

Successes & Challenges during the Development of a Dynamically Controlled Robotic Induction Welding System

Technology maturity cycle from Lab to Production

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“Future Org” Aerospace

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- Challenge of funding ideas
- Successes & Challenges in technology development case study
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Presenters

- Evan Young – Head of Engineering for “Future Org”
- John Monsees – Chief R&D Technologist for “Future Org”

About “Future Org” Aerospace



"Future Org" is a premier manufacturer of cutting-edge composite components and assemblies at all levels of complexity, with products installed on the industry's most advanced commercial and military aircraft.

As a US-based company with a global footprint of nearly 1.6M square feet of state-of-the-art facilities, "Future Org" has the capabilities and resources to solve the market's toughest challenges with **Quality Assured**.

Our Locations

RED OAK, TX



- 123-acre site
- 38 miles SE of DFW Int'l Airport
- 772,000 ft² of manufacturing space
- 350 employees
- Large Complex Structural Assembly
- AS9100D and NADCAP Certified

MILLEDGEVILLE, GA



- 165-acre site
- 93 miles SE of Atlanta, GA
- 650,000 ft² of manufacturing space
- 270 employees
- Premier Composite Manufacturing
- AS9100D and NADCAP Certified

RAYONG, THAILAND



- 44-acre site
- 62 miles from Suvarnabhumi Int'l Airport
- 150,000 ft² of manufacturing space
- 165 employees
- Low-cost Complex Composite Components
- AS9100D and NADCAP Certified

