



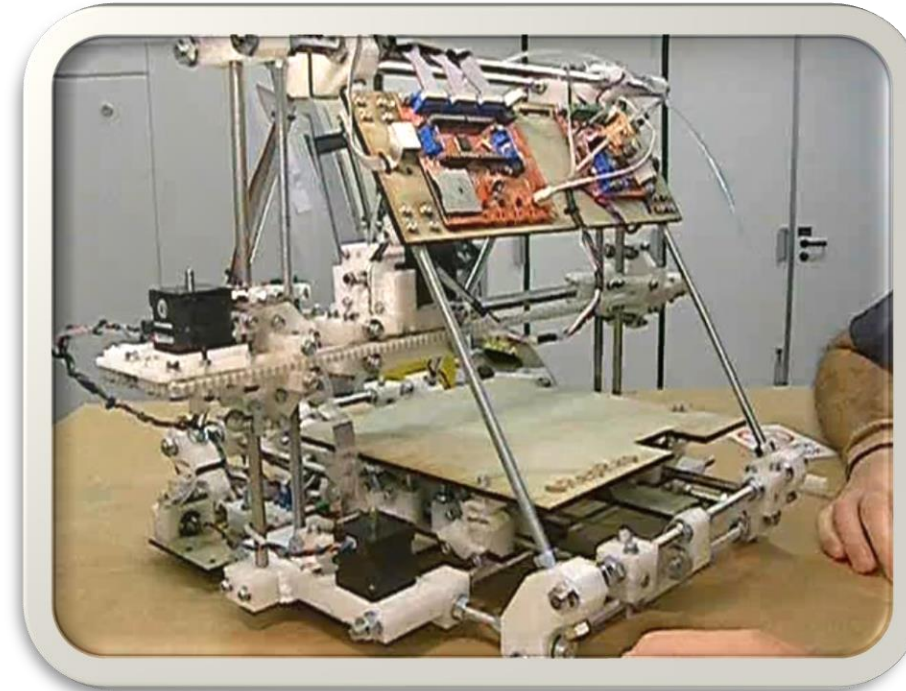
Milestones and Case Studies of Additive Manufacturing





The revolution era

- 2005 RepRap Project
- University of Bath (UK)
- Dr. Adrian Bowyer
- Self reproducing 3D Printer





The revolution era

- ~2008 commercial models
- Mostly from China
- Prusa Company (Czech republic)
- Numerous updates on a daily basis
- Semi-professional equipment

30.000,00€ → 300,00€





Internet of Things

Thingiverse

shapeways*





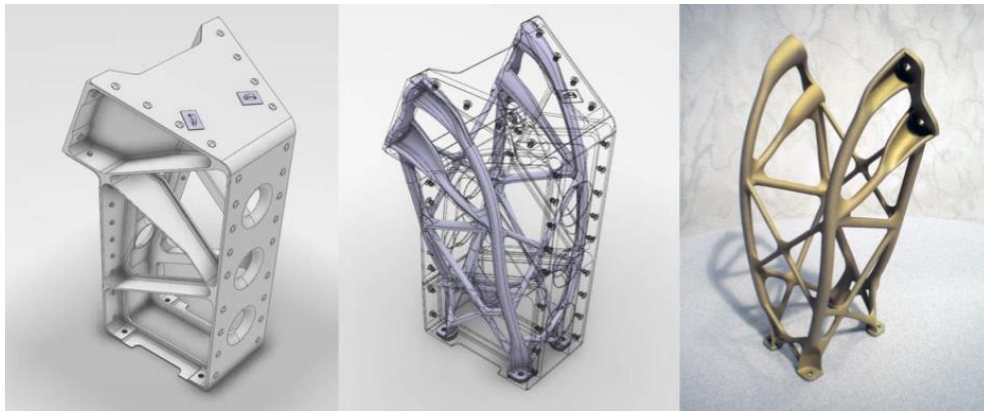
Additive Manufacturing In the industry





Indicative applications:

