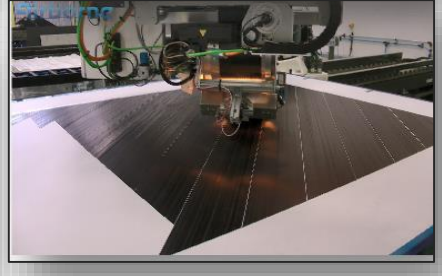
- Technology leader in advanced composites
- Provider of automation solutions for composites
- Legacy in Aerospace, Marine and Oil & Gas
- 150 + employees

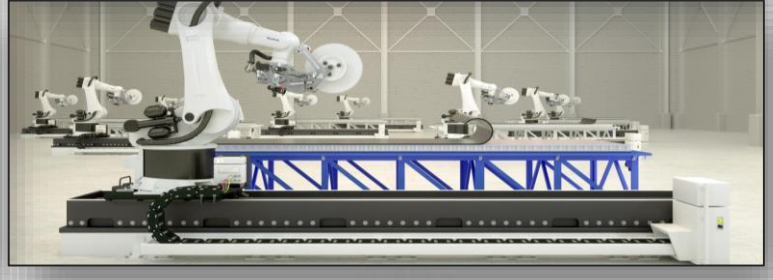


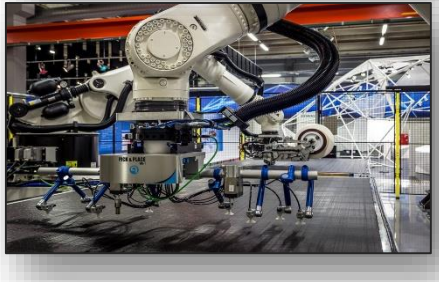
Parts manufacturing

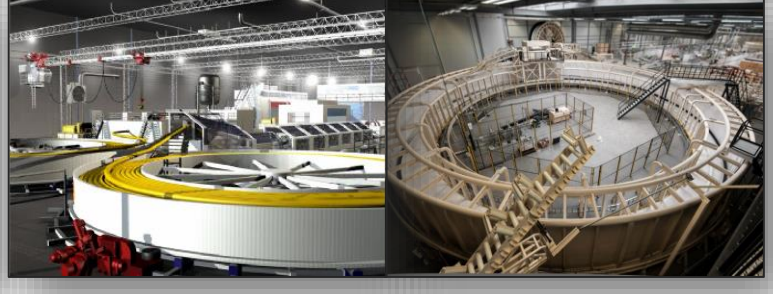
Automation solutions









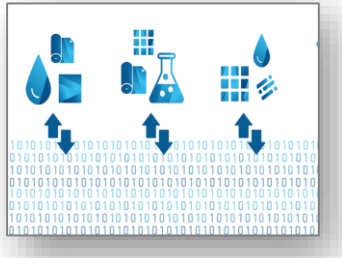


Composite Manufacturing **Know-How**

Know-how of Composite Manufacturing

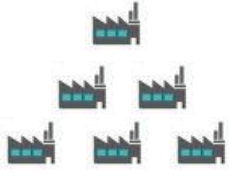
Part manufacturing

Automated *processes*



Digital manufacturing

Scalability



The **Fieldlab** Digital Factory for Composites

Airborne

Composites and Automation

SIEMENS

Automation and Digitalisation

10
10
10

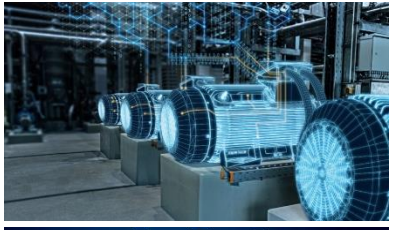
DFC digital factory for composites

KUKA

Robotics

The **Fieldlab** Digital Factory for Composites

- Experience and Collaboration Centre
- Exploring **Digital Factory** concepts
- Focus on **Composites**
- Led and funded by **private** companies
- To create **business** opportunites
- Supported by **Public Private Partnerships** for projects
- To build a vibrant and international **ecosystem**