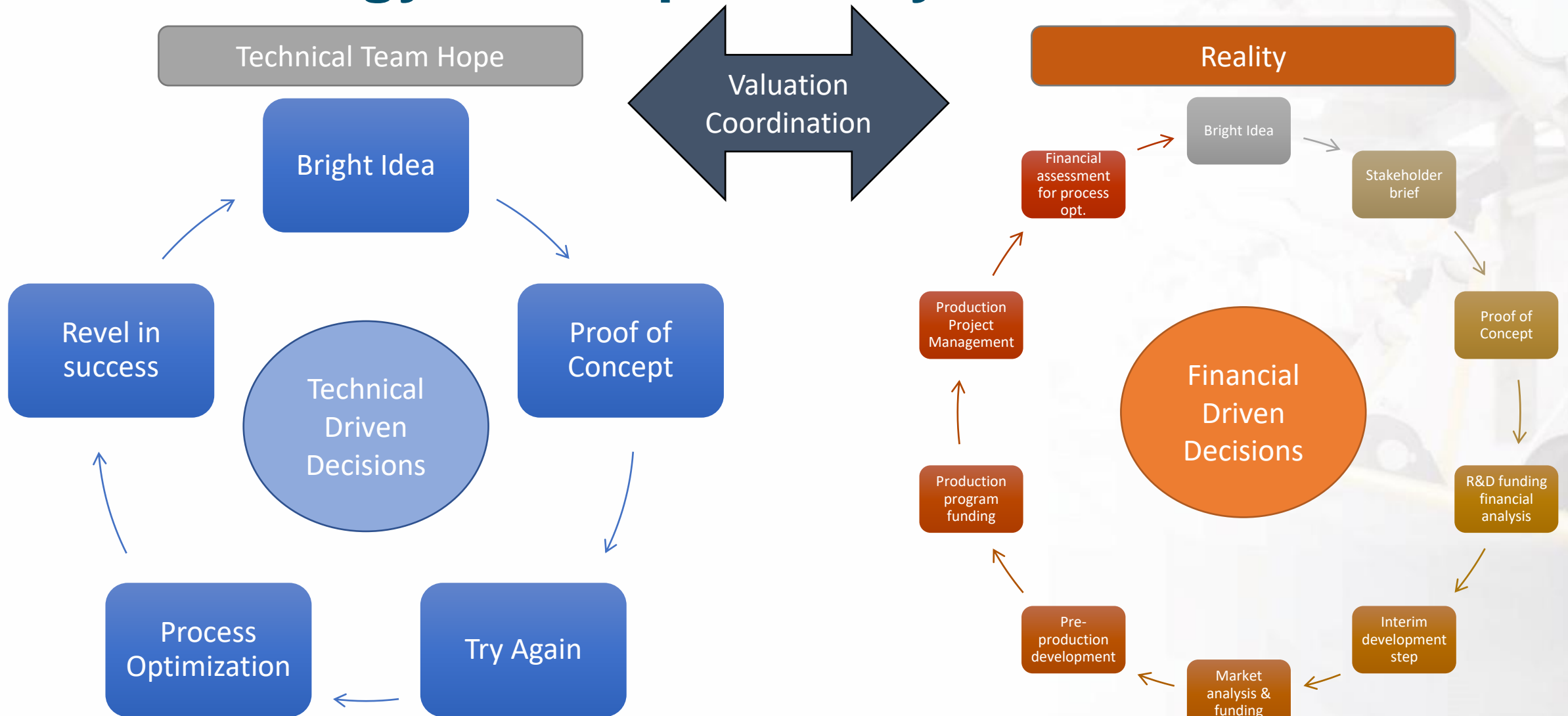


Technology Development From Lab to Production

Engineers vs. Accountants-



Technology Development Cycle



The challenge – Induction Welding of Thermoplastics to meet customer needs

- Technical Challenges
 - Is the new innovative idea technically viable?
 - How do we evaluate the technology capability
 - Can we merge dynamic induction welding and robotic process control while developing sufficient joint strength on a repeatable and inspectable basis
 - Can we reduce development time through predictive analysis supported by physical tests
- Organizational Leadership Challenges
 - Is there a market for this technology
 - What is the Return on Investment of pursuing this technology
 - What is the opportunity cost of pursuing this technology versus other potential developmental programs
 - What off-ramps exist at what investment levels

Provide customer value through technology development



Technology Development Case Study

Successes and Challenges

The Idea – Develop unique new technology that has industry demand and applications

- Thermoplastic composite unidirectional tape for induction welding
 - Reduce eddy current generation by using UD tape & localized electrical isolation
 - Leap forward industrialization of fusion welding

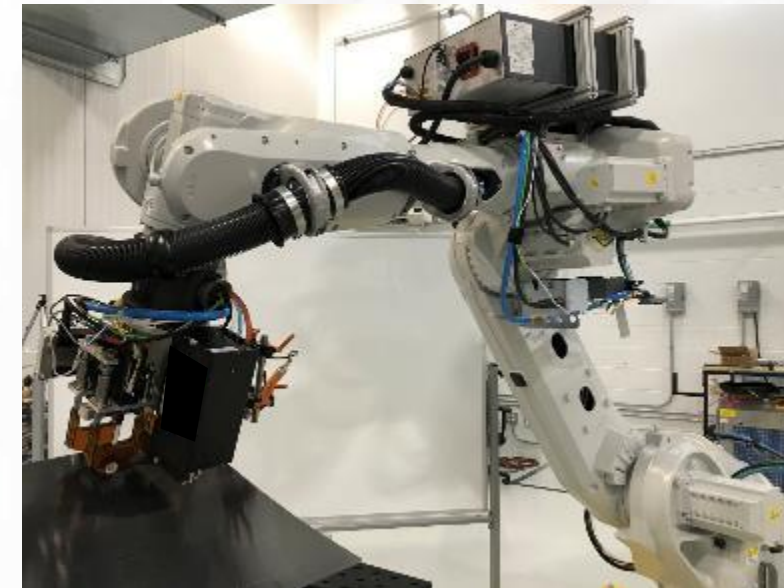
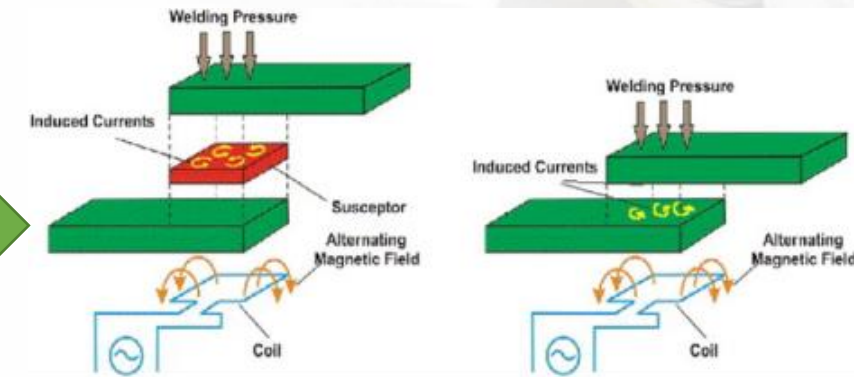
What is Dynamic Induction Welding?