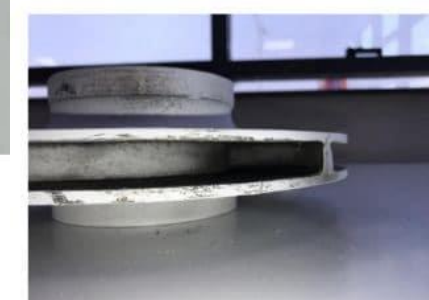
- Aston Martin → New suspension system with 40% improvement in the fluids flow, made with Metal 3D Printing
- BMW → Roof hinges in the BMW i8 model, weight reduction 70%, Metal 3D Printing
- Naples → Trolley spare parts
- Rolls-Royce Airplane engines → combustion chambers, Metal 3D Printing
- Alfa Romeo → AM department for polymeric parts mass production





India navy-Think3D:

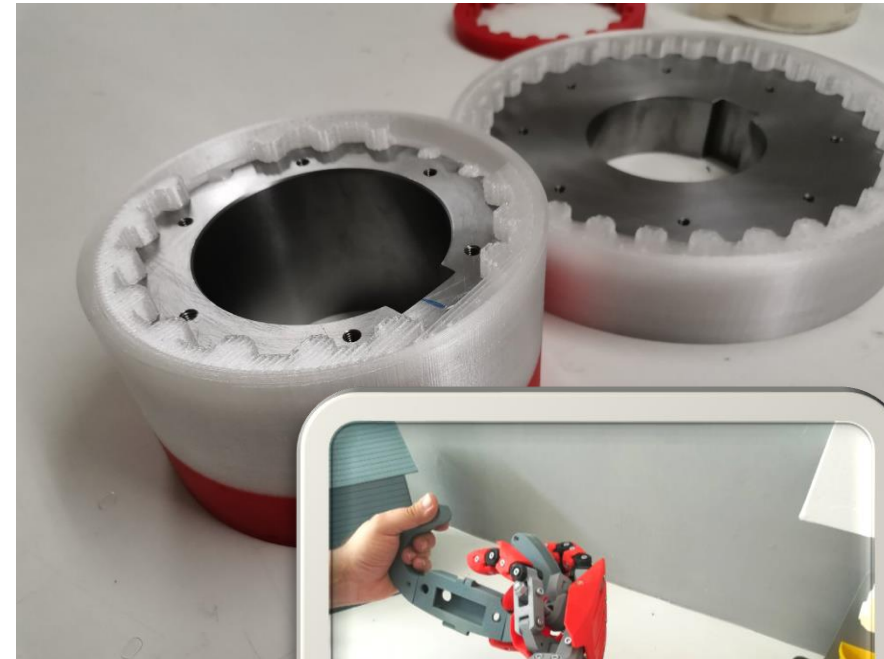
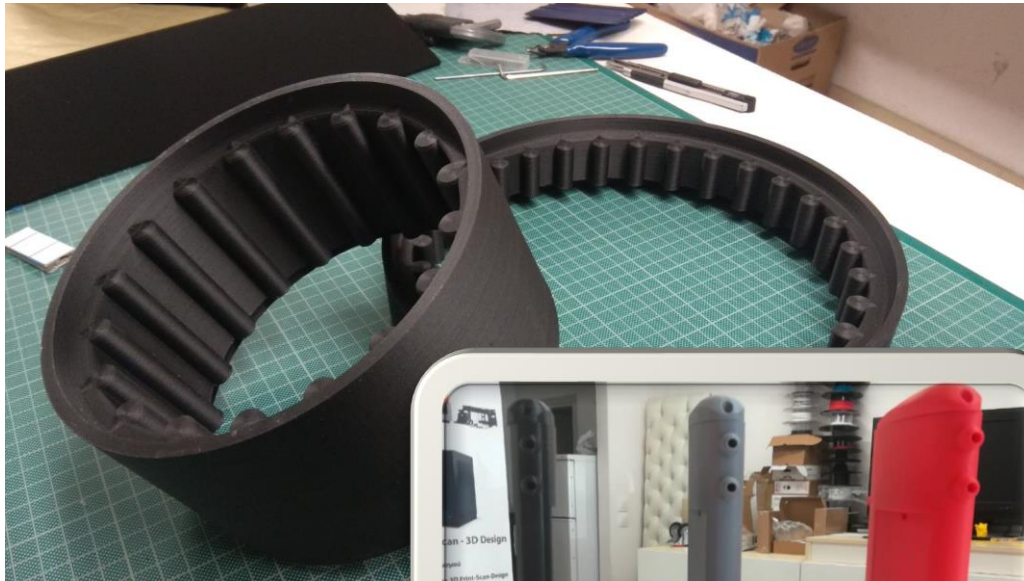
- 3 months lead time
- 2 days on-board (Additive Manufacturing)
- 40% cost reduction
- Weight reduction 8k→1kg

