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Digital Thread in Product Lifecycle
Part 2: D&E to Manufacturing

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Agenda

1. Overview - Letting imagination take flight
2. D&E Digital Thread needs and industry direction
3. Connecting D&E, Production, Inspection, MRO
4. Case Studies

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Letting imagination take flight

This is aviation. Everything must be **optimised** for safe and efficient flight. Every component, material, shape, idea and design.

Hexagon's solutions provide the platform to elevate and accelerate that process.

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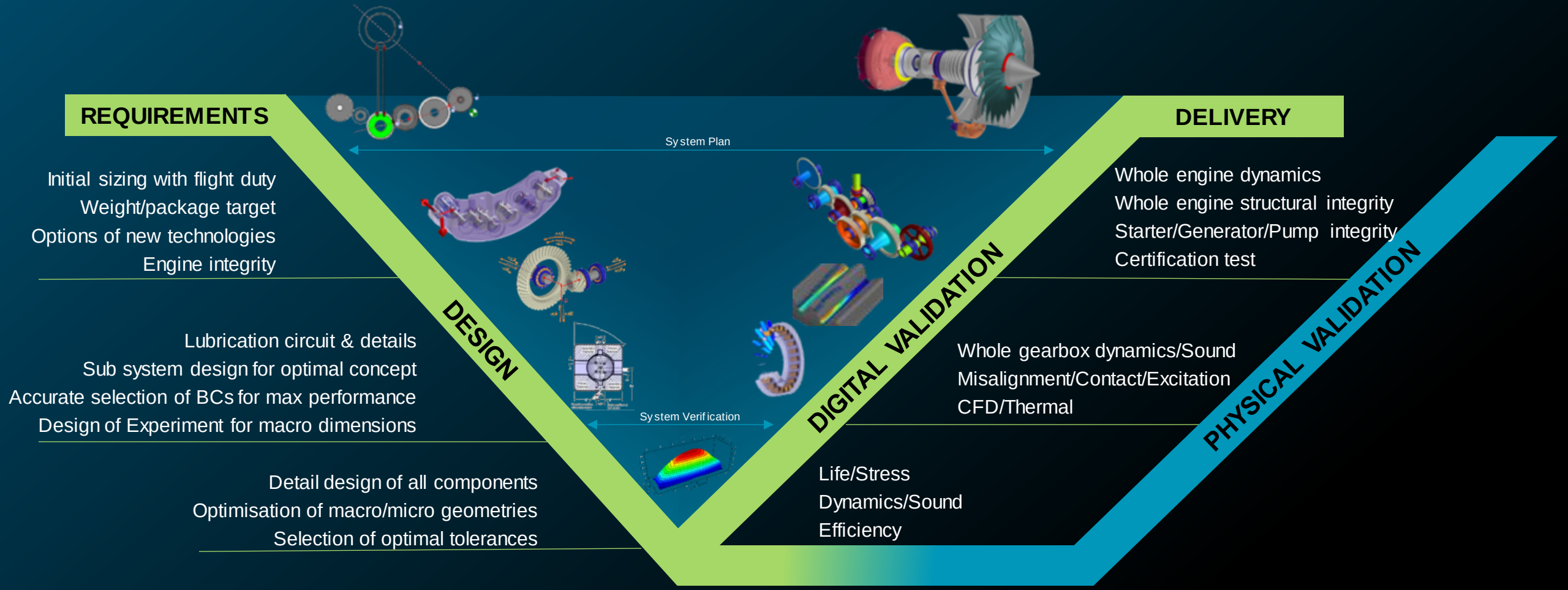
Digitally Driven Design Process

Closing the loop between the real and the virtual



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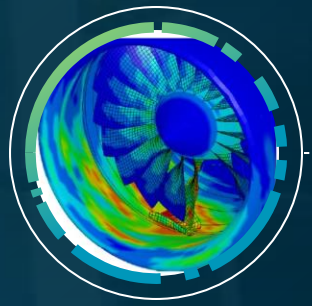
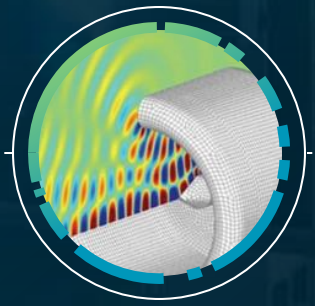
Putting data to work from concept to flight operations

