# Benefits of the adaptive tooling technology for maritime applications

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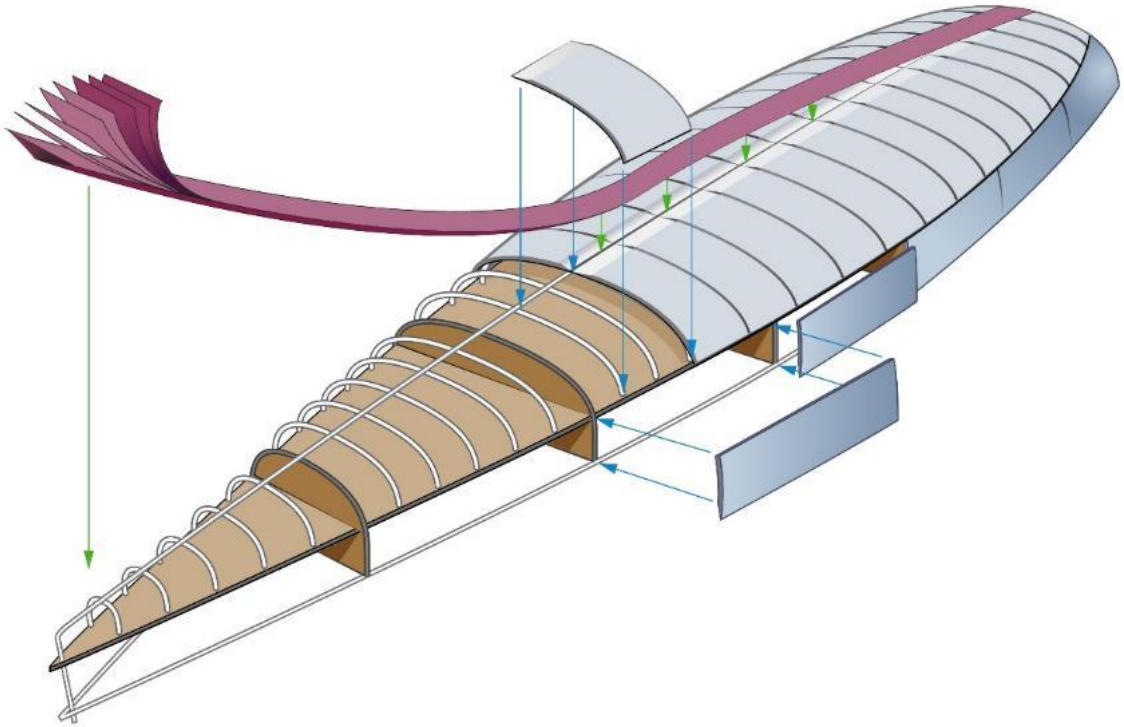
Curved Panels + Panel Assemblies