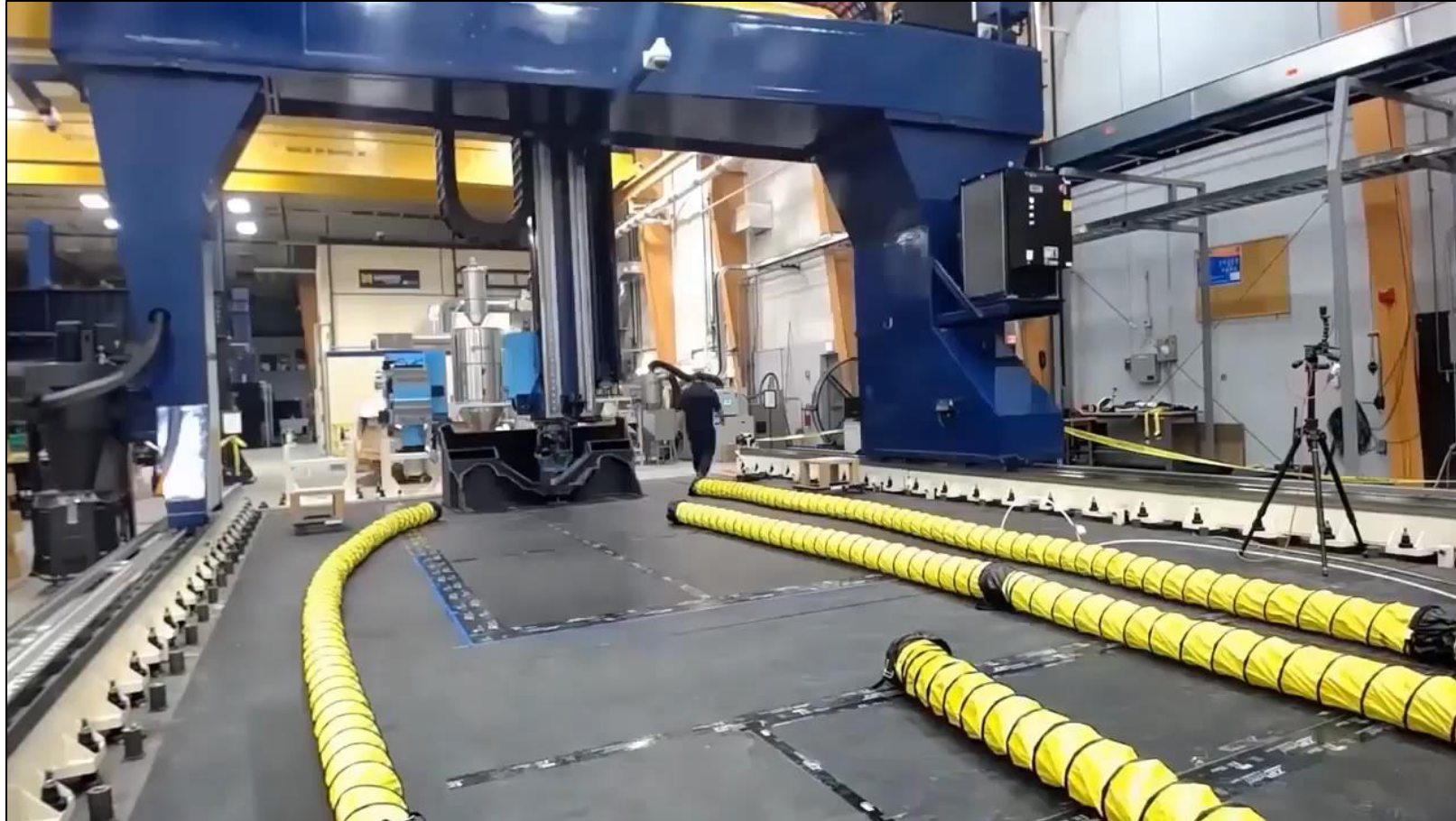




Additive Manufacturing – Mass Production – Covid19









- University of Maine
- Wood Cellulose Composite
- 7.6 m
- 2268 kg

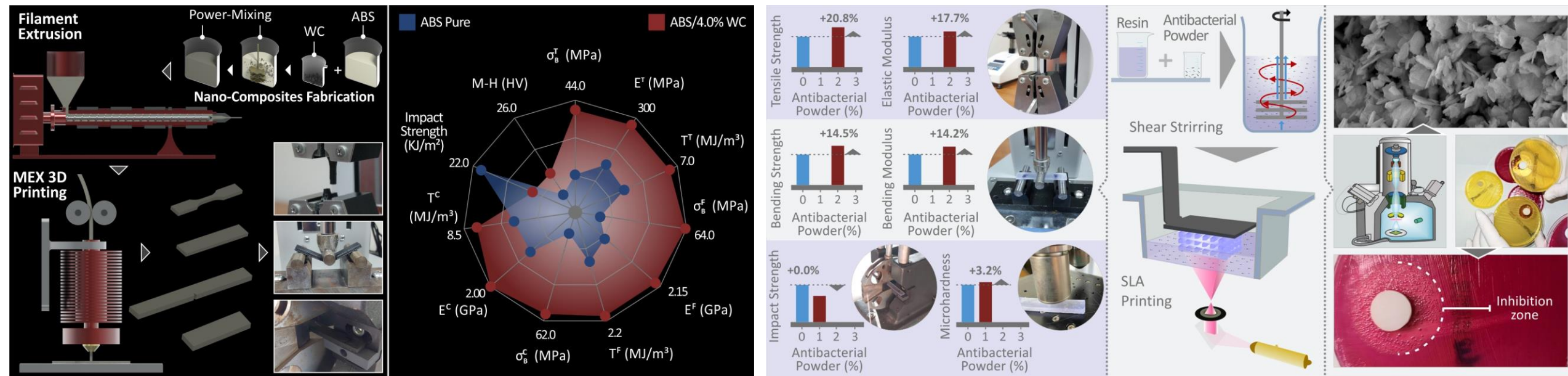






Laboratory research

- Composites and nanocomposites development with improved mechanical properties, antibacterial properties, etc. for the material extrusion and the vat photopolymerization 3D printing processes
- Hybrid additive manufacturing
- Bio-plotting

