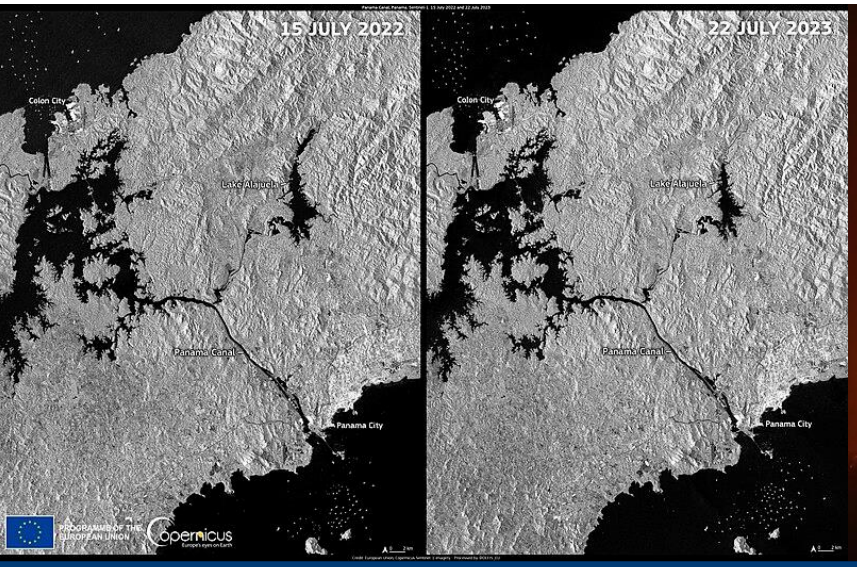
PELAGUS·3D

A THYSSENKRUPP - WILHELMSEN JOINT VENTURE

# Enabling Global Distributed Manufacturing On-Demand

Maintech Conference 16.April 2024

# THE TRADITIONAL SUPPLY CHAIN IS VULNERABLE AND OFTEN FACED WITH SUPPLY CHAIN DISRUPTIONS CAUSING OPERATIONAL ISSUES ACROSS INDUSTRIES

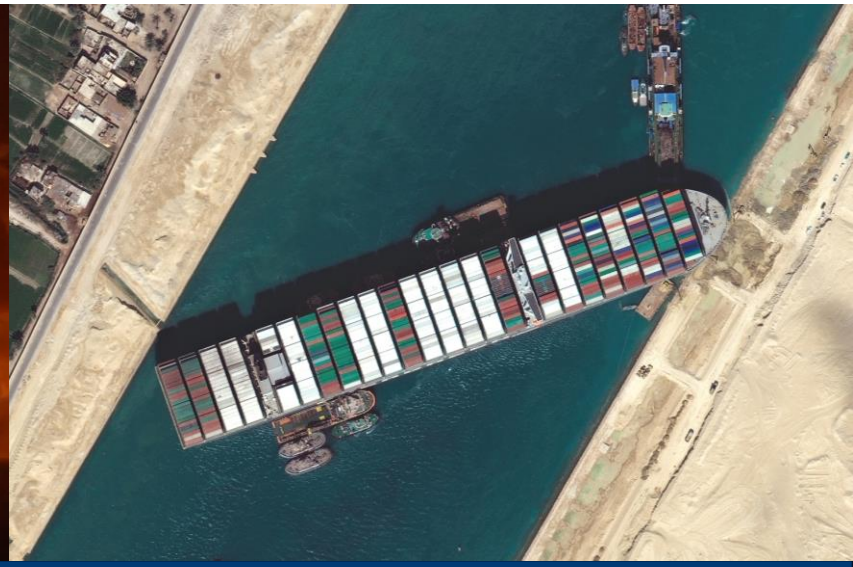



Drought in Panama Canal

Environmental

Attacks on merchant fleet in the Red Sea

Geopolitical



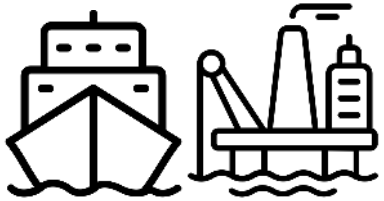
Ship blocking the Suez Canal

Mechanical

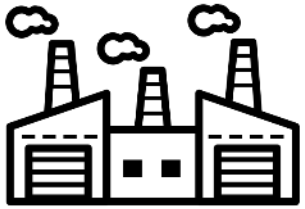
# OEMS AND END USERS EXPERIENCE LONG LEAD TIMES, POOR PERFORMING PARTS AND OBSOLETE PARTS CHALLENGING THEIR ORGANIZATION ABILITY TO DELIVER ON TARGET

**Stakeholders**

**End Users**



**Spare Part Manufacturers**
the OEMs



**Pain Points (LPO)**

**L**ong-lead time

**P**oor part performance

**O**bsolete / Legacy parts

**Examples**

**Pump Impeller**
*Current issue*
> 3 months
lead time

**Water Cooling Pipe Connector**
135 days lead time

**Fan Impeller**
Frequent failure due
to corrosion issues

**Valve Block**
Experiencing flow losses

**Side thruster propeller blade**
Low-volume / legacy part

**Inert Gas Fan Impeller**
Obsolete part

# MOVING TO A DISTRIBUTED ON-DEMAND MANUFACTURING MODEL, SIGNIFICANT SUPPLY CHAIN ISSUES CAN BE RESOLVED

## What you need

- Reduces cost and material waste by only manufacturing what you need
- Custom design for the application