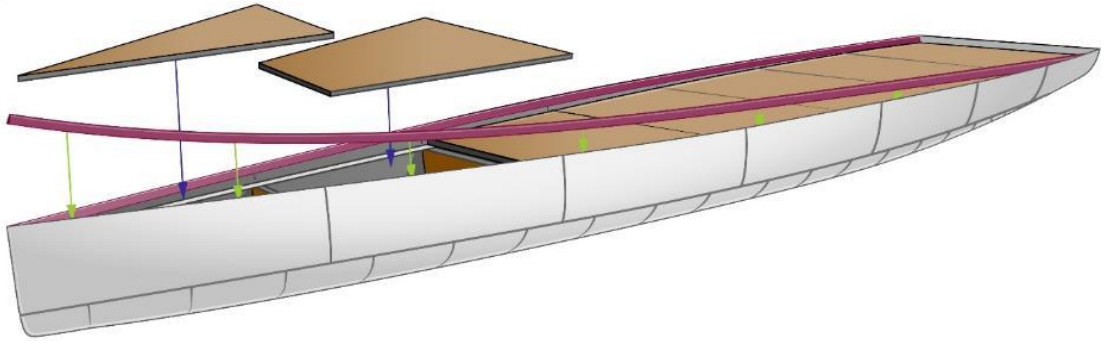
Adaptive Tooling solutions

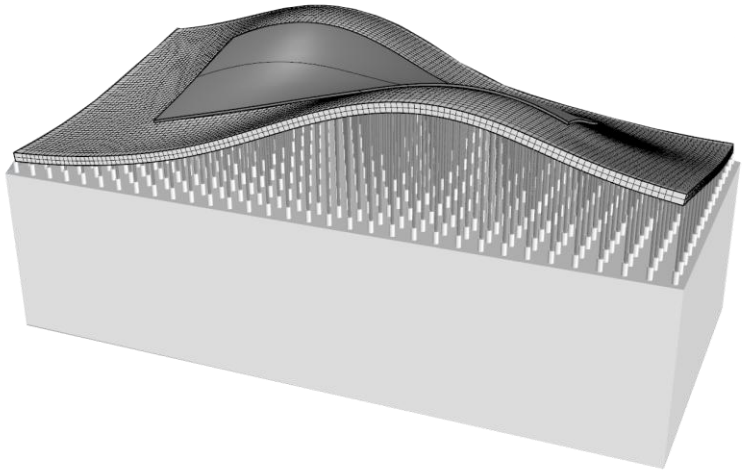
# Adaptive tooling:
# Enabling tool-less manufacturing