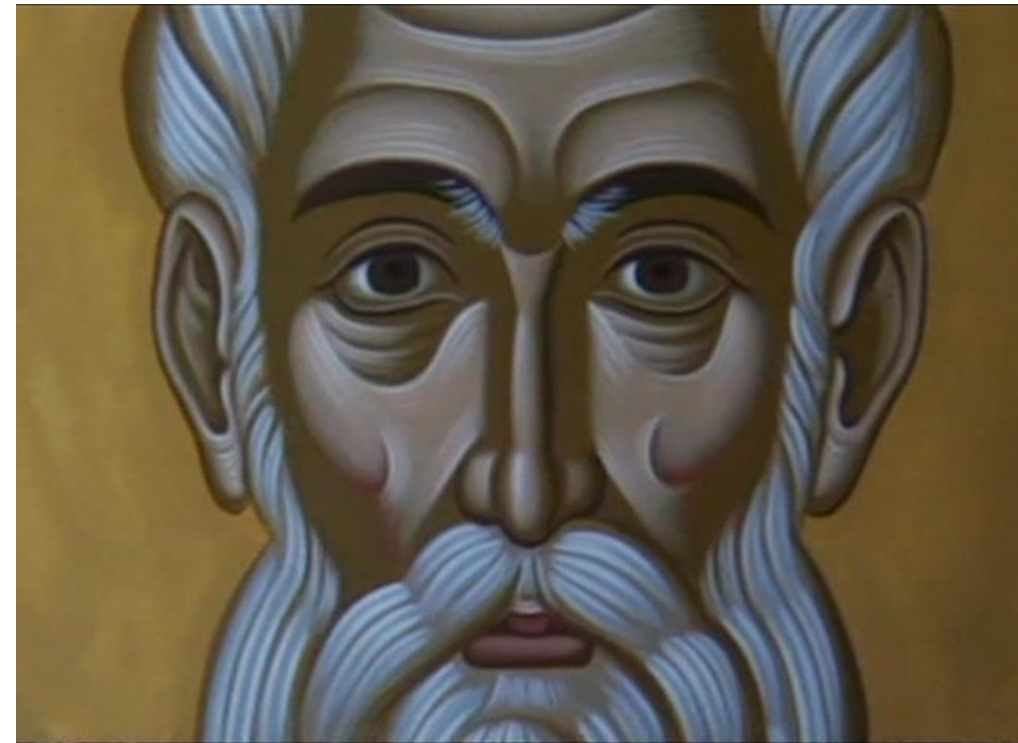




Laboratory forensics case study

Forensics face reconstruction of a Greek orthodox church saint

1. Heraklion University Hospital forensics and plastic surgery department
2. LPMREB





Forensics examination

CT scan to produce a digital copy of the geometry

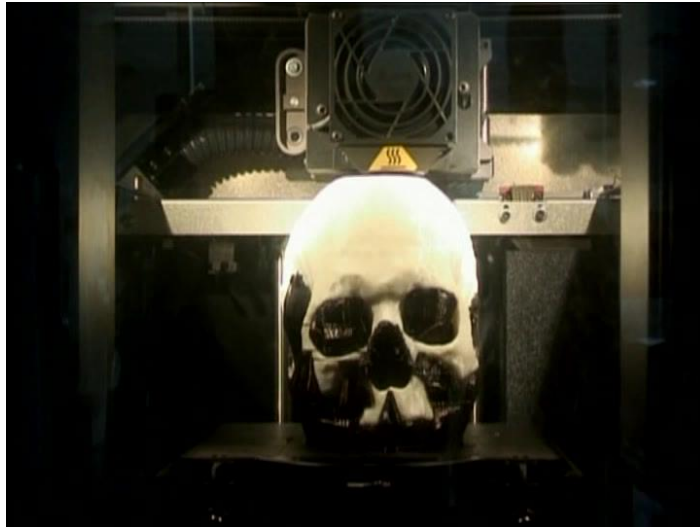




CT Scan to point cloud