Computational Electromagnetics

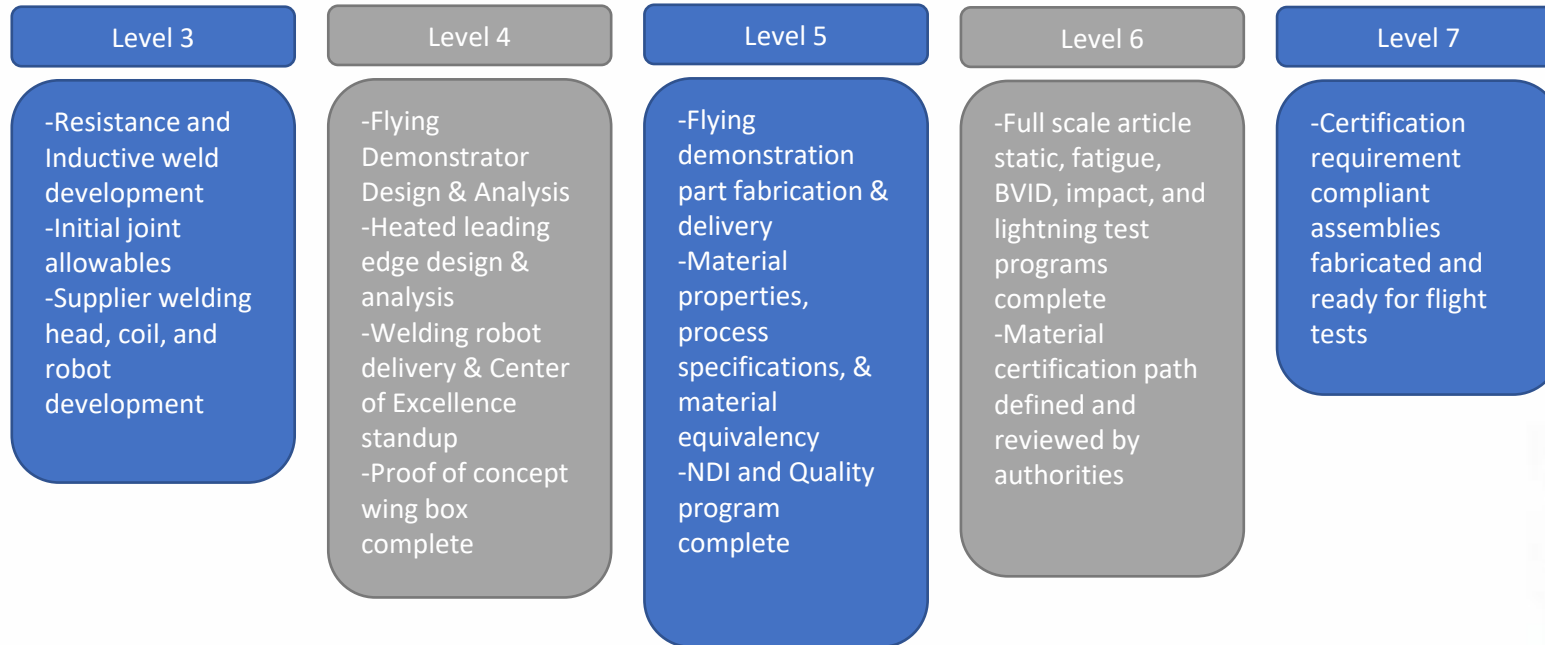
Applied Thermodynamics

Polymer Chemistry

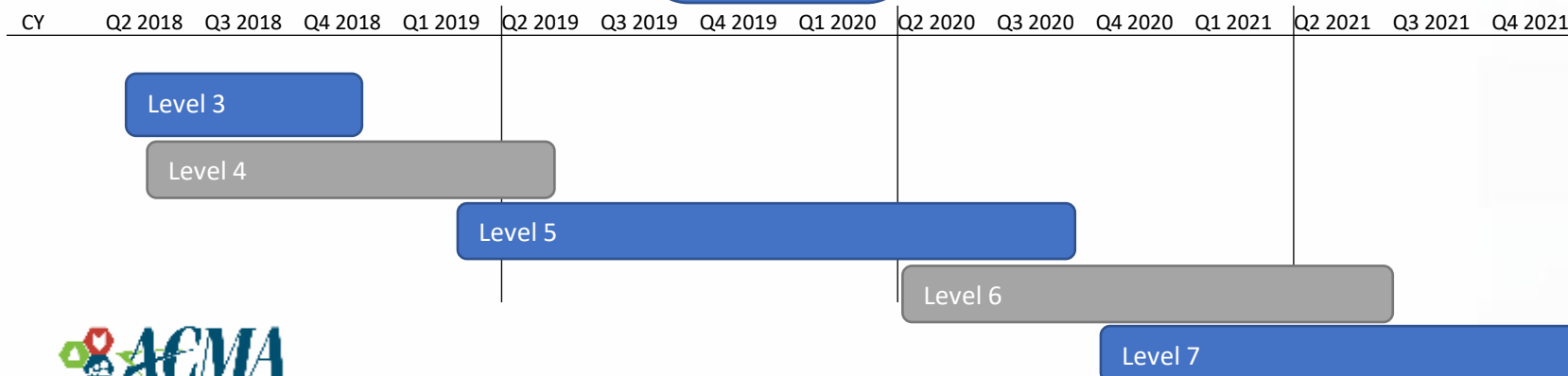