*Title page E-Lass meeting in January 2019 in Piteå*

# Adaptive tooling:
# Enabling tool-less manufacturing

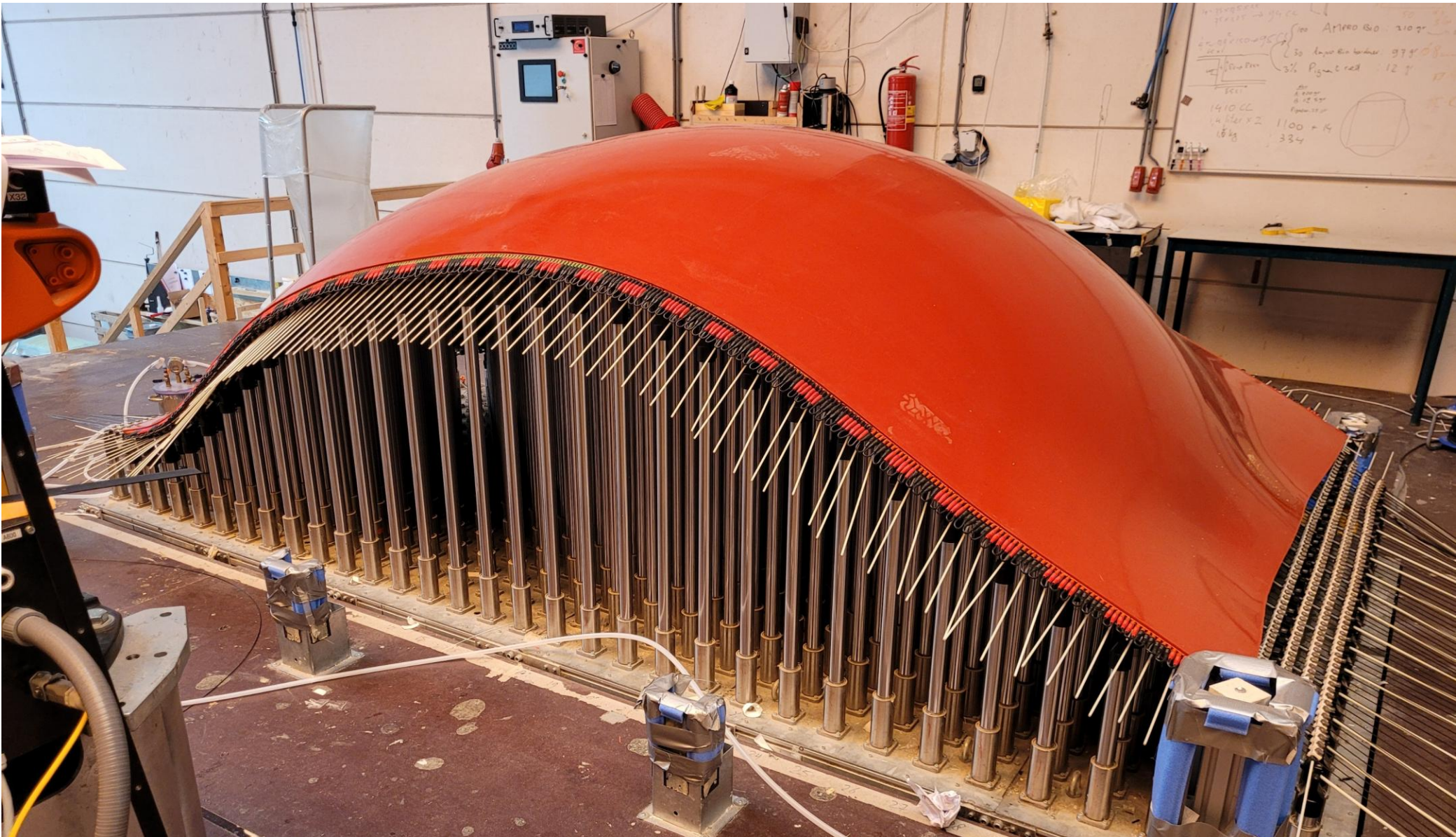




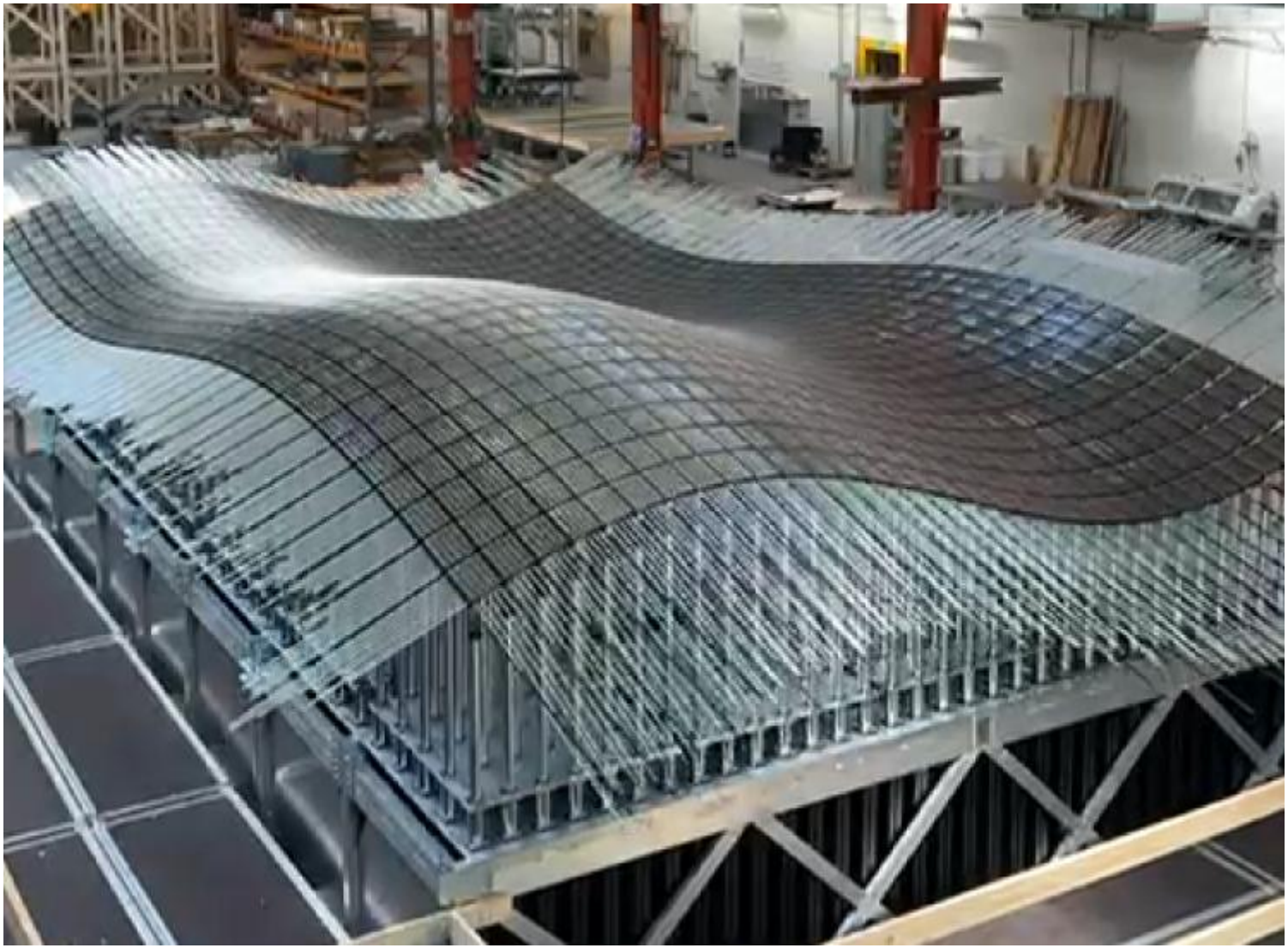


From design to production of large curved structures in virtually the click of a button

# Adaptive tooling



# Adaptive tooling



7x4m mould at Thyssenkrupp in Kiel

# Benefits of the adaptive tooling technology for maritime applications

Thermoformed Core Kits

