

GO BIG – Architectural Scale Additive Manufacturing with Composites

Dimensional Innovations



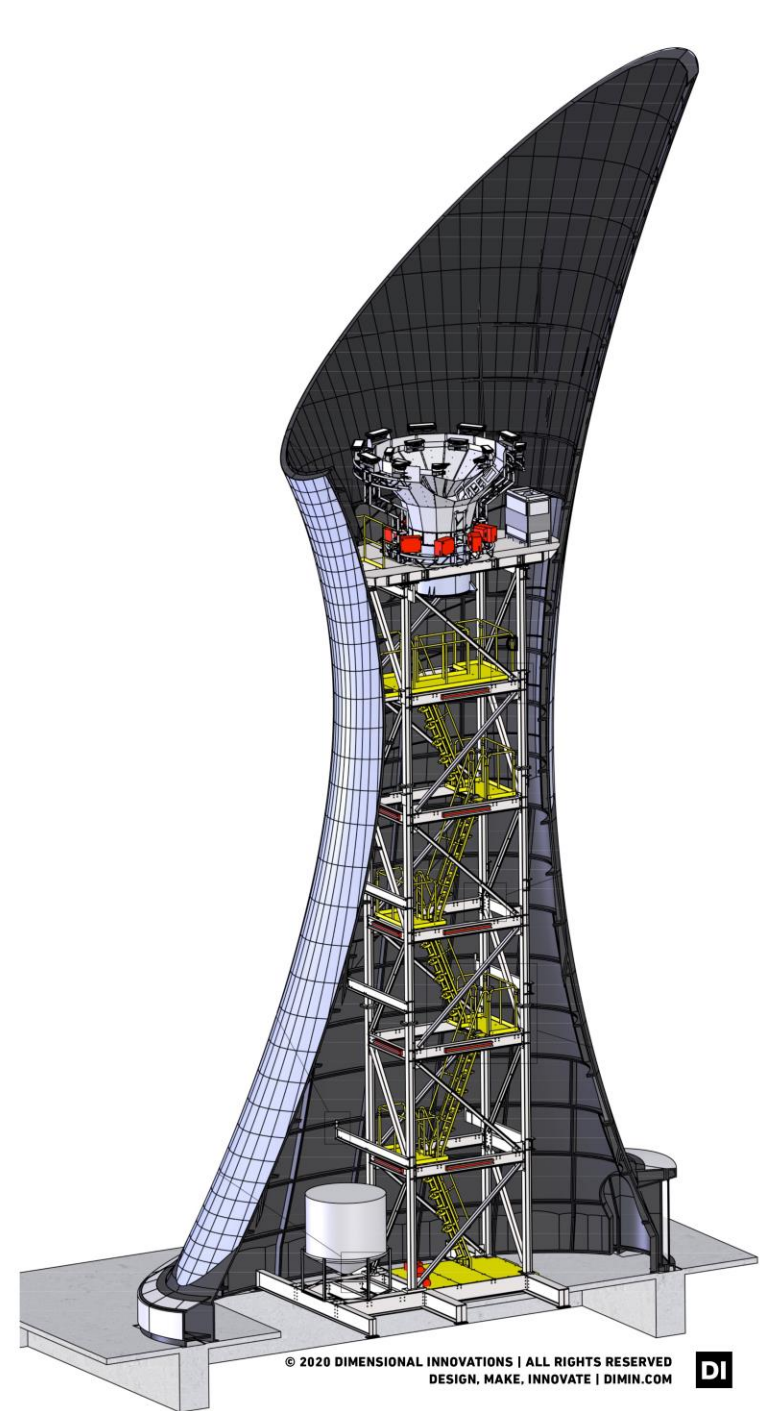
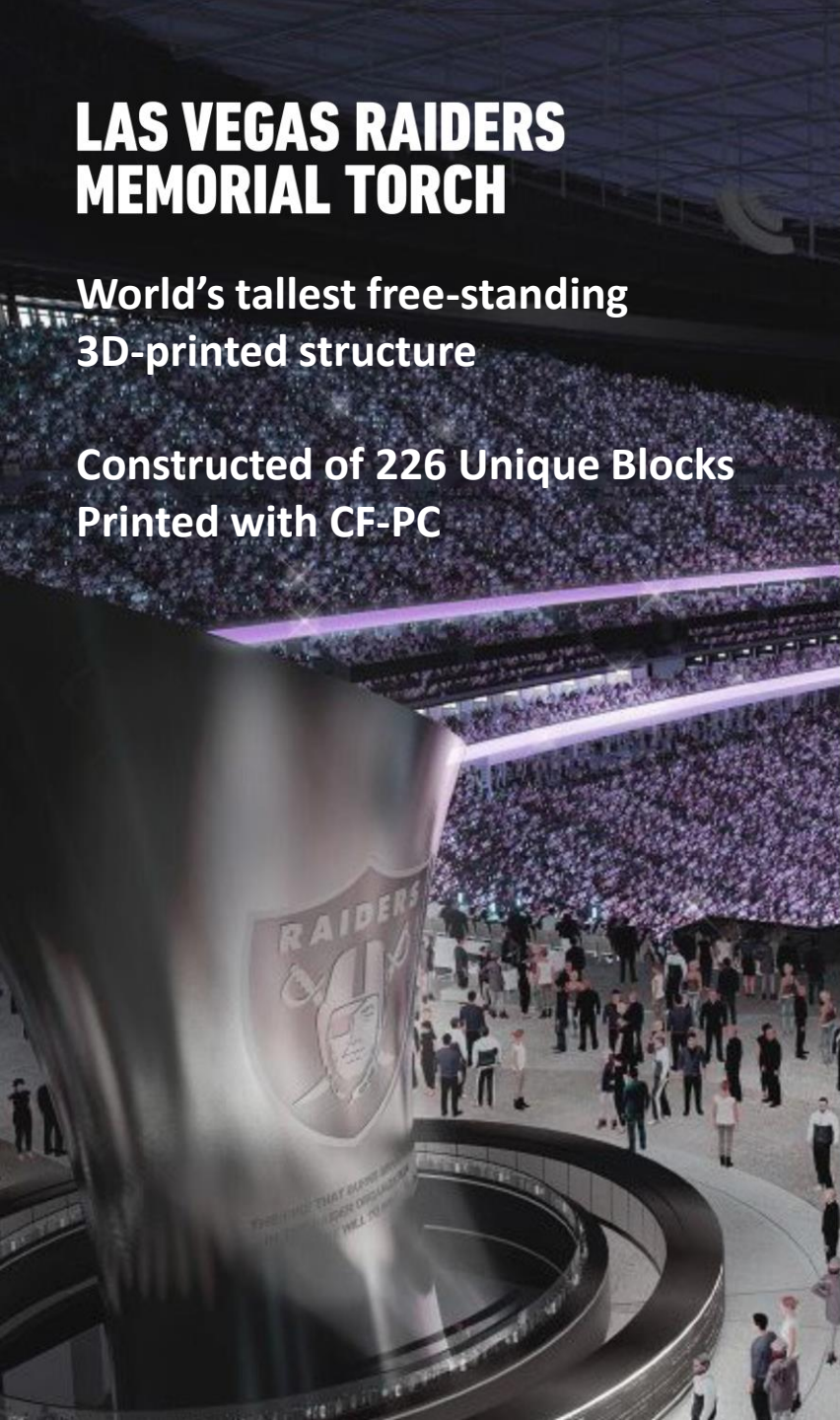
THERMWOOD