Point cloud to .stl file- G-Code production





Fabrication of a 1:1 scale plastic replica of the skull with the FDM 3D printing method

Face reconstruction with the Wilton Marion Crogman method and the Sasouni method for the missing parts of the face





Rhine tables for the human tissue thickness

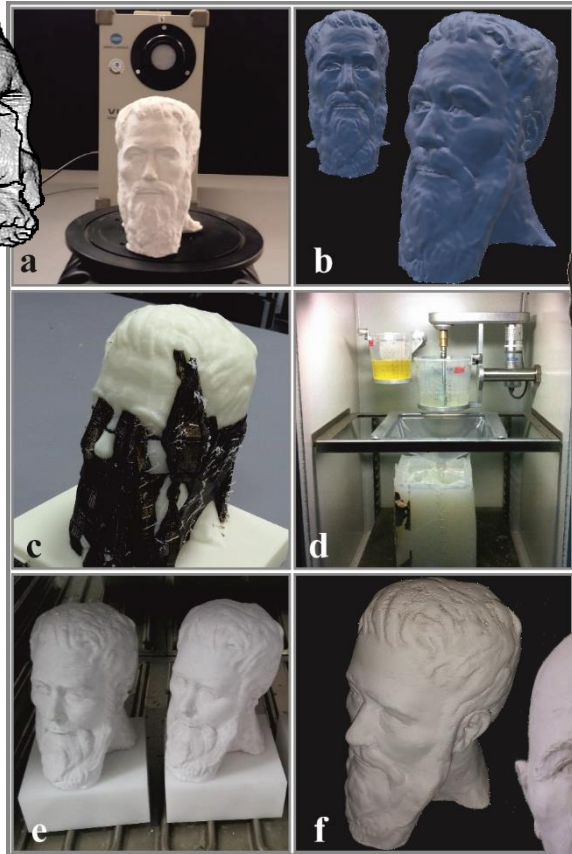
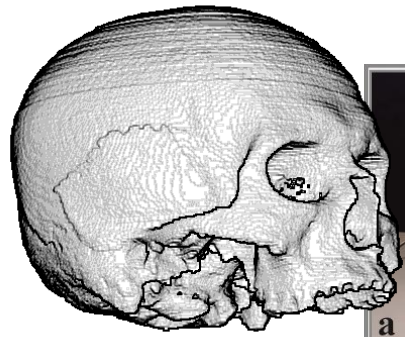
Clay deposition



