

Convergent Aeronautics Solutions (CAS)
Sustainable Manufacturing of Aircraft
(SUMAC)

Manufacturing and Scale-Up of Natural Fiber Composite eVTOL Propeller Skin and C- Channel

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Emerging Composites Technologies Working Group
March 17, 2026



Sustainable Manufacturing of AirCRAFT (SUMAC)

Overarching Goal: To demonstrate sustainable composite technologies for advanced air mobility (AAM)



Materials Development

Combine bio-based thermoplastic resins and natural fiber reinforcements to develop and characterize composite

Computational Analysis

Reduce experimental scope and provide insight into component performance

Integrated Sensing

Monitor health and performance for materials awareness

Systems Analysis

Evaluate the full life cycle of bio-based thermoplastic composites compared to incumbent materials

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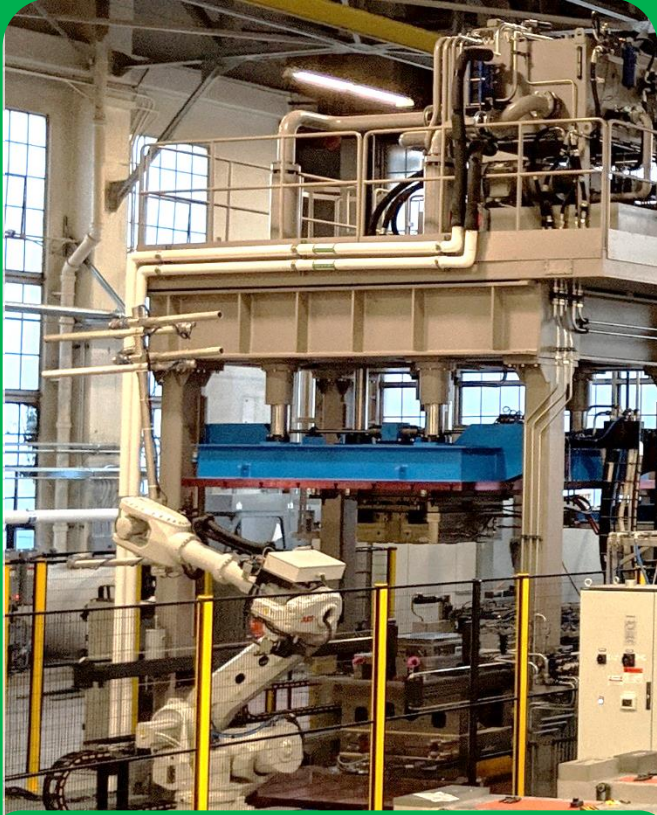


Manufacturing Demonstration

Ames High Rate Composite Manufacturing Facility



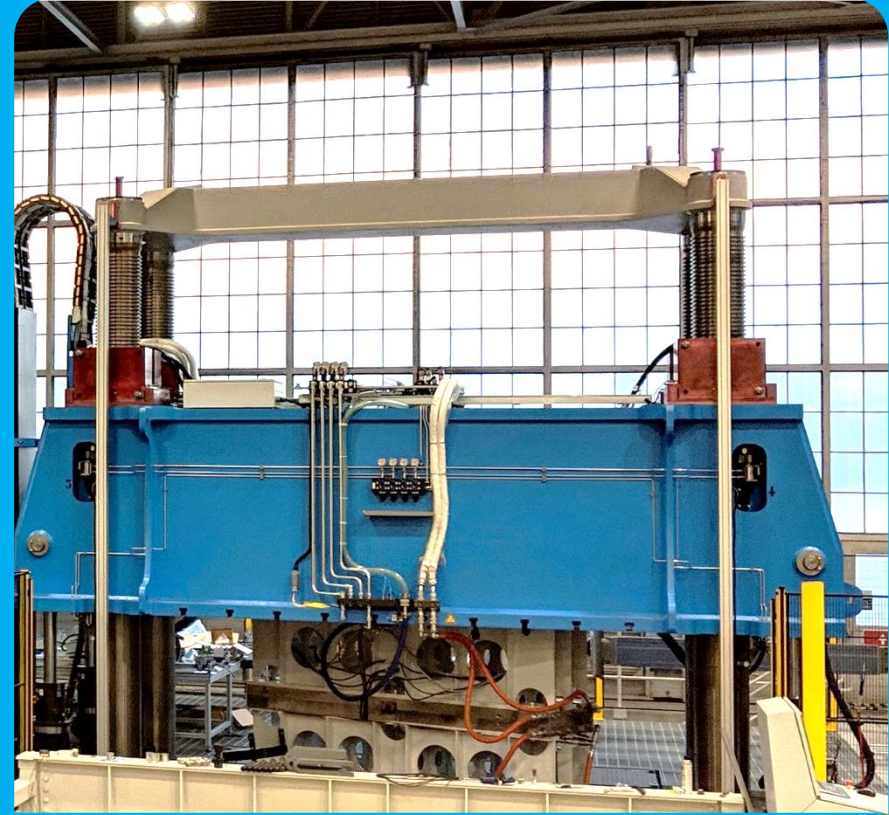
Ames High Rate Composite Manufacturing Facility



