



# 3D PRINTING FOR REMANUFACTURING

The future **in motion**

# Panalpina's core activities



## AIR FREIGHT

- Among global top 4
- Tailored service levels, from intermodal sea-air to temperature-controlled services, also available door-to-door
- Central procurement and strategic partnerships with leading airlines
- Charter Network
- 24/7 hub, charter and emergency services



## OCEAN FREIGHT

- Among global top 4
- Central procurement and capacity management
- Strategic partnership with leading carriers
- NVOCC Pantainer Express Line
- Intermodal services
- 500+ LCL services



## LOGISTICS AND MANUFACTURING

- **Core logistics**
- VAS Warehousing
- Distribution
- Overland (road and rail)
- **Logistics Manufacturing Services**
- Distributed manufacturing
- Repair and remanufacture
- Installations
- **Digital Logistics Manufacturing Services**



## ENERGY AND PROJECT SOLUTIONS

- Turnkey project logistics management
- Out-of-gauge and heavy lift handling and transport
- Break bulk and chartering
- Project planning and study consulting
- Transport engineering
- Oil and gas tailored hub logistics
- Offshore marine services
- Rig move and field supply concepts

## TRADITIONAL CORE COMPETENCIES

Air and Ocean Freight forwarding are the foundations of our business to support the needs of all our customers

## NEW CORE COMPETENCE

Complex VAS logistics services provided across the world

## SPECIALTY

Specialty expertise for the energy and project sector

# A GLANCE AT PANALPINA'S KEY TECHNOLOGY SITES

A global network of high value logistics operations supported by the latest technologies