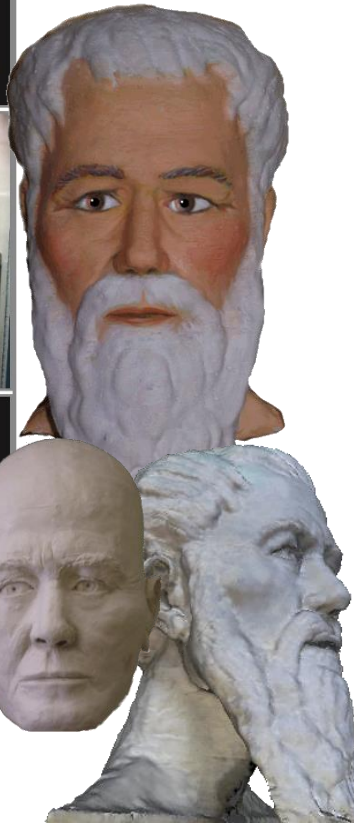


Sculpturing and final bust





- 3D scan of the bust
- 3D printing of a bust replica
- Silicon mold creation
- Mass production





Circular Economy

- **Autonomous factory**
- **3.10m height**
- **1500 oranges**









3D Printed in less than 48h

20-30 % Cost Reduction

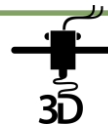


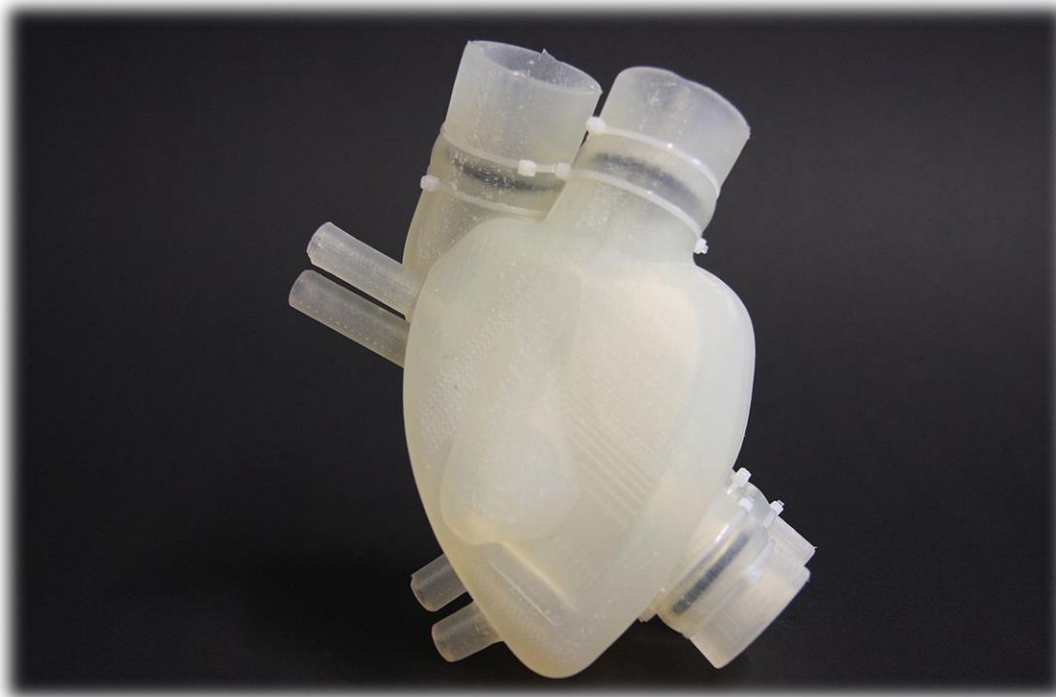






3D Printing in Space





Artificial heart:

- ETH Zurich
- 390gr / 679cm³
- 3D Printing/Lost Wax Silicone Mold
- 3000 beats (30min)