Presenter: Eduardo Barocio, Purdue University

LAS VEGAS RAIDERS MEMORIAL TORCH

World's tallest free-standing
3D-printed structure

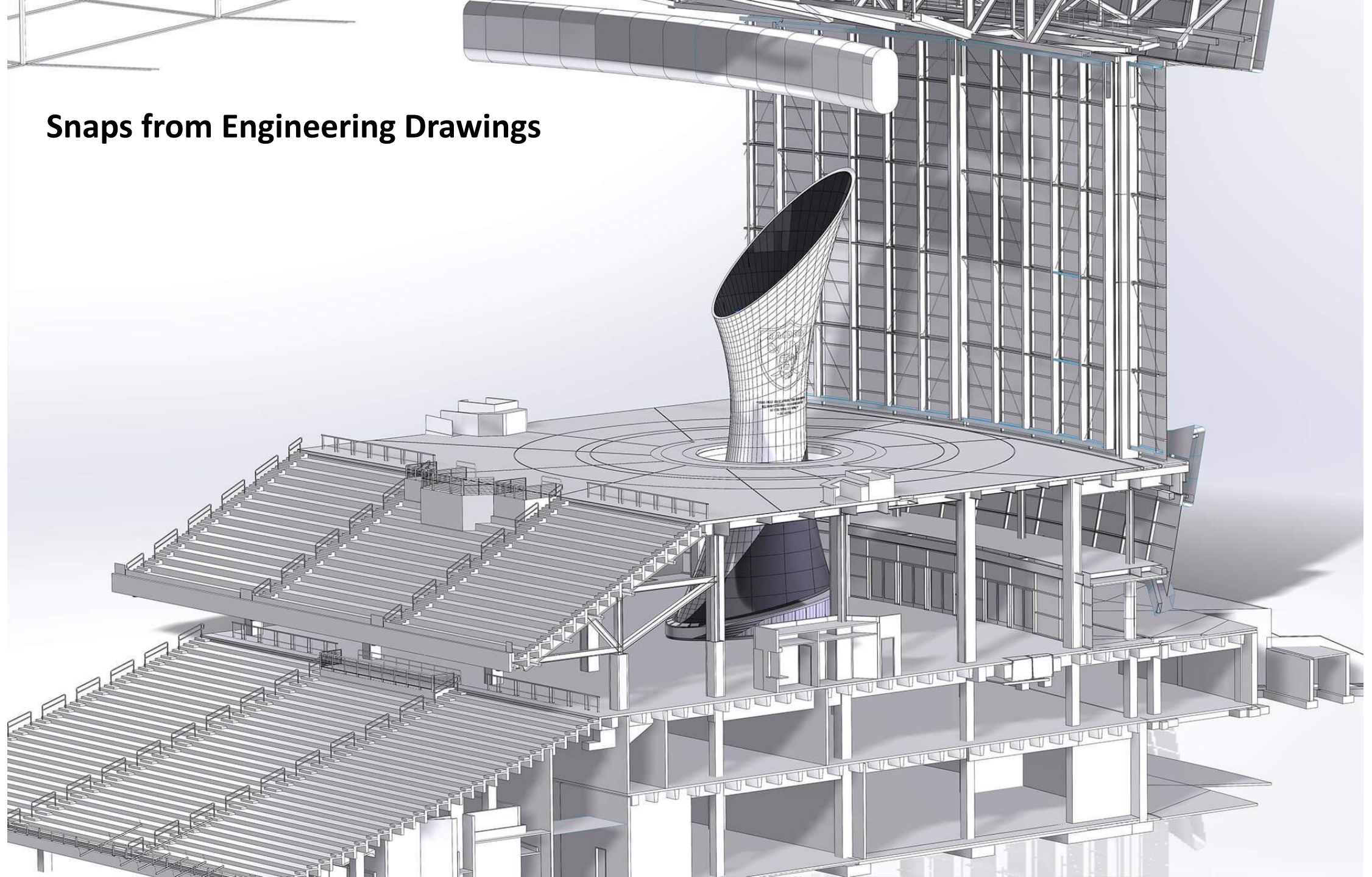
Constructed of 226 Unique Blocks
Printed with CF-PC



Early rendering from Manica
(Design Architect)