## When you need it

- From just-in-case to just-in-time
- Short lead time
- Lower inventory cost and tied up capital
- Predictive maintenance

## Where you need it

- Send parts globally with Digital warehousing
- Reduce transportation cost and emissions
- Wide network of redundant suppliers gives supply chain security

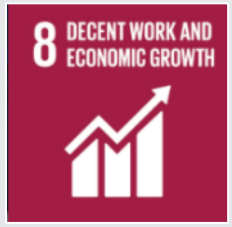
**DIGITAL WAREHOUSING**

**ADDITIVE MANUFACTURING**

**DISTRIBUTED MANUFACTURING**

# IN ADDITION, DISTRIBUTED MANUFACTURING ON-DEMAND CONTRIBUTES TO GLOBAL SUSTAINABILITY

## Towards UN Sustainability Development Goals






### Reduced Physical Transportation

Produce parts where they are needed locally

### Circular Economy

Selected polymers and metal parts can be recycled as 3D printing materials

### Lean Manufacturing

Fewer tools and processes compared to traditional methods. In smaller, quieter factories.

### Less Raw Materials

Allows efficient designs and remove need to cut out parts from blocks forming waste

### Repair Working Systems

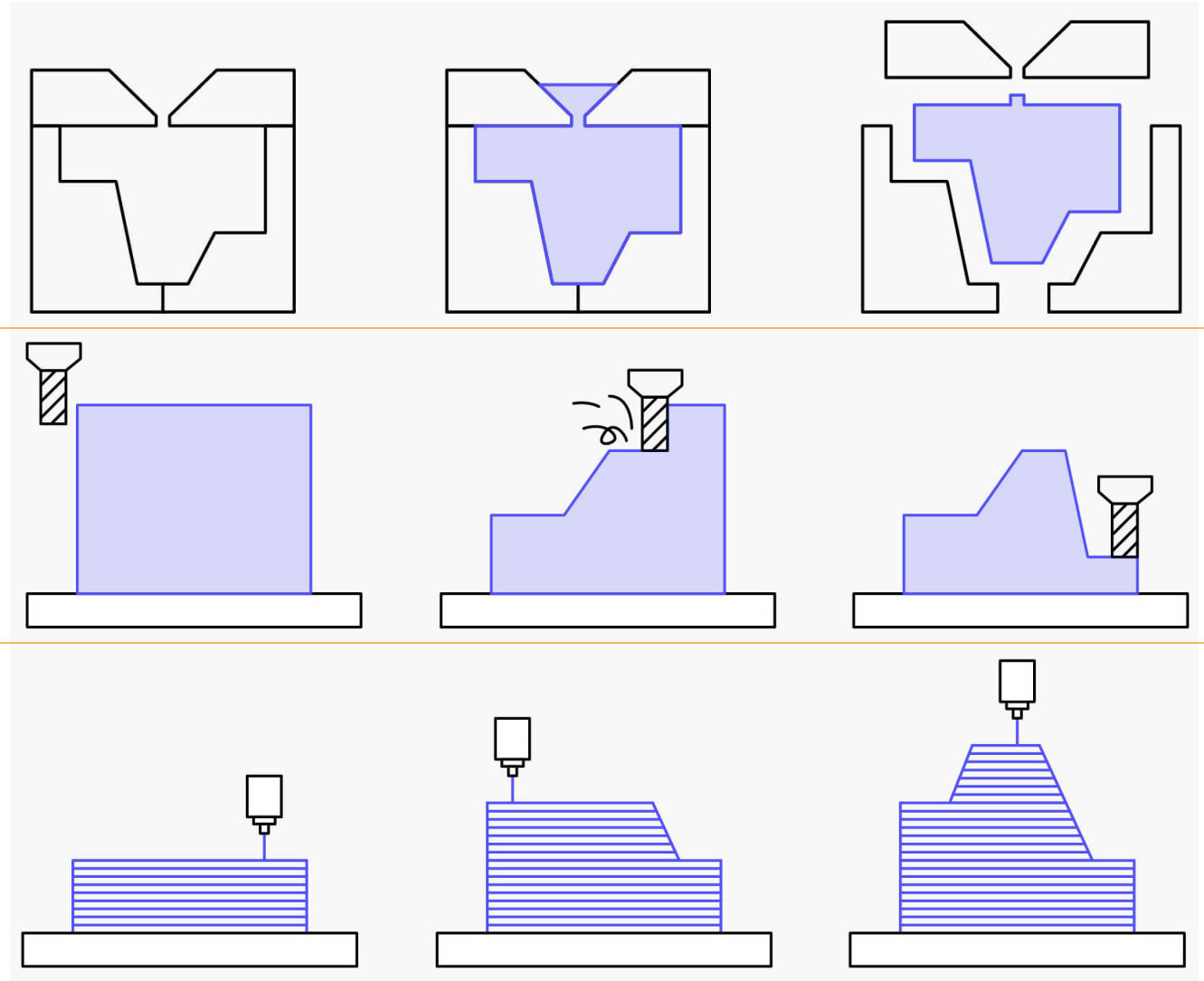
Replace obsolete spare parts rather than full systems

