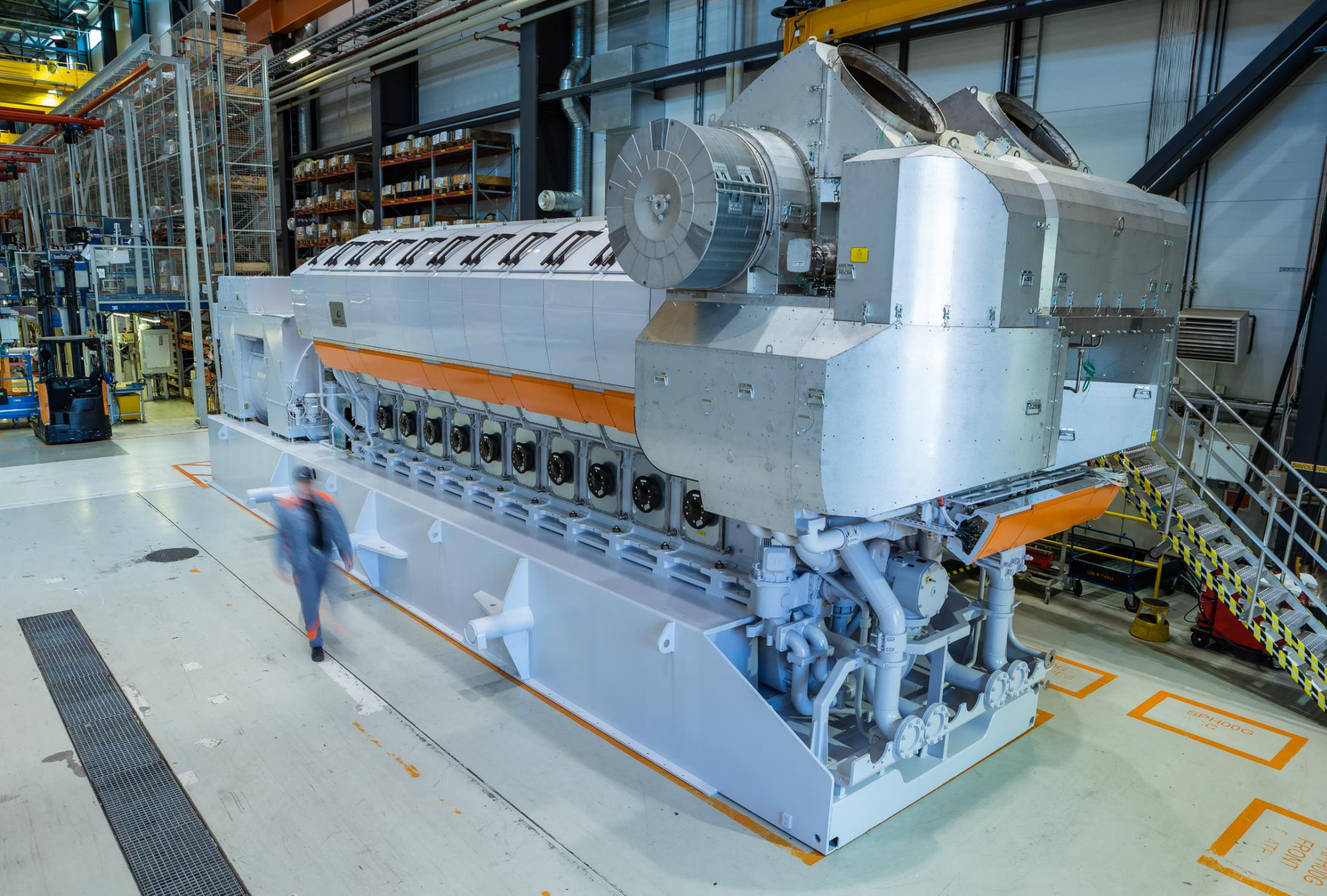
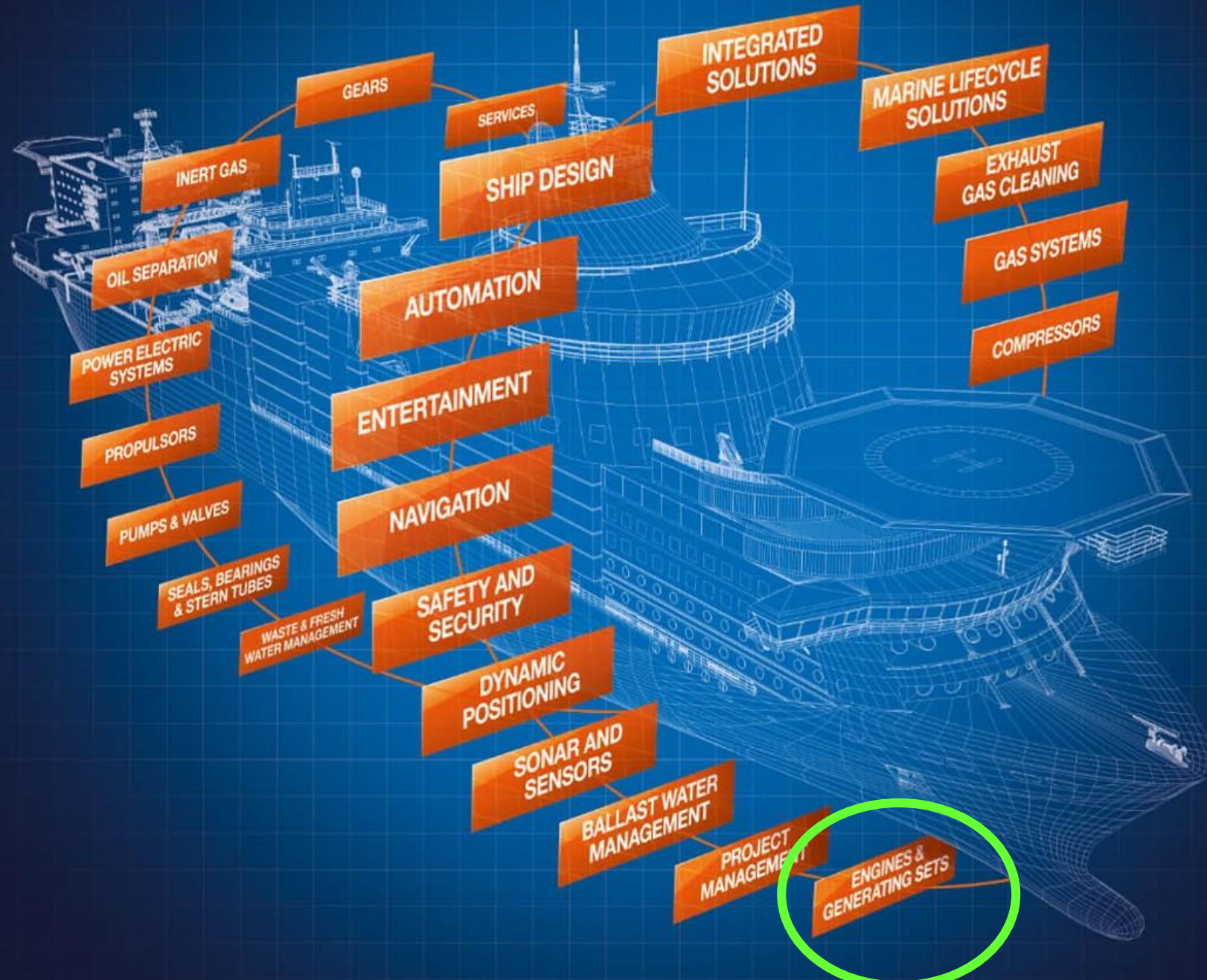