Airborne

SIEMENS

سابك sabic

GUNNAR advanced cutting solutions

PLATAINE people-smart automation

GTM ADVANCED STRUCTURES

ViscoTec

SCHMALZ

PROMOLDING CREATING | POLYMER | SOLUTIONS

KVE COMPOSITES GROUP

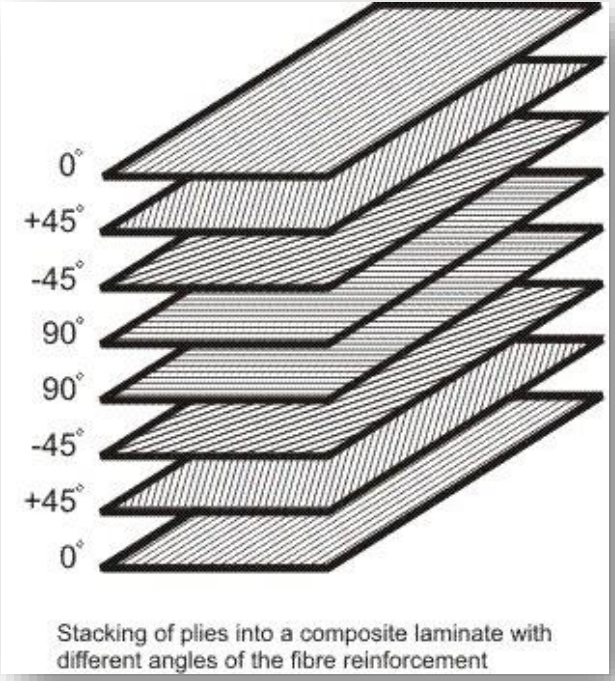
DE HAAGSE HOGESCHOOL