PREFORMER LINE
(aka Small Press)
Max Force 330T



RESIN INJECTION



BIG PRESS
Max Force 3600T

Facility Applications

- Component Manufacturing Process Development
 - Heating and cooling requirements
 - Pressing requirements
 - Resin injection requirements
 - Material handling requirements
 - Process optimization
- Component Manufacturing Process Certification
 - Quality assessment
 - Consistency/repeatability assessment
- Composite Material Development/Assessment
- Composite Component Manufacture

Ames High Rate Composite Manufacturing Facility



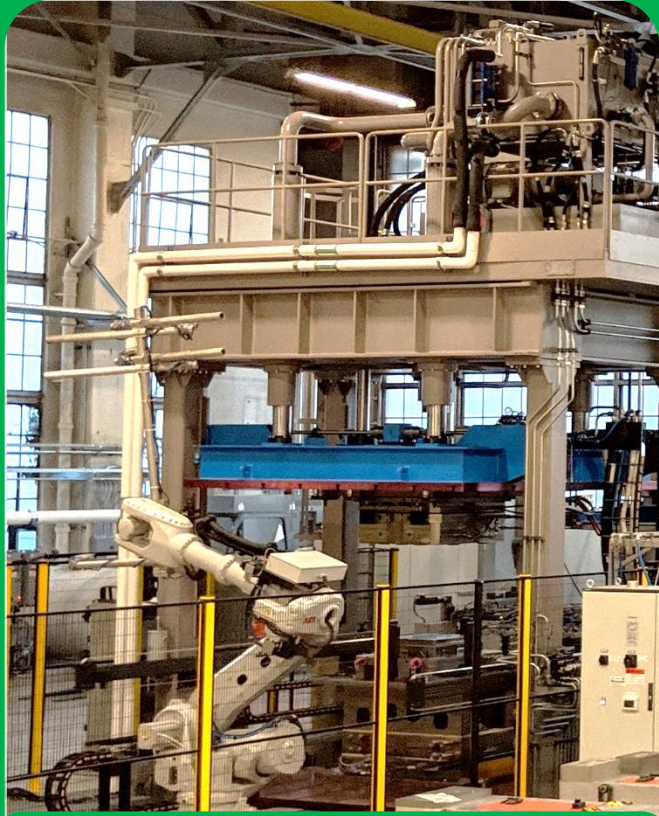
BIG PRESS
Max Force 3600T

Big Press

- Fixed lower plane with wings
- Moving upper plane
- Automated material handling
 - Five-axis ABB robot (not shown)
 - Sliding table
- Parallelism control system for active mol alignment
- Four hydraulic columns with locks