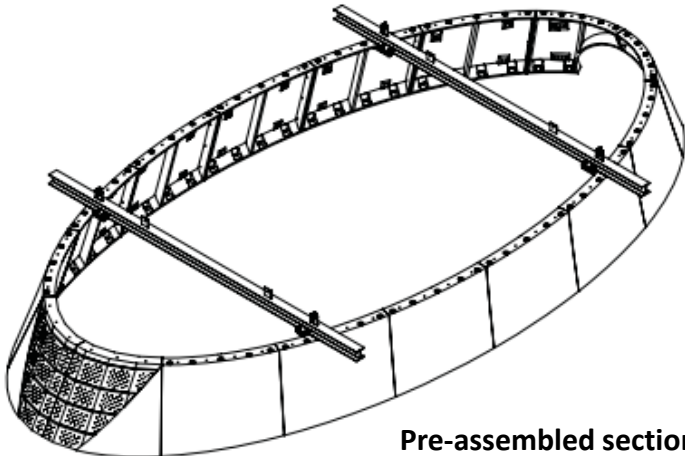


Snaps from Engineering Drawings



Structural Details

226 Unique Blocks

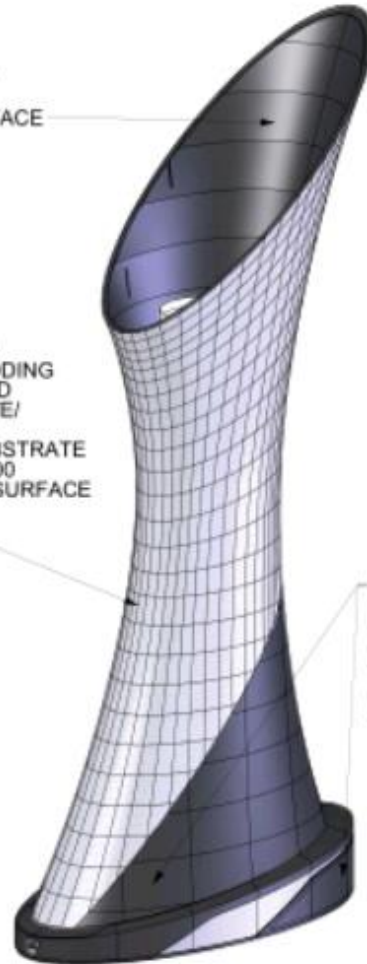


Pre-assembled sections

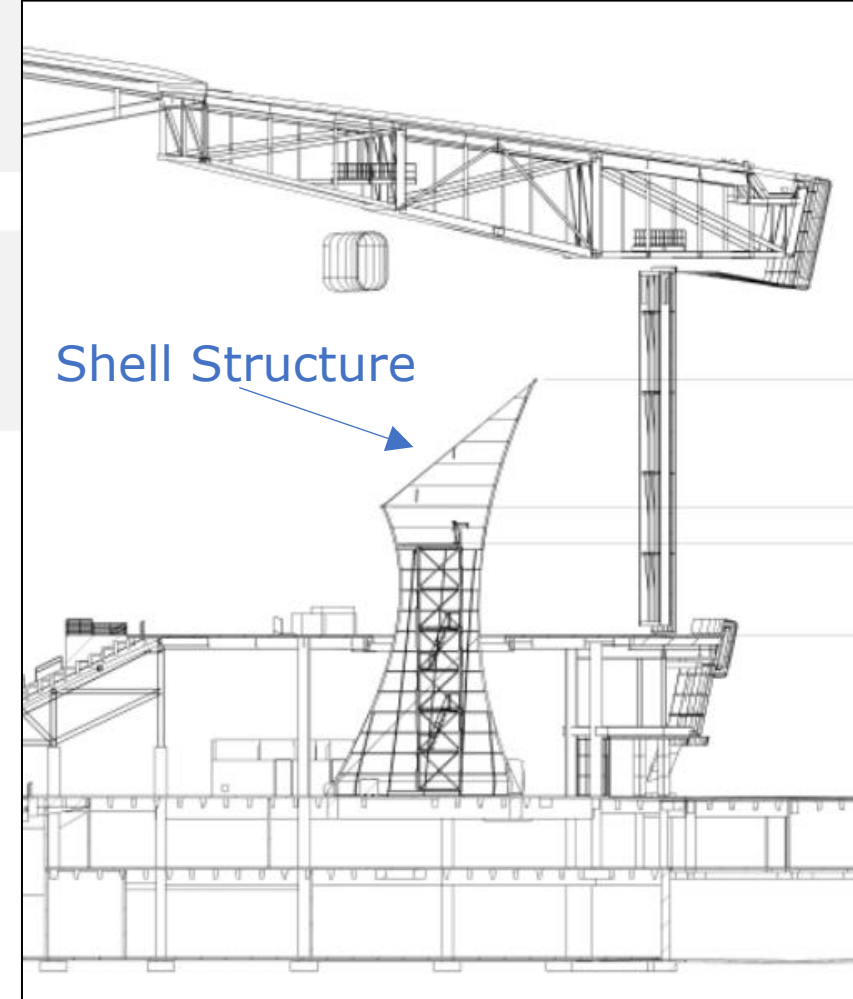
BLACK PAINTED
ROLLED METAL
ON INSIDE SURFACE

~1/2" MACHINED
ALUMINUM CLADDING
WITH 3D PRINTED
POLYCARBONATE/
CARBON FIBER
COMPOSITE SUBSTRATE
TOTAL SQFT: 3200
(68% OF TOTAL SURFACE
SQFT)

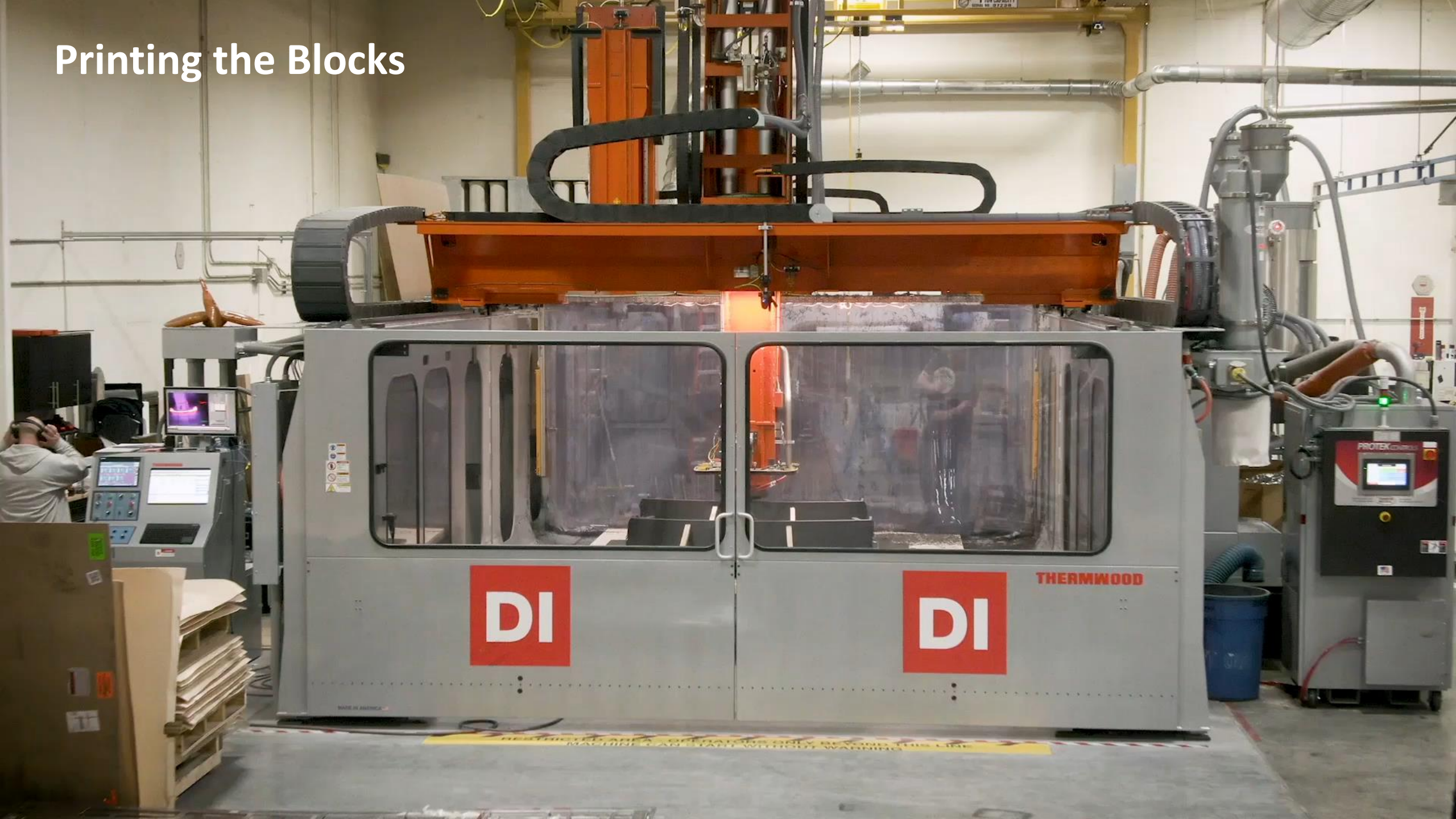
EXPOSED 3D PRINTED
POLYCARBONATE/
CARBON FIBER
COMPOSITE
TOTAL SQFT: 1500
(32% OF TOTAL SURFACE
SQFT)