Thermoformed solid sheets
(*i.e. glazing, Corian & Maridur*)

3D Composite Kits™

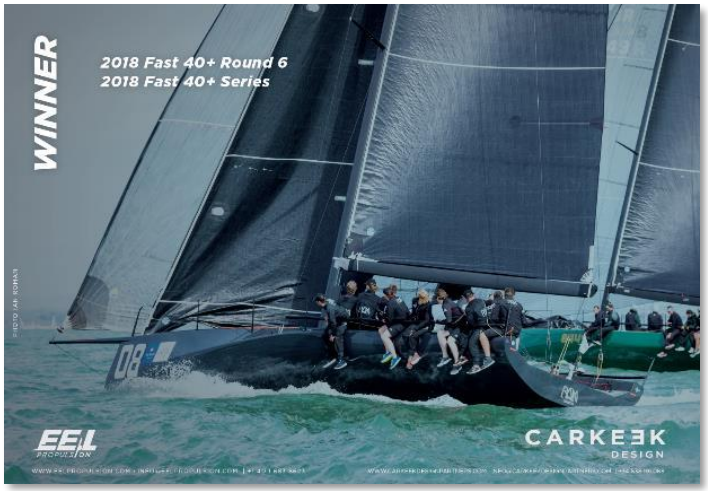
3D Plywood™
*(Patented)*

Non-Structural & Structural

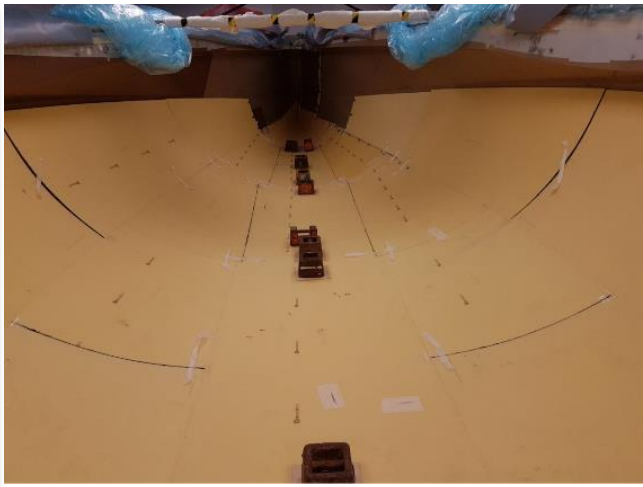
Curve Works developed for all 4 products unique manufacturing processes (*3D Core Kits™, thermoformed sheets and 3D Plywood™*) and unique building methods (*3D Composite Kits™ and 3D Plywood™*).

