

Mould making by 3D printing

Eve Saarikoski, Product Manager
UPM Biocomposites



Our businesses



UPM Pulp
A versatile range of chemical pulp for many growing end uses



UPM Timber
Certified sawn timber



UPM Forest
Sourcing wood raw material for sustainable and recyclable products



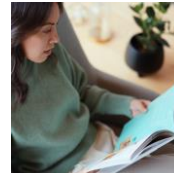
UPM Energy
Low-emission electricity generation of hydro, nuclear and thermal power



UPM Raflatac
Self-adhesive label materials for promotion, information and functional labelling



UPM Specialty Papers
Labelling materials, release base papers, flexible packaging papers, office and graphic papers



UPM Communication Papers
Magazine paper, newsprint and fine papers for a wide range of end uses



UPM Plywood
Plywood and veneer products for construction, vehicle flooring and LNG shipbuilding



UPM Biofuels
Wood-based renewable diesel and naphtha



UPM Biochemicals
Glycols, lignin products, renewable functional fillers



UPM Biomedicals
Wood-based biomedical products for medical and life science applications



UPM Biocomposites
UPM ProFi composite decking materials and UPM Formi bio-based composites



UPM Biocomposites

Leading the way to a more sustainable future

UPM Biocomposites



- Implements UPM Biofore strategy:
Creating innovation driven, high-performing bio based alternatives to non-renewable materials
- One of the leading natural fibre composite manufacturers in Europe
- Corporate start-up – part of UPM Kymmene Oyj
- Great patent portfolio on material and production technology





UPM Formi

Sustainability meets high performance

UPM Formi

Product lines

UPM Formi Pro

- enhancing sound performance, reducing noise

UPM Formi EcoAce

- sustainable design based on almost 100% renewable resources

UPM Formi 3D

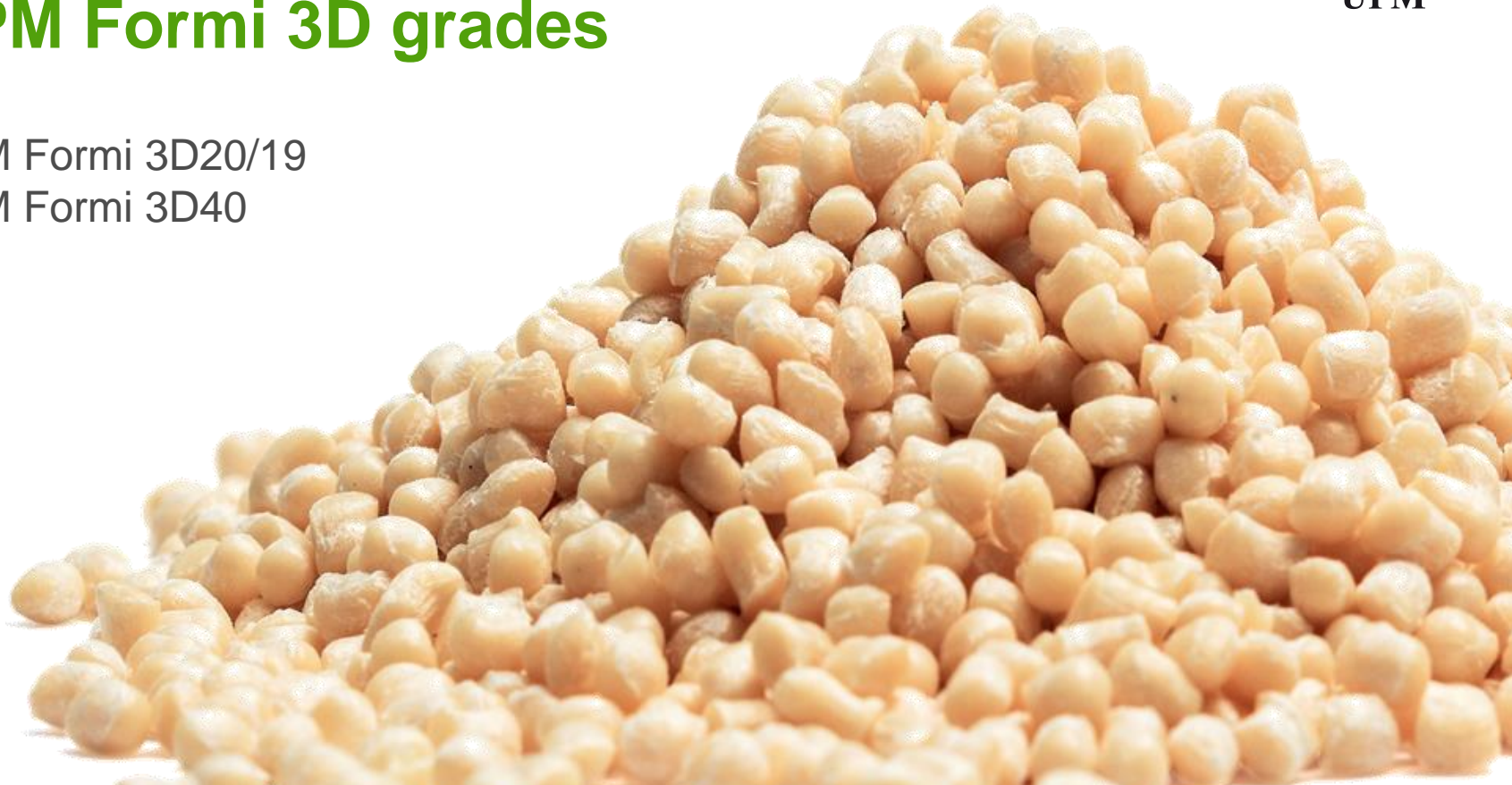
- outperforming traditional designing with wood like materials