Assembly and installations solution  
Sorocaba



Testing and customisation solution  
Colon, Panama



High value tech (spare parts)  
Tillburg



High value e-com solution  
New York



Technology repair & returns solution  
Dubai

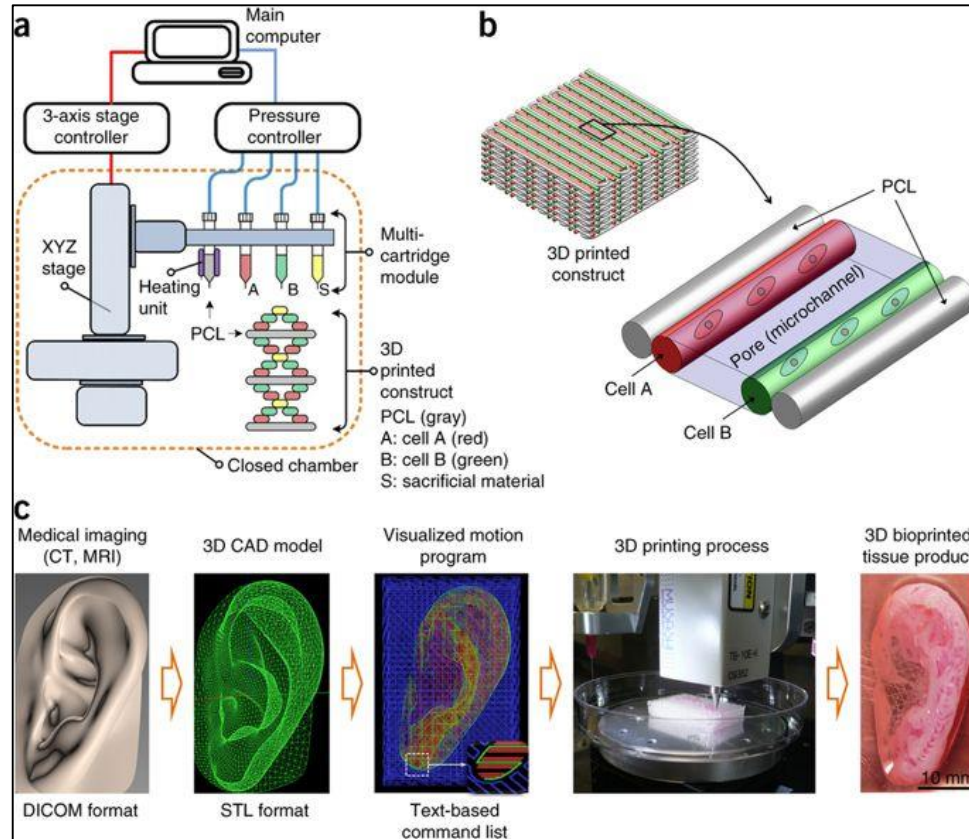


High value tech & medical devices  
Singapore

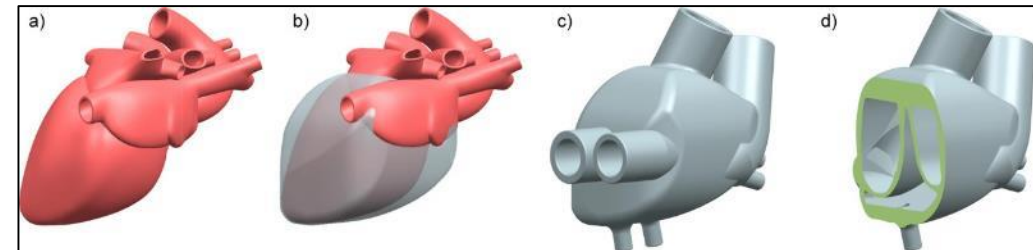


# 3D Printing and the healthcare industry

## Tissue constructs of human-sized external ears

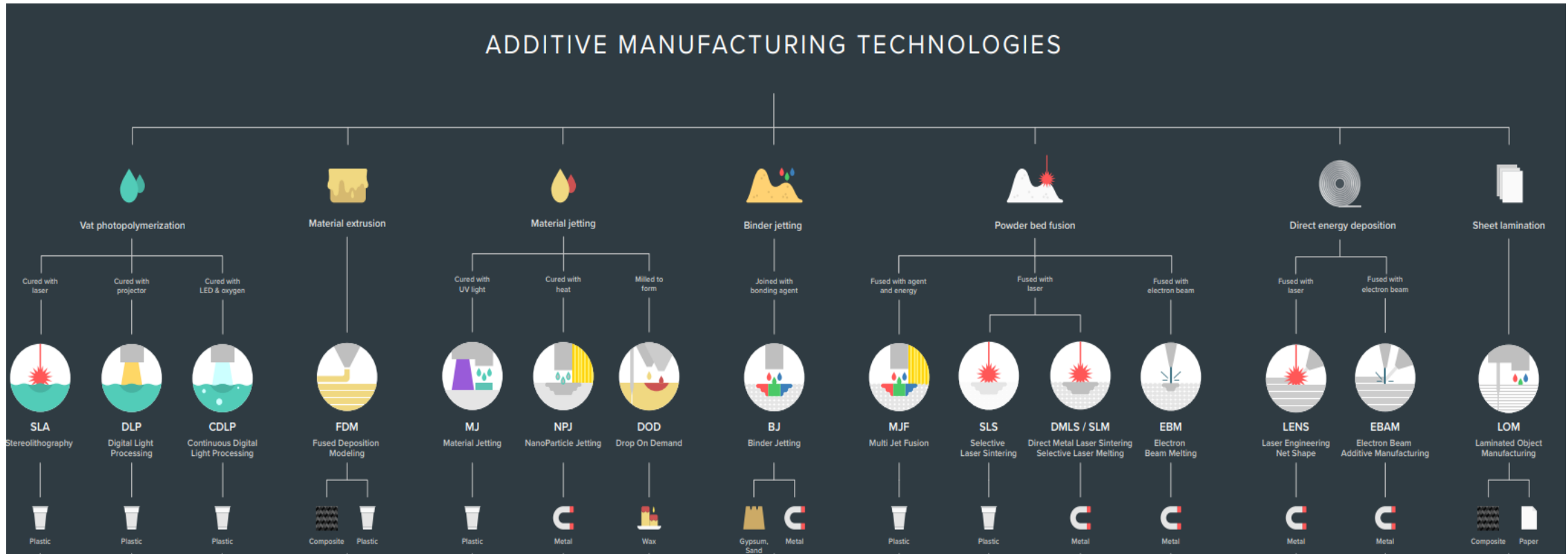


A completely soft pneumatically driven artificial heart from silicone elastomers.

