

NIAR Large Scale Manufacturing/Testing Capability



WICHITA STATE UNIVERSITY

NATIONAL INSTITUTE FOR AVIATION RESEARCH

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NIAR[®]

https://www.wichita.edu/industry_and_defense/NIAR/Laboratories/atlas/atlas.php

ATLAS Promotional Video

**AS9100D
CERTIFIED
ISO 9001**



ATLAS

ADVANCED TECHNOLOGIES LAB FOR
AEROSPACE SYSTEMS

NIAR[®]

WICHITA STATE UNIVERSITY

MISSION

To strengthen university research capabilities; provide applied learning opportunities for students; and support the aviation and manufacturing industries - while driving innovation and prosperity for the community, region and state.

WWW.NIAR.WICHITA.EDU

**WICHITA, KS
HUNTSVILLE, AL**
LOCATIONS

\$340+ MILLION
YEARLY R&D

2.0 MILLION
SQUARE FEET

SIX WICHITA AREA
LOCATIONS

1985
ESTABLISHED

1,900
EMPLOYEES



Develop a multi-disciplinary manufacturing environment and an engineering education program to prepare engineers and educators for the *Factory of the Future* and to aid current workforce in seamlessly adapting to advancements in the workplace.



Future - *Workforce Education*

- Developing a robust pipeline of “industry-ready” engineers through experiential learning
 - Advanced materials and manufacturing processes
 - Machine learning and artificial intelligence



Present - *Industry R&D*

- Promoting equitable access to advanced manufacturing
- Makerspace for advanced R&D and rapid prototyping
- R&D extension for both startups and large corporations



Past - *Upskilling labor force*

- Develop workforce training programs for upskilling traditional manufacturers - create new job opportunities
- Bridging legacy enterprise with emerging technologies



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AEROSPACE SYSTEMS



ATLAS Timeline..



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AEROSPACE SYSTEMS



C Coriolis C1 AFP



Mikrosam Slitter



A ASC 13'x26' Autoclave



Mikrosam AFP+ATL+FM



A Electroimpact SCRAM++



XCT / UT / PT / LS (Sector X)



ElectroImpact AFP+ATL



UT CNC



KraussMaffei M & ENGEL
Thermoplastic Presses
(TF / IM / CF)



Filament
Winding

HP-RTM



Cevotec Fiber Patch Placement



Sector **T**



7,200 sq.ft.



3,600 sq.ft.

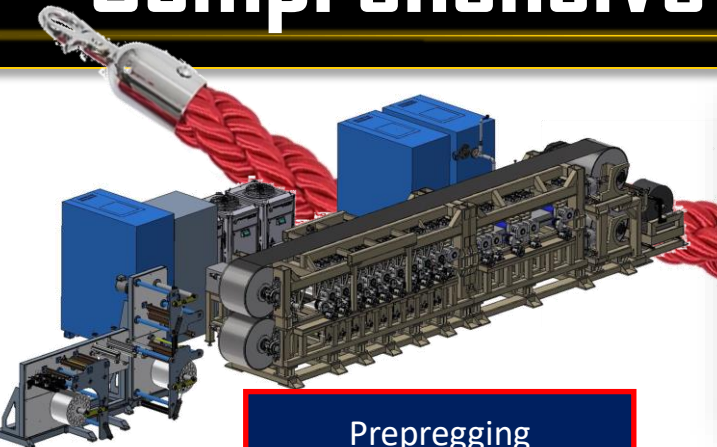


4,700 sq.ft.



128,000 sq.ft. (next to Spirit AeroSystems)

Comprehensive Support for Manufacturing R&D



Prepregging
(Thermoset & Thermoplastic)

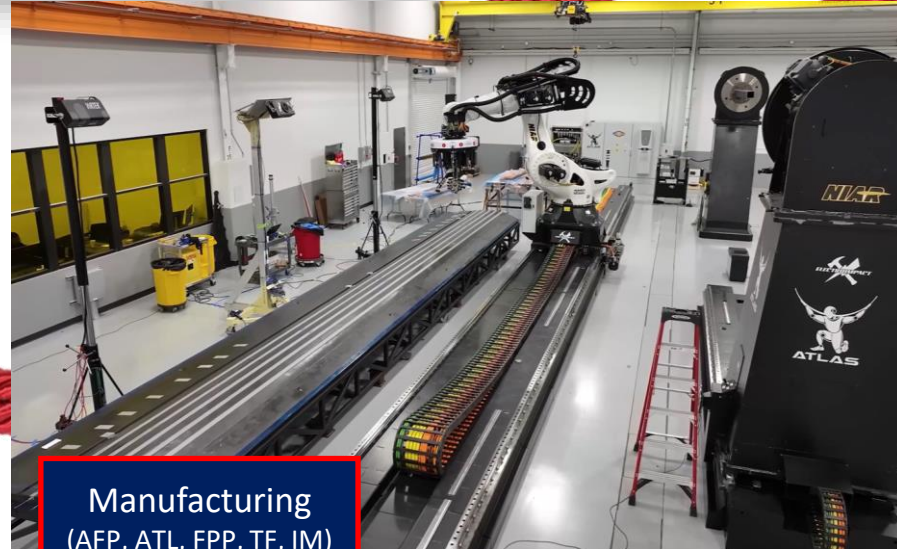


Slitting
(Advanced QA)