### Remove Inventory Needs

Mass production could overstock parts which will never be used

# INTRODUCTION TO ADDITIVE MANUFACTURING

# ADDITIVE MANUFACTURING (AM) IS THE PROCESS OF CREATING AN OBJECT BY BUILDING IT ONE LAYER AT A TIME



Formative Manufacturing

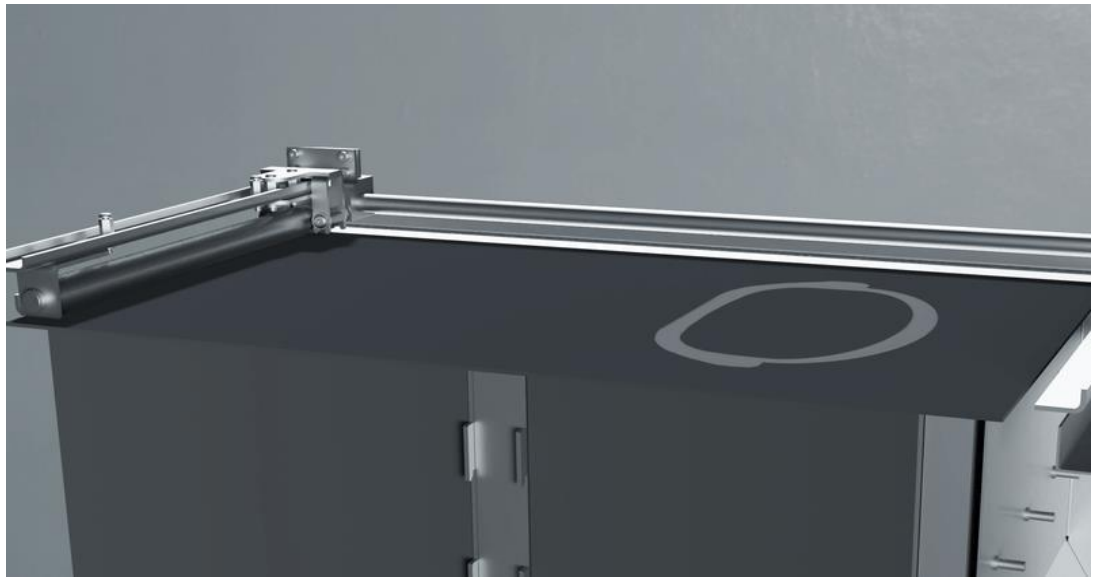
- Injection molding
- Forging
- Casting
- Bending
- etc.

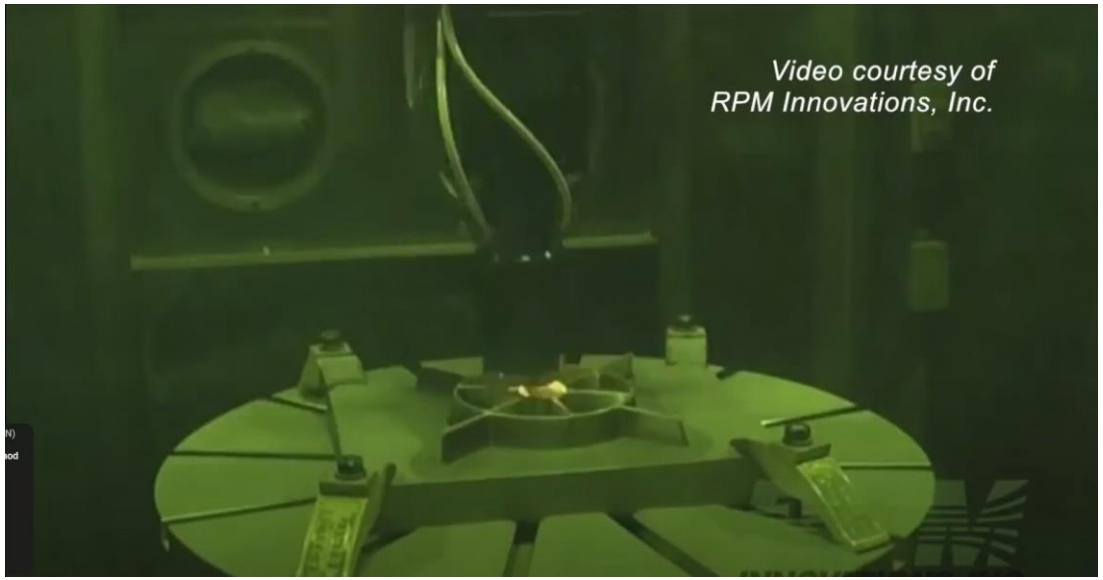
Subtractive Manufacturing

- Milling
- Turning
- Drilling
- Grinding
- etc.

Additive Manufacturing

- Material Extrusion (MEX)
- Powder Bed Fusion (PBF)
- Vat Photopolymerisation (VPP)
- Material Jetting (MJ)
- Binder Jetting (BJ)
- Direct Energy Deposition (DED)
- Sheet Lamination (SL)




Video courtesy of
RPM Innovations, Inc.