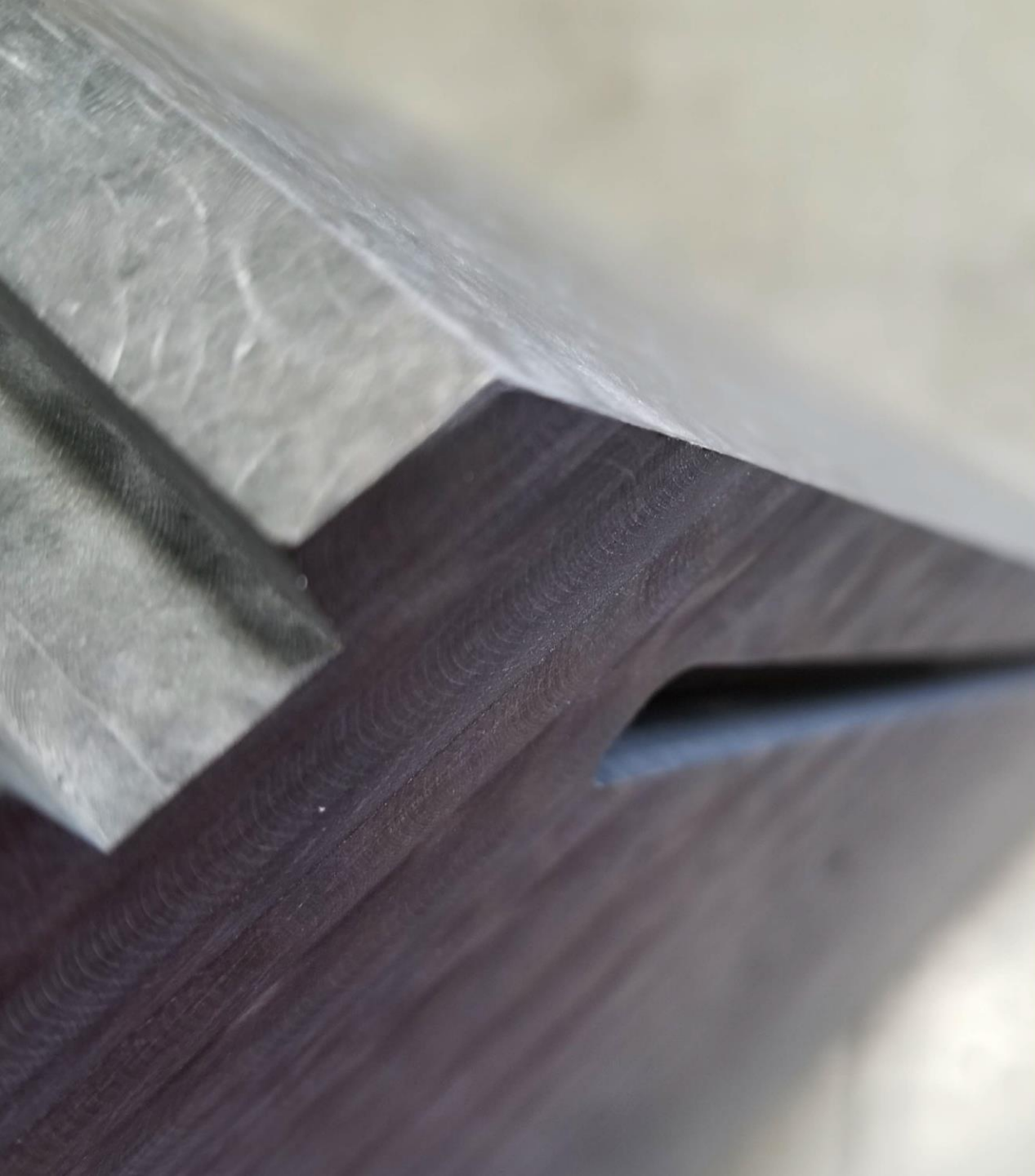
Shell Structure



Printing the Blocks

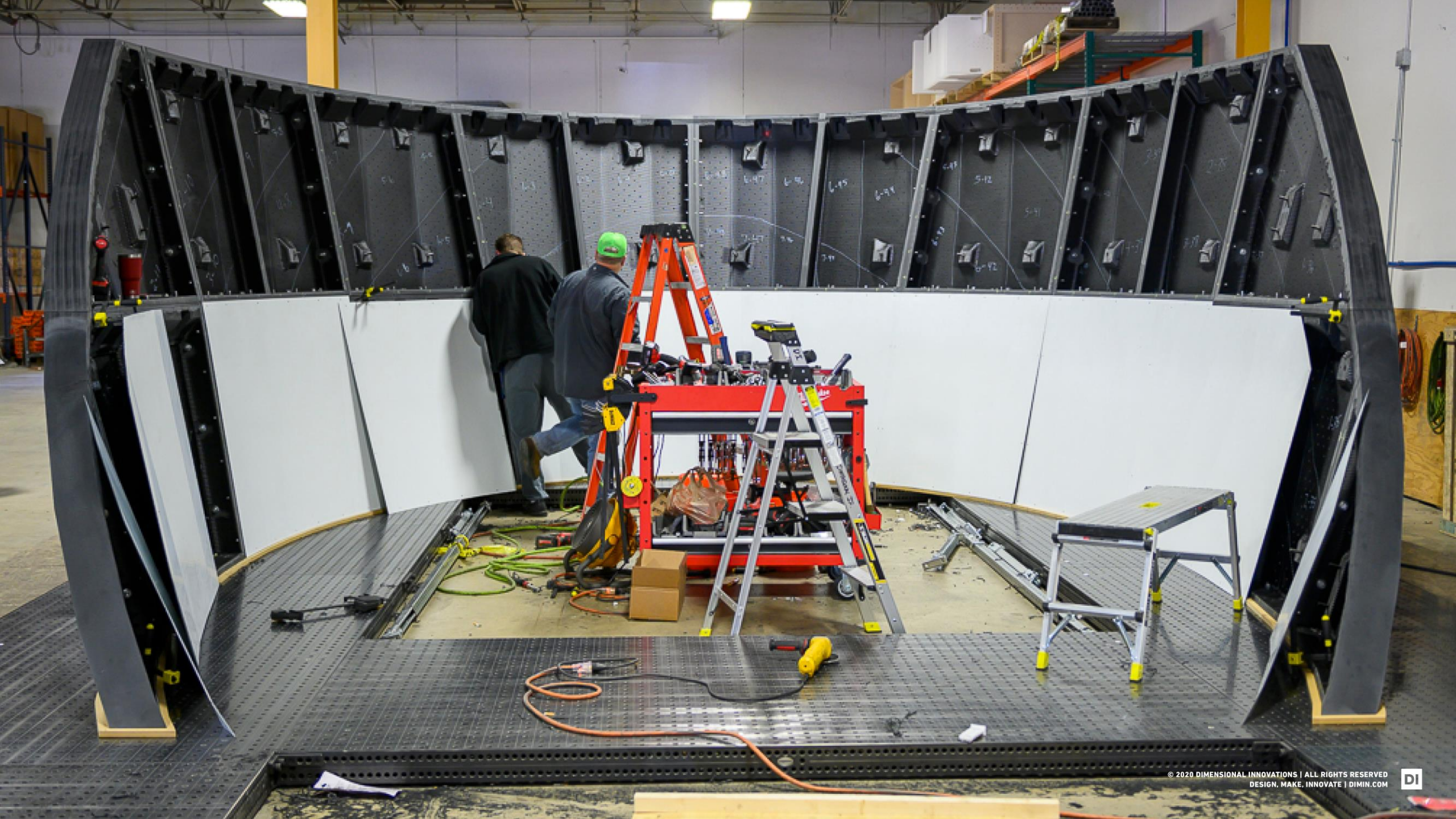








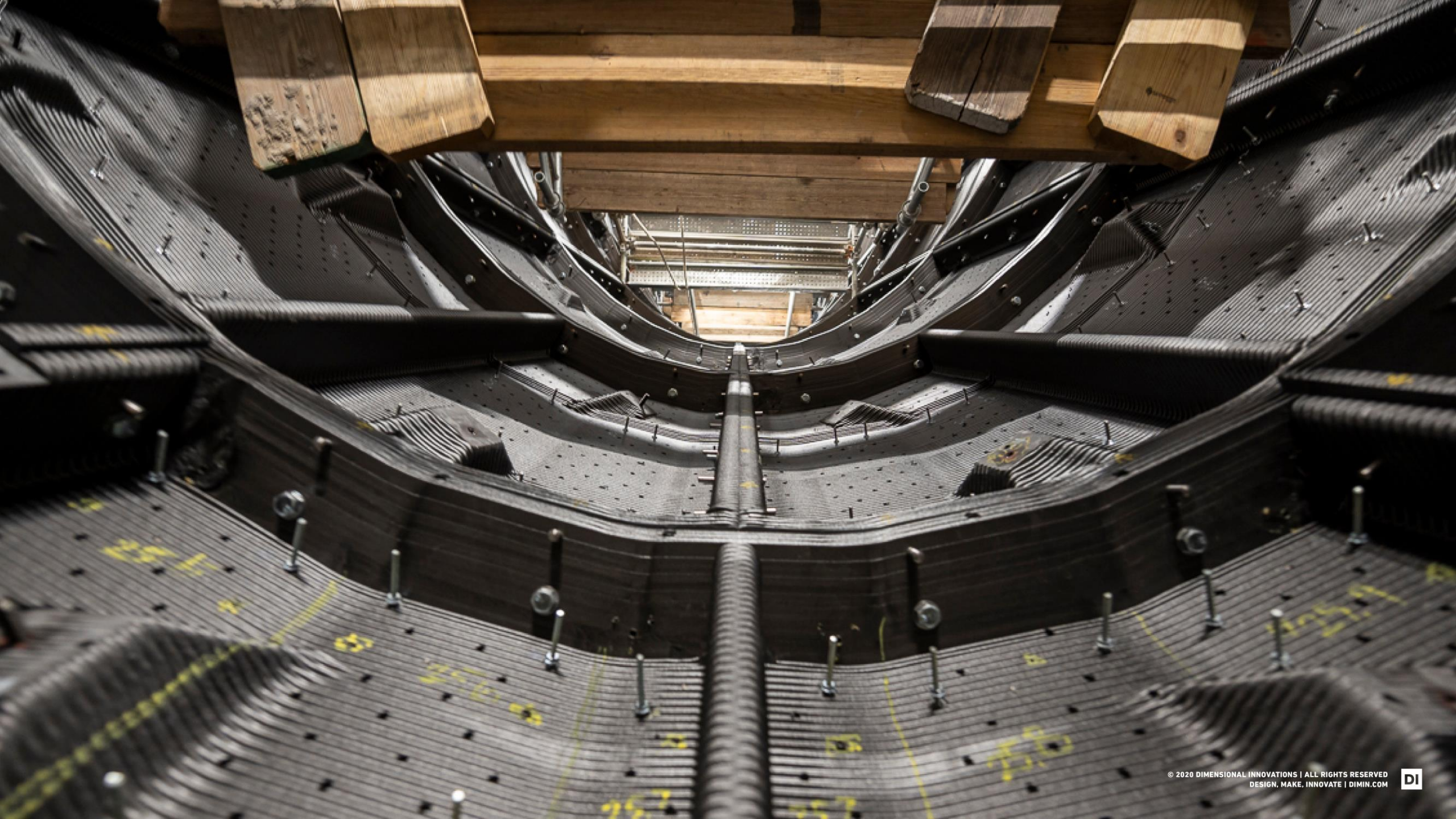
















1960
1976

COMMITMENT
TO
EXCELLENCE