UPM Formi 3D grades

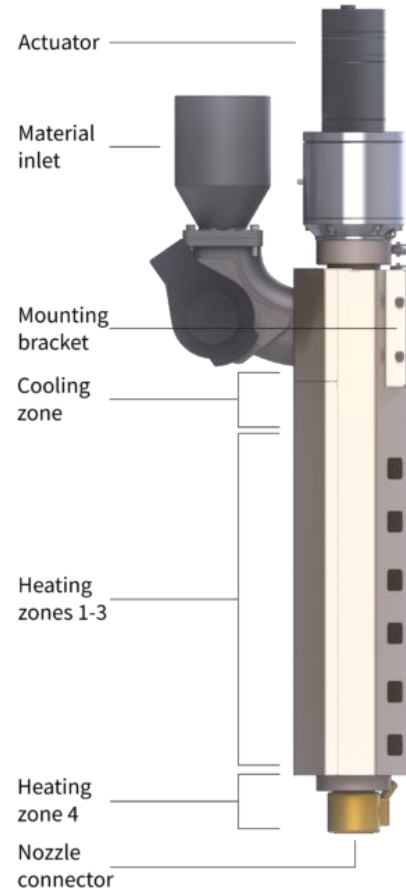
UPM Formi 3D20/19

UPM Formi 3D40



Large scale additive manufacturing

- Granulate based large-scale additive manufacturing (LSAM) enables large constructions to be 3D printed efficiently
- Possible to extrude pellets even at 84 kg/h with the most powerful extruders
- Savings in production time and material
- ~10 times lower material costs compared to filament-based printing



Courtesy of CEAD



UPM Formi 3D20/2019 by UPM Biocomposites



Patented grade **developed especially for granulate based large scale additive manufacturing (LSAM)**

Produced in Lahti, Finland. Launched in 2019.