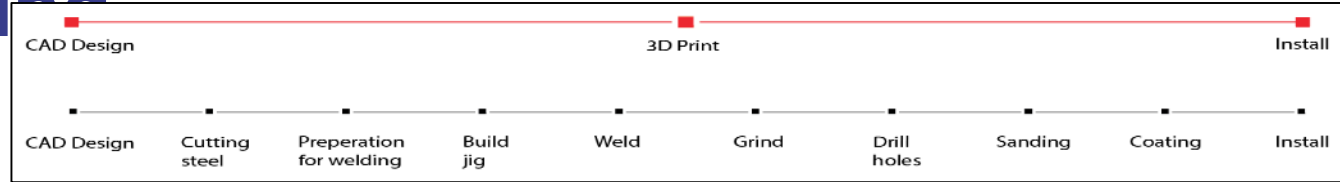


- Cohrs, Nicholas H., et al. "A soft total artificial heart—first concept evaluation on a hybrid mock circulation." *Artificial organs* 41.10 (2017): 948-958.
- A 3D bio printing system to produce human-scale tissue constructs with structural integrity

# Technology overview



# Advantages of 3D Printing over conventional manufacturing



Single step manufacture



Speed



Cost



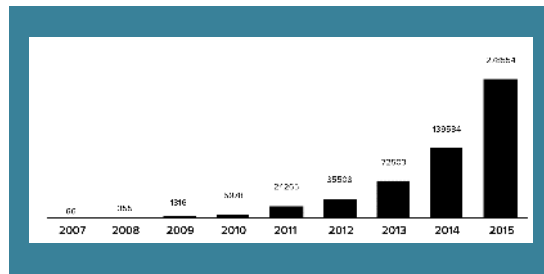
Risk mitigation



Complexity and design freedom



Customizable



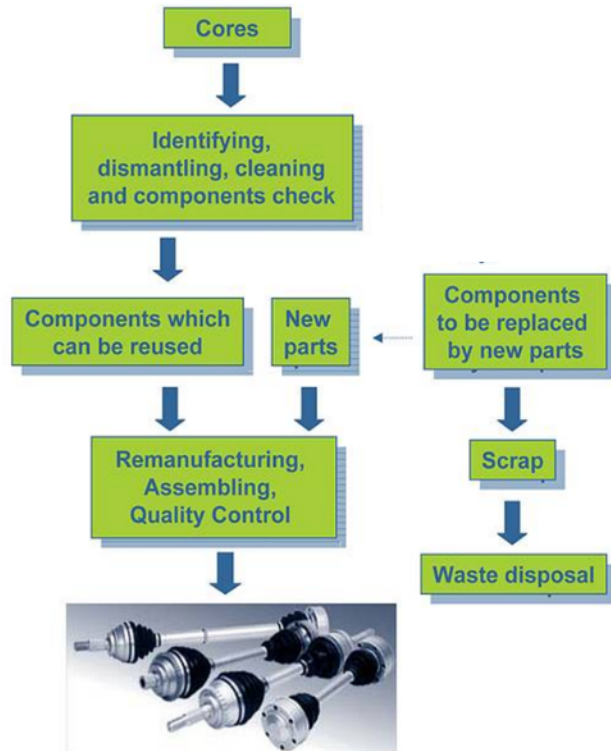
Ease of access



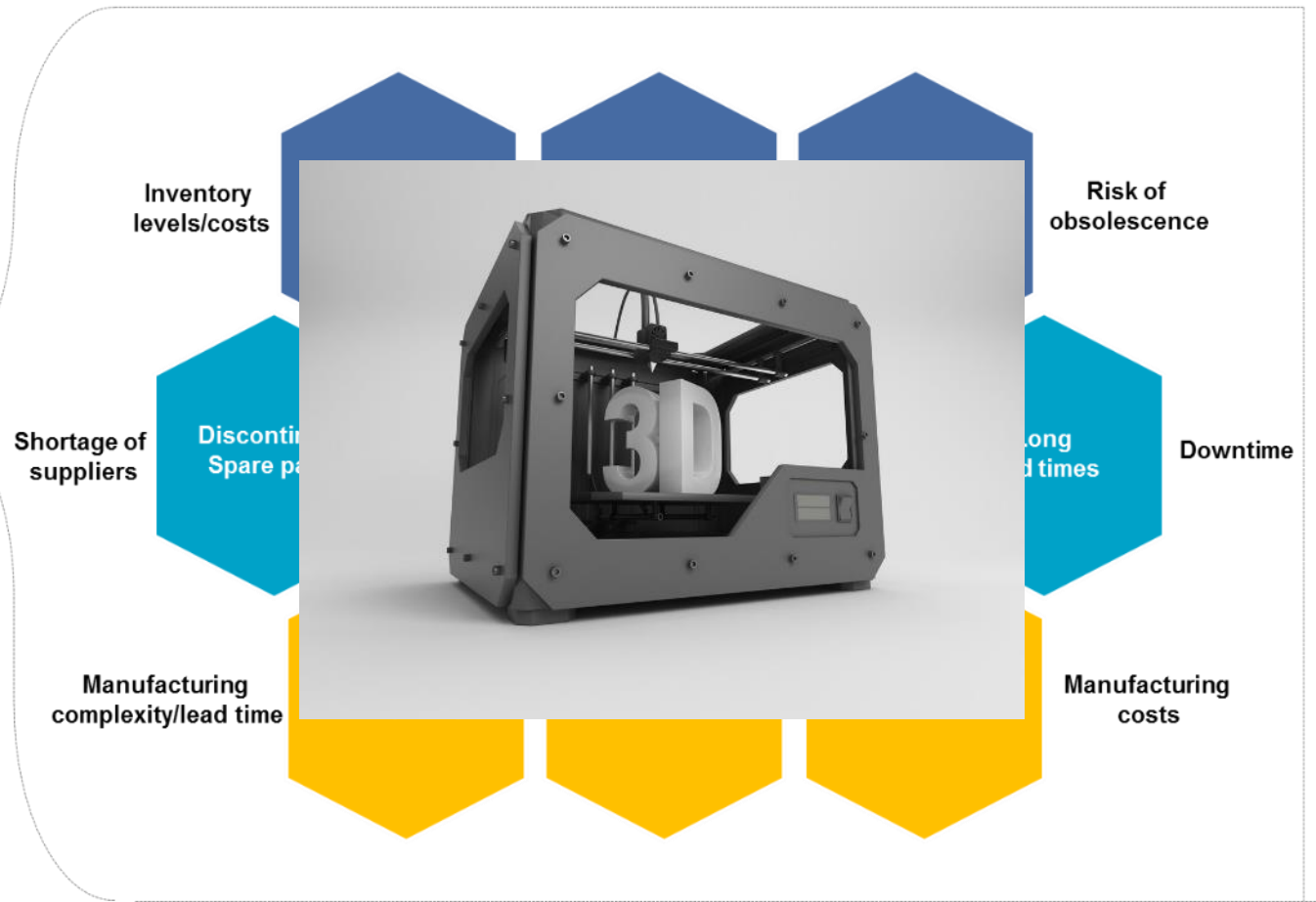
Sustainability

# 3D Printing for Remanufacturing

## Remanufacturing Process

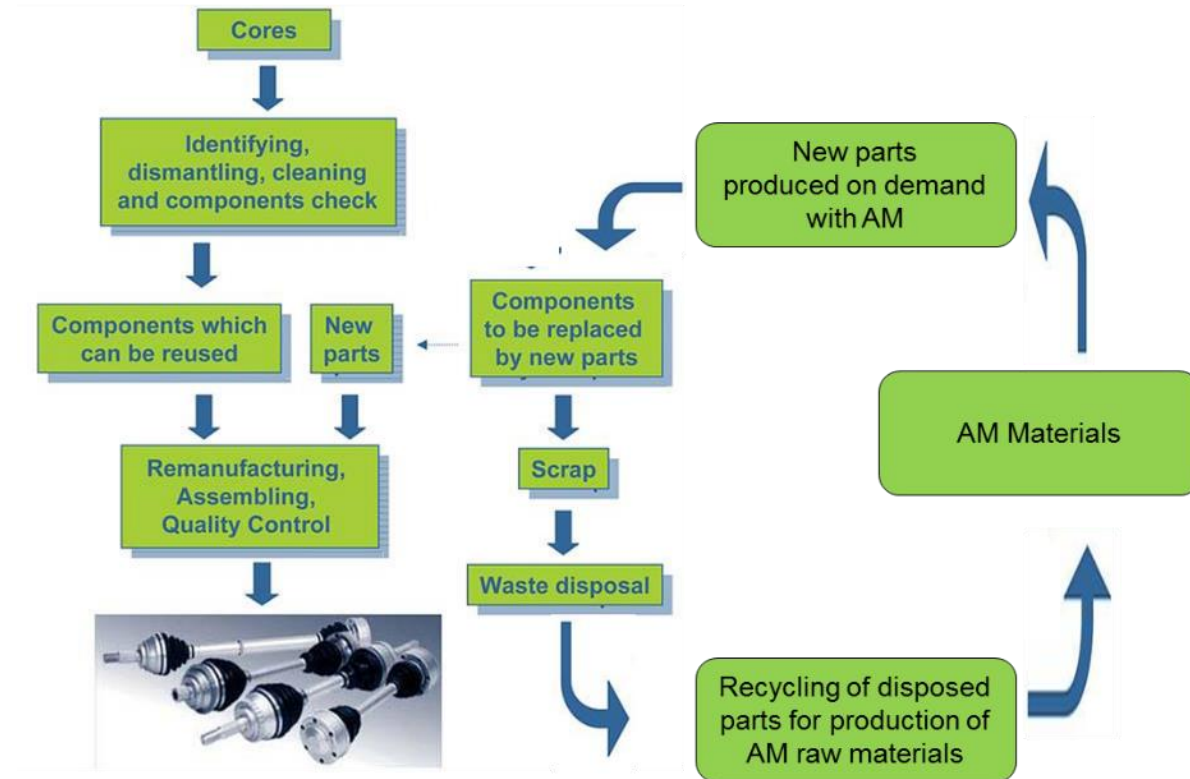


*Adopted by GKN (re-manufacturing and recycling of used driveshafts for the automotive aftermarket)*