holland composites

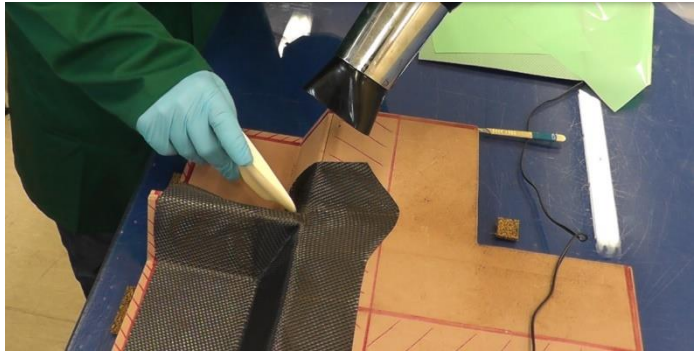
nlr

TU Delft

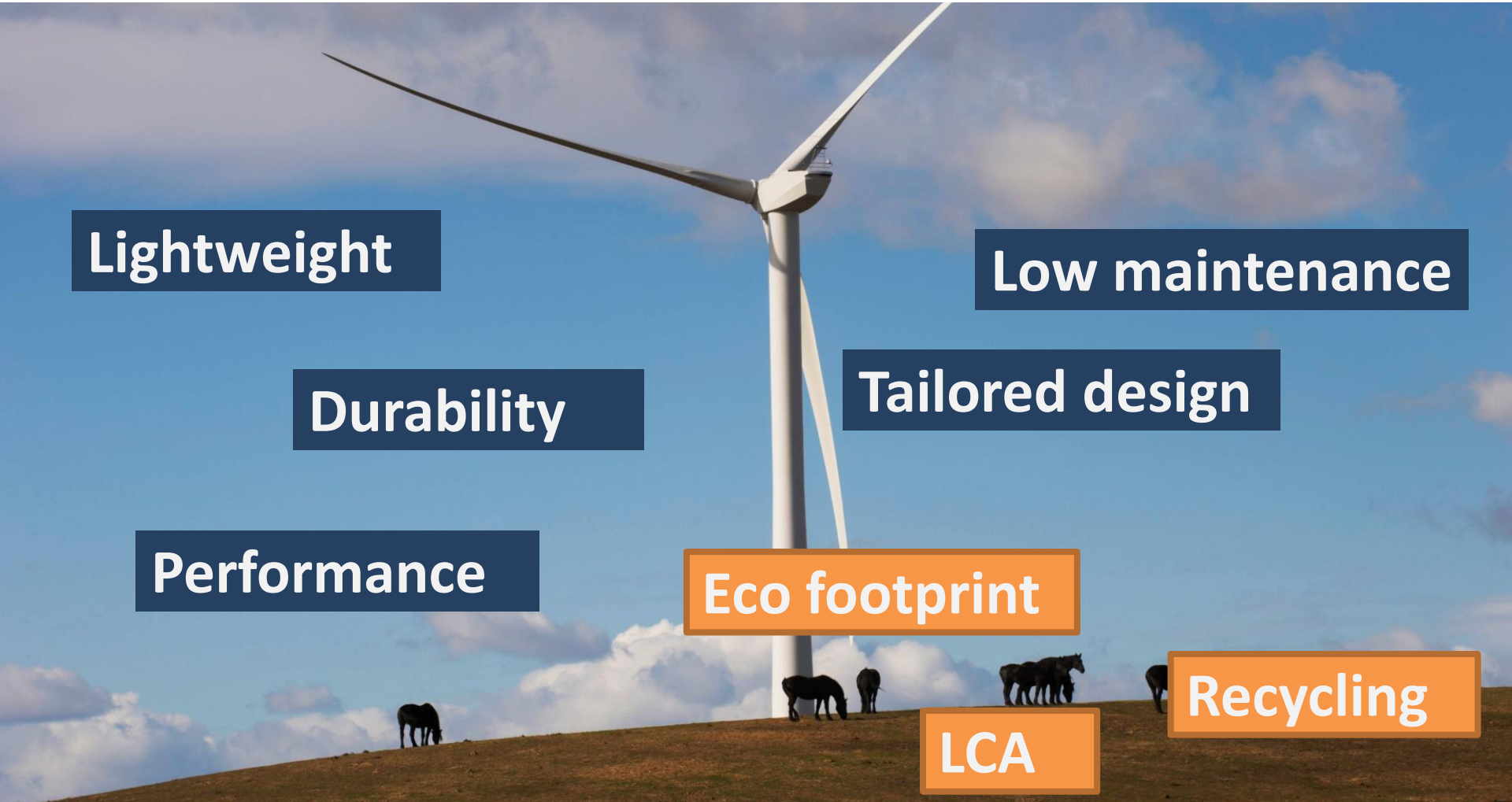
Composite



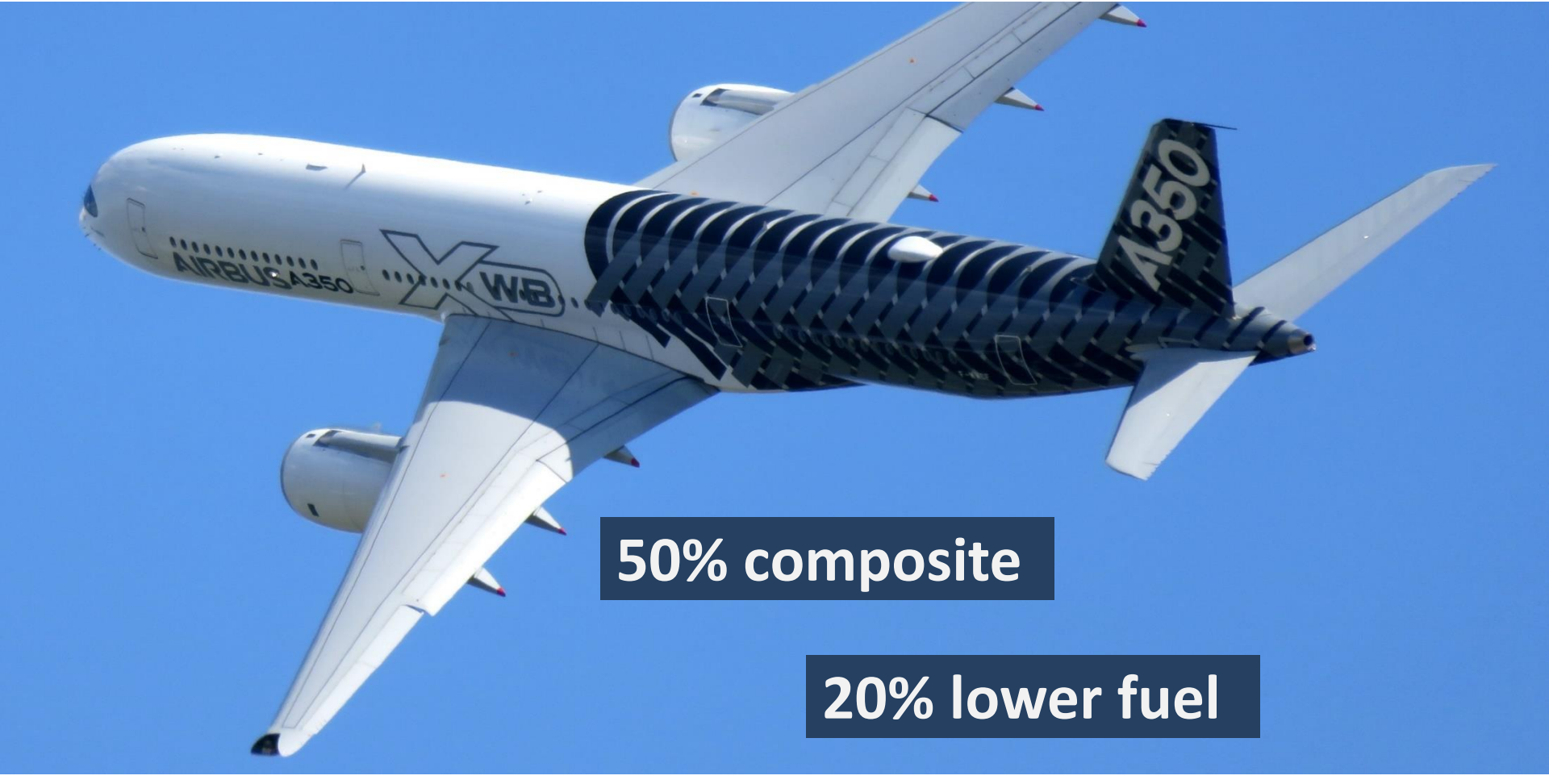
Stacking of plies into a composite laminate with different angles of the fibre reinforcement