Robotic Automation & Integration



Road Map Presented Jan 2018

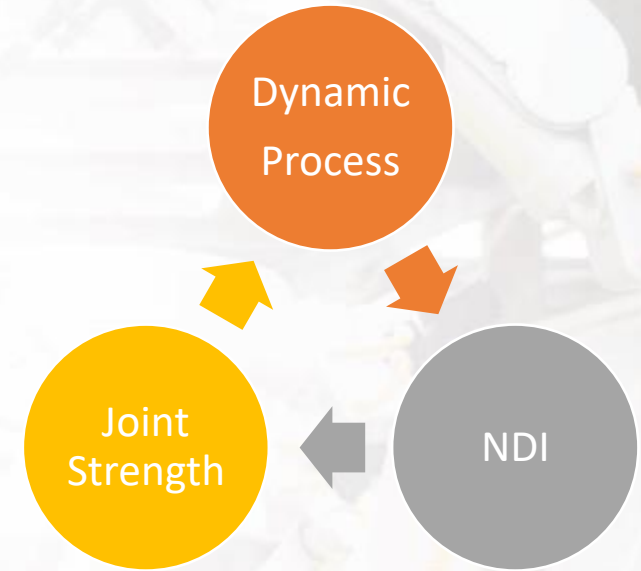
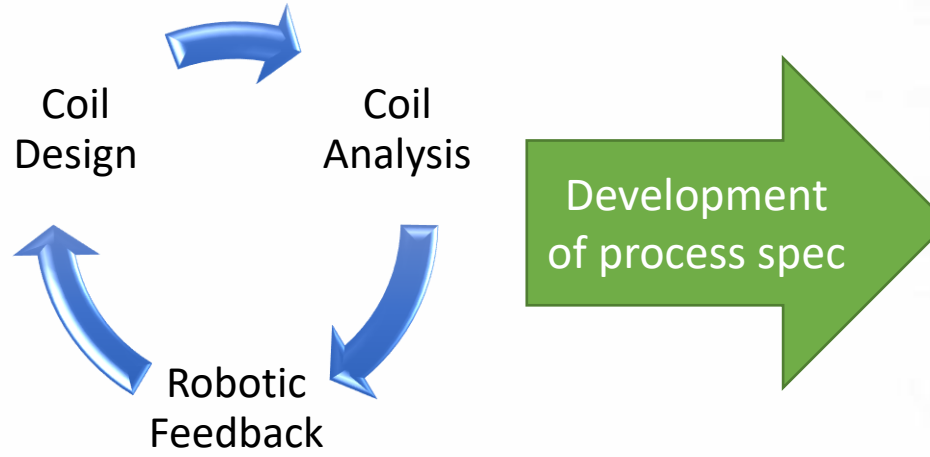
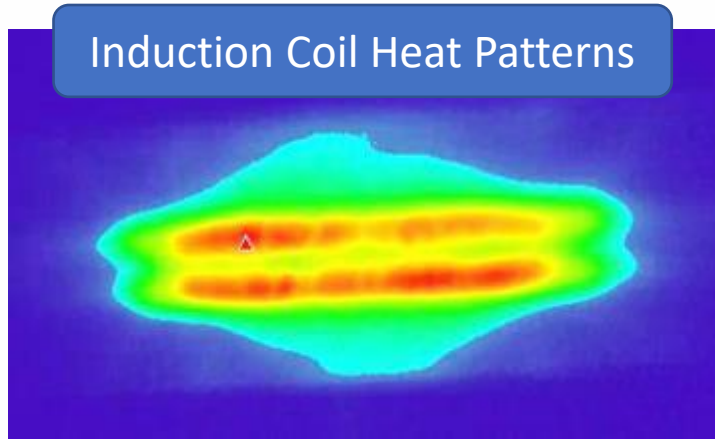


