Composite Materials for Space and Aeronautics Applications

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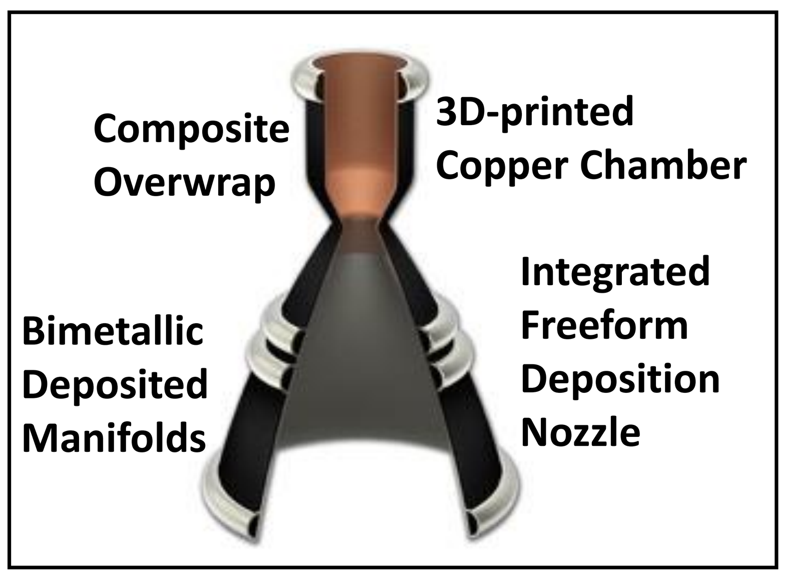
About Me

- Current Position (2018-present):
  - Materials Research Engineer
  - NASA Langley Research Center (LaRC)
- Research Focus:
  - Manufacturing and process monitoring of advanced aerospace composite structures
- Current Projects:
  - Rapid Analysis and Manufacturing Propulsion Technology (RAMPT)
  - Hi-Rate Composite Aircraft Manufacturing (HiCAM)
  - Transformational Tools and Technologies (TTT)
- Education:
  - Ph.D. Aerospace Engineering, N.C. State University, 2017
  - M.S. Mechanical Engineering, N.C. State University, 2014
  - B.S. Civil Engineering, N.C. State University, 2012

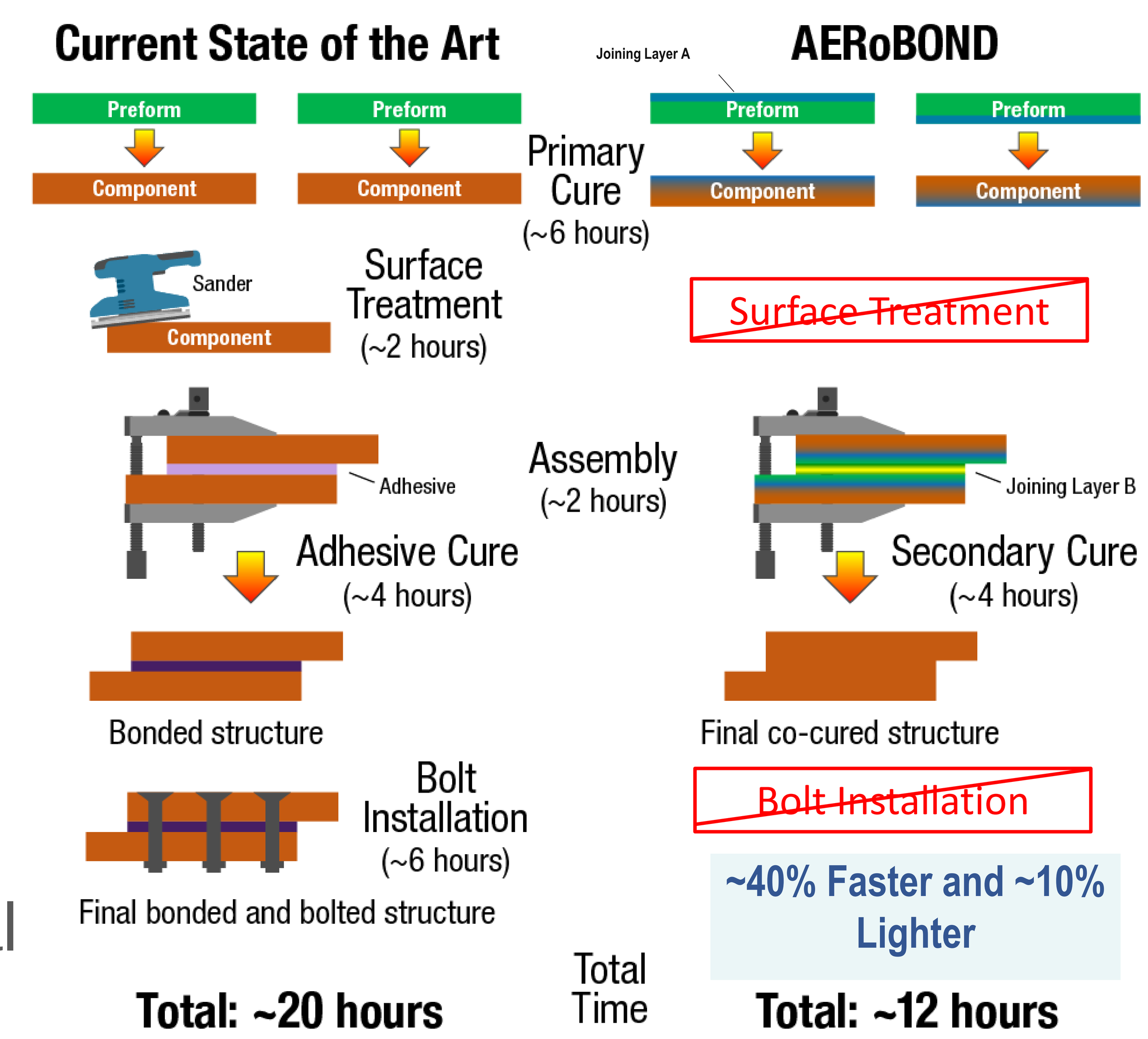
Rapid Analysis and Manufacturing Propulsion Technology (RAMPT)