# 3D Printing for Remanufacturing and Circular Economy

## Remanufacturing Process



Adopted by GKN (re-manufacturing and recycling of used driveshafts for the automotive aftermarket)



Recycling of plastics for 3D printing



# Case study



## Remanufacturing broken teeth on a gear using Direct Energy Deposition (DED)

\* Source: Optomec: Restoring Industrial Components with Directed Energy Deposition Saves Time and Costs available at :<https://www.optomec.com/restoring-industrial-components-with-directed-energy-deposition-saves-time-and-costs/>

# The interface between remanufacturing and 3D Printing in Panalpina

Customer: Watch remanufacturer

## Product:

- Type: Legacy spare part for watch
- Product composition: Metal hands
- Legacy parts: Sourcing difficulties, manufacturer has stopped production.

## What we we did:

- Conversion of 2D drawings to 3D CAD model
- Conversion of 3D CAD model to printable STL file
- Material analysis & deviation analysis
- Design modification following deviation analysis
- RFQ from metal AM partner

## Result:

- 3D Printing seems to be the only feasible alternative



# Panalpina's Manufacturing and Supply Chain Analysis



## STEP 1: Analysis – SKU Qualification for SPOD

- Select SKU's that are desirable to be sourced on-demand vs. conventional (*supply chain angle*)
- Select SKU's that are technically possible to be manufactured on-demand (*technical angle*)
- Supply chain re-engineering of „SPOD qualified” parts (*process angle*)

## STEP 2: Digital re-engineering of SPOD qualified SKU's

- Product re-engineering for on-demand manufacturing
- Qualifications
- 3D CAD and digital manufacturing specifications



## STEP 3: Digital Inventory and Order Management

- Cloud based e-commerce suite
- Product catalogue and order processing
- Fully integrated, global end-to-end solution