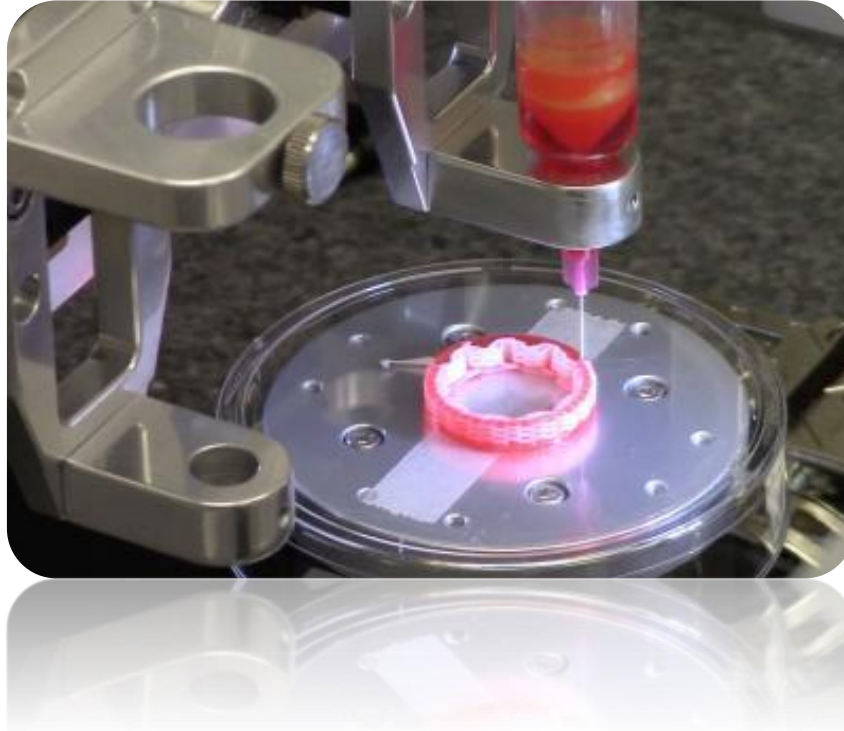


Hellenic Mediterranean University



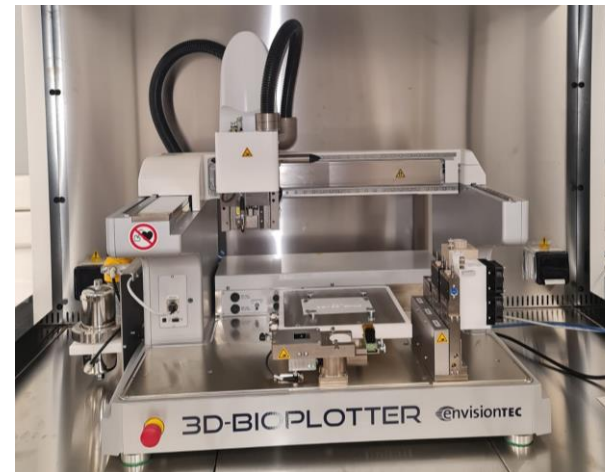
Laboratory of Precision Machining,
Reverse Engineering and Biomechanics





BioPrinting:

- Ability to 3D print cells
- Zopf DA, Hollister SJ, Nelson ME, Ohye RG, Green GE (May 2013). "Bioresorbable airway splint created with a three-dimensional printer". *The New England Journal of Medicine*. **368** (21): 2043–5.





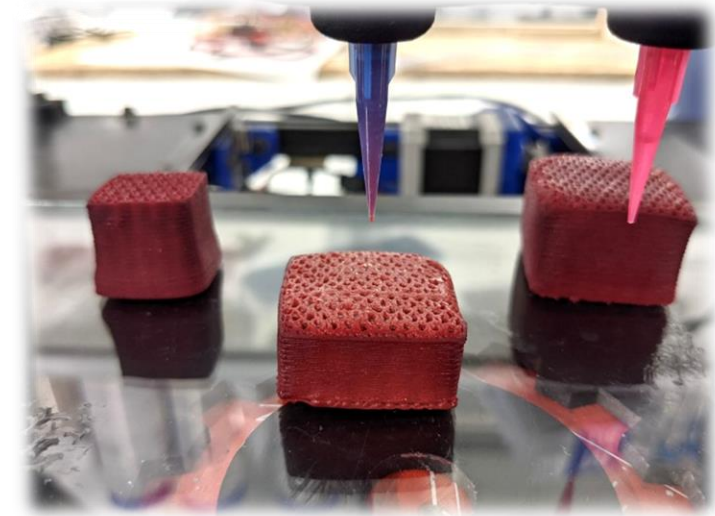
Peking University:

- 2017-2018
- 5 patients with bone issues
- Titanium implants EBM 3D Printing
- After 16 months: 2 excellent, 2 good, 1 fair



- Equipment cost: 2.500,00€
- Material: PLA combined with silicon
- Previous attempt: Titanium with a cost of 9.000,00€





Food Applications