Composites to make the world a **better** place



Composites in **Aerospace**



Composites in **Automotive**

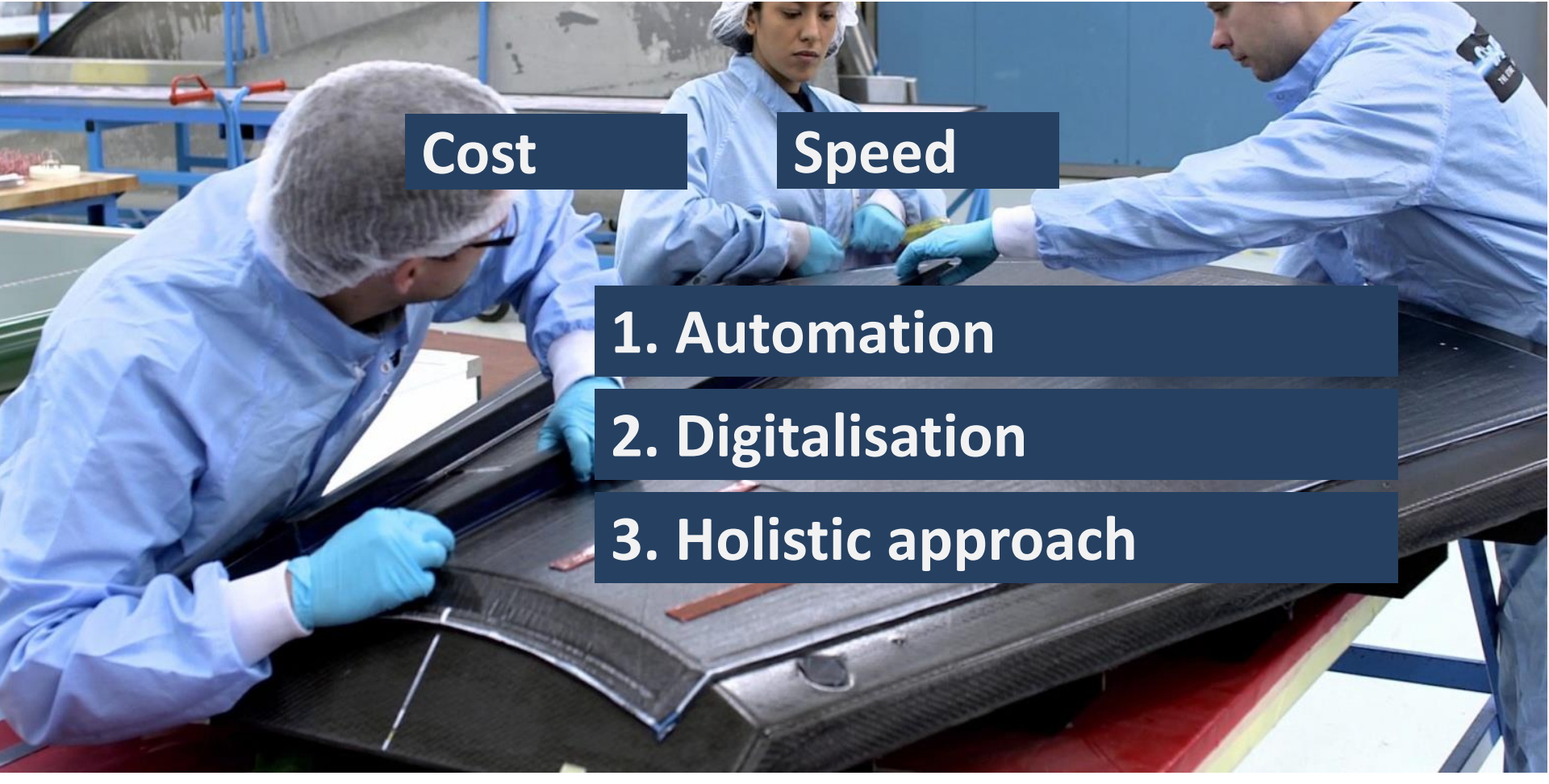
20% lighter

Lower fuel consumption

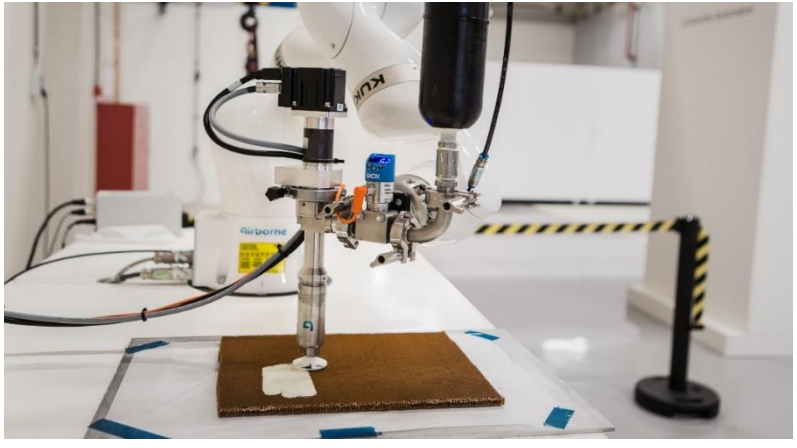
Longer range

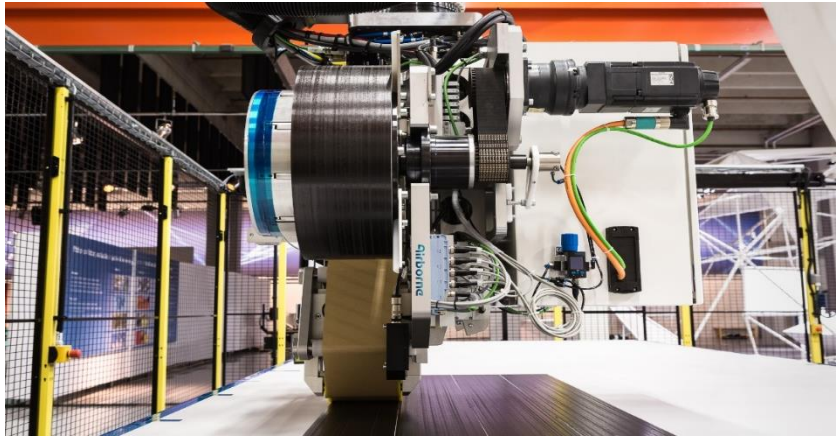
Composites in **Infrastructure**

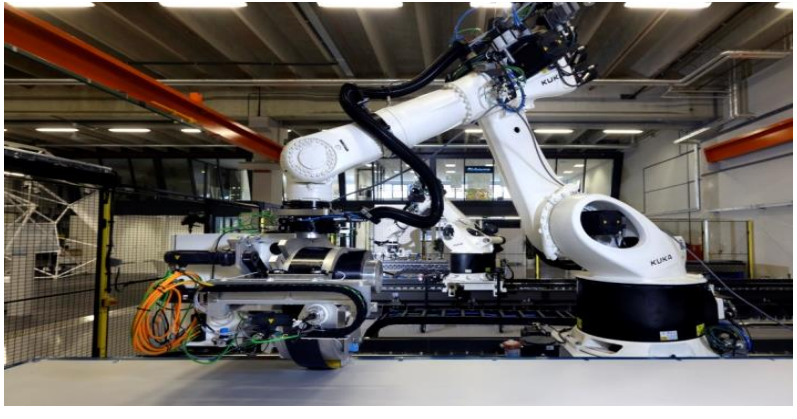
The **Great Cost challenge** of composites