# Benefits of the thermoformed Core-Kit

**Less Resin Uptake**




**Best Slamming Performance**



**Faster Installation**

***Our 3D Core Kits are Bureau Veritas certified***

Analysis of Core Resin Uptake: [Resin-uptake calculator for structural foams - Curve Works]

More information in our 3D Core Kits™ brochure: [2023-3D-Core-Kits-brochure.pdf]

BUREAU VERITAS 1828 BUREAU VERITAS Marine & Offshore

# Alternative for the thermoformed Core Kit

**SC – Single Cut** – Provides flexibility in a single direction on one or both sides of a sheet. If done on both sides, the cuts intersect so no bleeder holes are necessary for vaccum bagging. Maximum sheet size is half of a full-size sheet.

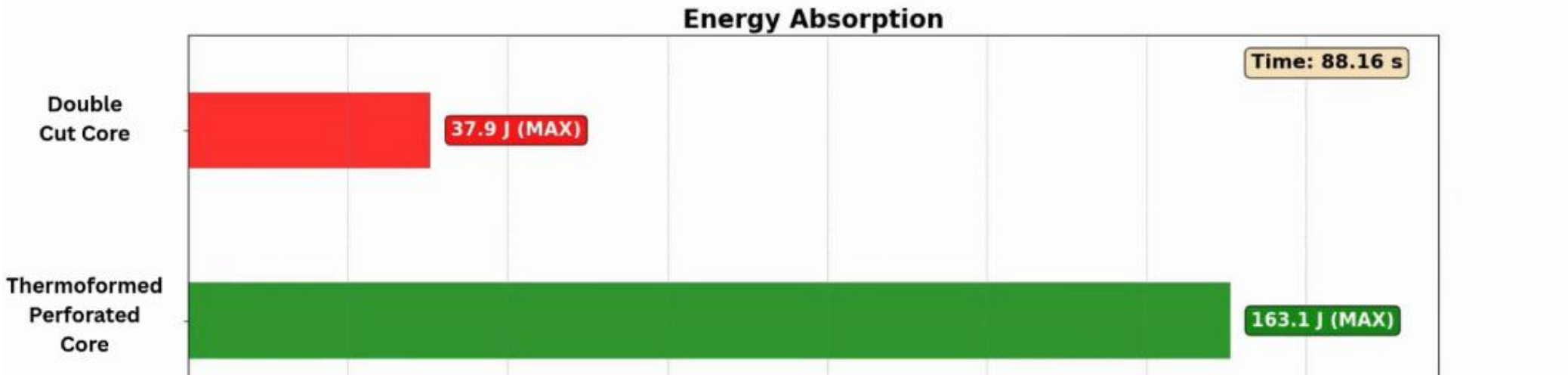
**DC – Double Cut** – Provides flexibility in two directions on one or both sides of the sheet. If Double Cut on both sides, the intersecting cuts make DC a highly effective resin infusion medium. The cuts are not visible when the sheets lie flat and these narrow knife-cuts minimise unnecessary resin accumulations compared to sawn core materials.

**CS – Contour Scrim** – provides optimum flexibility in two directions. Sheets are knife-cut in squares and bonded to a glass scrim. Available on sheets up to 25mm (0.98") thick. Maximum standard sheet size is half the full sheet.

Surface grooves for infusion – Available on all foam types

# Energy absorption: cut vs thermoformed core





# Tool-less manufacturing with 3D Core Kits

Courtesy: Paul Dijkstra Composites

# Composite Kits

# Tool-less manufacturing with composite Kits


# Tool-less manufacturing with composite Kits


AWARD WINNER
*Panel assemblies for tool-less boat building*

JEC WORLD INNOVATION AWARDS WINNER 2025

**Youtube animation:** [Panel Assembly Curve Works]

# Adaptive Tooling: Morphing Technologies continueing Adapa's technology

## Adapa's Bankruptcy – July 2025

Adapa was unable to establish a sustainable business model. Their approach relied on delivering client-specific adaptive moulds, but this model did not scale.