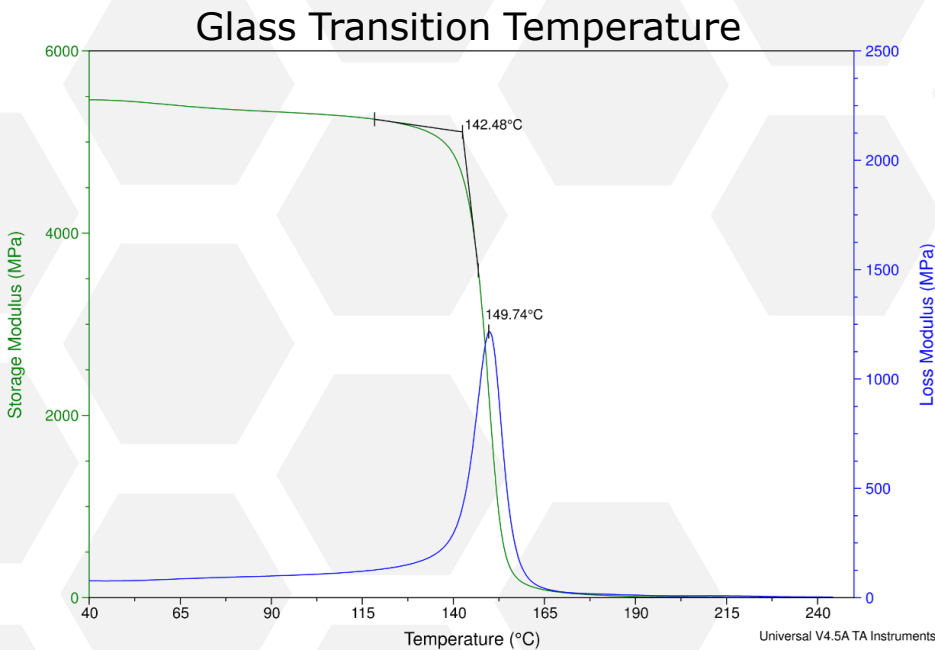
THE FIRE THAT BURNS THE BRIGHTEST
IN THE RAIDERS ORGANIZATION
IS THE WILL TO WIN

-AL DAVIS-

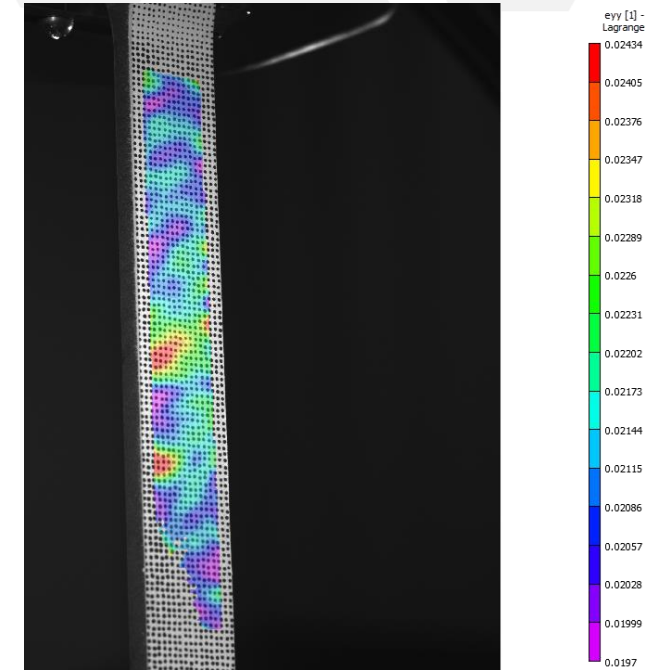
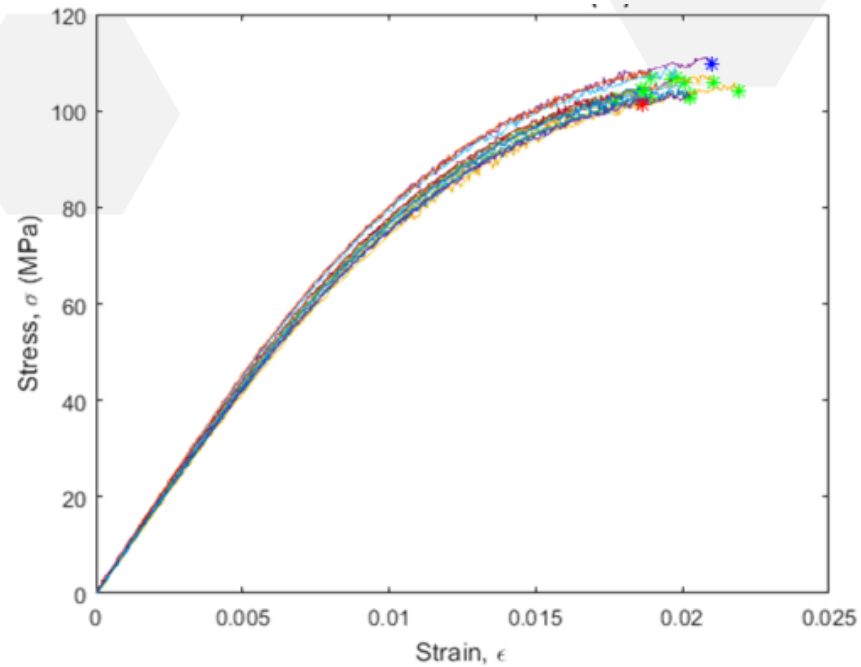
1976
1980