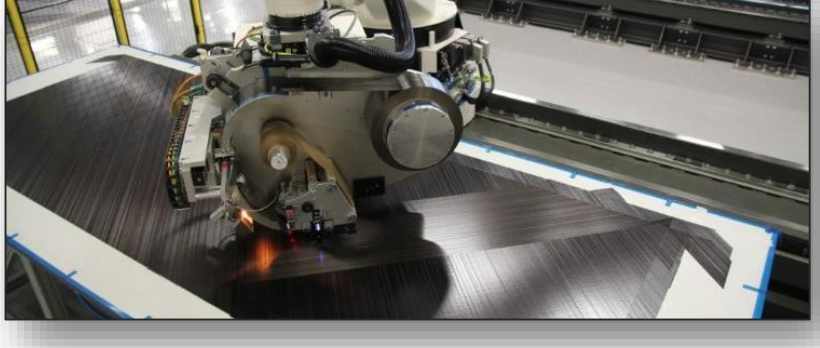
Automation **Building Blocks**







Automated **Laminating Cell**



Functionality

Laminating cell for thermoset prepreg

Combines three functions:

- Automated tape laying
- Cutting of laminate into shape
- Pick & place for offloading of laminate

Specifications

- Tape width 150 mm / 6”
- Lay down rate 300 lm/hr (45 m^2/h)
- Variable angle cutting, on-the-fly
- Laminate cutting 30 m/min
- Pick & Place cycle 10 seconds
- Automated tool change < 1 minute

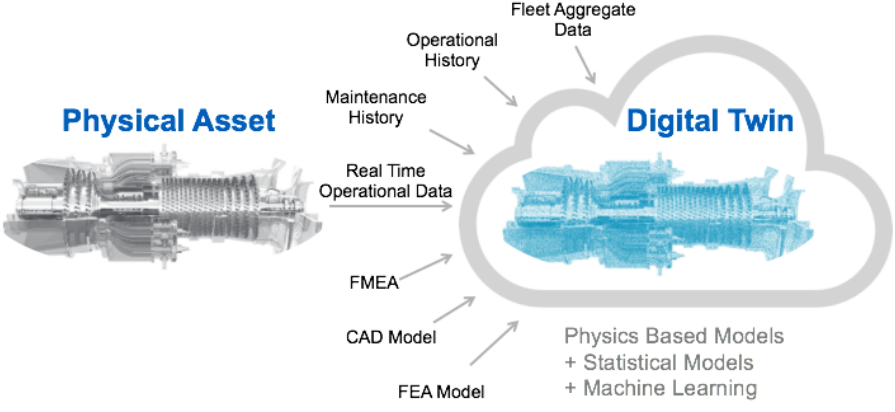
End-to-end automation: **Thermoplastic Composite Pipes**

- In-situ consolidation
- End-to-end automation
- Digital manufacturing concepts:
  - Process Data driven quality assurance
  - Model-based, adaptive process control

Digital manufacturing – what is it?

- Digital Twin:

  "A living, integrated digital representation of the physical world that can predict"