Processing
(Oven, Autoclave)



Prototype Tooling
(AM + AFP)



Manufacturing
(AFP, ATL, FPP, TF, IM)



Inspections
(XCT, PT, LS, UT, EC)



Manufacturing Simulations
(Optimization & Cure Kinetics)

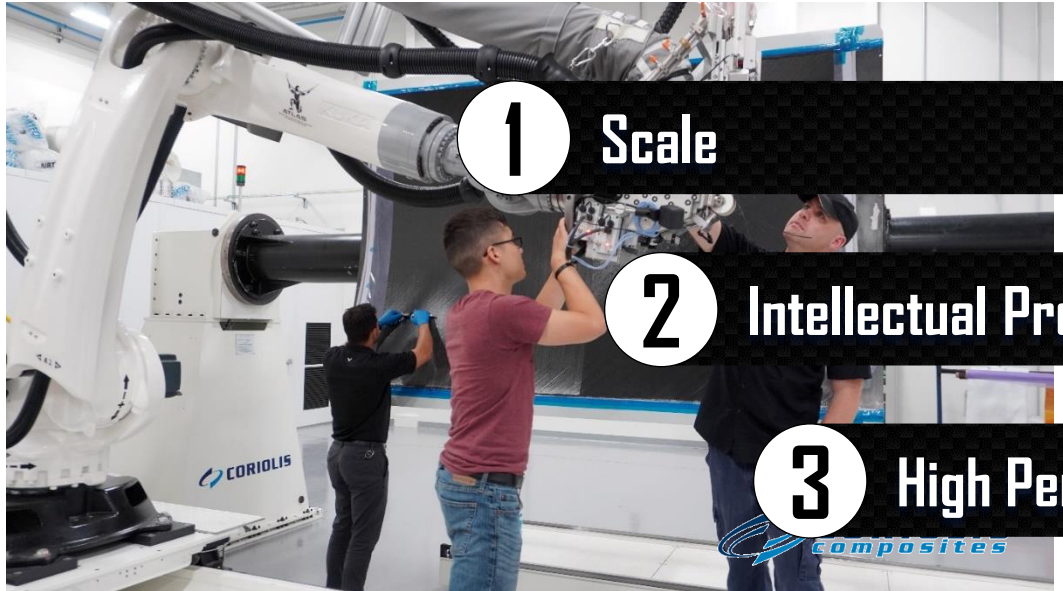


Testing
(Multi-Scale & Env.)