The Printed Composite Material (CF-PC)

- Carbon fiber reinforced polycarbonate developed by Techmer PM.
- Experimental characterization of printed material carried out at Purdue



Tensile Properties – 1-Dir

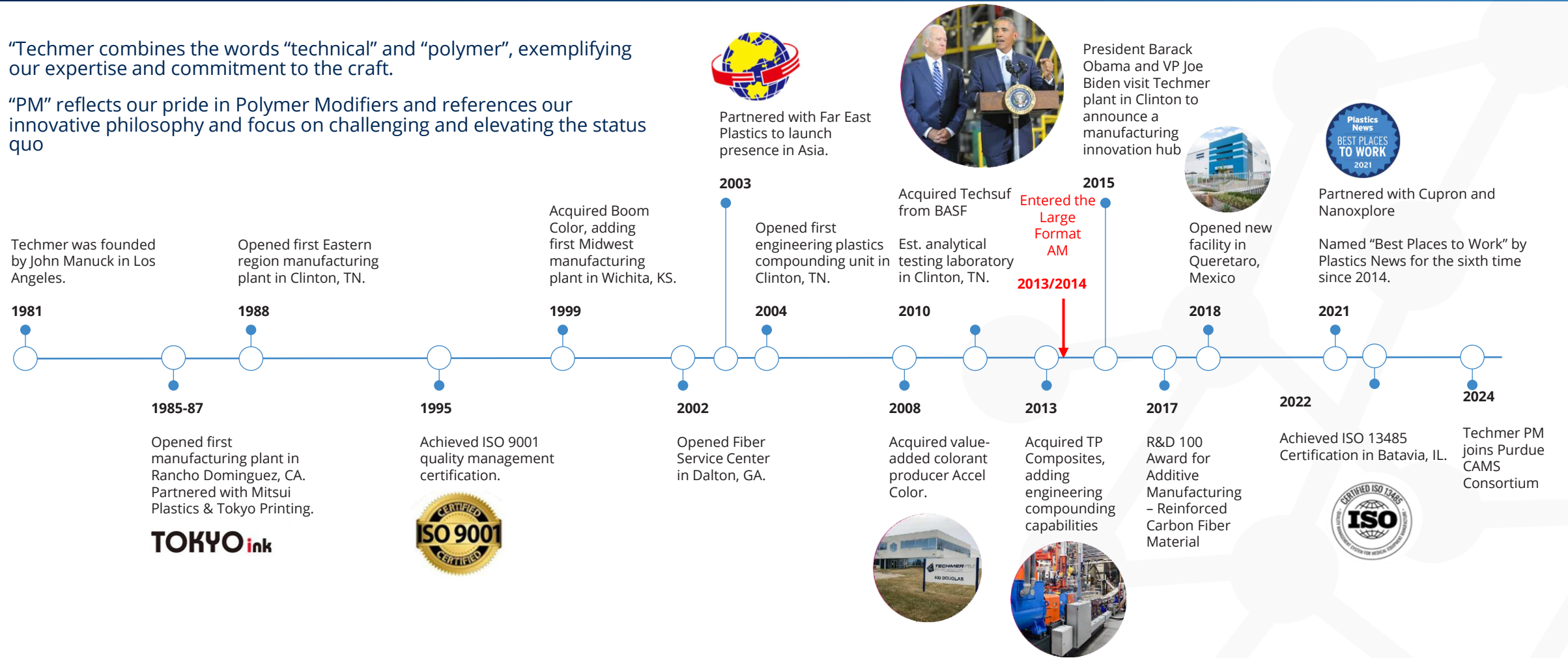


Strain field in the loading direction (ϵ_{yy}) recorded before failure of specimen 10 occurred.

Techmer's History

"Techmer combines the words "technical" and "polymer", exemplifying our expertise and commitment to the craft.

"PM" reflects our pride in Polymer Modifiers and references our innovative philosophy and focus on challenging and elevating the status quo