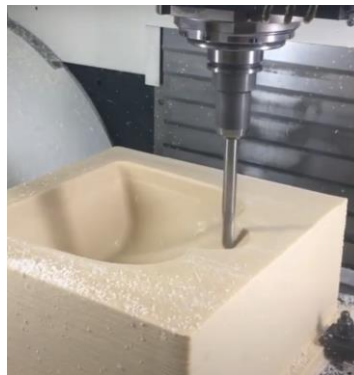
80% biobased, PLA used as base material, contains 20% fine cellulose fibres from **certified sustainably managed forests**

Easy-to-use “drop-in” material that allows **high-definition production**. The wood-based cellulose fibres of the material offer **extra functionality** and wood-like post-processing properties (e.g. milling, sanding, varnishing)

Lot of technical information available for customers e.g. Mechanical performance, water resistance values, coefficient of thermal expansion and HDT of printed parts. Technical support and print settings available from UPM.

Mechanical performance validation system with partner companies.

Main applications: Furnitures, moulds and patterns, interior design, panels, frames, sculptures, prototypes



Mould making by 3D printing

- 1) LSAM technology solutions, CEAD
- 2) Non-planar 3D printing with robot
- 3) LSAM possibilities in Finland
- 4) Vacuum infusion boat moulds, Parexo boats
- 5) Concrete casting moulds, with post processing, CEAD
- 6) Concrete casting moulds, without post processing, Lumotuli

ABOUT CEAD B.V.



Founded in 2014 in Delft, the Netherlands
by Maarten Logtenberg & Lucas Janssen

10+ years experience in
3D printing & machine building



On the frontier of composite additive
manufacturing with pellet based material
extrusion



Delivering and installing systems
worldwide

Machines & Products



Technology components
Used by integrators and clients for
specific applications.



Robot based solutions
Modular solutions specific
to clients needs.



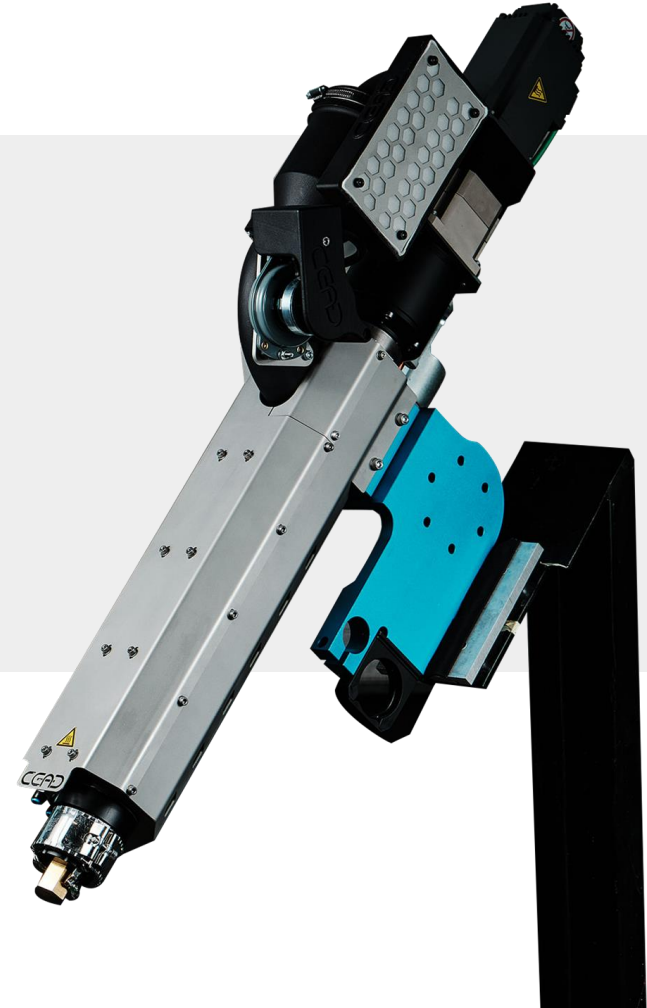
Gantry based solutions
High speed and
high accuracy solutions.