Additive Manufacturing **in Wärtsilä**

Juho Raukola, Innovation Expert (Additive Manufacturing)



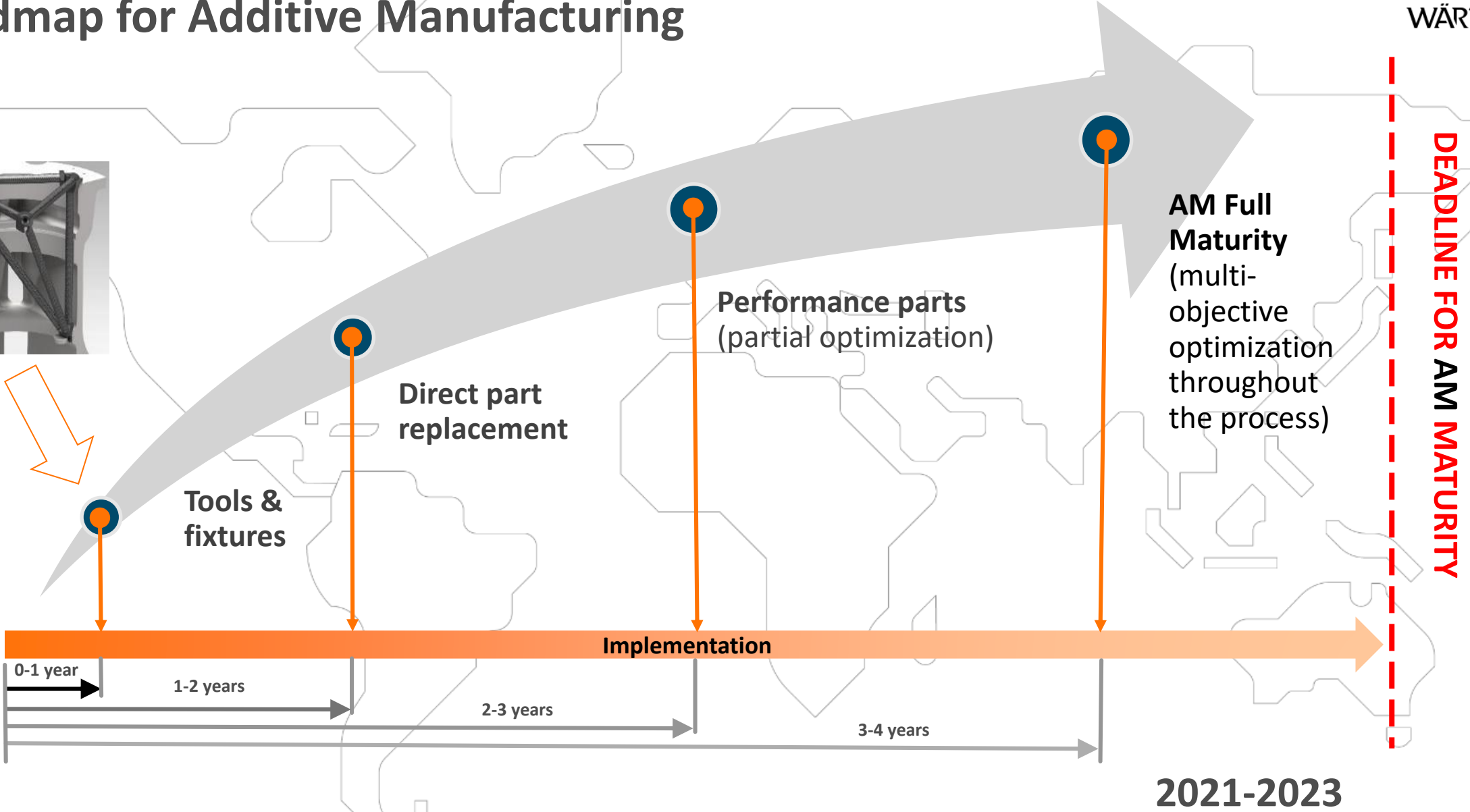
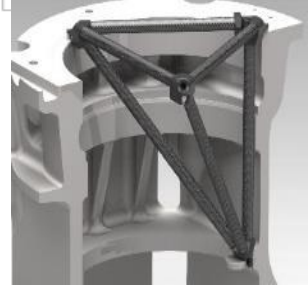
THE MOST COMPLETE MARINE OFFERING ON EARTH





WÄRTSILÄ

Roadmap for Additive Manufacturing



When does Additive Manufacturing make sense?