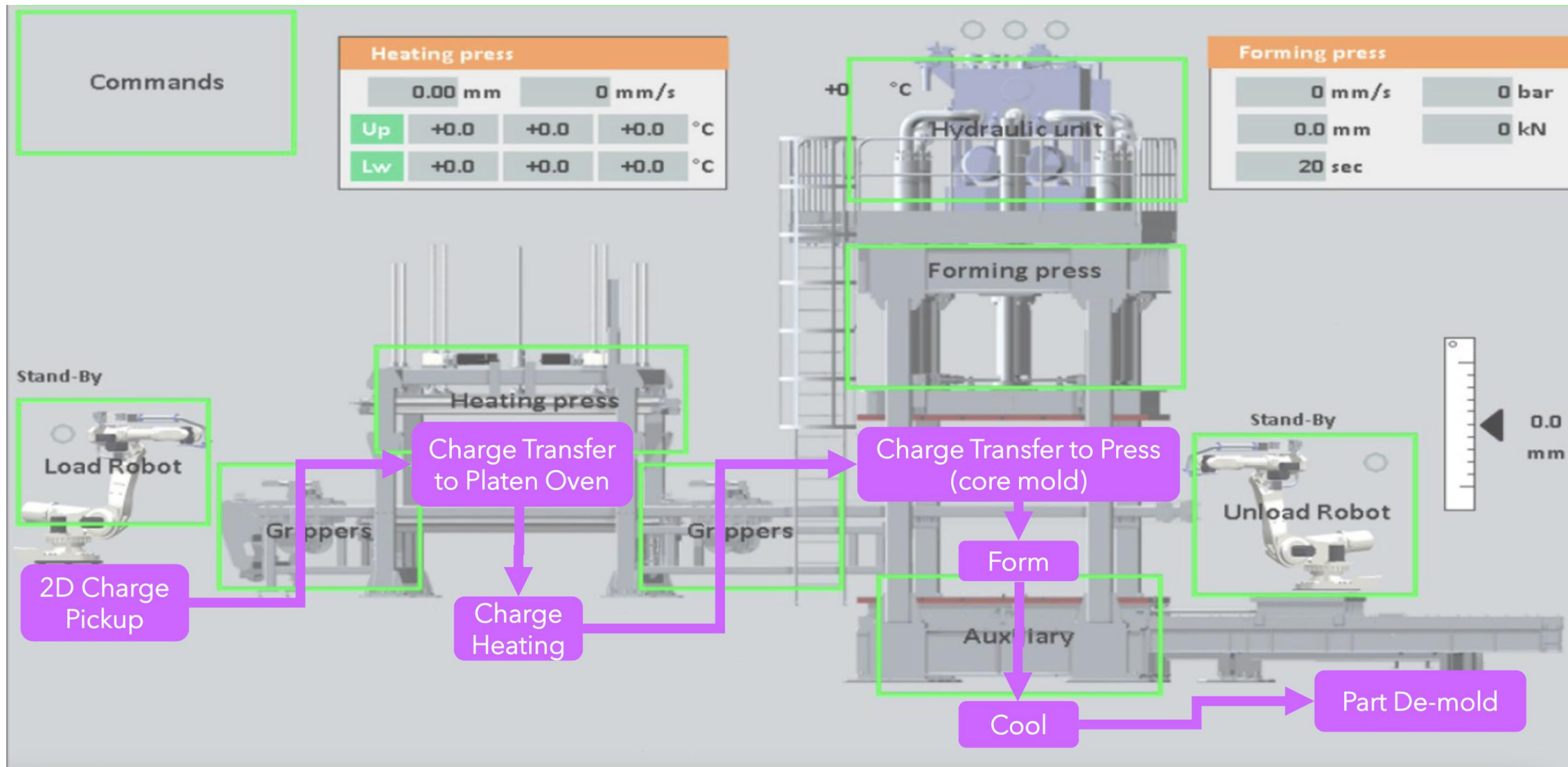
Ames High Rate Composite Manufacturing Facility