Additive Manufacturing Specialty Additives

Environmental Protection

- Thermal
- UV Stability
- Anti-Microbial
- Hydrolysis

Flame Retardants

- Halogen
- Non-Halogen

Reinforcements

- Glass Fiber
- Carbon Fiber
- Mineral

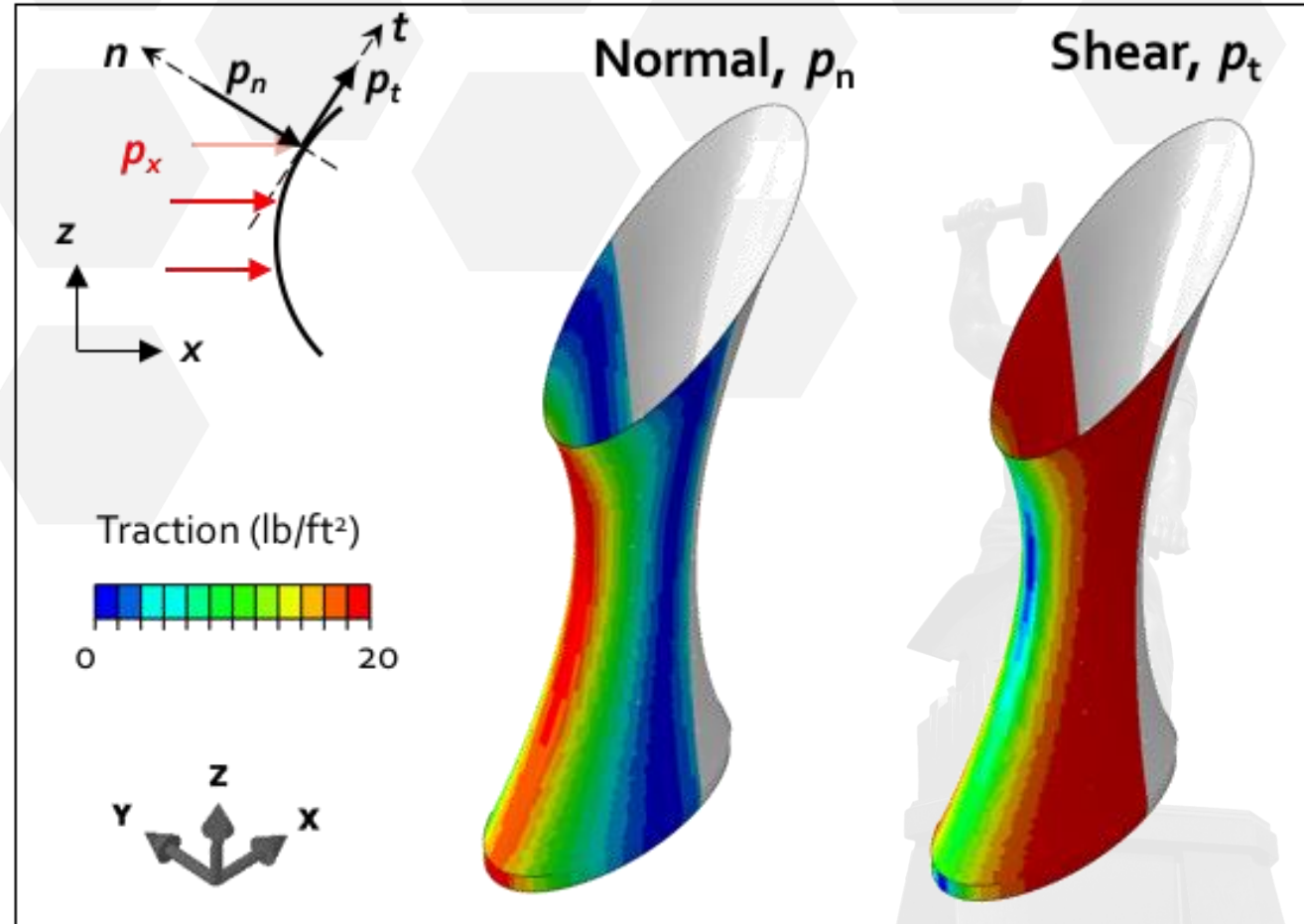
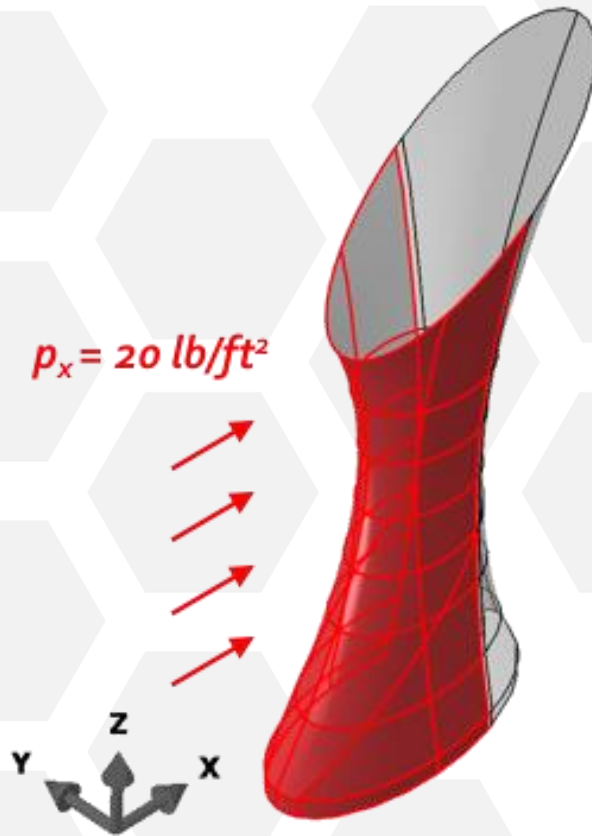
Conductivity

- Conductive
- Anti-Static

High Wear Applications

- PFAS or Non-PFAS Solutions

Analysis: Application of Wind Load



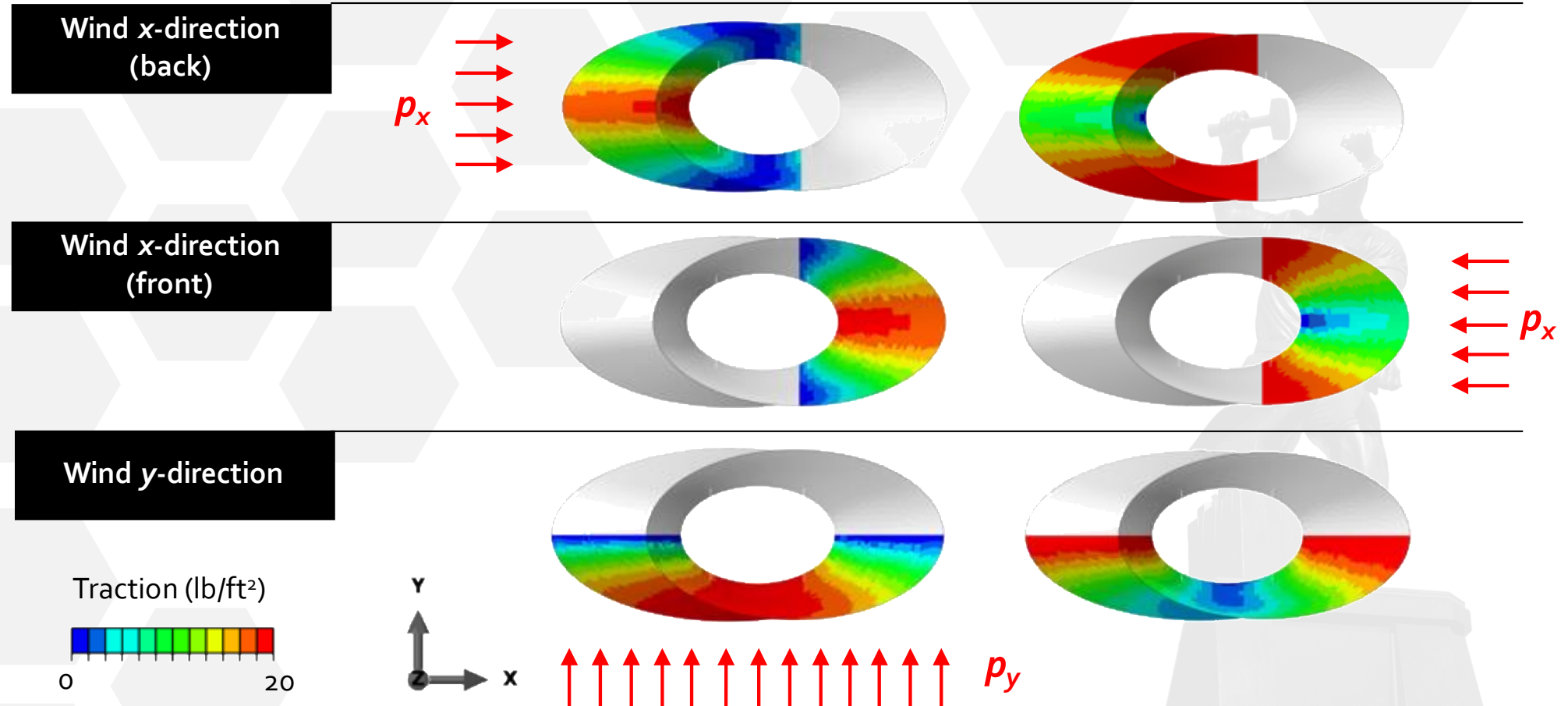
n – surface local normal; t – surface local tangent