Time

- Urgent need
- Expensive stand-by
- Rapid prototyping,
Emergency spares

Performance

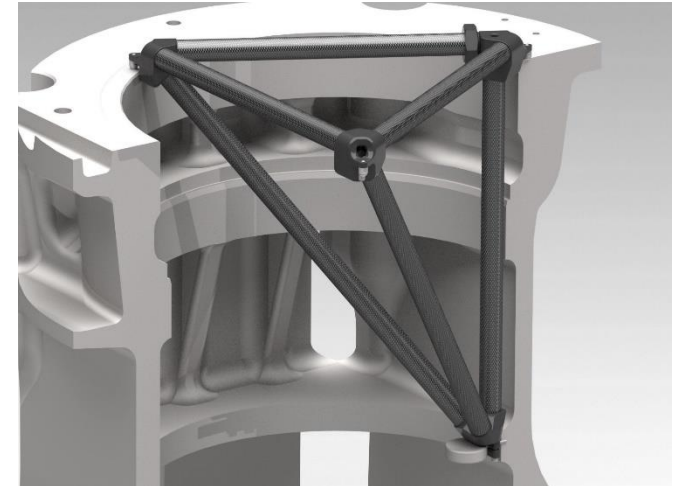
- Complex parts
- Impossible by other means
- Small but critical engine
components

Money

- One-off parts
- Savings by simplified supply chain
- Tools, infrequent spare parts



Valve spring tool



Pre-chamber with internal cooling

Measuring tool

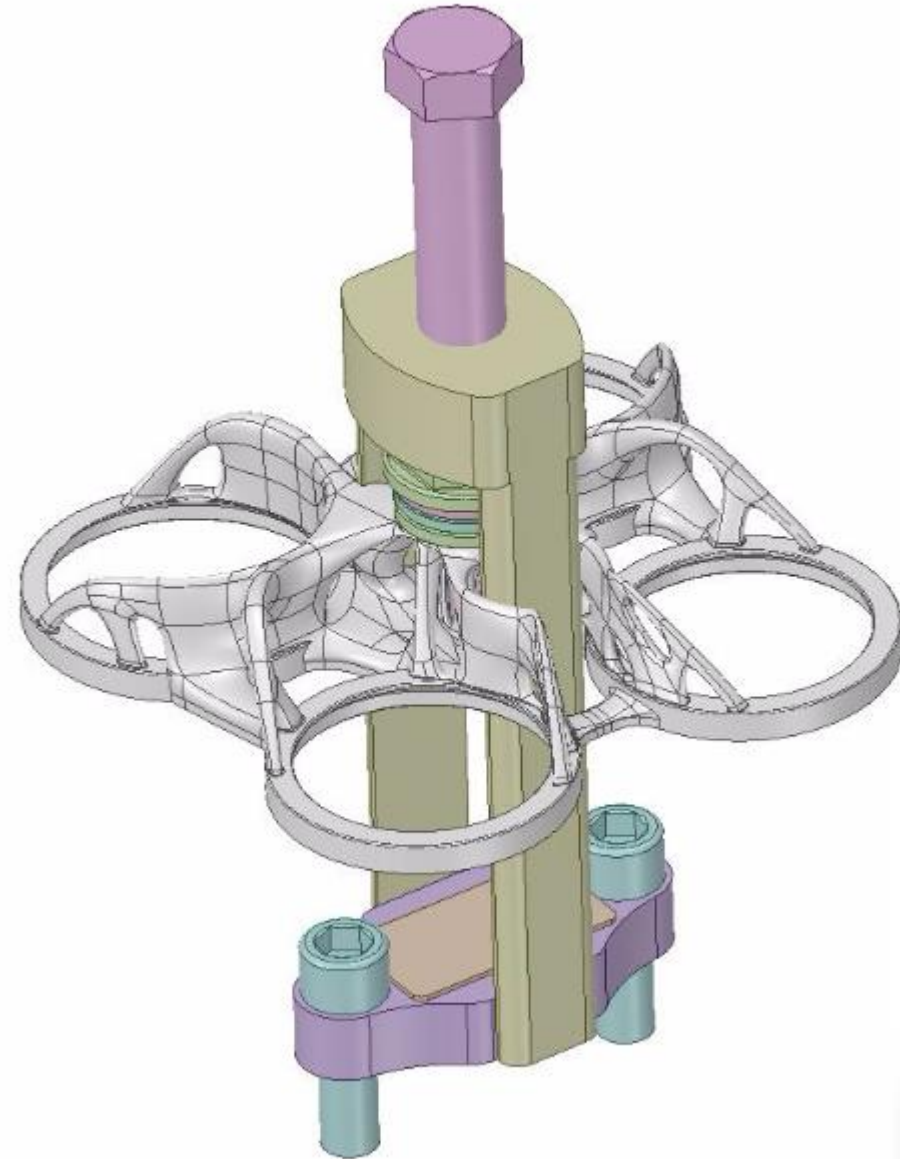


SandBox Vaasa

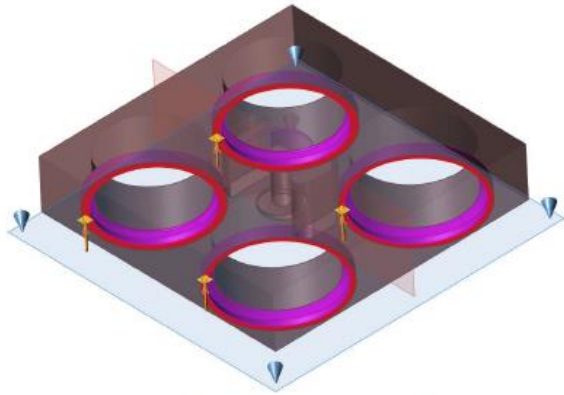
Time

W24 – Valve spring assembly tool

- One-off tool
- Urgent need
- Assembly consists of simple machined parts & printed center piece