# WHAT CAN WE MAKE USING AM?

## Geometry

- Mechanical parts
- From 1mm to 15m in size (Technology dependent)
- Typical 20mm - 500mm$^3$ (metals)

## Materials

- Metals: stainless steal, nickel alloys, titanium, aluminum, and more
- Polymers: plastic, PEAK, fiberglass filaments, carbon filaments, and more

## Quality

- DNV, API, ABS qualified parts
- Pair with material standards (NORSOK)
- Structural load bearing, safety critical, pressurized parts

*Micro-laser sintering technology (MLS) that can be used to create miniature metal components.*

*12-metre, 4.5tonn 3D-printed pedestrian bridge in Amsterdam*

# WHAT PARTS SHOULD WE MAKE WITH AM?

# WHAT PARTS SHOULD WE MAKE WITH AM?

## What is success?

- ✓ Reduced cost
- ✓ Lower risk
- ✓ Reduced emissions
- ✓ Unsolved problem

**End Users**

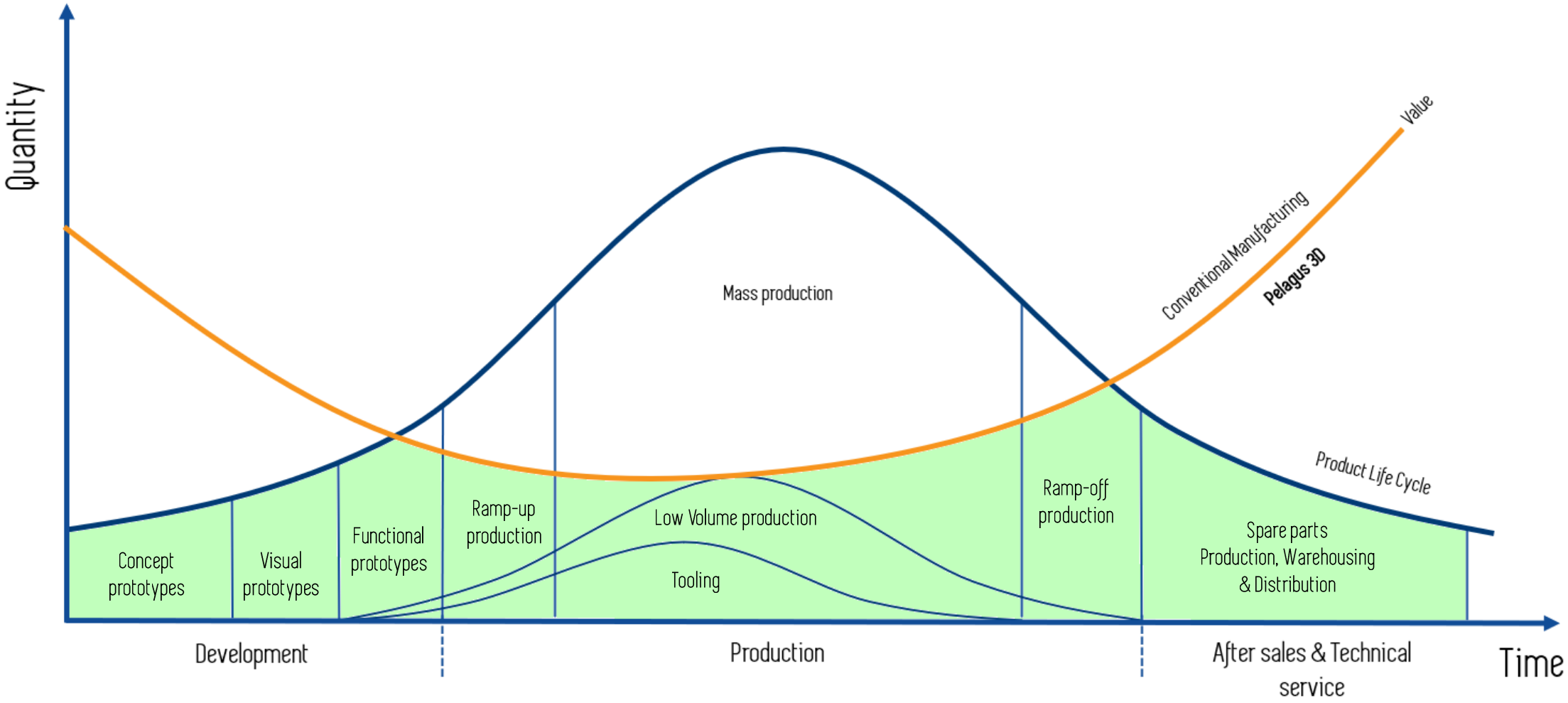
- Long-lead time
- High cost

**OEM**

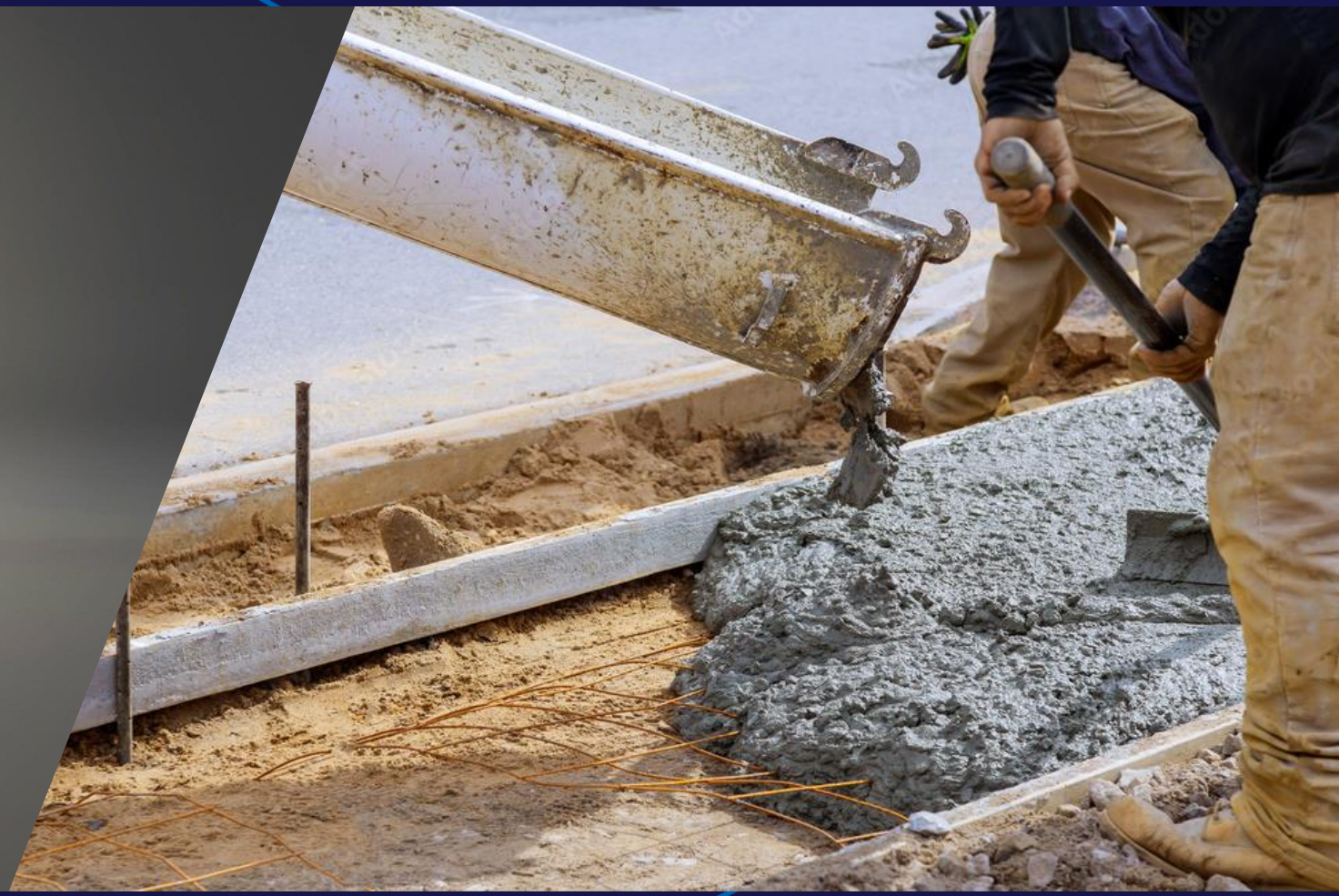
- Poor part performance
- Obsolete / Legacy parts

- Create a good business case
  - Comparison with traditional manufacturing and design
- Re-design the part for AM
- Consider the total cost of ownership
  - Put a price on all aspects of the part
- New previously impossible designs
  - Geometrical complexity
  - Consolidated parts

# AM IN A IN A PRODUCT LIFE CYCLE



# HOW TO GO FROM THIS IDEA TO REALITY?



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# Enabling Global Distributed Manufacturing On-Demand

# PELAGUS·3D

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# FACT SHEET

Pelagus 3D is a global digital manufacturing partner, solving maintenance needs on-demand through a fulfilment platform.
We offer an extensive printable spare parts catalogue, with deep knowledge of certification and performance for on-demand production, with a globally integrated delivery platform that is strategically attractive to OEMs, End Users & Manufacturing Partners.

## Stakeholders

Spare Part Manufacturers (OEMs)

Supporting the OEM in building digital inventory and manufacturing parts.

End Users

Facilitating the End User to request On-demand parts from OEMs and manufacture non-OEM parts.

## KEY METRICS

**4000+**
assets served

**80+ and growing**
manufacturing suppliers

**25**
End Users

**21**
OEMs

All figures provided above are based from 2022, under Wilhelmsen Ships Service.