Wind Load Cases

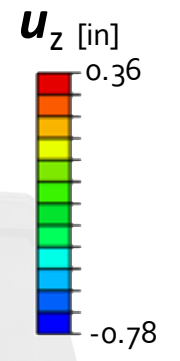
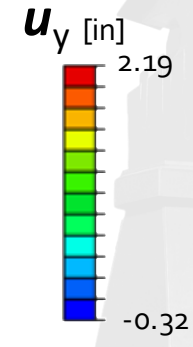
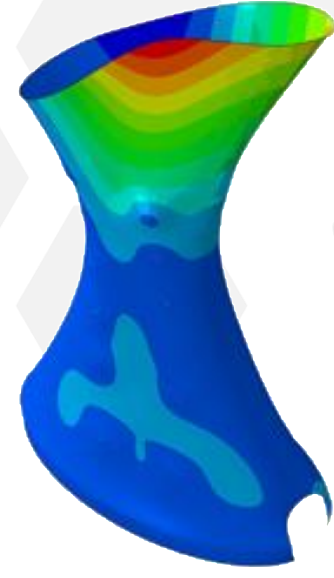
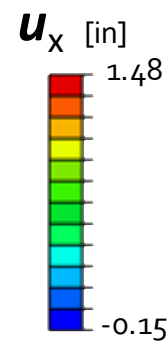
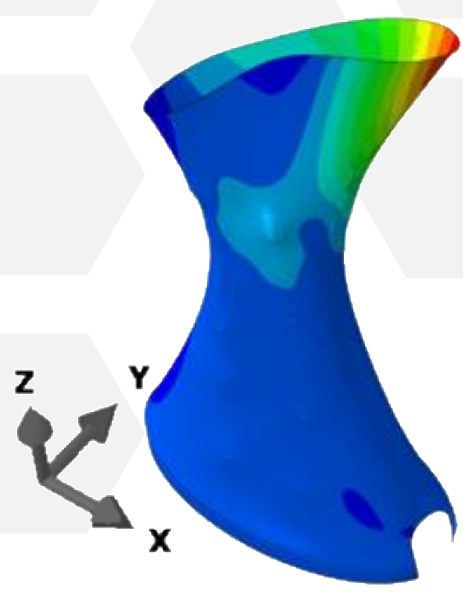
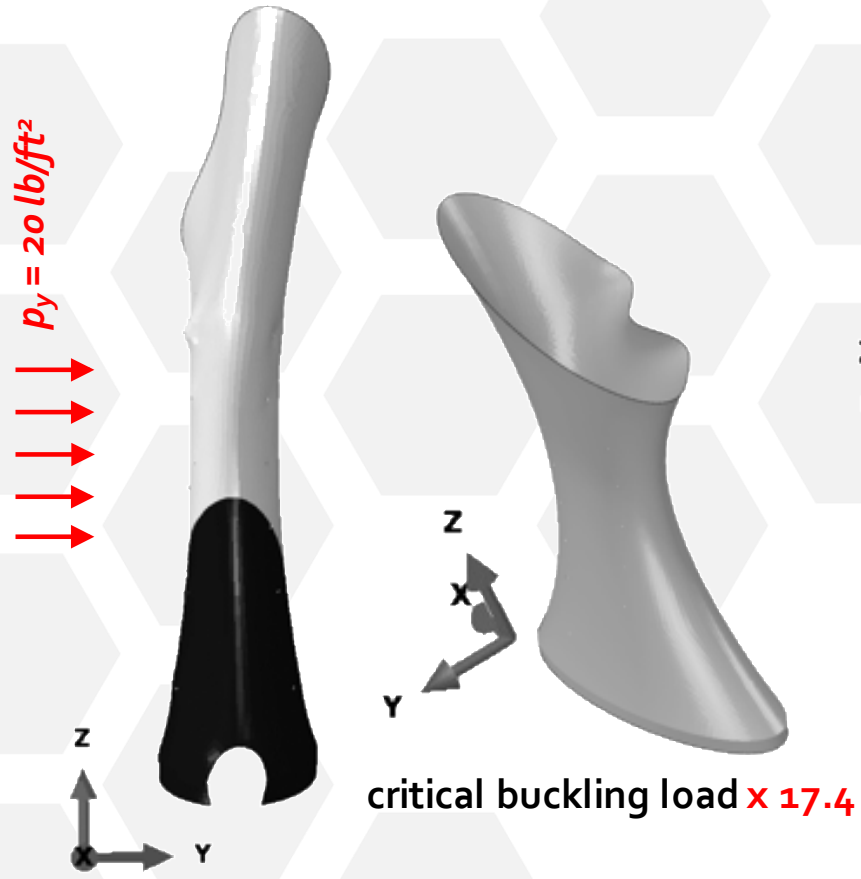
Applied Pressure Distribution

Normal, p_n

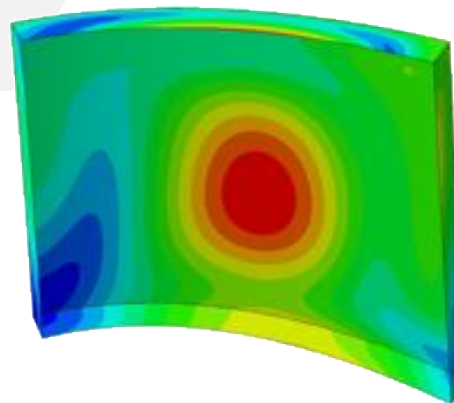
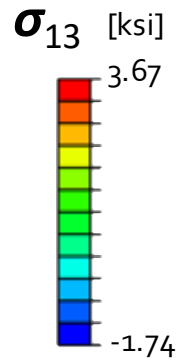
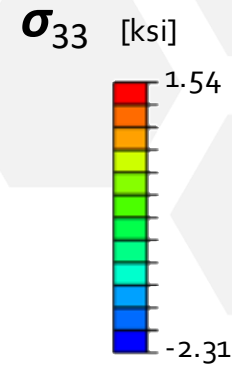
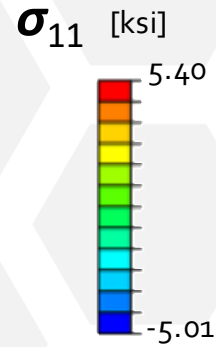
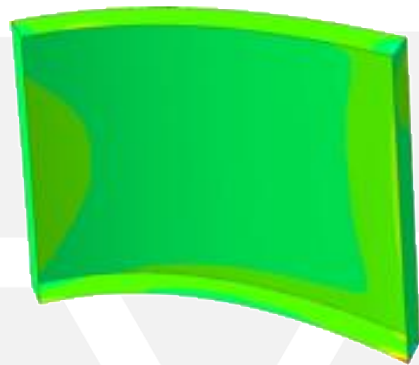
Shear, p_t



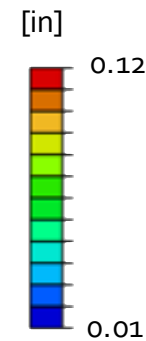
Global Deformation



Local Stress in a “Compression Side” Panel (Wind from the y-Direction)



Total Displacement



critical buckling load x 6.9





Team's Expertise Extended to AM Tooling for Large Scale Wind Blade



Wind Blade Manufacturer



Predictive Simulations for AM Process and as-
Manufactured Performance

THERMWOOD

Large Scale AM OEM



**Dimensional
Innovations**

Large Scale (>250') Modular
Structural Design and
Fabrication



Custom Material Formulations for LSAM



Simulation Tools



U.S. DEPARTMENT OF
ENERGY

A large, polished, metallic funnel-shaped structure, likely a space shuttle nozzle, is the central focus of the image. It is illuminated by several spotlights, creating bright highlights and deep shadows. The structure is set within a dark, industrial-looking environment with a grid-like ceiling and other lighting fixtures. The text "Thank You" is overlaid in the center of the image in a white, sans-serif font.

Thank You