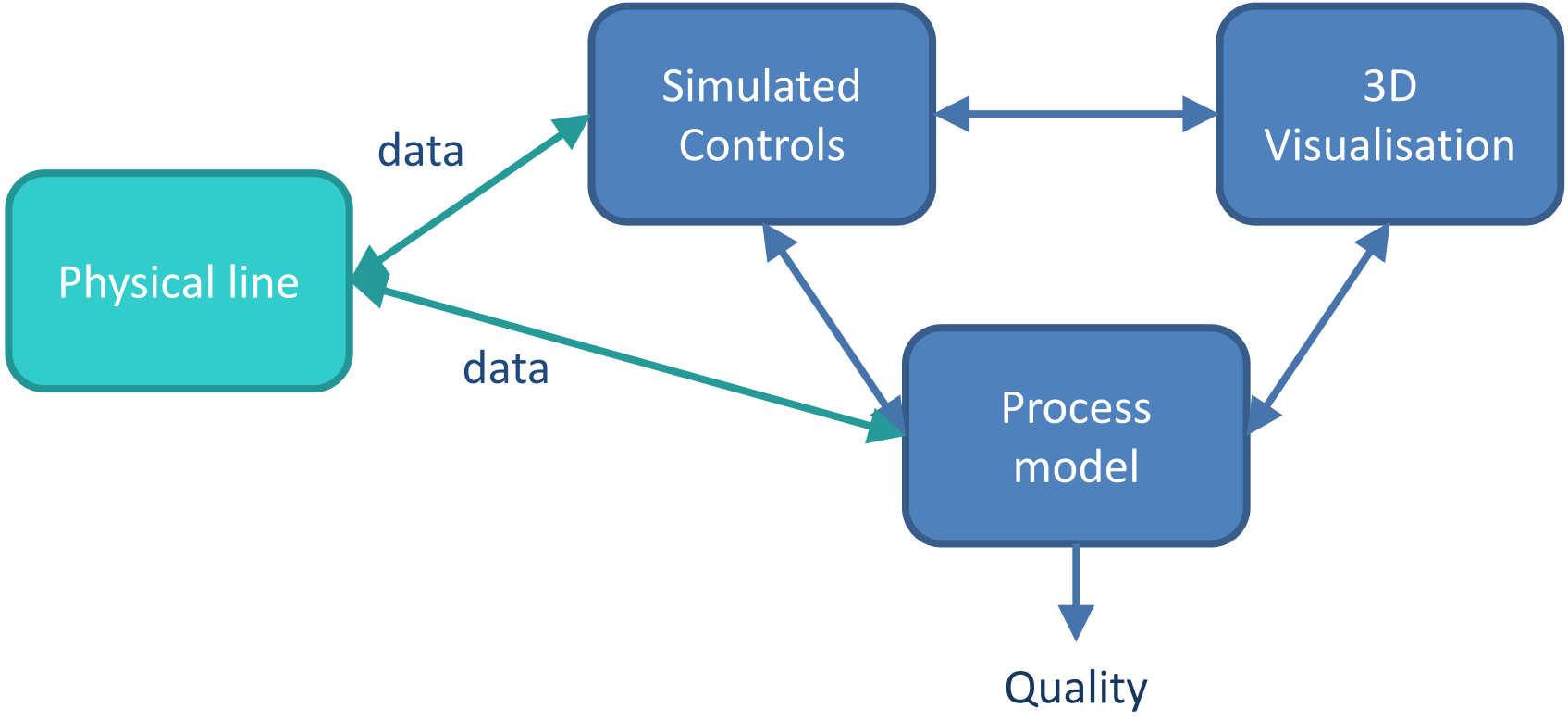
Digital manufacturing – what is it?

- Digital Twin in our manufacturing “world”:
  - Model that fully describes the manufacturing process, updated with real-time data.
  - It can predict the output quality and advise how to adapt or improve

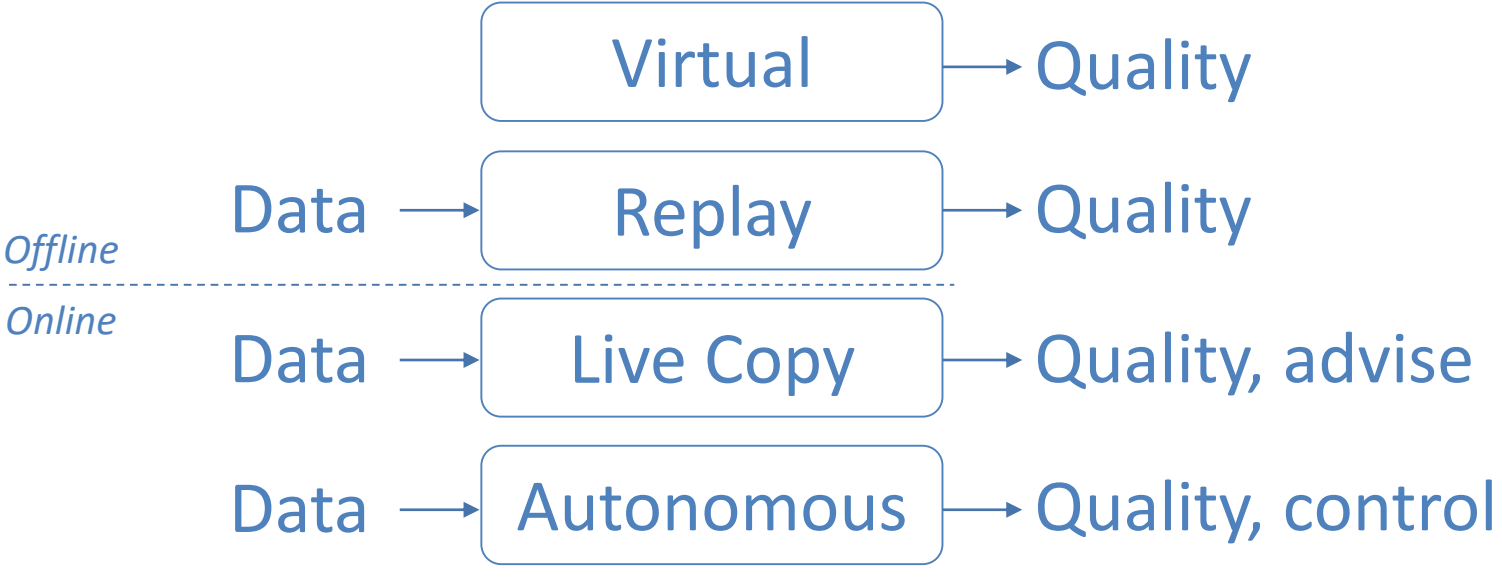
- Manufacturing process becomes:
  - Predictable: manufacturing processes can be designed up-front, with much less trial-and-error
  - Understandable: it becomes clear what drives the quality of the process. Problems can be quickly resolved
  - Adaptable: when input changes (for example material, environment, design), the process can be adapted to give the same quality