Technology components

CEAD E25 Robot Extruder

Low-investment alternative to explore large scale 3D printing

- » Pellet-based high output / low weight extruder
 - » 12 kg/hour
- » Material storage and transportation included
- » Easy integration with robot or gantry system
- » Processes wide variety of thermoplastic materials

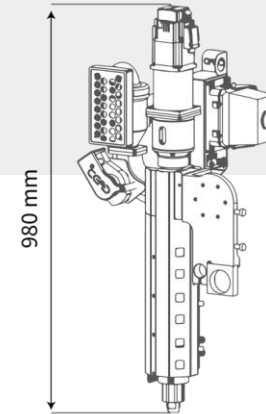


Technology components

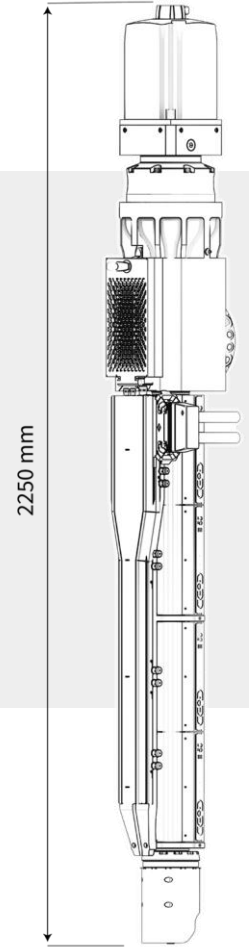
CEAD E50 Robot Extruder

Developed for high output large scale 3D printing

- » Pellet-based high output extruder
 - » 84 kg/hour
- » Material storage and transportation included
- » Easy integration with robot or gantry system
- » Processes wide variety of thermoplastic materials



E25



E50

Hybrid solutions - robot based

CEAD AM Flexbot

Large scale 3D printing and post-processing with robot arm

- » Easy-to-use proprietary print bed
- » Optional linear track for increased length
- » Tool changer: CNC milling head
 - » Milling tools
 - » Drilling tools
 - » Insert tools
 - » Grinding/sanding tools
- » Siemens Sinumerik for accurate CNC operations



Modular and scalable system that offers flexibility and high degree of design freedom

Hybrid solutions - gantry based



CEAD x Belotti

Large scale 3D printing and post-processing with gantry

- » Expertises of both branches combined
- » Rigid construction for accurate finishing
- » Large build envelope
- » Siemens Sinumerik for accurate CNC operations



For high precision additive manufacturing that is able to deliver the finish and tolerances that subtractive manufacturing offers

Non-planar 3D printing with robot



Non-planar 3D printing software's enable efficient optimization of 3D printed parts.

Self-supporting material properties and dimensional stability of UPM Formi 3D20/19 enables easy printing in angle



LSAM possibilities in Finland

- 1) TAMK, ABB robot on track with CEAD extuder
- 2) Savonia, Kuka robot with CEAD extruder
- 3) Centria, ABB robot on track with CEAD extruder

Boat moulds: The Challenge

Boat moulds are extremely expensive!

- Unlike automotive industry, volumes in marine industry are much lower
- Mould cost per boat is significantly higher!
- High mould cost makes new boat model launching slower