AS9100D
CERTIFIED
ISO 9001



Automated Manufacturing



Toolless Wing Skin Manufacturing

1 Scale

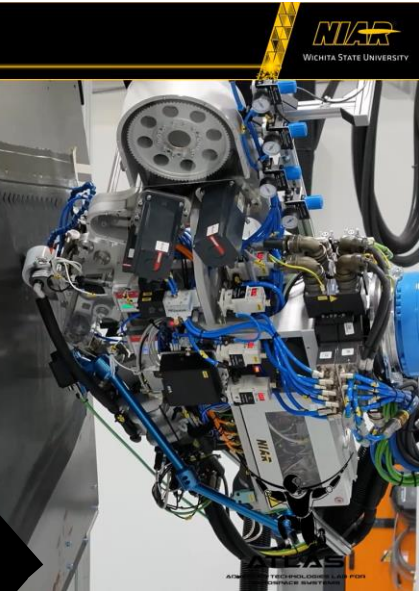
2 Intellectual Property

3 High Performing Team

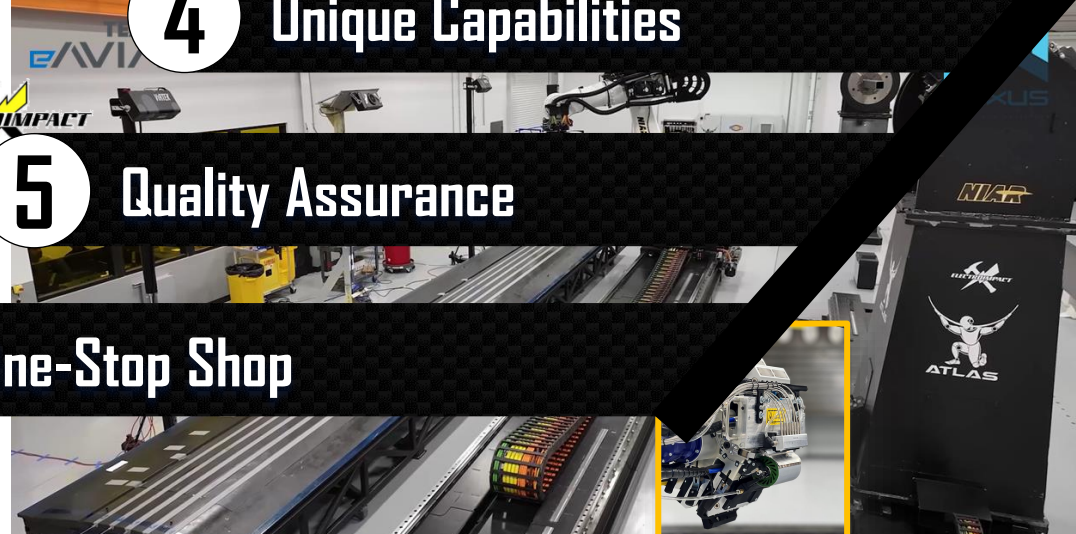
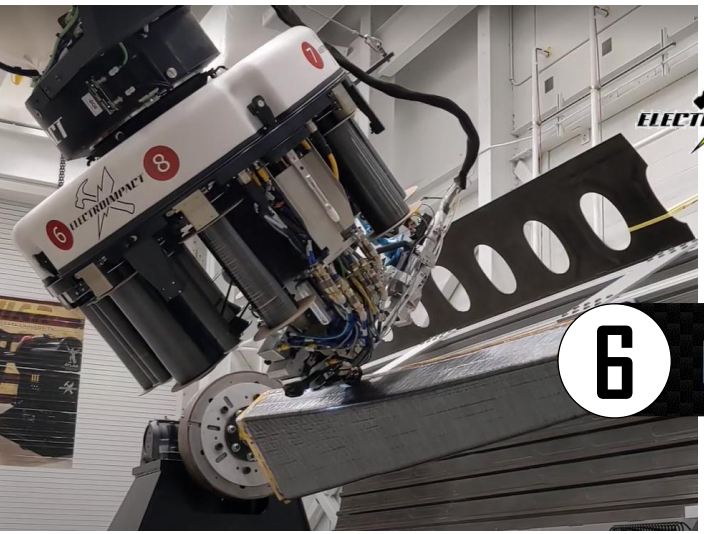
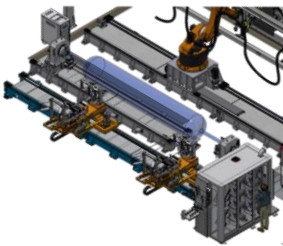
4 Unique Capabilities

5 Quality Assurance

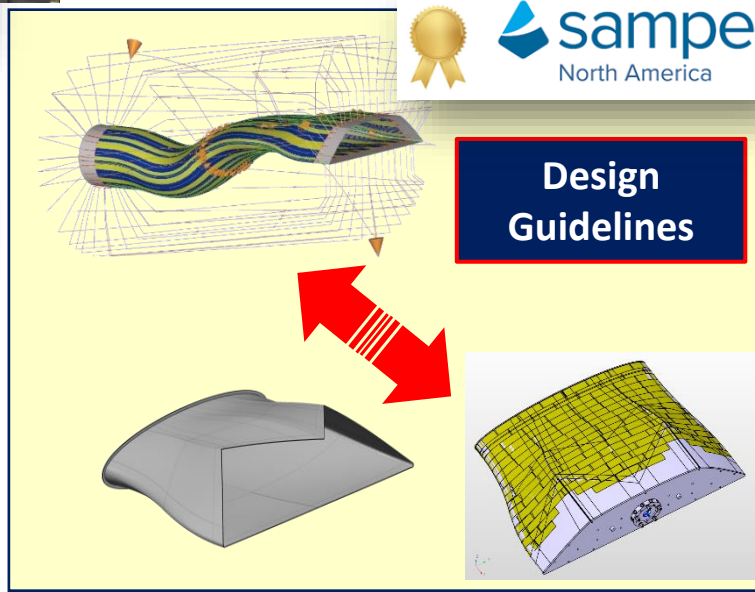
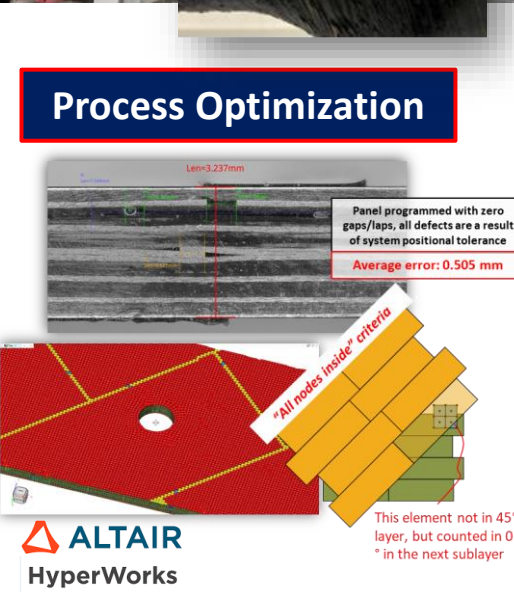
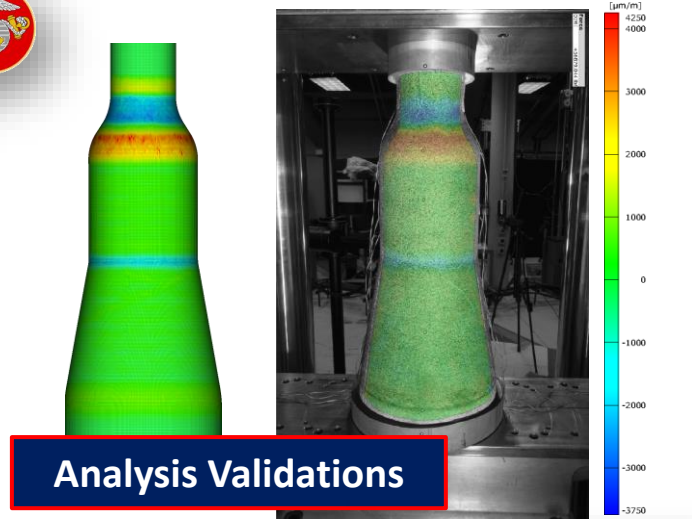
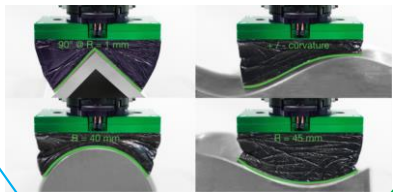
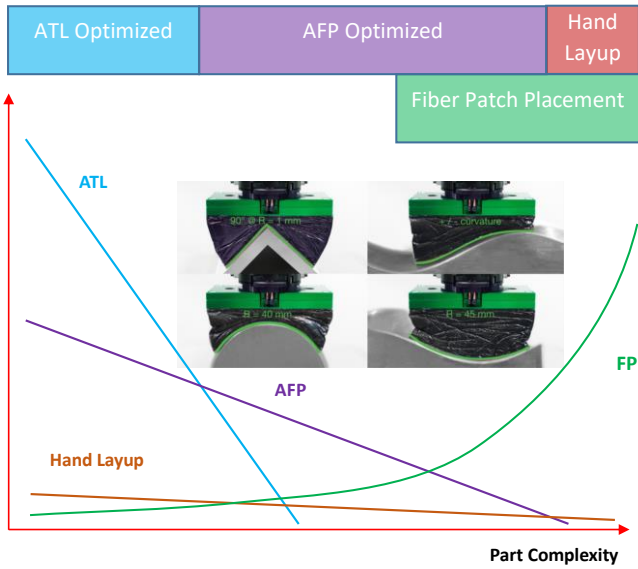
6 One-Stop Shop