# PELAGUS DISTRIBUTED NETWORK OF MANUFACTURING PARTNERS AND LOGISTICS SOLUTION TO EFFICIENTLY MANUFACTURE AND DELIVER PARTS AROUND THE WORLD


## Fabrication

80+ manufacturing partners globally

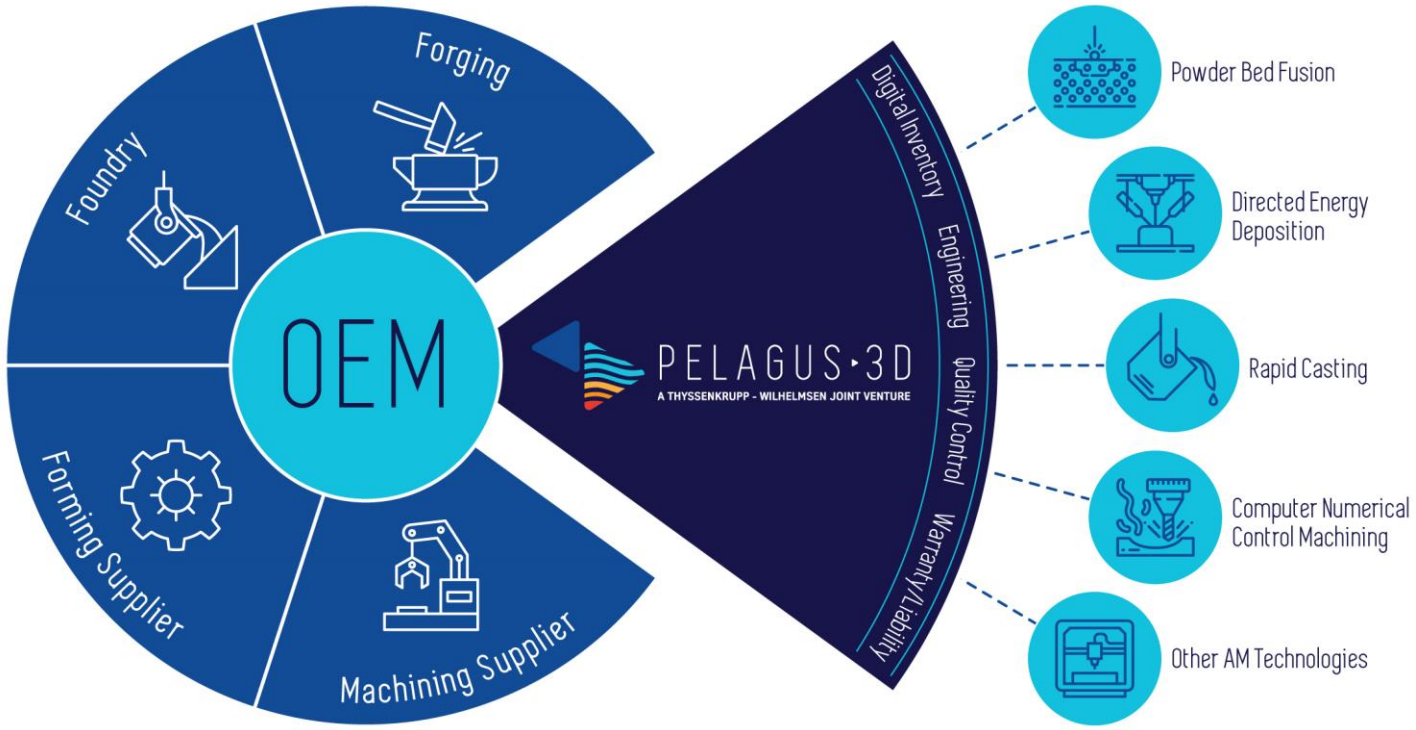
## Repackaging & Quality Check

126 Operations Sites

## Fulfilment

- Last mile delivery from Ops Sites to customer
- Typically by road or barge

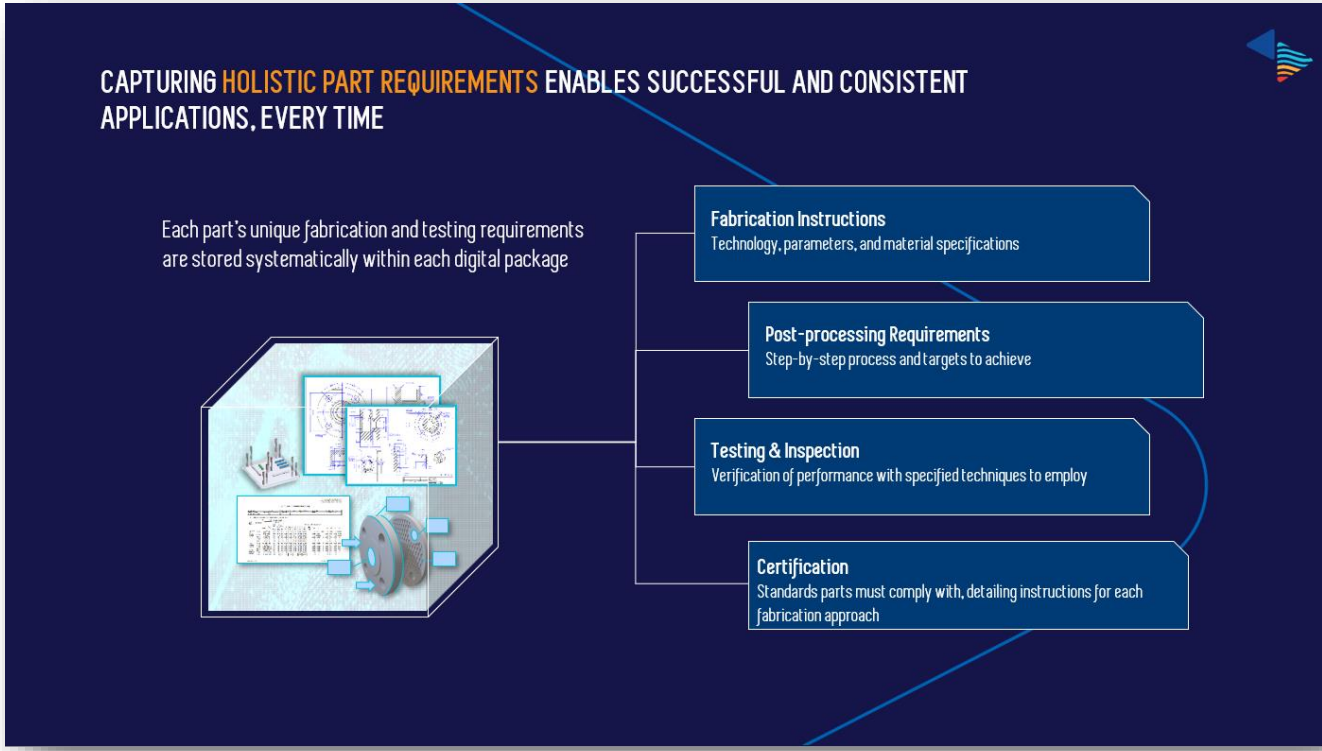
# PELAGUS IS SERVING AS A MANUFACTURING SUPPLIER FOR THE OEM, BY GIVING ACCESS TO A GLOBAL NETWORK OF PARTNERS AND TECHNOLOGIES