Propulsion digital thread

Design and engineering



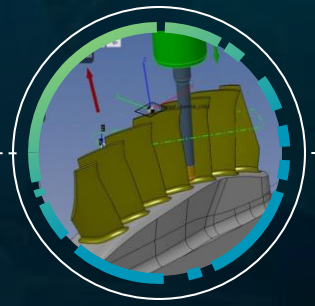
Structural concept and dynamics simulation



CFD and acoustics Co-simulation

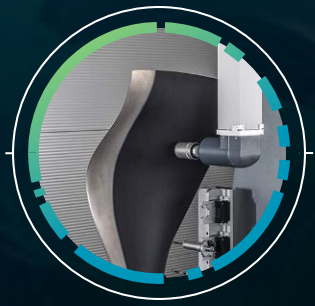
Production

Materials and processes simulation



CNC manufacturing

Inspection



In-process inspection and data analytics

MRO

Jet engine MRO

Process monitoring and corrections

Guidance for design optimisation

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Requirements for Digital Thread for D&E

Full Traceability

Compliance Workflows

Streamlined Processes

Centralized & Structured Data

Integration & Scalability

Effective Collaboration

Interactive tools to search, plot and view data

Quick access to data with full pedigree

Import & export from known CAE applications

Compare data against norms

Work requests and approval workflows

Adapt SimManager with no IT skills

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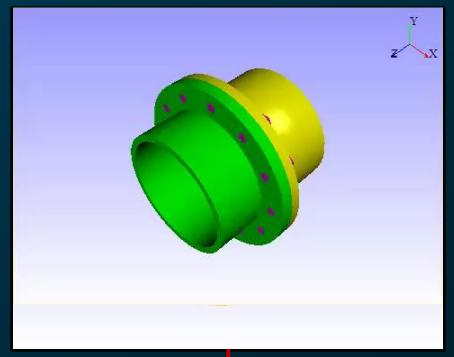
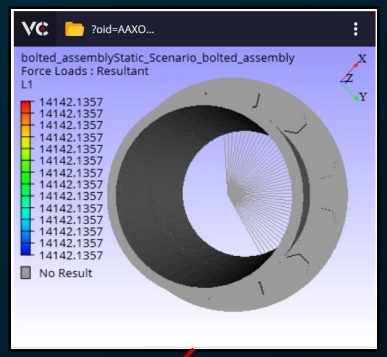
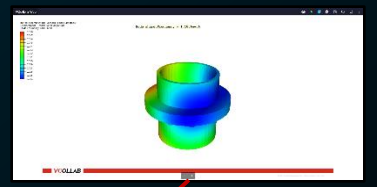
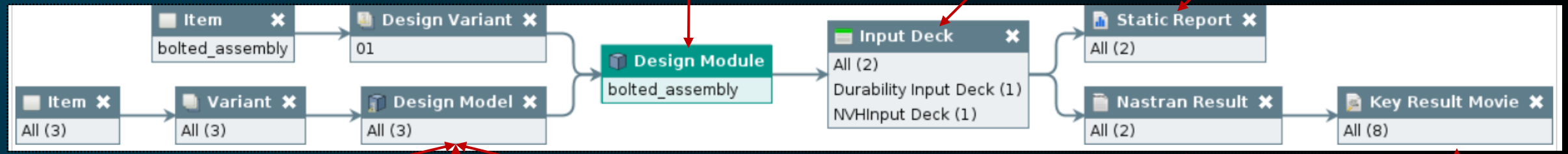
360 Degree Audit Trail