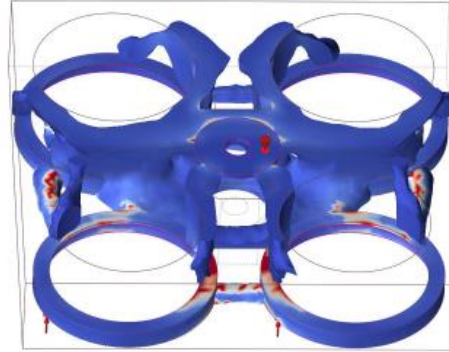
Simulation driven AM design



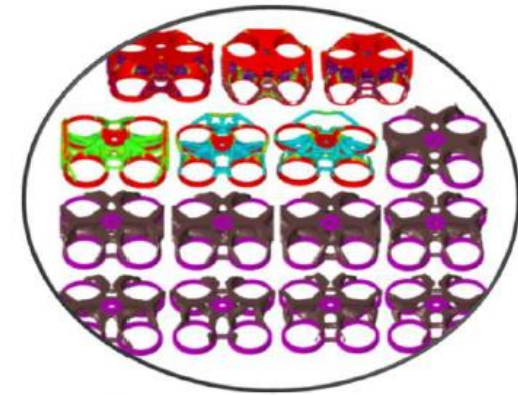
Load case & design space definition



Topology optimization



Preliminary design analysis



Design concept generation



Finalizing design



Design analysis



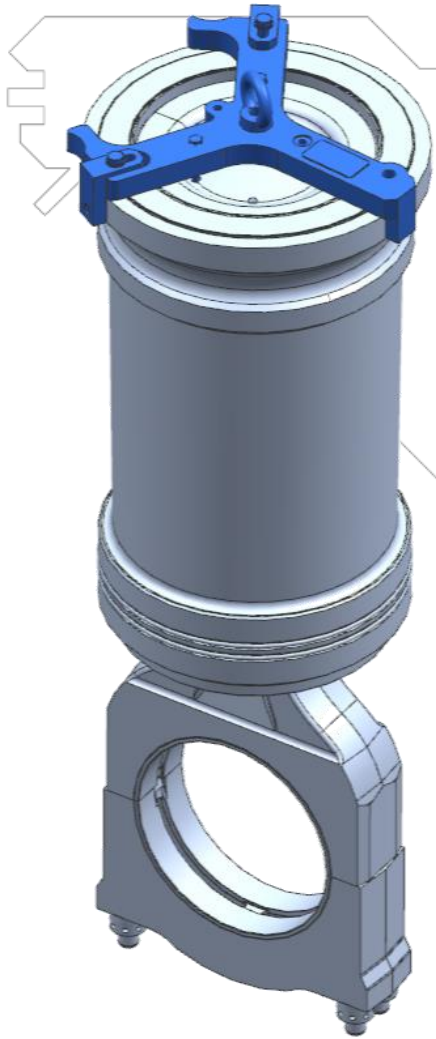
AM process simulation



Optimized design geometry

Performance

A Challenge: Lifting tool in 3D printed Composite

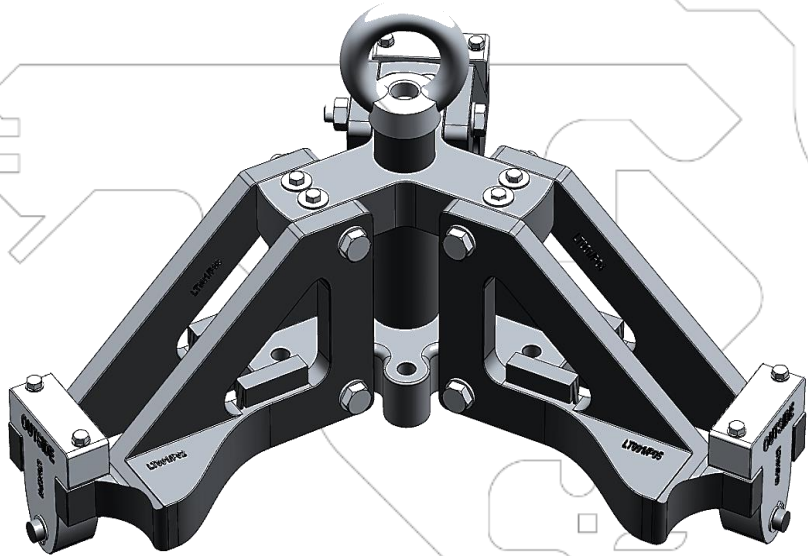


Working load 230 kg

- Must withstand 920 kg (safety factor of 4)
- 9kg weight
- Not easy to handle and «cumbersome»

3D Printed Composite: What do we have?

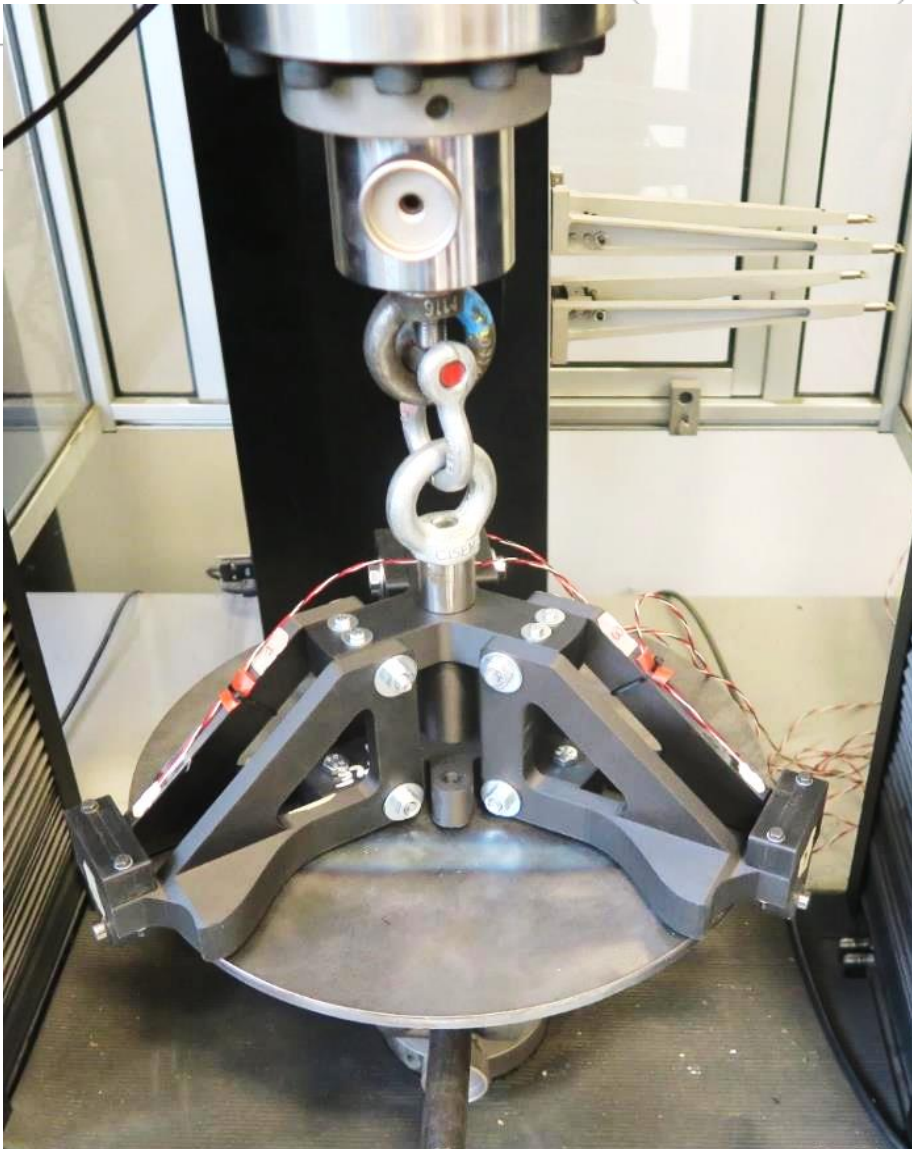
- No material data
- No applicable lifting tool standards
- No existing guidelines for design
- No experience