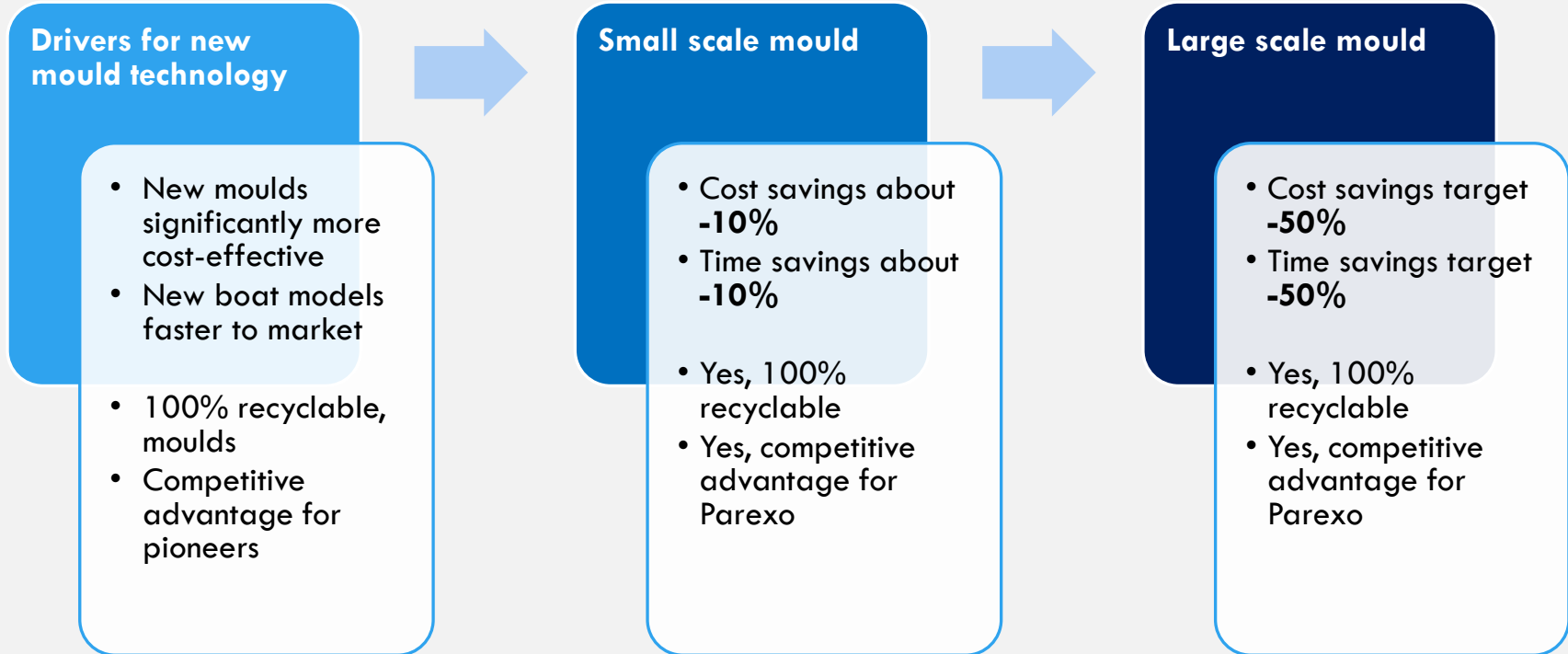
Time-to-market is too slow

- New boat models have to be on the market fast
- New agile methods and processes are definitely needed
- Modern concept development requires feedback quickly for improving next model

Reuse of old school mould is difficult

- Return on investment (ROI) should be fundamentally better

Proof Points for new mould technology



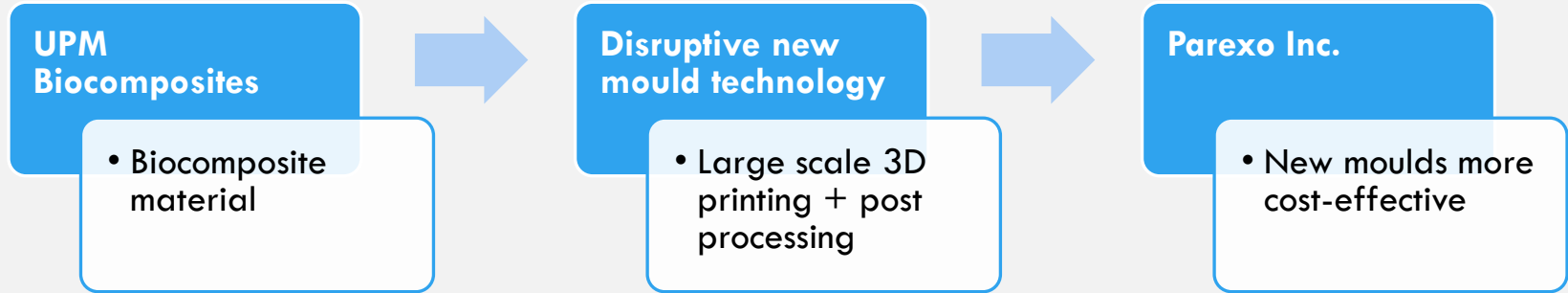
Drivers for new mould technology



- New moulds significantly more cost-effective
- New models faster to market
- 100% recyclable, moulds can be gridded down and recycled for new molds
- Competitive advantage for pioneers