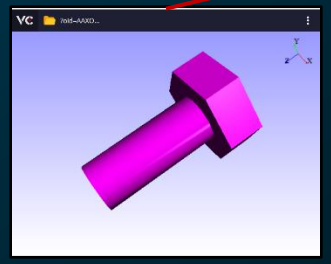
From design to reports

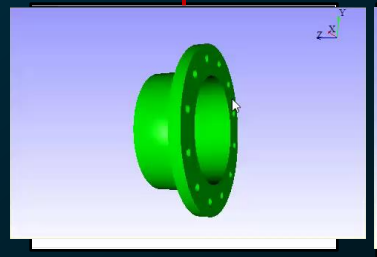


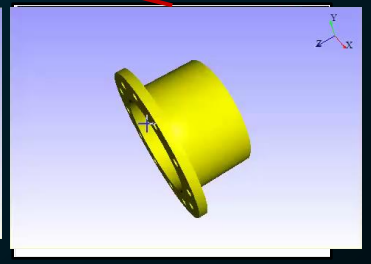


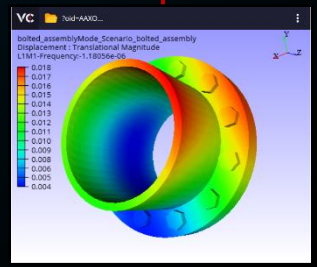


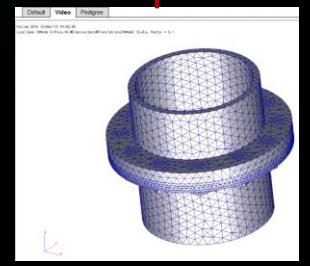












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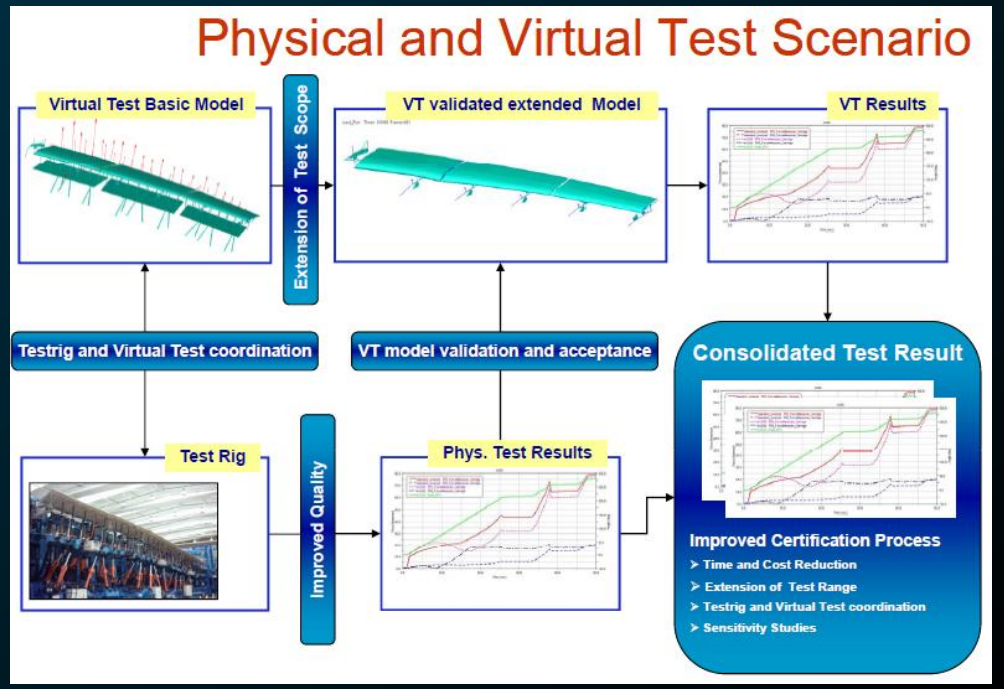
Airbus HLSVT

- Model data, Simulation results and corresponding evaluation data are integrated for the management of all test related data by the “High Lift Virtual Test Portal” and its connection to the existing test management system (TMS)

- Awarded “Greatest Business Impact of Simulation Technology” at NAFEMS World Conference 2013



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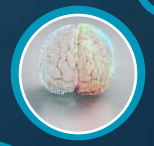
Industry Direction for D&E Digital Thread