- **Distributed manufacturing**
- **Full re-configurability**
- **Reduced production and shipment lead time**
- **Removable parts and easy shipment**



Result: **The first AM composite lifting tool** with the CE Certification



**BUREAU
VERITAS**

INDUSTRY & FACILITIES

TYPE APPROVAL CERTIFICATE

BV File n° TC3051/19/SM/PC

Type Approval n°IT-0001-19

Owner/Manufacturer: Wärtsilä Italia S.p.A.

Name and address of the factory:

Performance criteria: Design working Load: 230 kg
 Design test Load: 920 kg
 Service temperature range: 0 – 50

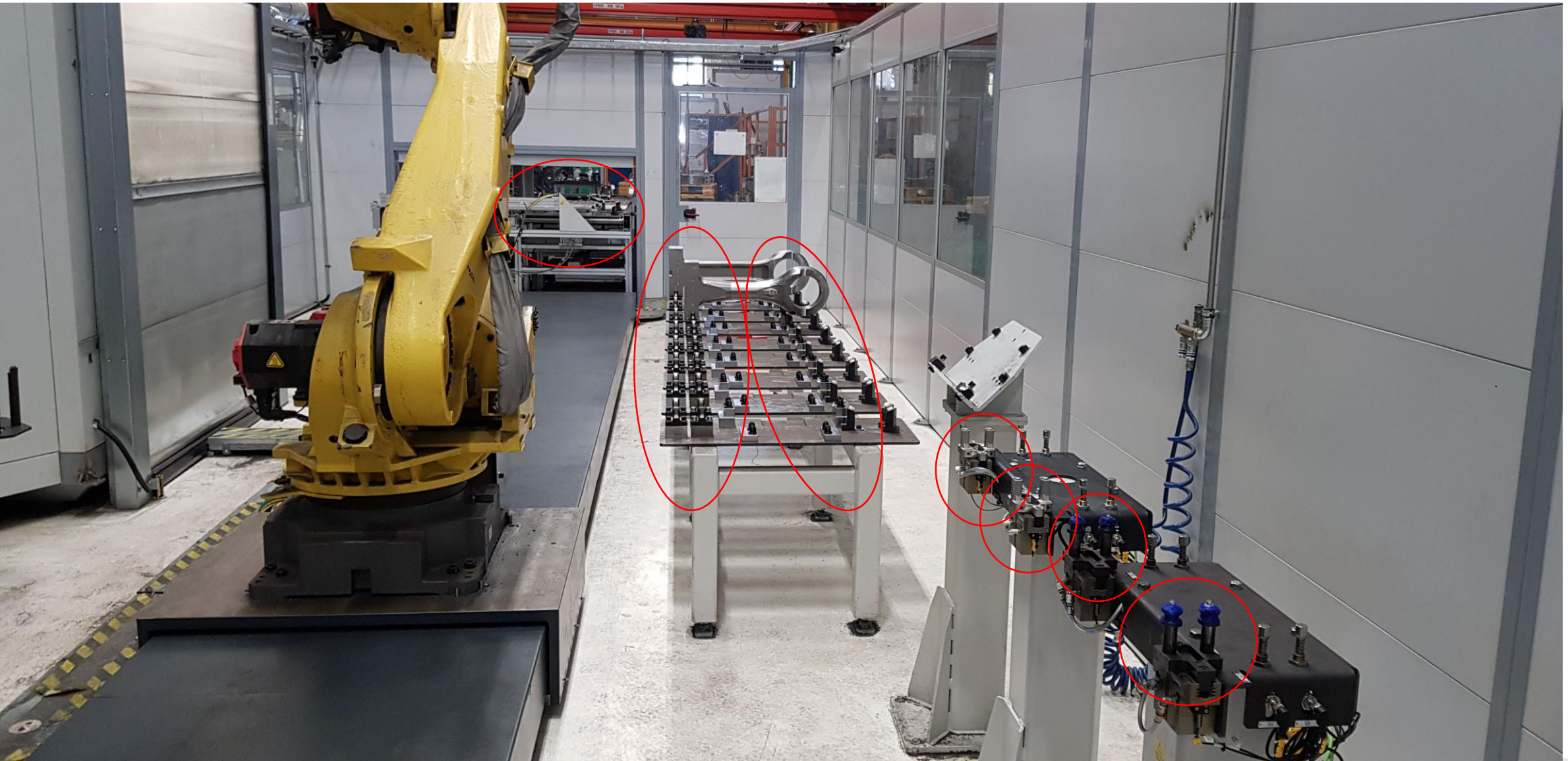
Type description

LIFTING TOOL FOR PISTON

Certificated by Bureau Veritas Additive Manufacturing Rules

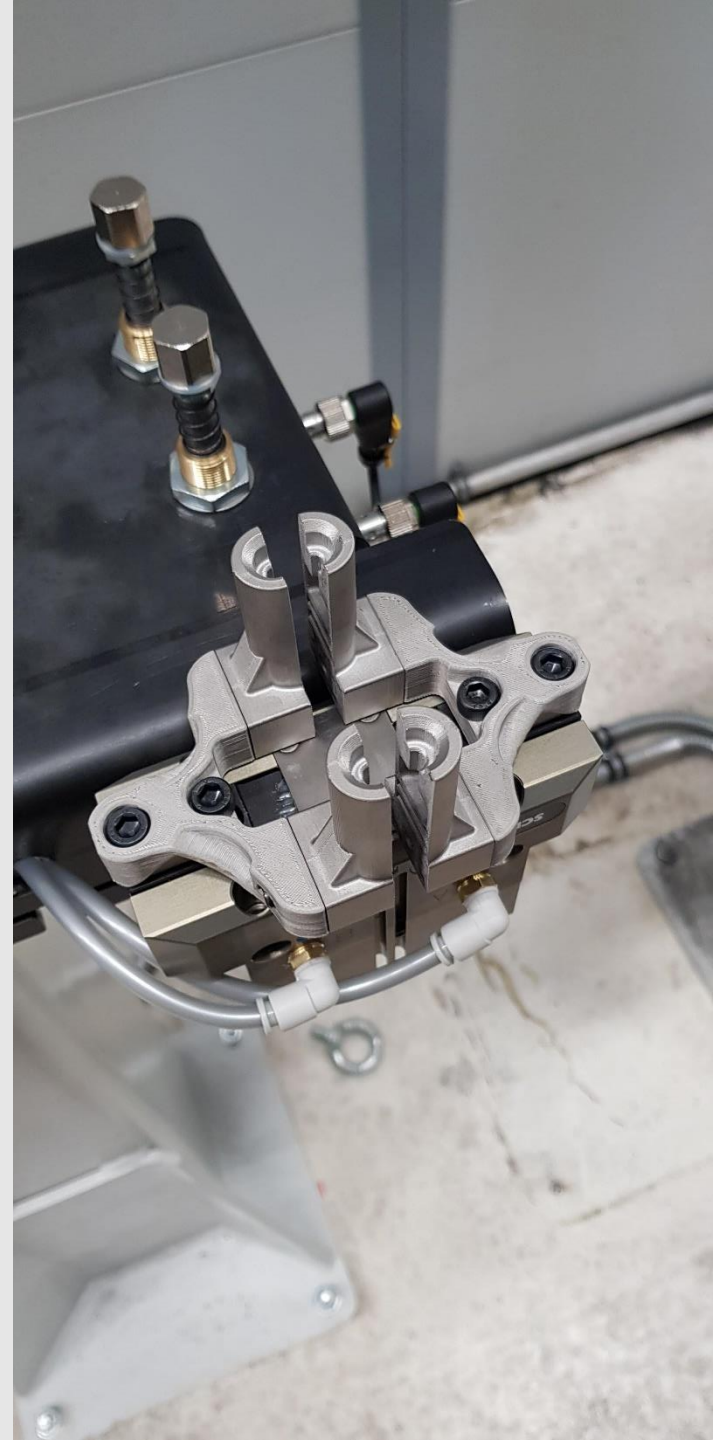
Money

Additive & Manufacturing process integration



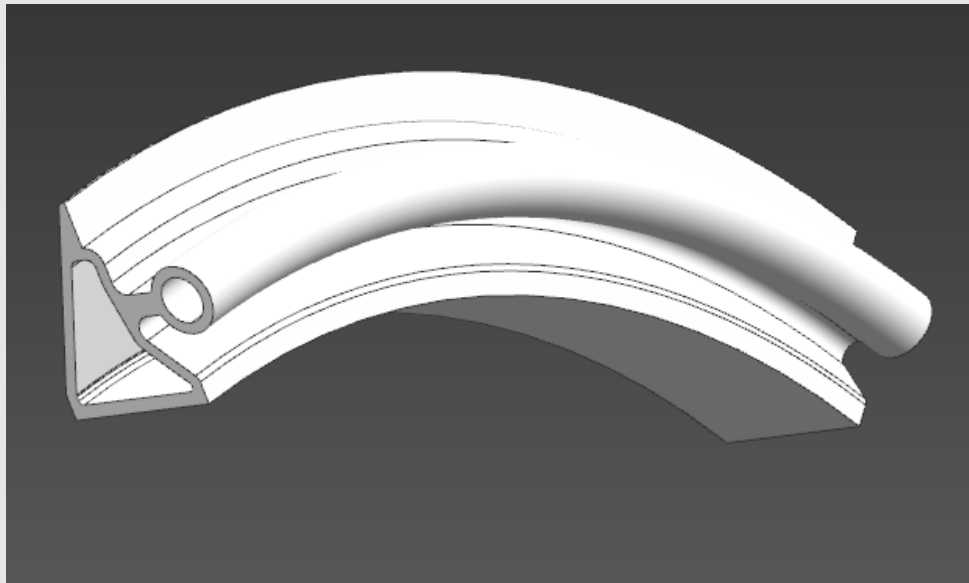
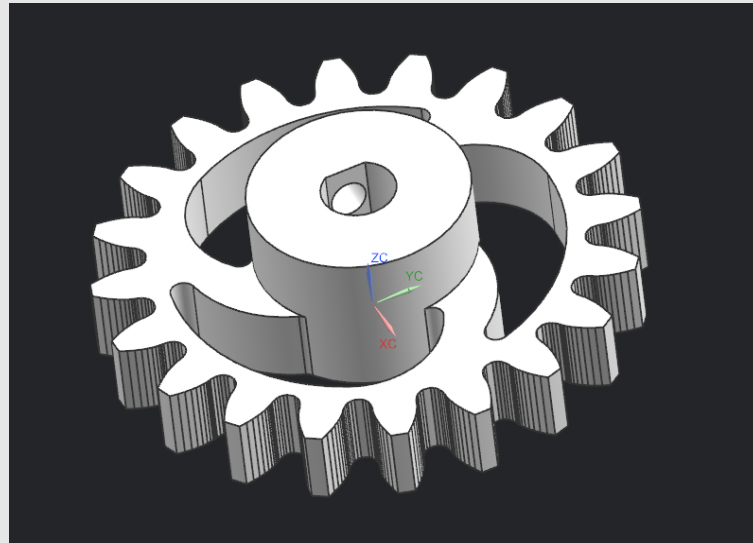
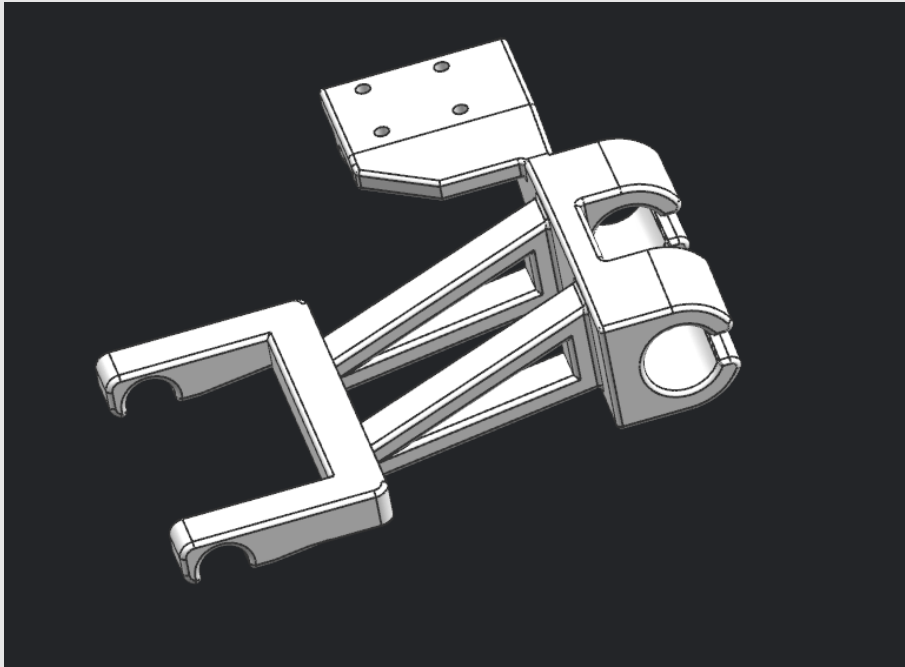