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PreFormer Line



PreFormer Line Demonstration



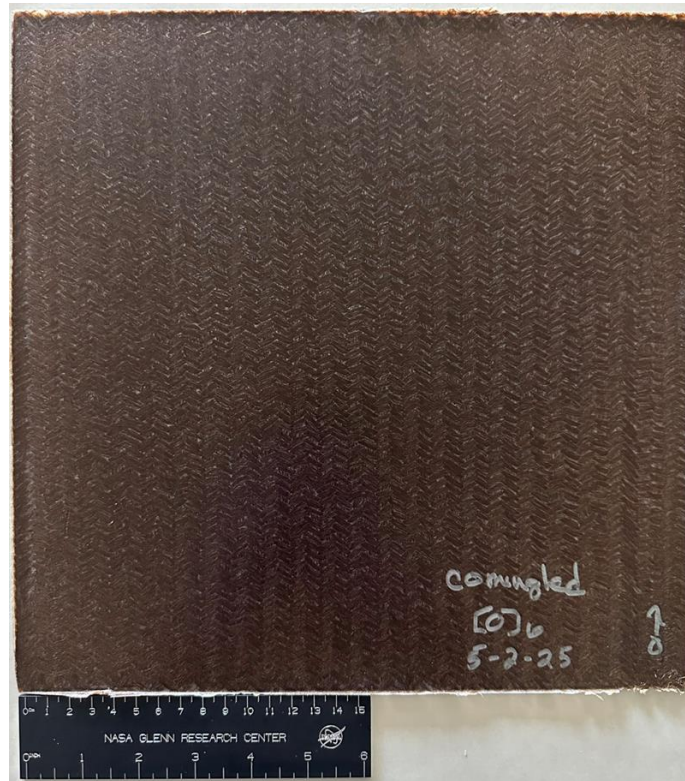
Alex Mazhari
a.mazhari@nasa.gov

Considerations for Scale-Up



Commingled Rilsan
PA-11/Flax braid
preform

12"x12" panel



Trial 1



- 4 Plies
- Placed directly on mold pre-coated with PTFE based mold release



Trial 1

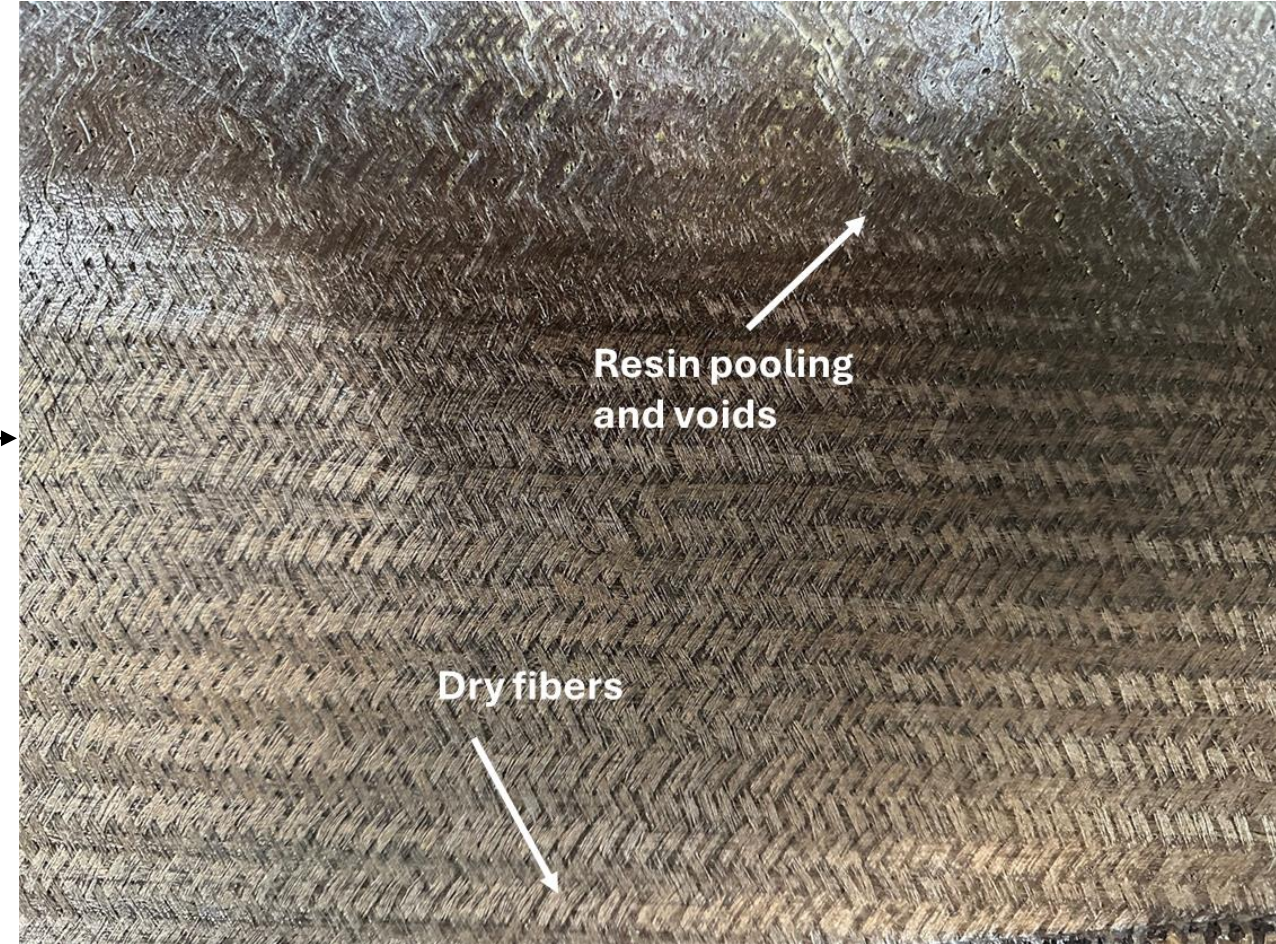


Trial 2



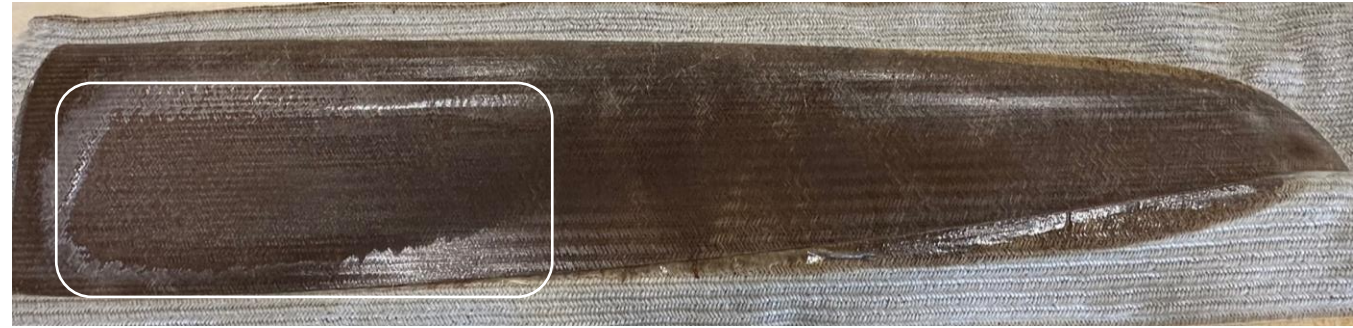
Much better result!

