KEY TAKEAWAYS/THEMES

2023 NRC Workshop On Advanced Manufacturing Technologies For Nuclear Applications

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R. Tregoning, E. Focht, A. Hull, A. Young, and M. Bayssie
U.S. NRC
Office of Nuclear Regulatory Research
Division of Engineering

SESSION 1: IMPLEMENTATION

- Several sectors are implementing AMT components to meet the needs of their stakeholders/customers which satisfies a business case
  - Improve parts availability ➔ readiness
  - Broaden supply chain
  - Manage component obsolescence
  - Optimize cost and performance
- Initial applications have been low risk to gather manufacturing and operating experience
- Safety-significant applications are proceeding cautiously
- Important for designers to be proactive and intimately involved with fabrication process, especially as safety-significance increases
- Significant opportunities exist for supporting both existing and future platforms

SESSION 2 - QUALIFICATION

- Multiple qualification pathways
  - Traditional testing based
  - Traditional coupled with better process controls and monitoring
  - Accelerated, with modeling and simulation (M&S) support (ICME)
- Initial qualification and certification (Q&C) is largely following traditional path used for conventional materials for adoption with Codes (e.g., ASME), material property databases (e.g., MMPDS) and applications (e.g., 1st article testing)
- M&S provides opportunity to both identify critical tests for optimizing/demonstrating AM systems while simultaneously accelerating Q&C
  - Building trust in M&S approaches is needed to fully realize their benefits
- There may be opportunities to leverage Q&C efforts developed (or being developed) within other industries.

SESSION 3 – PERFORMANCE

- Many studies are focusing on understanding and optimizing as-built performance to maximum AM value
  - Anisotropy considerations are a stronger consideration within this approach
- Build variability needs to be addressed at the outset and identifying critical process variables is essential to assessing differences among machines and operators
- Relevant performance metrics can be equivalent or better than conventional wrought materials
  - Important to understand and address causal factors for differences
- M&S provides a needed tool to most efficiently understanding environmental effects

SESSION 4 – CODES & STANDARDS

- Many standards already exist which support AM Qualification
  - Powder quality and handling
  - Heat treatment
  - Testing and characterization
  - Post-fabrication inspection
- Augmented or new standards needed to provide overall quality assurance
  - Identification and control of essential process variables
  - Implementation of in-process monitoring
- Incentivize knowledge and data sharing among practitioners
- Codification processes are incorporating AM but processes are lengthy by design and due to uncertainties
  - Integrated design, surveillance, and inspection strategies, coupled with targeted key testing can be used to more quickly implement AM systems