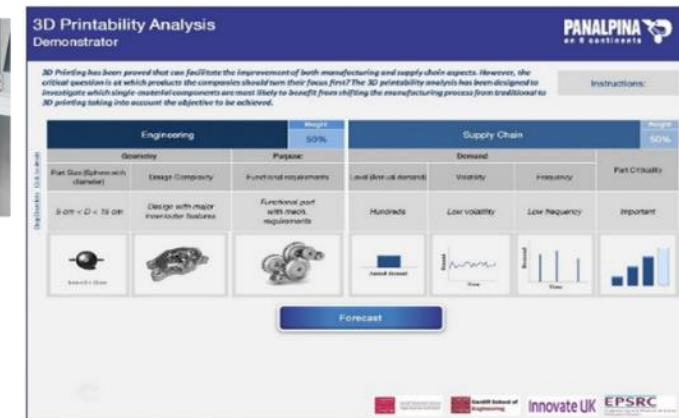
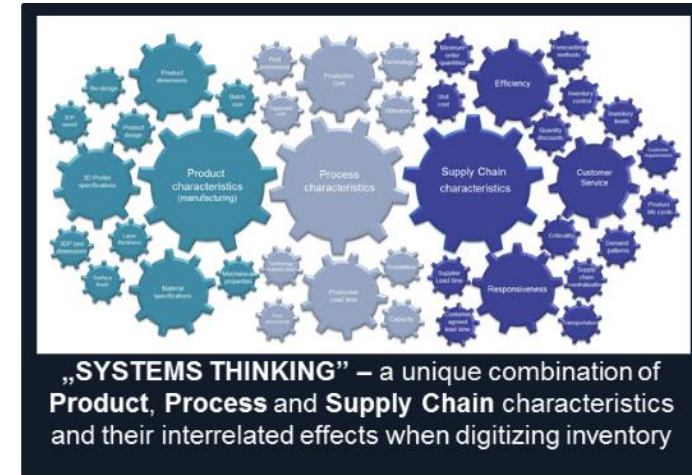
## STEP 4: Manufacturing on-demand

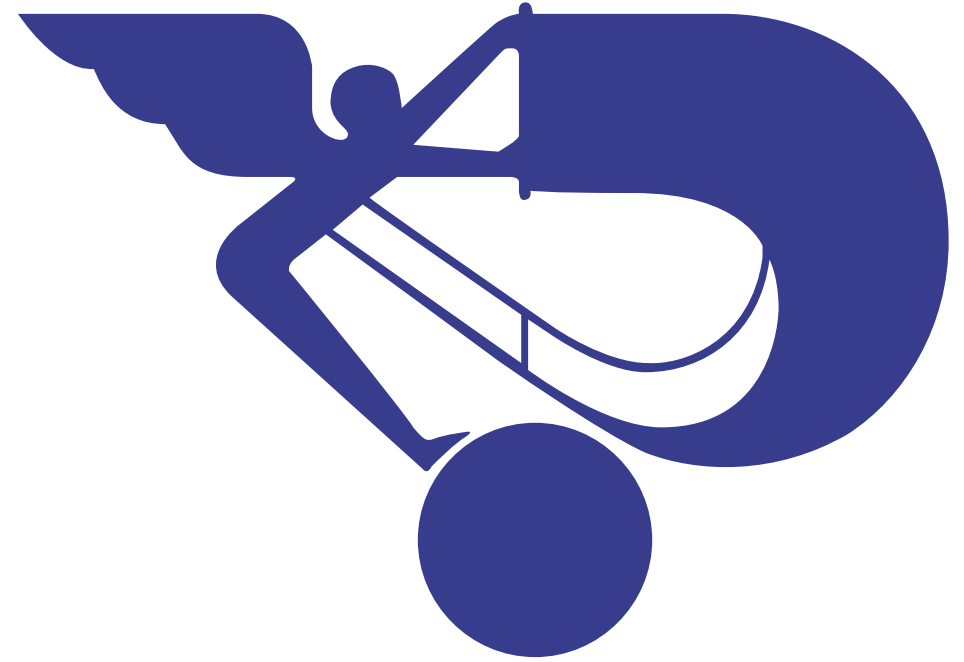
- Most suitable technology
  - Direct or indirect additive manufacturing
  - Conventional manufacturing methods
  - Hybrid solutions
- Distributed manufacturing – best proximity to demand
- Quality assurance



## STEP 5: Fulfillment

- Delivery seamlessly integrated into the rest of the supply chain





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