Process Optimization – Fiber Wetting



Additional resin layers to improve resin infiltration

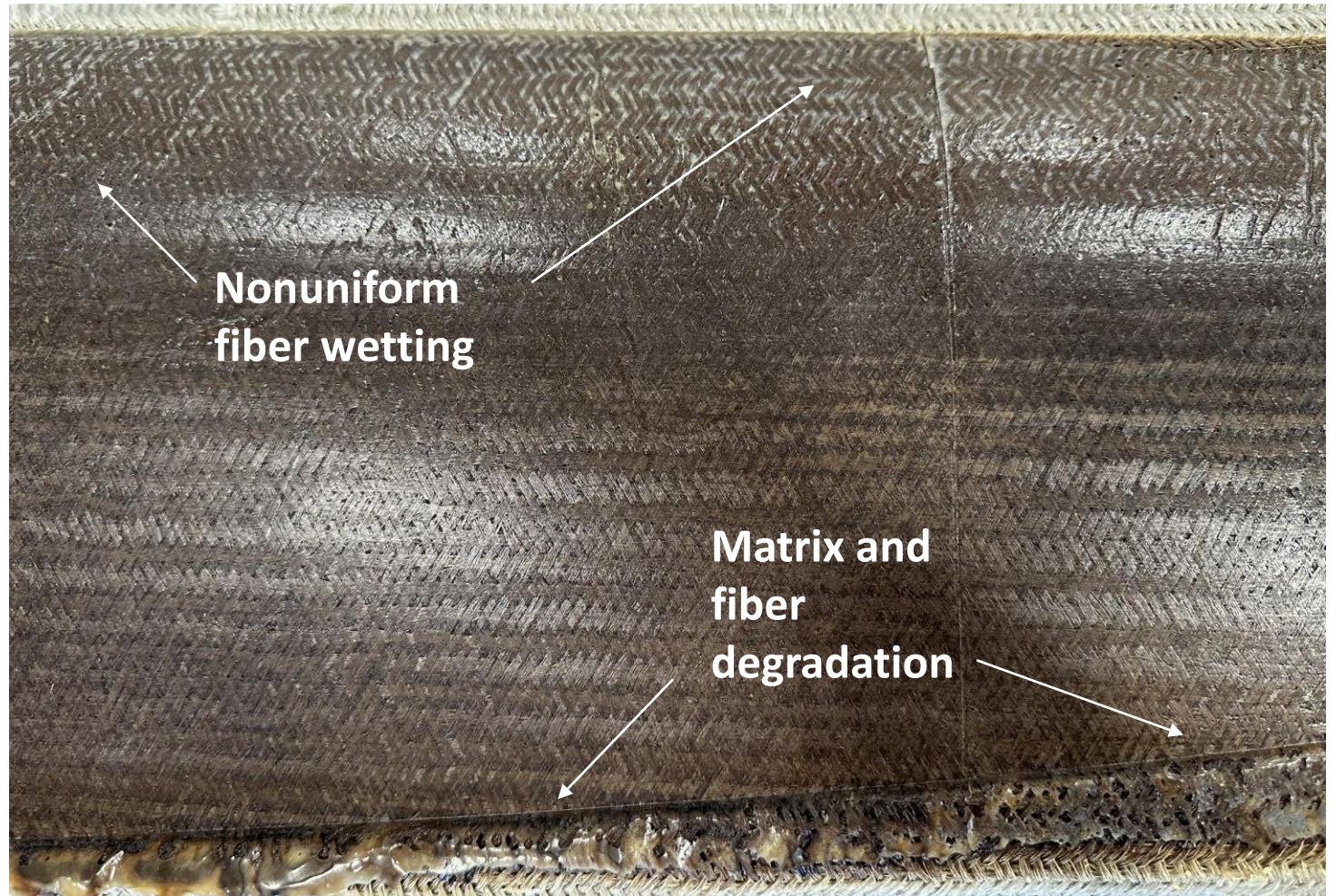
Process Optimization – Uniform pressure



Rubber insert added to
create uniform pressure

Key Takeaways & Next Steps

- Inconsistent heating and pressure profile due to mold design
- Environmental factors
- Resource constraints
- Time constraints



Successful Proof-of-Concept Demo!