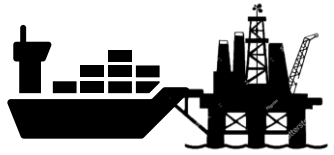

# PELAGUS CAN PROVIDE FULL SCOPE OF ENGINEERING SERVICE, PREPARING A COMPONENT FOR ON-DEMAND MANUFACTURING

Converting a traditional designed part to an AM part including full scope of quality description for manufacturing.

- Part selection
- Design modifications for AM
  - Design optimization for performance of part
- Technology selection
- Post processing requirements
- Quality assurance



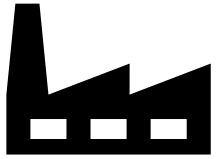
# THE SUPPLY CHAIN USING PELAGUS SOLUTIONS



End user


OEM


Pelagus



Manufacturing network

End Location

Order request of part

Orders part from Digital Inventory

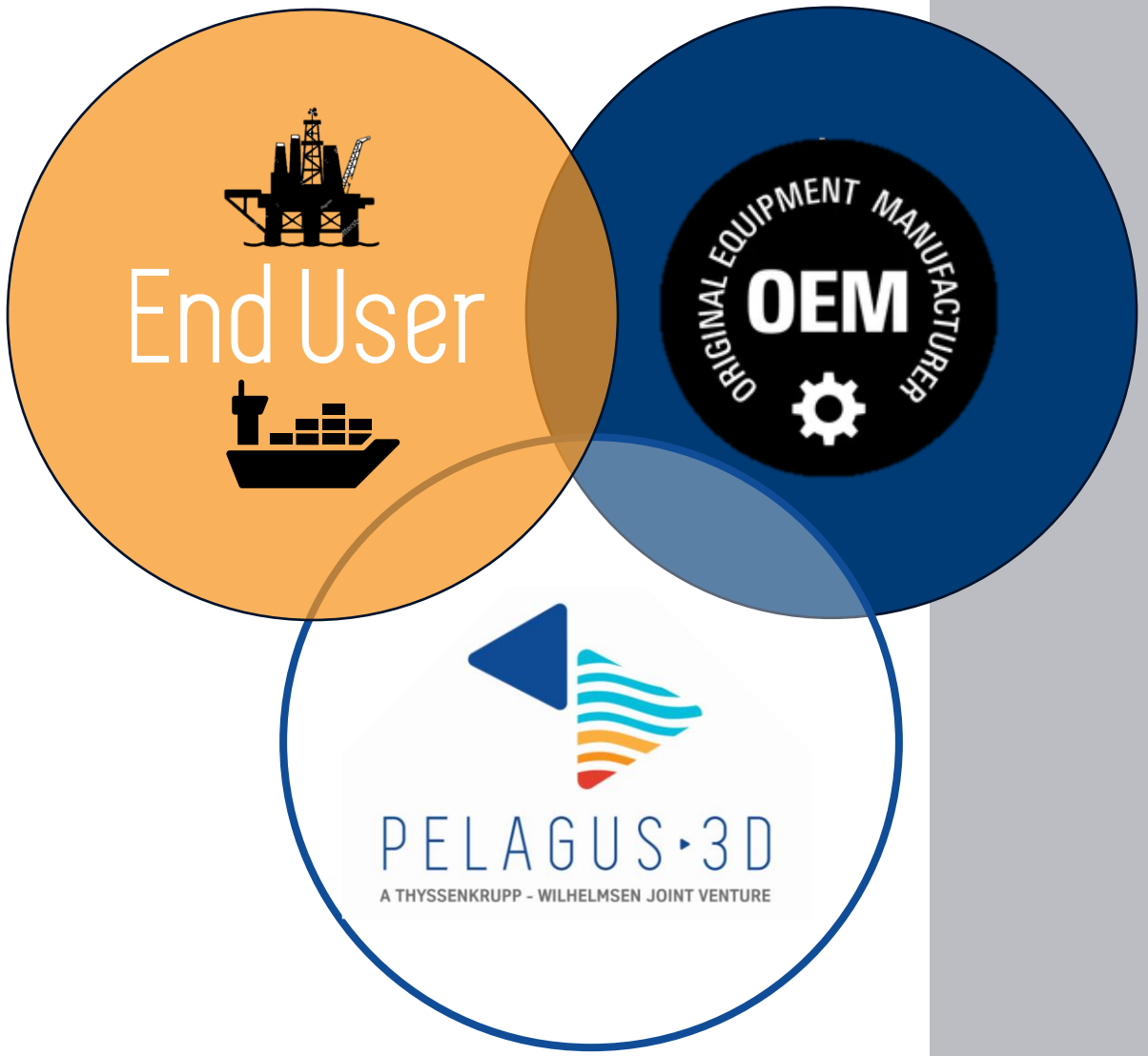
Puts out RFQ at multiple manufacturing suppliers