- Mature novel design and manufacturing technologies to increase scale, significantly reduce cost, and improve performance for regeneratively-cooled thrust chamber assemblies.
  - Highest-cost and longest-lead components on rocket engines.
- Five Key Technologies:
  1. Powder bed fusion copper combustion chamber
  2. Freeform blown powder nozzle
  3. **Composite overwrap structural jacket**
  4. Bimetallic radial deposition for manifolds
  5. Modeling and analysis tools for additive manufacturing and regeneratively-cooled designs



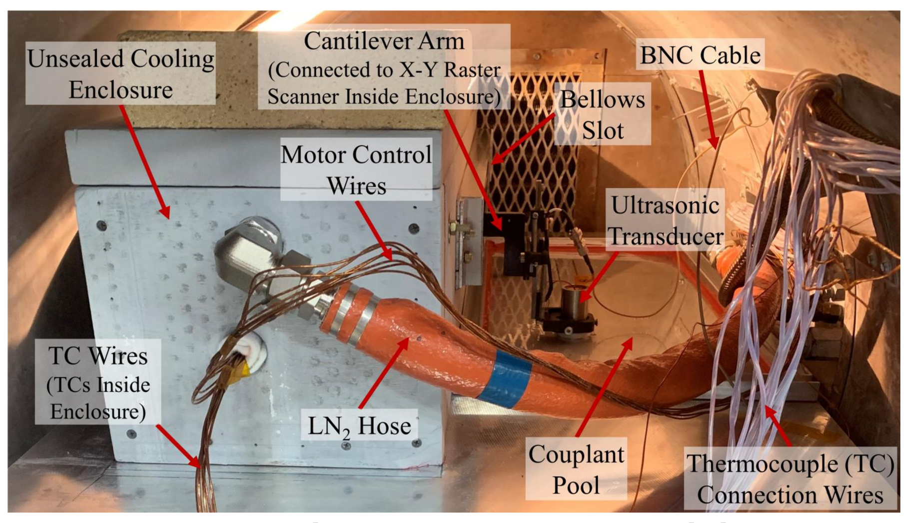
Hi-Rate Composite Aircraft Manufacturing (HiCAM)

- HiCAM aims to develop multiple composite manufacturing technologies to technology readiness level (TRL) 6-7 by 2027 to meet 80 shipsets/month (4 to 6 times current rate) for future single-aisle commercial transport aircraft.
- One of the technologies being investigated is the rapid assembly of components using a NASA-developed joining technique known as AERoBOND.
- Why is AERoBOND Transformational?
  - Eliminates the need for surface preparation.
  - Significantly reduces the reliance on redundant fasteners.
  - AERoBOND proven to have almost equivalent or improved mechanical properties to SoA.

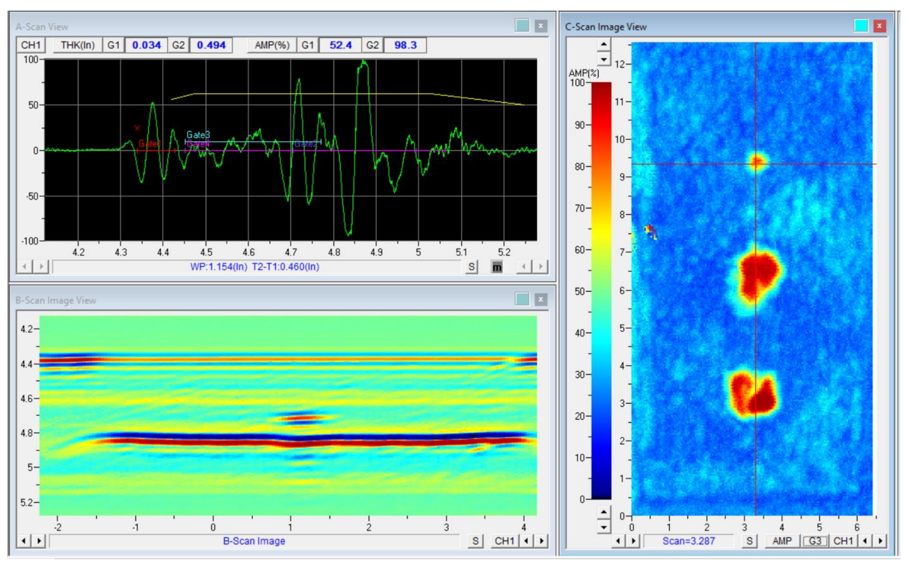


Transformational Tools and Technologies (TTT)

- Cure process monitoring of composites using first-of-its-kind ultrasonic inspection system operating inside an autoclave during cure.
- Features:
  - Defect detection, localization, and quantification during cure.
  - High spatial resolution cure monitoring of resin state and material properties.
  - Scalable from research and development to existing production lines.
- Applications:
  - Aircraft, launch vehicles, satellite buses, automotive, wind turbine blades, marine, etc.



Scanning System Inside Autoclave Prior to Cure



Ultrasonic Measurements (A-scan, B-scan, and C-scan)