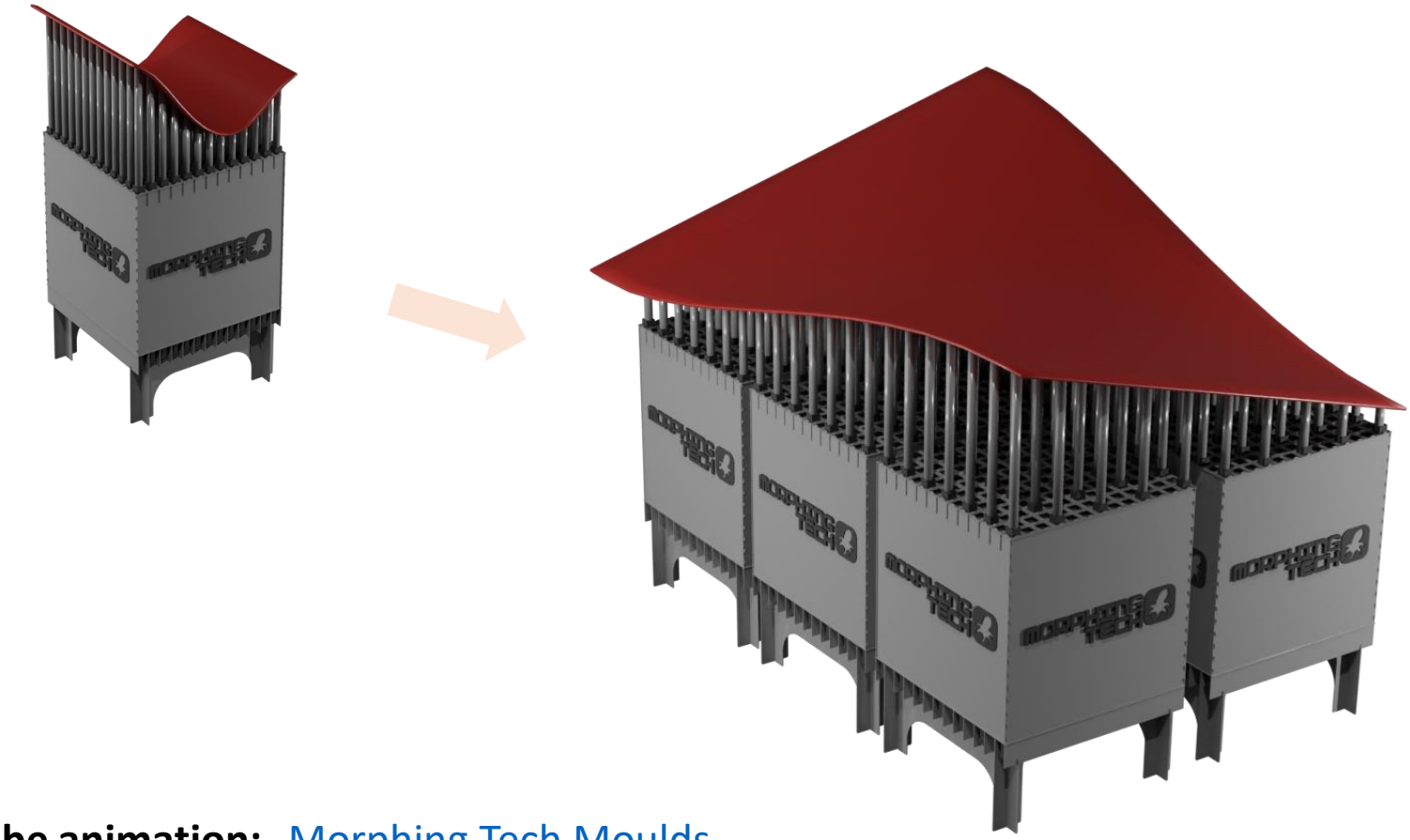
**Key challenges:**

- Most clients needed an adaptive mould for only a single project, making ownership hard to justify.
- Projects often required multiple moulds to meet deadlines, increasing costs further.
- To make the business case viable, lower-resolution moulds were offered, which reduced quality and left clients dissatisfied.