Trial 2



Trial 6



Trial 4



Trial 7



Trial 5

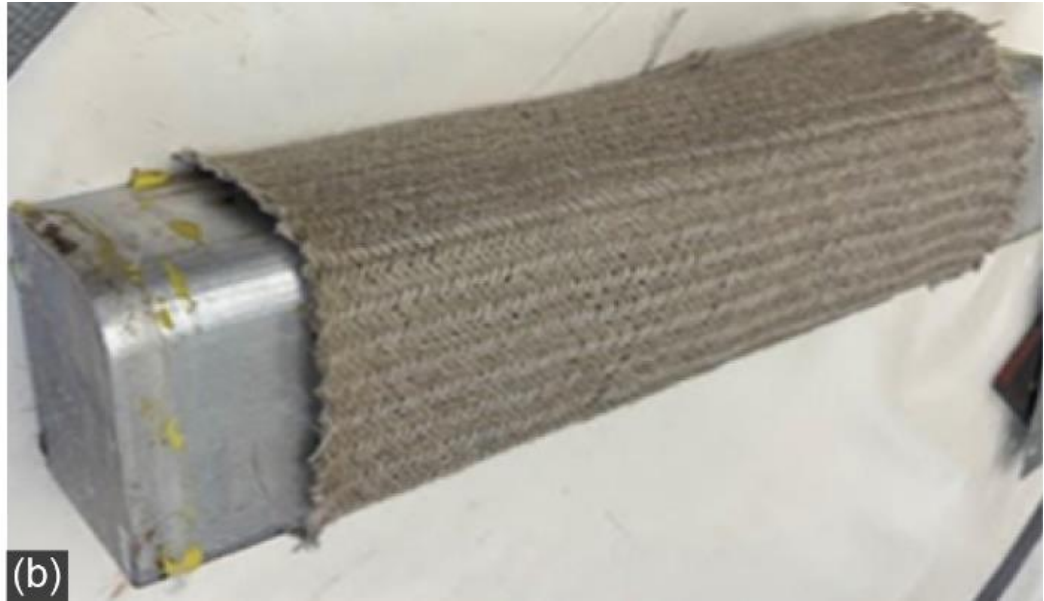


Trial 8

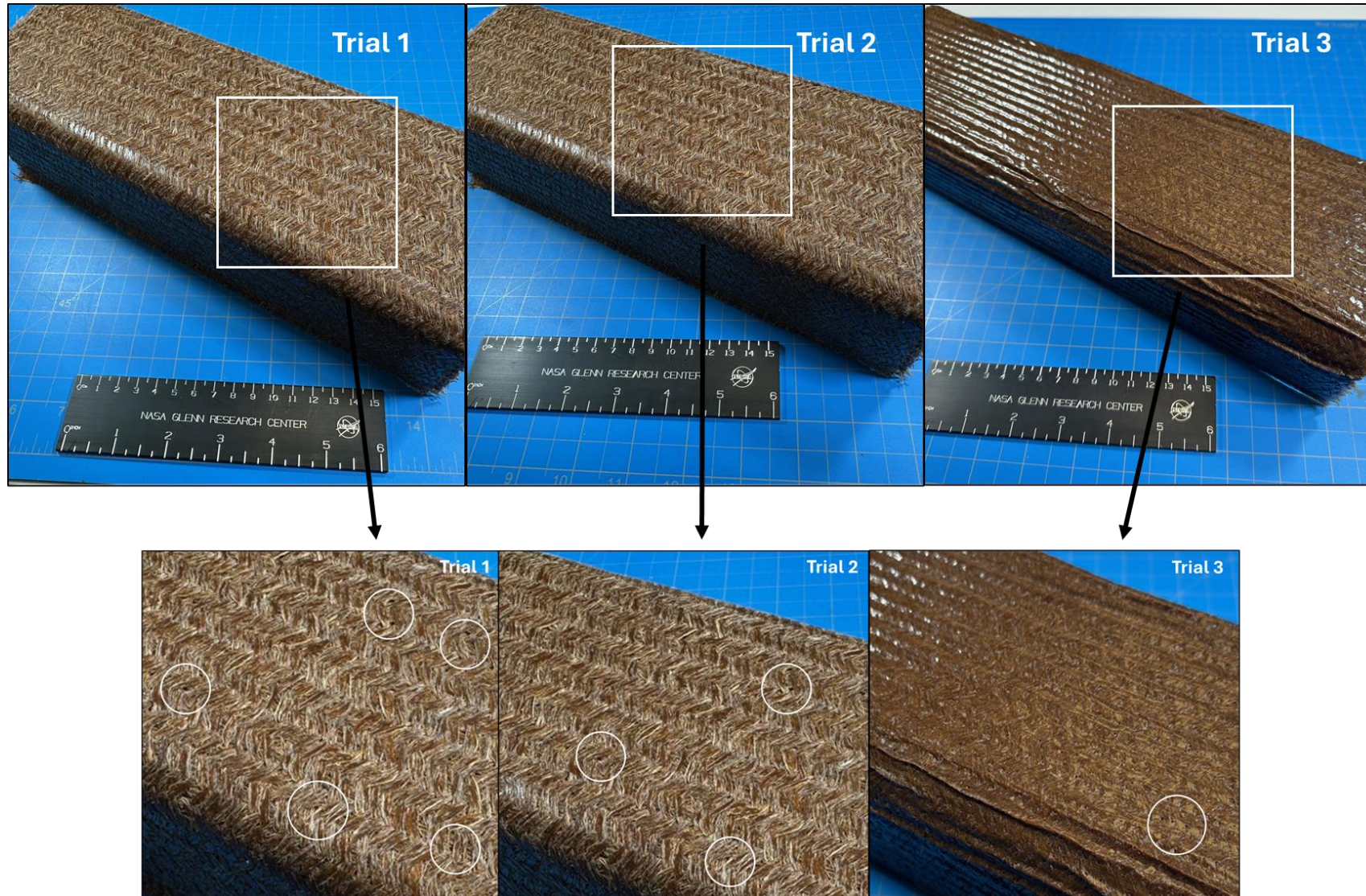


C-Channel Subcomponent

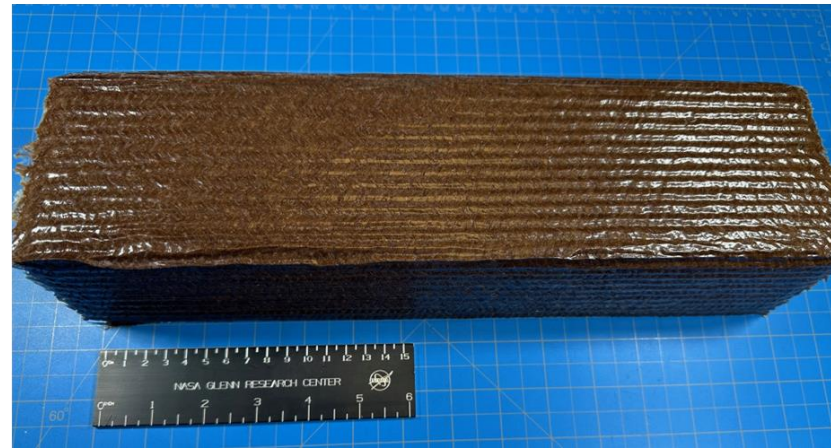