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Fiber Patch Placement (FPP)



Scalable Composite Robotic Additive Manufacturing

[SCRAM++]

“Full 3D” Additive
(FFF Head)



Subtractive
(Milling Head)

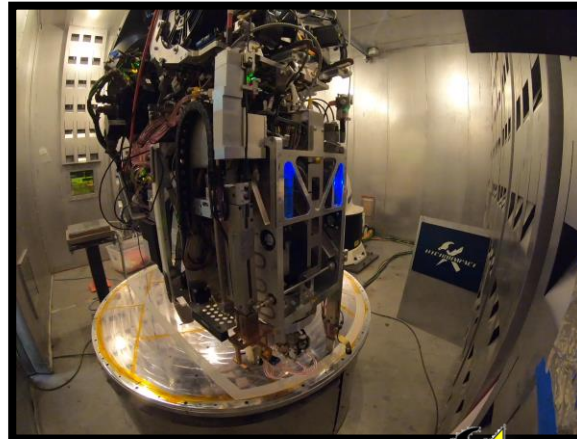


AFP
(Laser Heating for TP)

- Multiple Modular Heads
 - Dual Wire Polymer AM – FFF
 - Dual Wire Laser Metal Deposition AM
 - Pellet Extruder AM
 - Subtractive Milling Head
 - 1/8", 1/4", and 1/2" AFP Head (Laser Heating for Thermoplastics)
- 5' Diameter - 8.5' Tall Vertical Rotator
- 27' Long X-Axis
- 13' x 6.5' x 6.5' Heated Build Table with Vacuum
- 5,000 lb Horizontal Rotator
 - 7' Diameter & 16' Long Build Volume



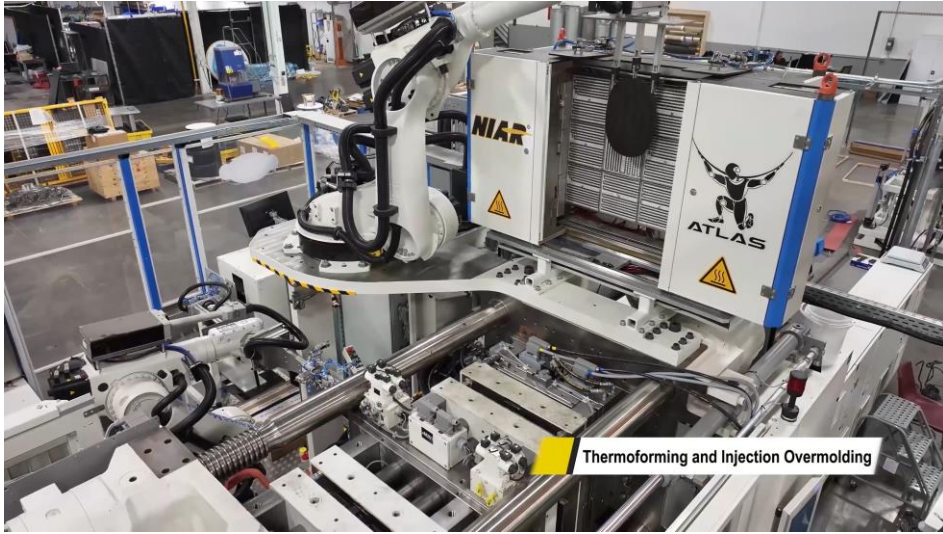
Thermoplastic Sandwich Parts



ELECTROIMPACT



Ultra-High-Rate Manufacturing



Building-Block Certification

- Material Characterization
- Design Allowables (NCAMP)
- Element to Component Testing (Full-Scale)
- Flight Testing
- **Certification**