Sustainable Value Chain

Disrupting Old School Methodologies



UPM Formi 3D



PAREXO

Video, Parexo crafts uses sustainable mould technology



3D printed biocomposite moulds for low temperature vacuum infusion



UPM Formi 3D and LSAM technology provide a cost and resource efficient way of reducing environmental impact of the mould production

- Waste-free production with freedom of design
- Significant time and cost savings
- Use of UPM Formi 3D reduces CO2 emissions compared to fossil-based plastics
- Material reusability in 3D printing applications for a sustainable future

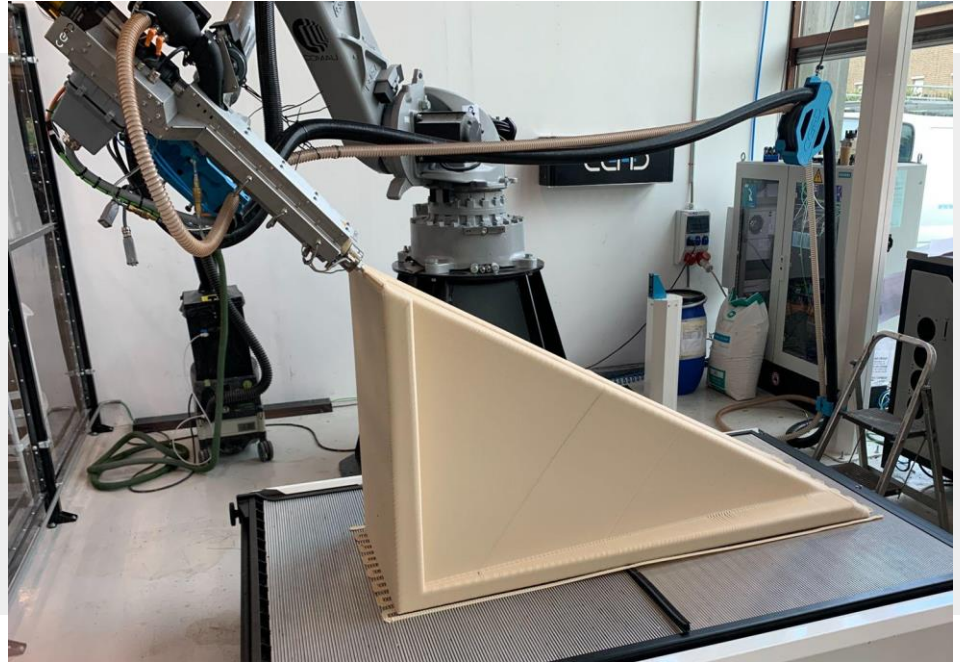


CEAD AM Flexbot, printing + milling

Concrete casting mold

3D print near net shape - CNC mill to tolerance

- » Replacing wood and manual labour
- » Commodity materials
 - » PP 30% GF
 - » UPM Formi (Biobased)
- » Form freedom



Lumotuli fireplace



Traditional mould making issue:

- Long production lead times of casting moulds
- Significant amount of waste generated by CNC milling

3D printed concrete casting moulds

Benefits

Streamlined and simplified local production, Faster lead time (5 weeks -> one week)

Minimum amount of manual work needed

Significant mould weight reduction (up to 80%)

No waste / high material efficiency, 100% recyclability

Biobased alternative, replacing fossil based

Compatibility with plywood structures

UPM **BIOFORE**
BEYOND FOSSILS