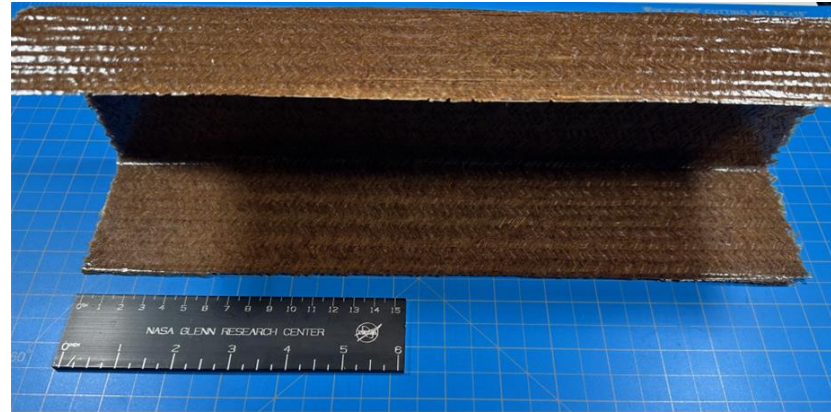
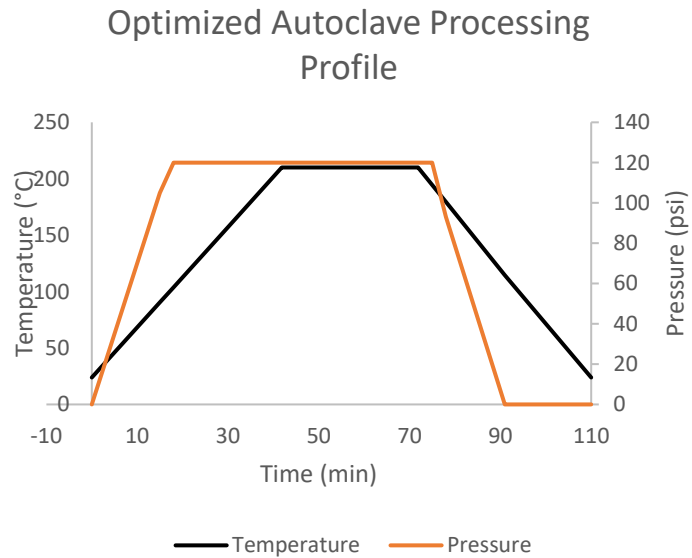
- Accelerated timeline due to project changes
- Commingled Rilsan PA-11/Flax braid preform
- Produced in autoclave