The Curve Works Holding and BeSpline have taken over Adapa's IP and assets continue Adapa's technology in Europe *(Morphing Technologies)* and North America respectivily.

# New Innovations (1) in Adaptive Tooling

## Configure-To-Specification: The adaptive module



**Youtube animation:** [Morphing Tech Moulds]

THE ADAPTIVE MODULE WILL BE PRESENTED AT THE JEC EXHIBITION IN MARCH 2026.

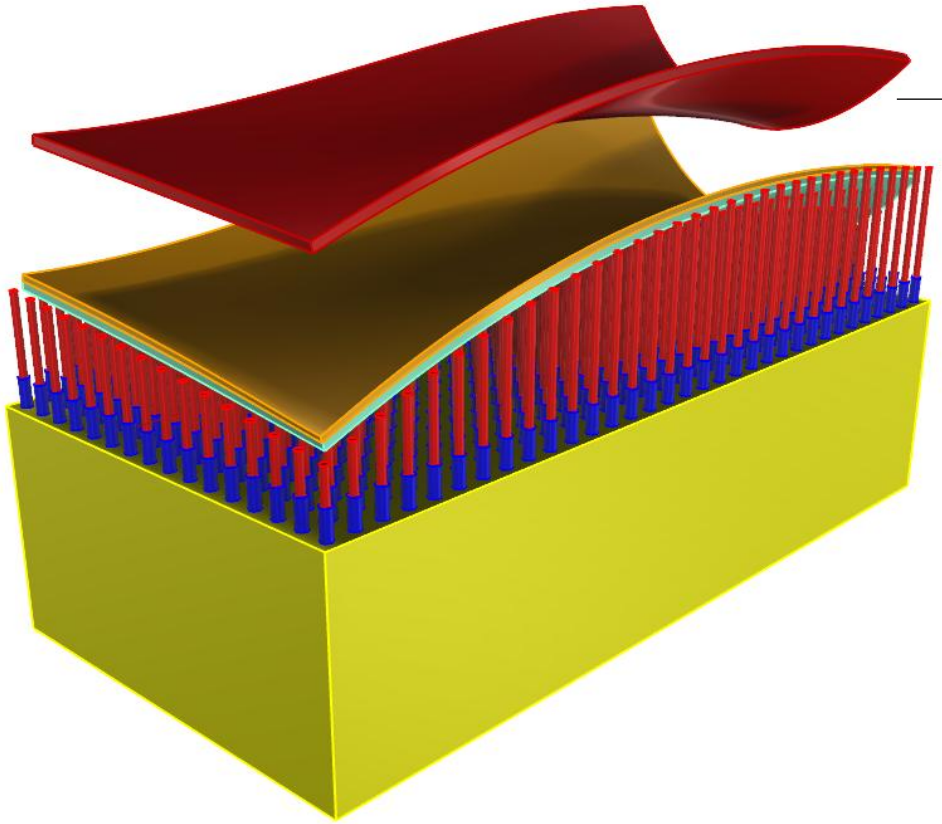
# New Innovations (1) in Adaptive Tooling

**Configure-To-Specification**

- Large moulds are assemblies of multiple modules
- The resolution can be configured to what is needed
- Easier to finance / lease / rent

# New Innovations (2) in Adaptive Tooling

Realise large projects with one single adaptive mould by using cost-effective reconfigurable tooling surfaces.



**Reconfigurable tooling surface** mounted on a reconfigurable backing structure.

This innovation was sponsored by the MIT R&D project UPWIND in collaboration with PONTIS ENGINEERING.

CURVE Works

# Curved panels + panel assemblies

3D Core Kits™ for tool-less boatbuilding

Unlimited size
composite structures


Aero Wing Sail from
3D Composite Kit™

Lightweight hatches,
canopies & super structures