Process Optimization

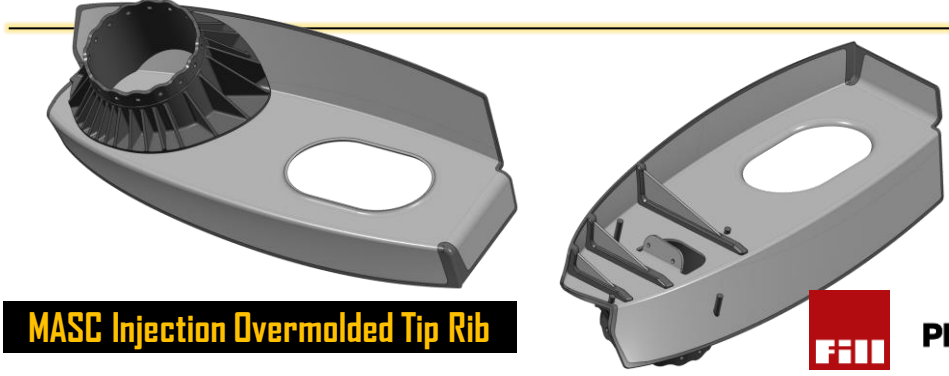
- Validated Analysis → Process Optimization
- **Material & Process Specifications**
- Workforce Development

Manufacturing Process Development

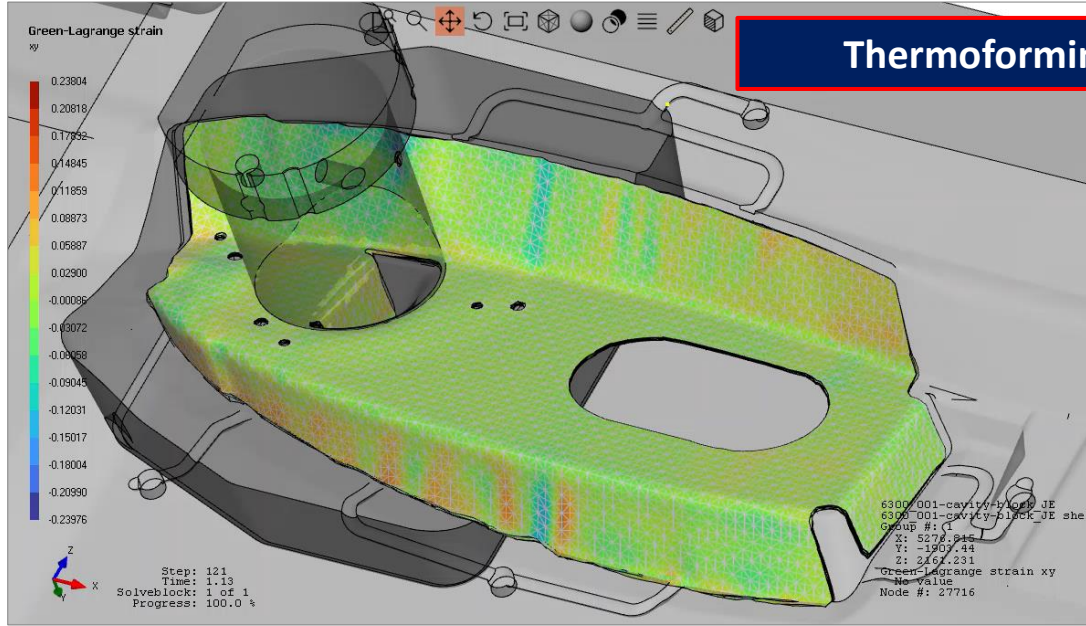
- Material Screening & Compatibility
- Process Modeling
- **Multi-Physics High-Fidelity Analyses**
- Model Validations
- Manufacturing Tool Design