- Removes the ‘Black Magic’ of composites

Manufacturing Digital Twin

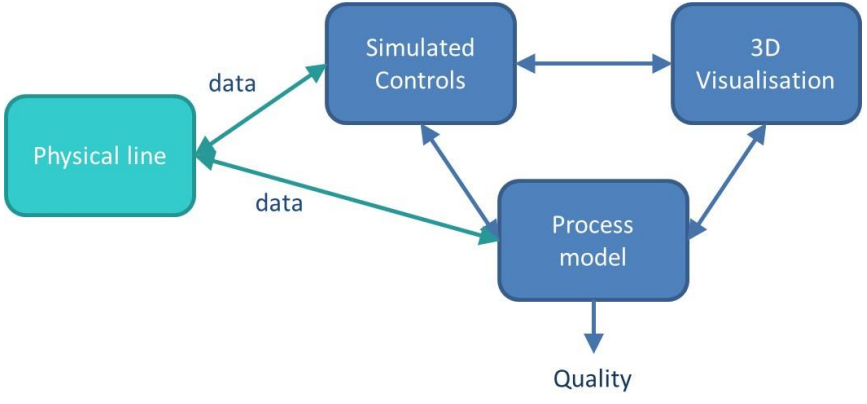


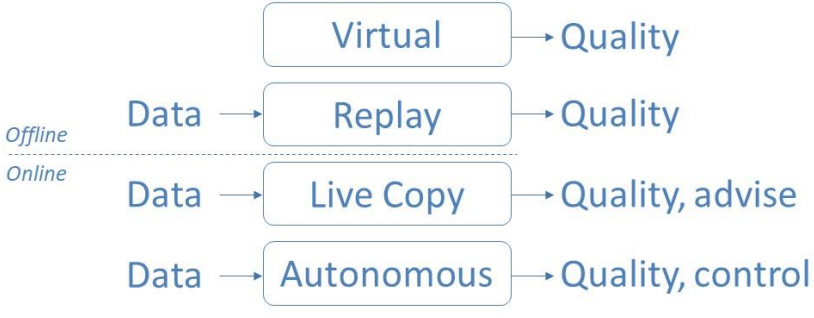
Digital twin modes



How can a digital twin be used?

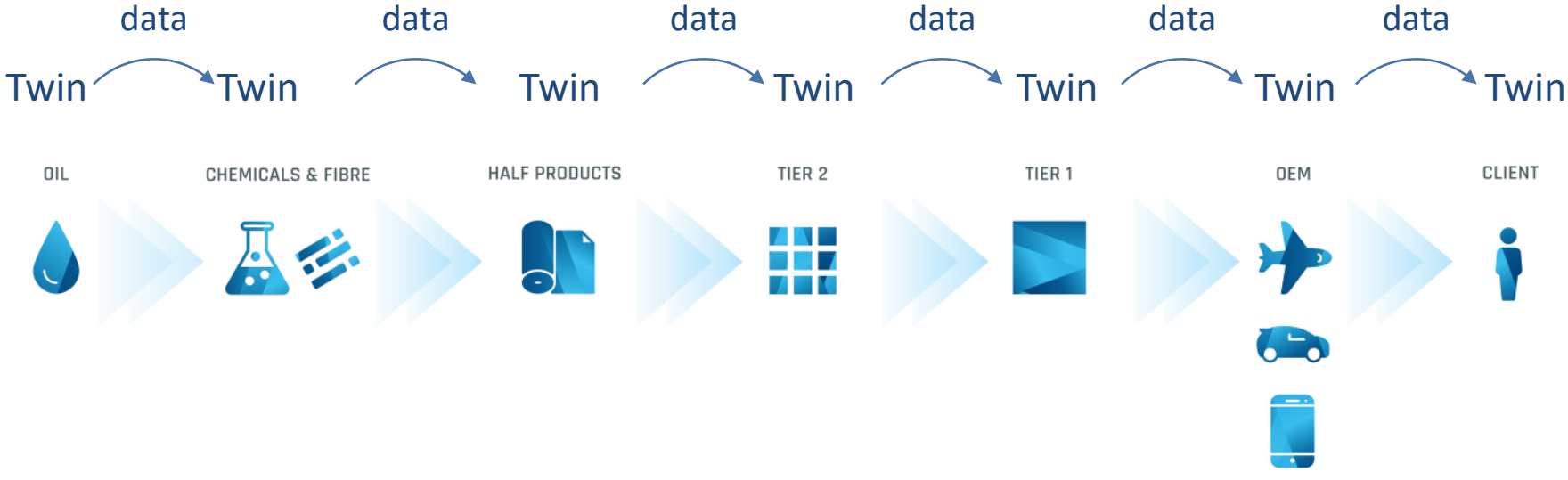
- Integrated simulation up-front (CAD + programming + process)
- Operator training
- Assistant for operators and engineers during production
- Problem solving during production issues
- Optimisation of production without need for trials or standstill
- Offline testing and debugging of new hardware / software
- Trend analysis, machine learning