Integrate AI applications



AI

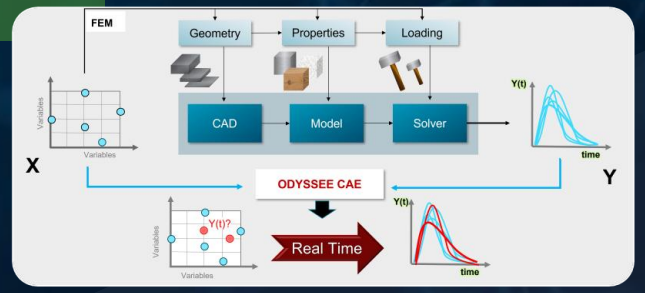
Collaboration

Performance

Cloud

User Experience

Data Management



Real-time CAE Processes

Learn from Experimental Data

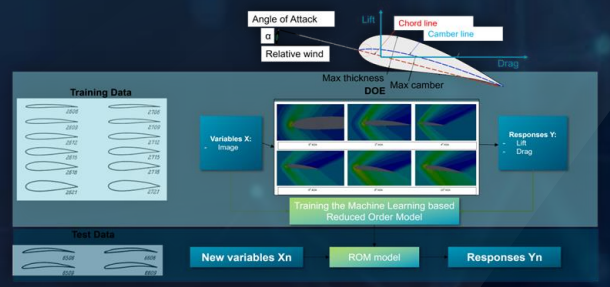
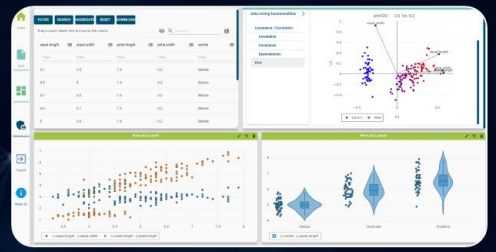


Image Learning



Data Mining

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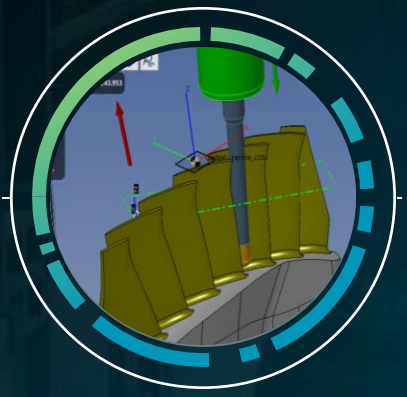
Aero-structure component end-to-end milling

Reducing the CNC machining scrap rate as well as the need for skilled operators

Quoting & planning

- Human & materials ressources estimation
- Ressources planning

Preparing plans and programming machines

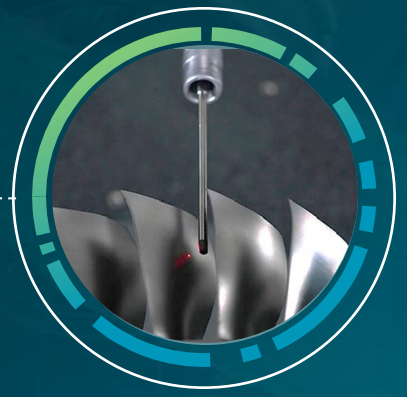


- 3D model import and preparation for manufacturing
- Tool path generation (CAM)
- CNC simulation & optimized tool path generation
- Metrology program generation & simulation

Machining and in-process inspection

- CNC machine calibration
- On-machine probing
- Tool patch correction calculation and real time implementation

Final quality inspection & reporting



- Absolute inspection off the CNC machine
- Quality control reporting & export
- Post treatment analysis (incl. statistical trend analysis)
- Non-Conformity case creation and tracking if any

Improved cost and productivity by up to 50%

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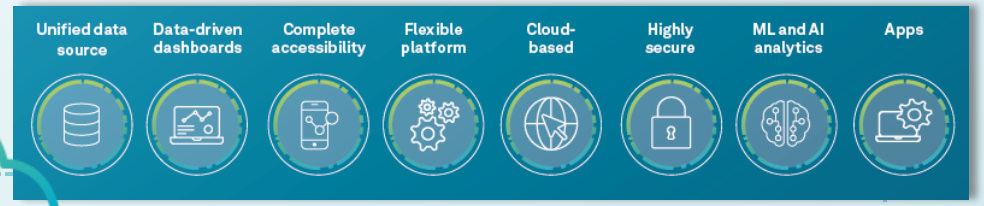
USE CASE
Composite fan blade & materials design