TRL	Plan	Actual
3	Dec 2018	Dec 2018
4	June 2019	Oct 2019
5	Oct 2020	Feb 2021
6	June 2021	TBD
7	Dec 2021	TBD

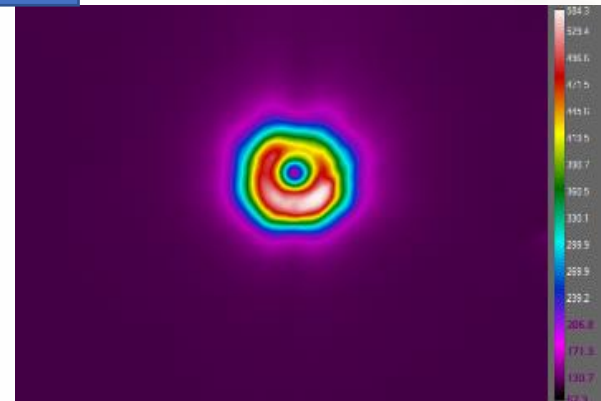
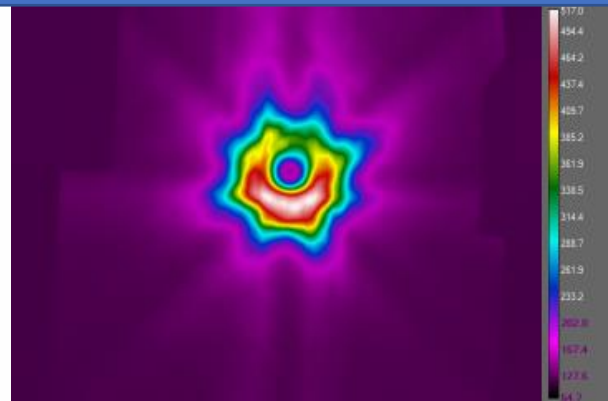
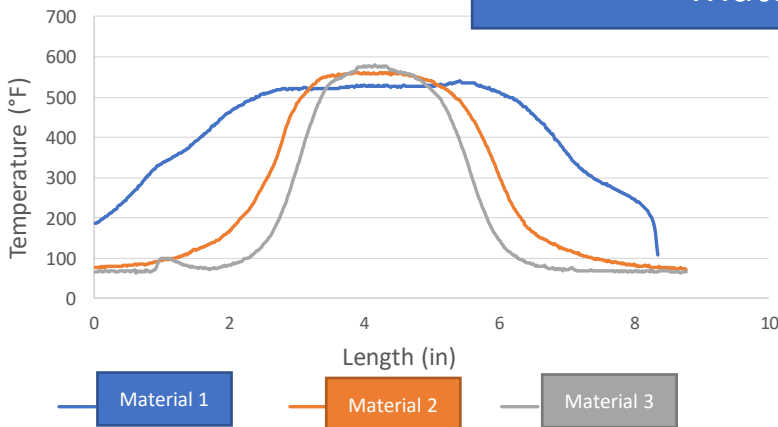