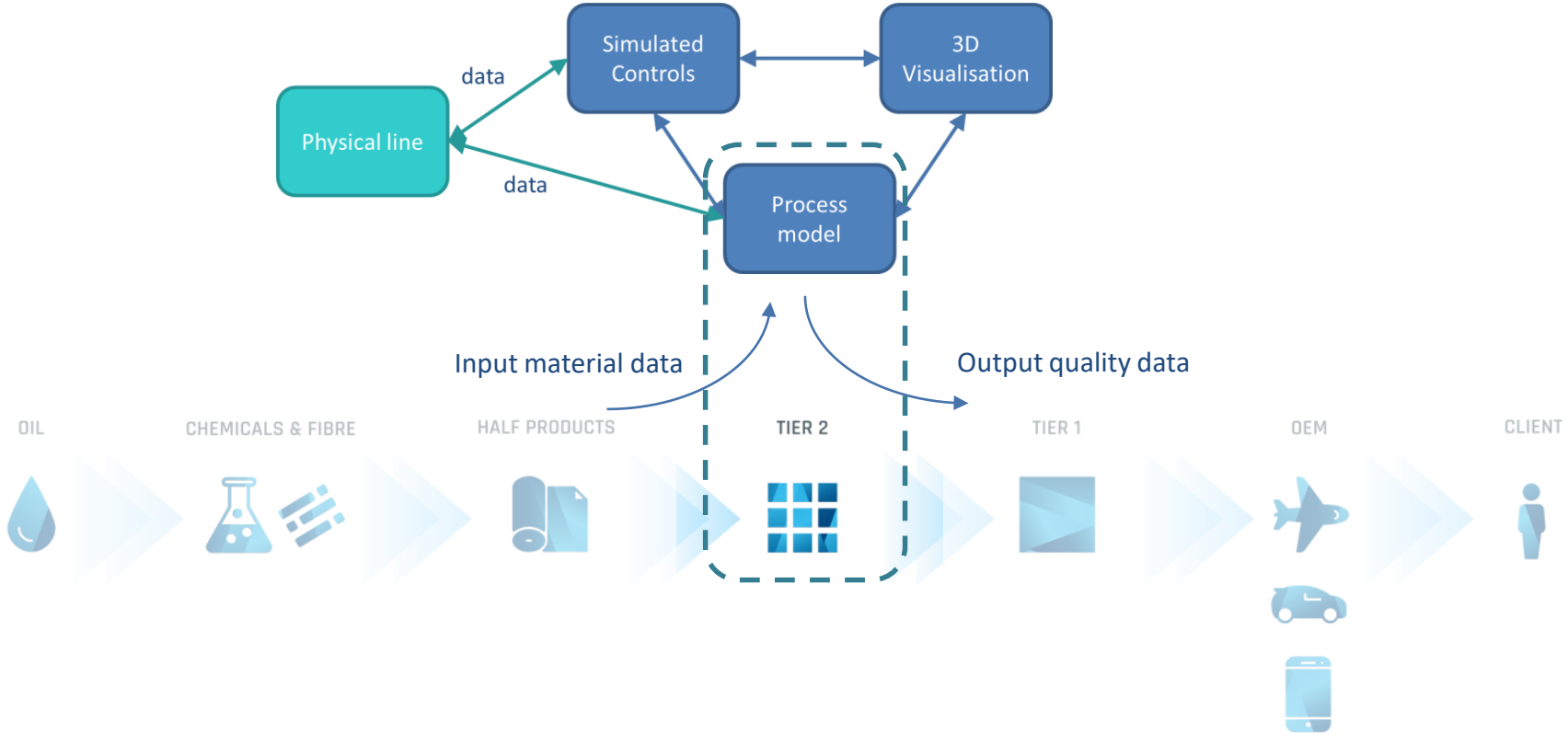


Product Digital Twin

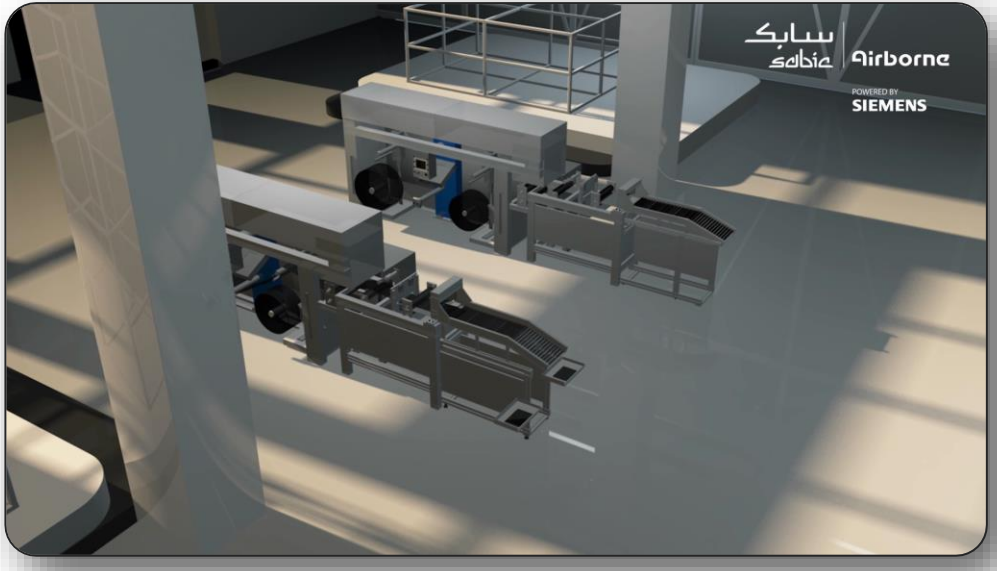
Shared Digital Twin environment



Product and Manufacturing Digital Twin



High Volume Thermoplastic Composite Line



- End-to-end automation, digital manufacturing
- 1 minute cycle time, 1.5 million parts / year
- Full quality inspection at incoming material ánd outgoing product
  - Adaptive control and self-learning possible

Composite **client portal**

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