Manufactures part

Ships is to the OEM's and End Users agreed location

# SUPPORTING THE END USER IN THE INTERACTION WITH THE OEM, BY PROVIDING A SOLUTION FOR ON-DEMAND MANUFACTURING

- Facilitating the End User to request On-demand parts from the OEMs
- Direct manufacturing for the End User
  - Obsolete parts
  - New parts
  - Generic parts



# PELAGUS 3D GIVES OEMS AND END USERS FULL ACCESS TO ON-DEMAND MANUFACTURING USING DIGITAL INVENTORY AND A DISTRIBUTED NETWORK OF SUPPLIERS

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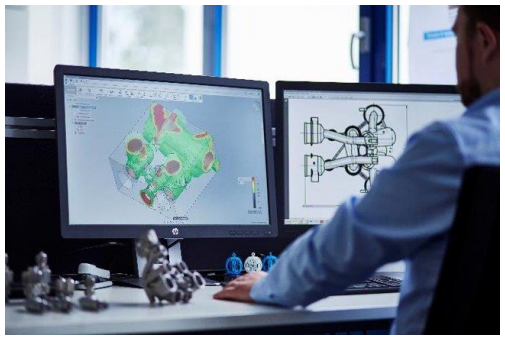
## Engineering service provider



## Digital Inventory Platform


## Global Fabricator Network

# CASE STUDY – RETURN OIL STAND PIPE

**Part**: Return Oil Standpipe

**OEM**: Kawasaki Heavy Industries

**End User**: Wallenius Wilhelmsen (Vessel: TYSLA)

**Delivery Location:** Onboard vessel, Kobe, Japan

"The received part exceeded our expectations regarding the quality and materials used to produce the mentioned part. This is a perfect example of the benefits of 3D printing, such as shortened delivery times and no restrictions on the shape of the printed part"

Zbigniew Pilch, Chief Engineer M/V Tysla, Wilhelmsen Ship Management

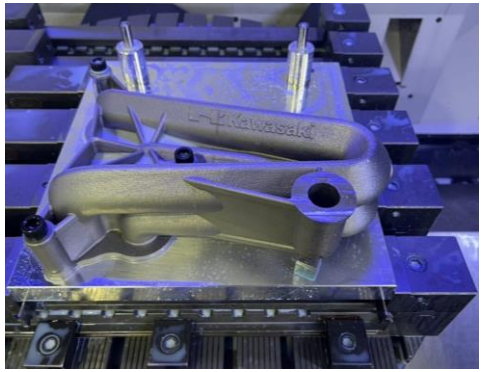
## Conventional vs digital supply chain

| | |
|---|---|
| Conventional supply chain | Production lead time: **135 days.**<br>Part weight: **75 kg.**<br>Annual storage costs: **340 USD.** |
| Digital supply chain | Production lead time: **15 days.**<br>Part weight: **7.5 kg**<br>Annual storage costs: **0 USD** |

### Part Assessment

### Design & Engineering

### Manufacturing



### Logistics

### Delivery to customer

# HOW SHOULD YOUR COMPANY APPROACH AM/ON-DEMAND?

## Start simple and cheap

- Manufacture some simple polymer parts at local supplier to get basic experience

1-2 weeks

## Nominate and assess some problem parts from your catalogue

- LPO
- Work with expert providers
- Perform total cost of ownership calculation
- Technology and material selection
- Manufacture, qualify, sell and install first part

4-12 weeks

## Mass assessment of your catalogue

- Technical and commercial assessment of all parts in catalogue to identify the potential of On-demand for your business
- Digitization of selected parts
- Adjust supply chain model to accommodate On-demand manufacturing and digital warehousing

12-26 weeks

# PELAGUS·3D

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Sondre Halden
Customer Success Manager

+47 40044188
Sondre.Halden@pelagus.com

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