Product Development

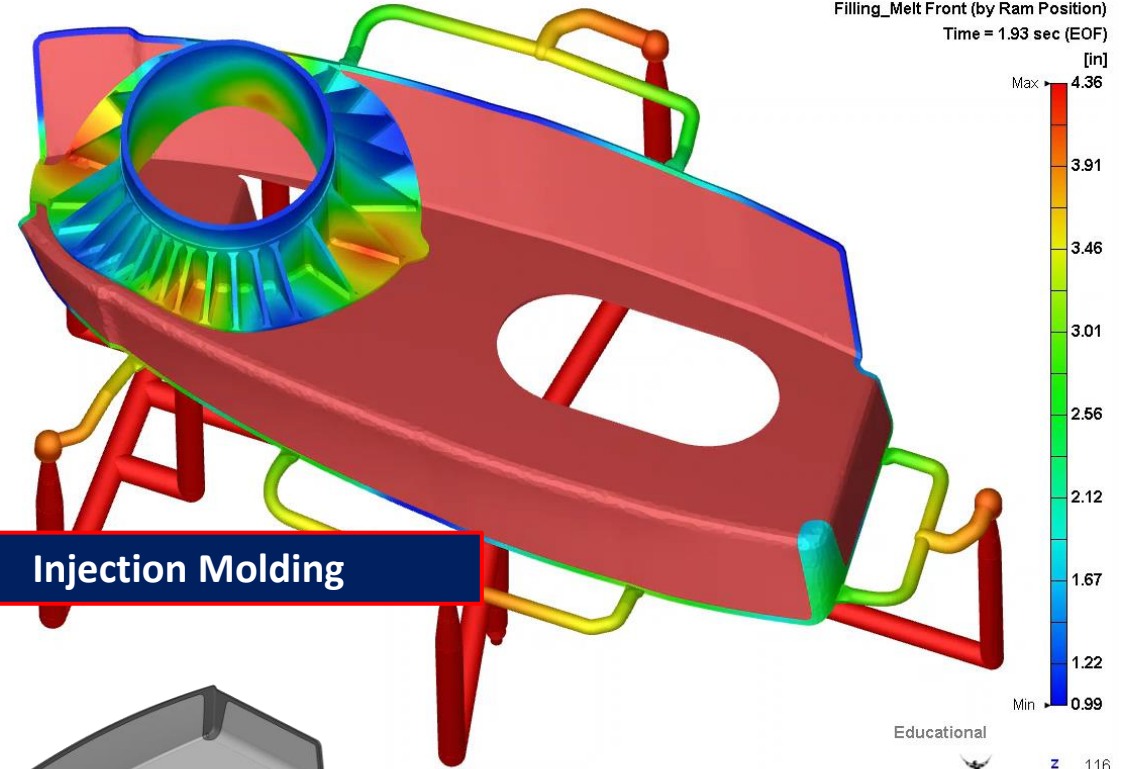
- **Part Design for Manufacturing**
- New Products
- Material Changes
- **Metal-to-Composite Conversions**
- Structural Analysis



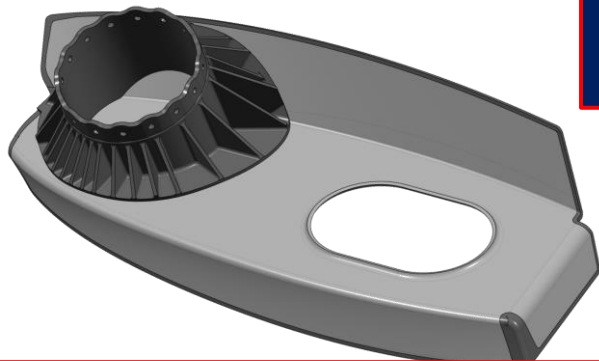
eVTOL Tip Rib Hybrid Overmolding



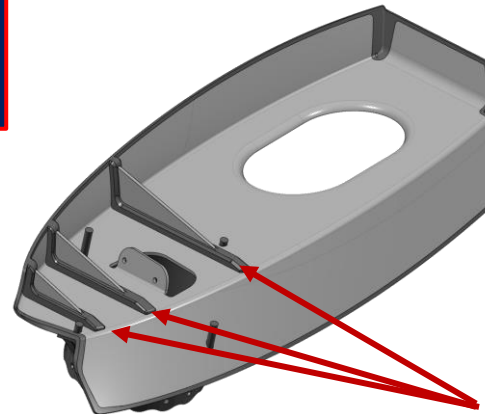
Thermoforming



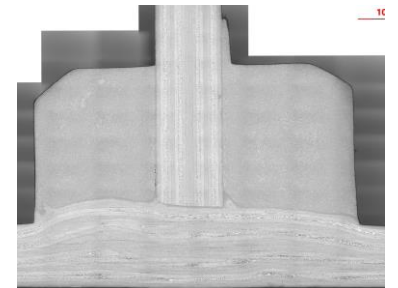
Injection Molding



Thermoplastic Overmolding



Injection Welding



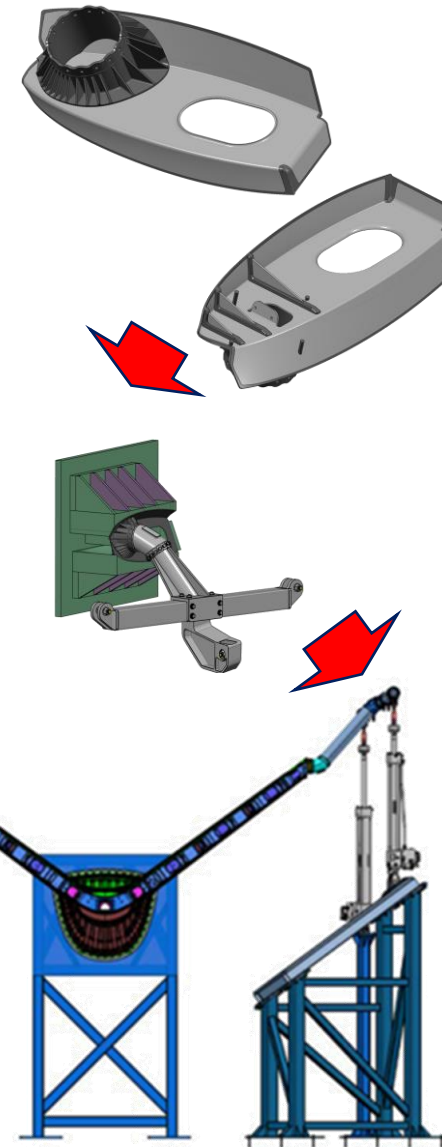
Metal: 100 hrs of CNC → Thermoplastic: 2 min Overmolding