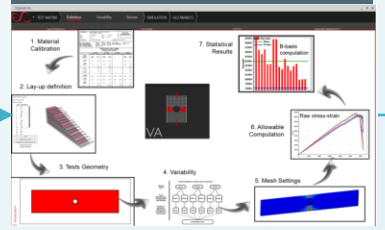
DIGITAL MANUFACTURING PLATFORM

WORKFLOW MANAGER

MES

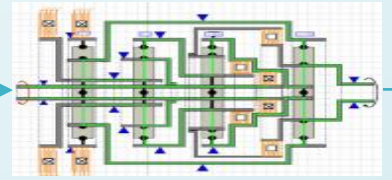
From System requirements

ENGINEERING SW



VIRTUAL ALLOWABLE MATERIALS CHARACT.

ENGINEERING SW



SYSTEM DESIGN

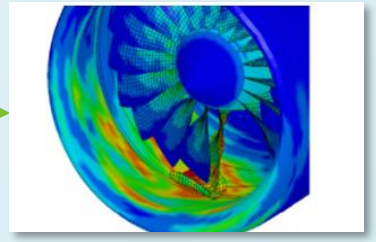
PLM

CAD

ENGINEERING SW

LOW FIDELITY CONCEPT DESIGN

ENGINEERING SW



HIGH FIDELITY STRUCTURAL ENGINEERING

ENGINEEERING & PRODUCTION SW

MANUFACTURING SIMULATION

METROLOGY

AFP/ATL MANUFACTURING & INSPECTION

To manufacturing

Asset Management

Material/Process Data Management

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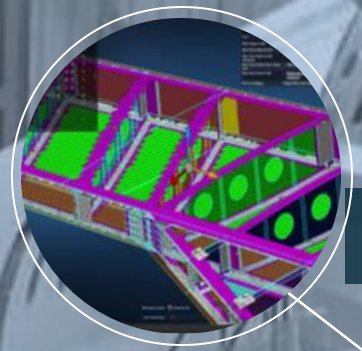
Applications

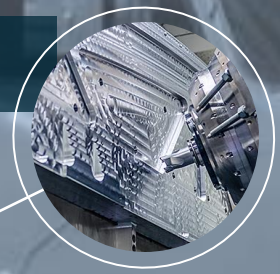
- Turbine blades need periodic inspection and repair.
- Normally they are certified by the manufacture of the blade itself.
- The blank blade prior to machining requires low tolerance inspection prior to machining. This can be accomplished with vision systems, laser scanners and other low tolerance devices.
- Due to their shape hand tools are not the ideal instrument for this task.
- After machining high tolerance CMM's are required to inspect the blade tolerances.

From smart manufacturing to sustainable operations



Structures & materials light-weighting design

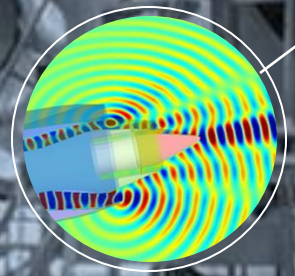
Closed loop CNC machining



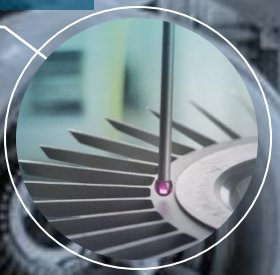
E2E Additive manufacturing

Virtual assembly

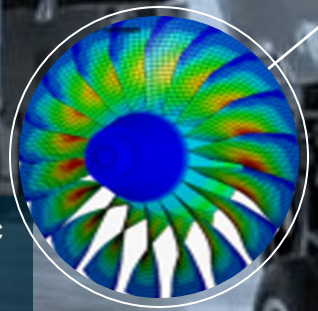
How can we partner you?



Extreme environment & hypersonics vehicle engineering

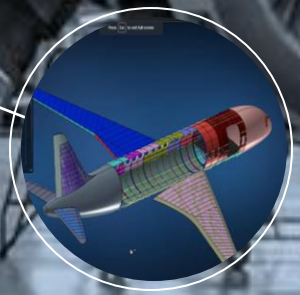


In-process automation & inspection



Hydrogen-electric propulsion engineering

Digitization & reverse engineering



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Thank you

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