Present logical and measurable technology maturation = funding

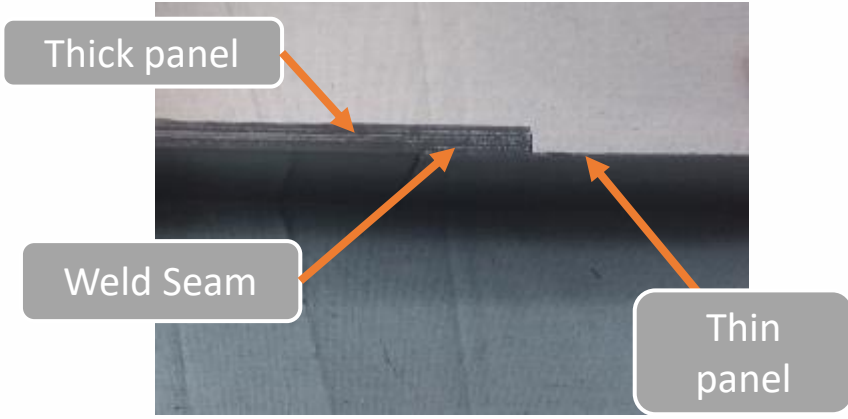
Fusion Welding technical challenges



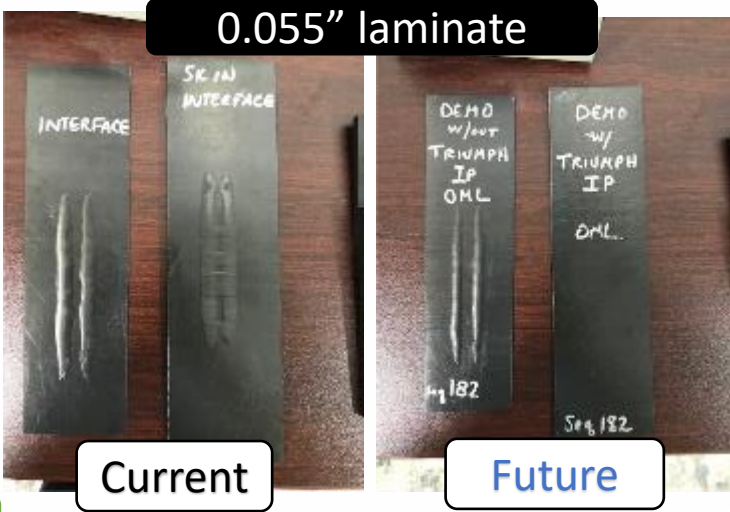
Material response evaluations



Technology Achievements



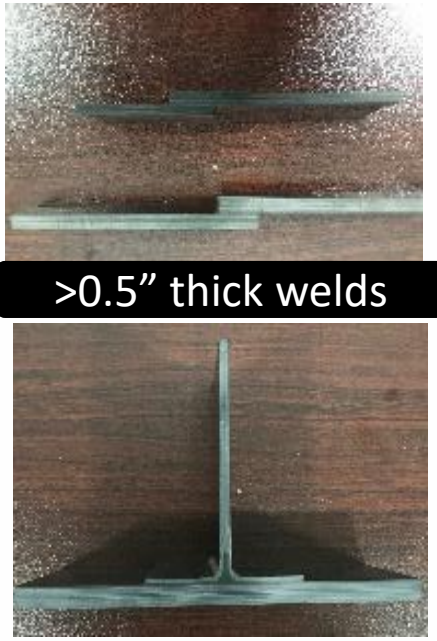
Technology Validation Q3 2018



Robotic welding head Q1 2019



Assembly proof of concept Q2 2019



TRL 5 Achievement Q1 2021



Next Steps for industrial revolution for composite structure

Is there a path to production?

Path to Production

- "Future Org" is a tier 1 structures manufacturer
- Research to date shows promise of the technology
 - Capability to weld dis-similar structure
 - Capability to weld a closed box assembly
 - Capability to demonstrate strong & repeatable joints
 - Capability to reduce manufacturing time and increase flexibility
- OEM applications and requirements are needed

Thank You

- Q&A