1/29/2019

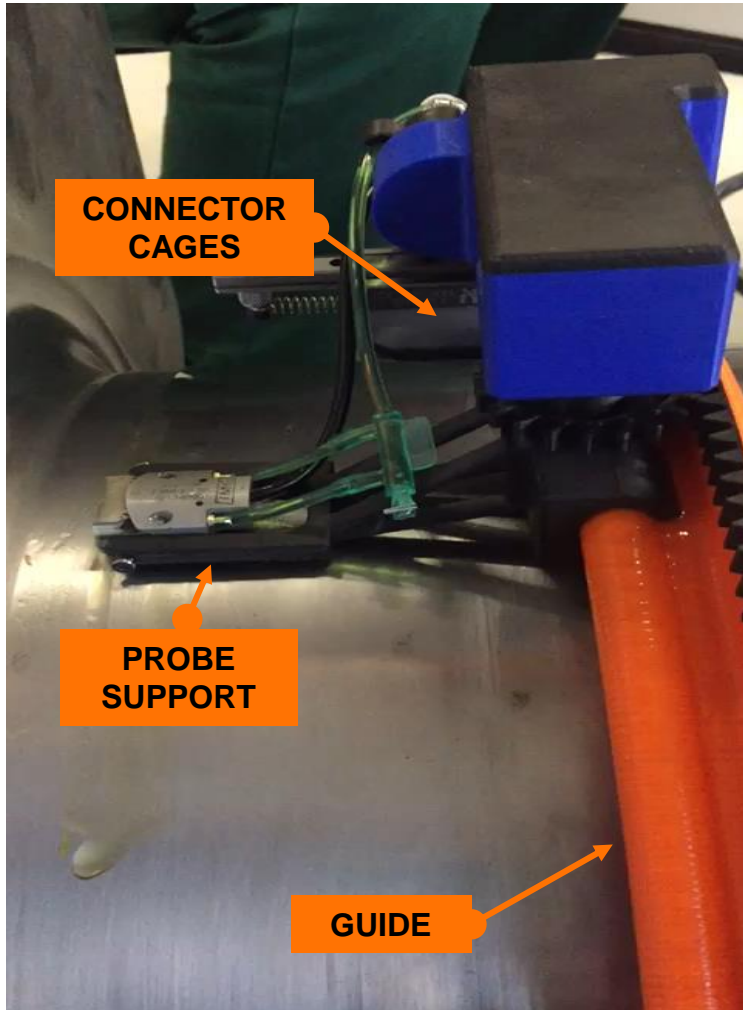




Case example: Ultrasonic testing equipment



SUPPORT FOR AUTOMATED ULTRASONIC TESTING



Manufacturing

Printing Hours ~ 115 h

Material Costs ~ 70 €

Costs

Tool 3D printing cost ~ 230 €

Original tool cost = 14'000 €

Total Cost Saving > 10'000 €

Advantages

Cost saving

Customised design

Rapid tool development

Main targets

- Increased cooling capability
- Longer lifetime & enhanced reliability
- Design & material freedom
 - Eliminate a bottleneck in engine performance

Results

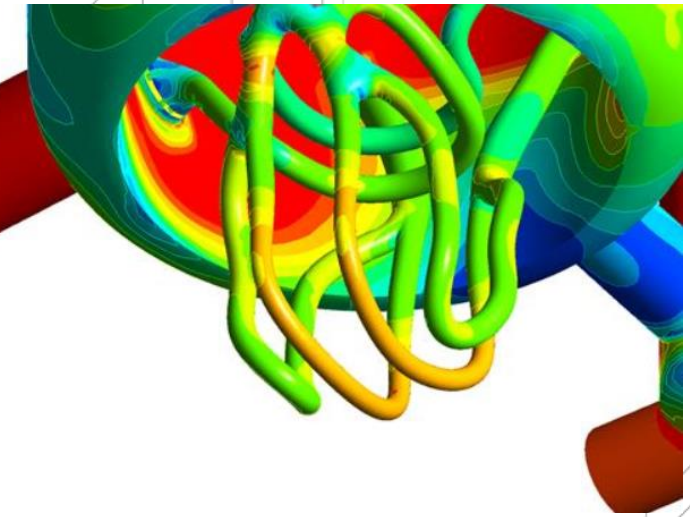
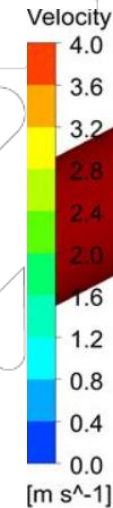
- **250 degrees decrease in operational temperature**
- Cross-company approach
- Bridging competencies
- **Love the problem, not the solution**