Manufacturing Trials

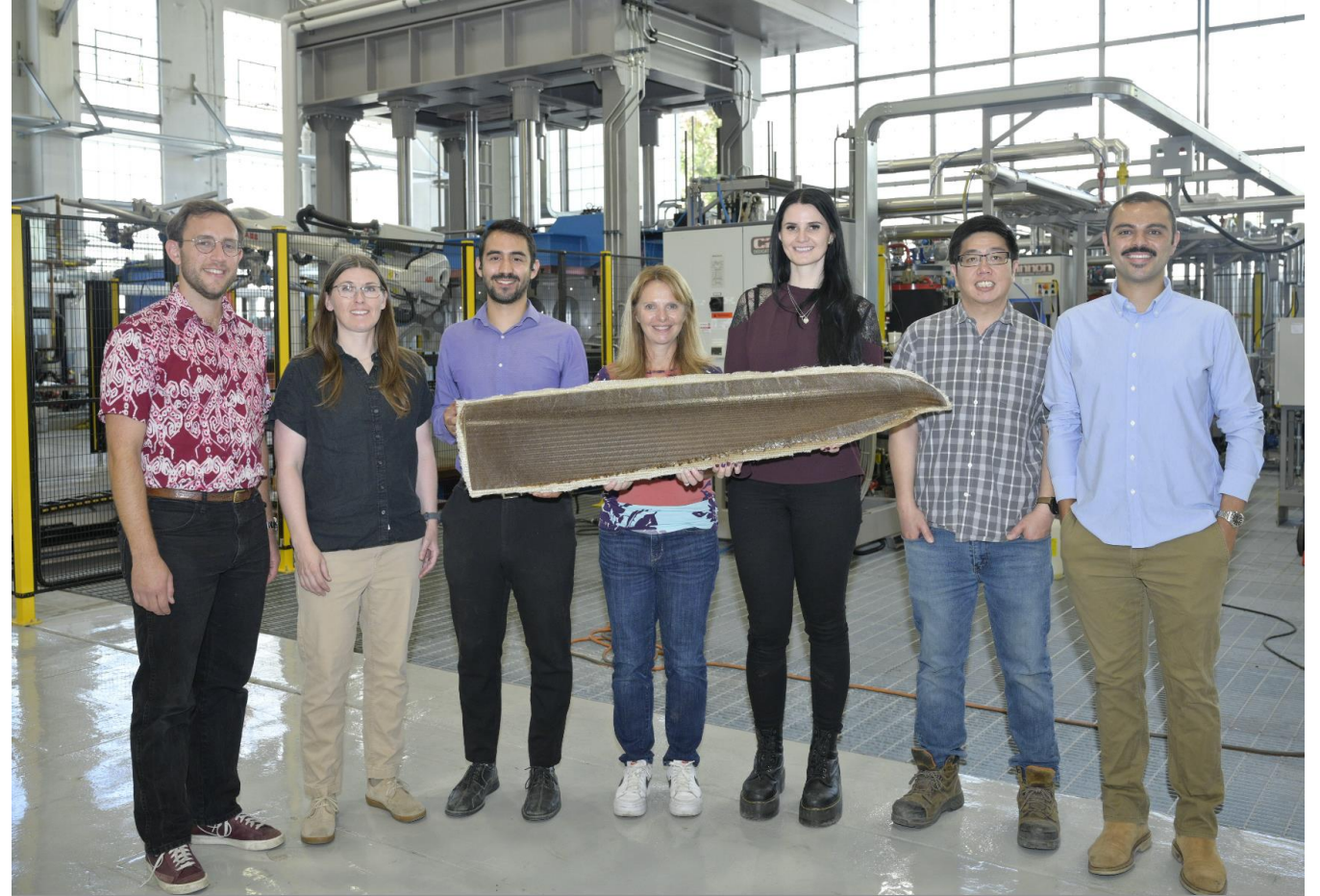


Optimized Manufacturing Profile



Acknowledgements

- SUMAC team
- Joby aviation
- AHRCM team
- NASA ARMD Convergent Aeronautics Solutions program



Manufacturing Demo Team

Questions?

NASA/TM-20260001009
March 27, 2026



LaRC intern Pearl Yoon with
propeller skin