eVTOL Tip Rib Hybrid Overmolding



100 hrs of CNC → 2 min Overmolding

Video: <https://www.youtube.com/watch?v=jV49kUNiMDQ>

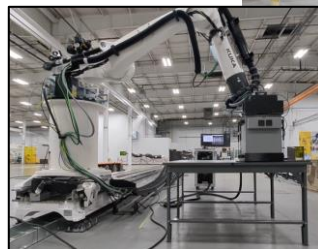


Automated Assembly-Inspection-Repair

▶▶ ANIMaL-AIR

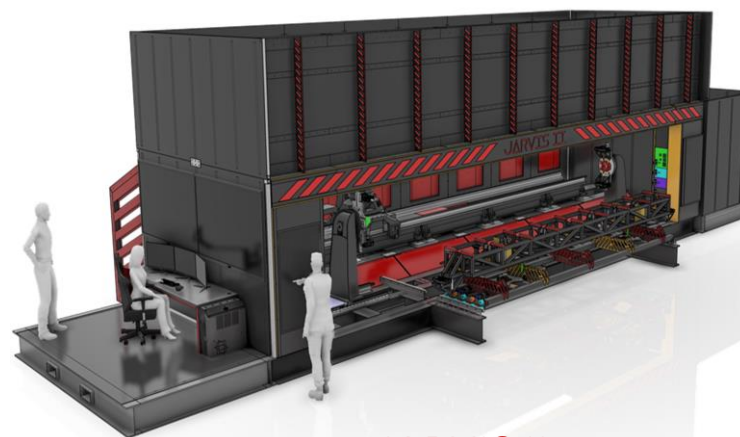
(Artificial Numerical Intelligence & Machine Learning for Assembly Inspection & Repair)

- Integrate assembly, inspection & repair
- Based on **JARVIS II** for helicopter blades



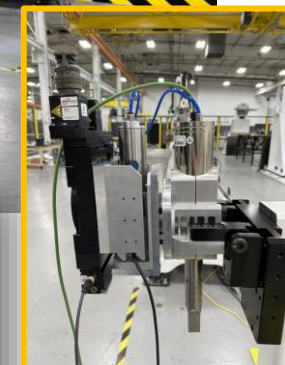
▶▶ Technologies

- Pulsed Thermography, Laser Shearography, Ultrasonic Inspection, Eddy Current
- Atmospheric Plasma, Surface Analyst,
- Laser Ablation, Milling Head
- **Ultrasonic Welding, Induction Welding, and Conduction Welding**

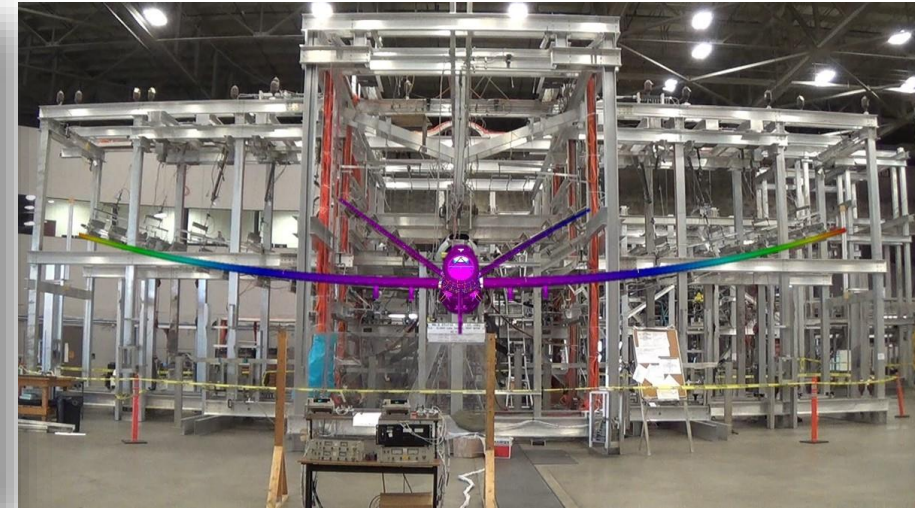


JARVIS II

(Joint Autonomous Repair Verification and Inspection System)

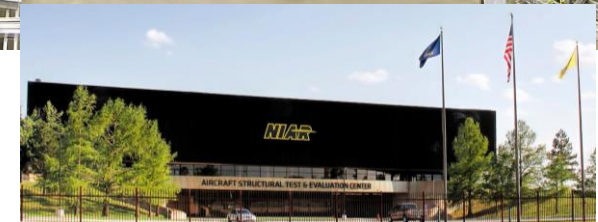


Testing - Coupon to Full-Scale Structures



- ~1,200 material property test coupons a week
- Work with FAA/DoD/Industry partners to qualify material systems
- FAA/EASA accept composite specification and design values directly from NIAR
- High temperature capability to 5000F
- Works with all material types and processes from prepregs to additively manufactured metals