2014



2018

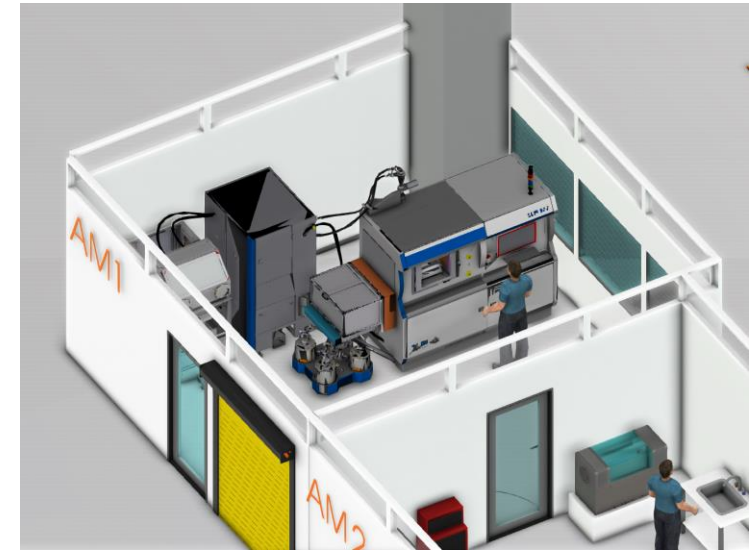


2019

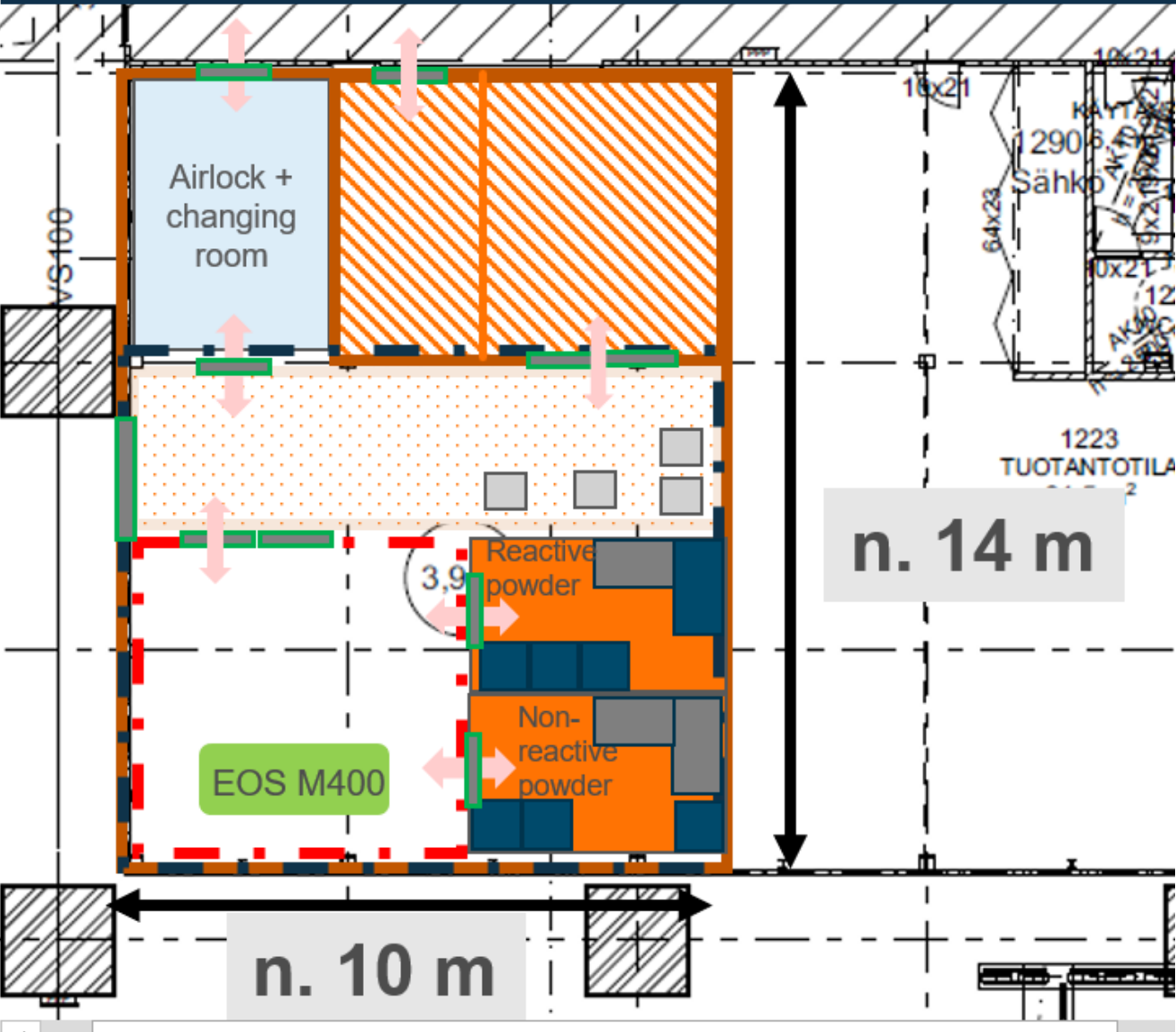
STH & AM Campus



STH Setting up a production for AM



STH Setting up a production for AM








Inside dirty area

- Heat treatment oven (dirty)
- Shot peening / sandblasting (dirty)
- Band saw (dirty)
- Manual support removal (dirty)
- Material storage cupboard (dirty)

Supporting operations needed elsewhere (Clean area)

- Machining operations
- Measuring/scanning of parts
- Manual assembly
- Material testing lab
- (surface treatments)

Legend

-  SandBox area (plastic + composite printing, print job preparation & design)
-  Dirty area (powder can be present)
-  Metal powder 3D printing (concealed room)
-  Post processing
-  Passage (sliding doors)



How to work as a **TEAM**

- **Individual and interactions** over process and tools
- **Working solution** over comprehensive documentation
- **Responding to change** over following a plan
- **Customer collaboration** over contract negotiation

VAASA AM CAMPUS

EXCI

**Let's do it
– together!**



WÄRTSILÄ