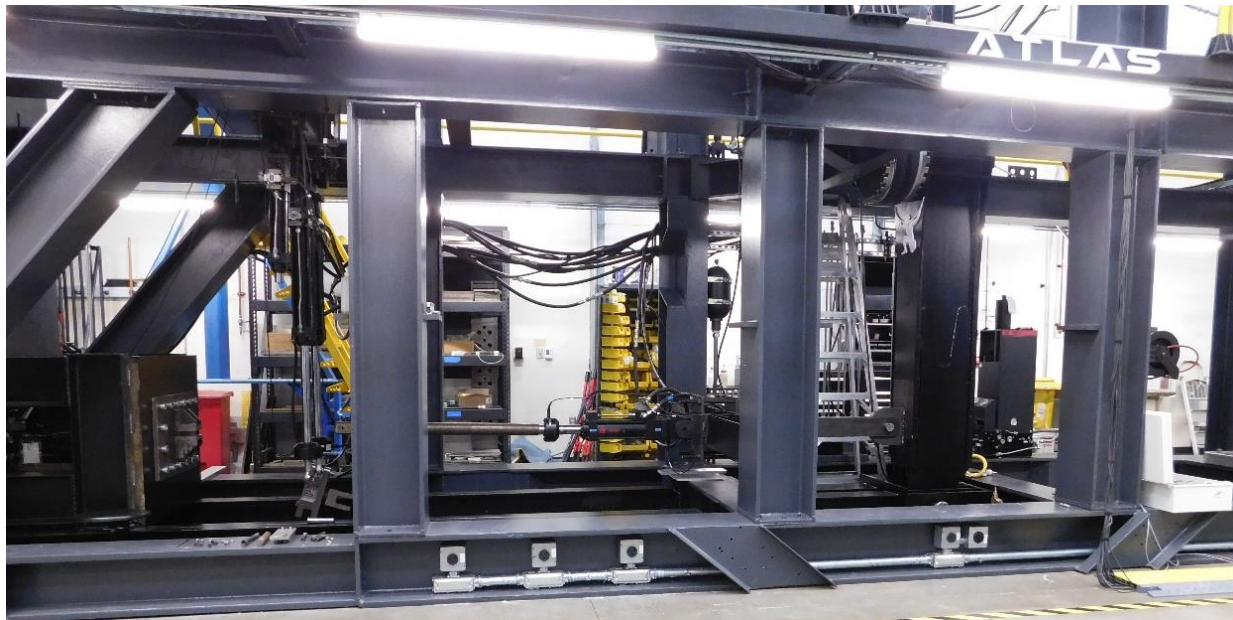
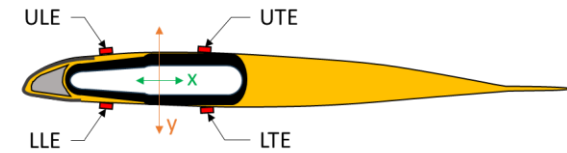
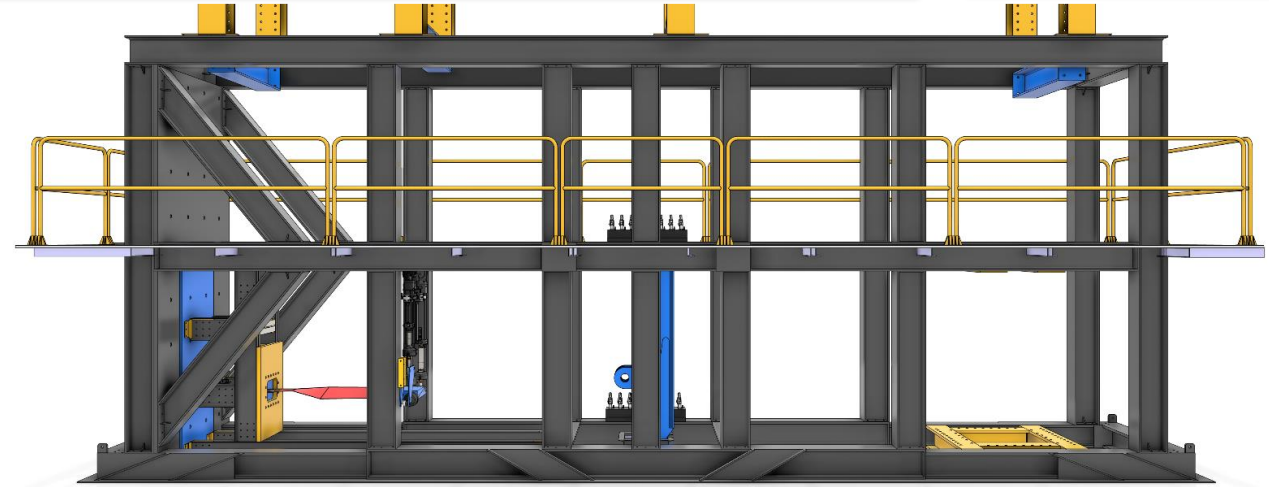
- Component to Full-Scale Test Capability
- 3rd largest test facility in the world
- Fatigue and Static Test
 - Test Plan Generation
 - Fixture Design/Fabrication
 - On-site NDI Support
 - US Citizen restricted facility
- 2-125 Cylinders per test setup
- 2000+ strain/deflection locations per setup possible



NIAR ATLAS Test Rig Development

▶▶ Loading Capabilities

- Centrifugal
- Flatwise Bending
- Torsion
- Edgewise Bending
- Optional Damper





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Thank You...