Westinghouse Advanced Manufacturing Development & Needs

Advanced Manufacturing & Supply Chain Innovation Nuclear Energy Leadership Summit and Showcase
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Advanced Manufacturing Program Objectives

• Improve Westinghouse competitiveness, through the development and implementation of advanced manufacturing (AM) technologies
  • Drive cost reductions in Westinghouse manufacturing
  • Enable new products and services that provide innovative customer solutions
  • Leverage external funding sources and collaborative development
Additive Manufacturing / 3D Printing Development Efforts
Additive Manufacturing Development Objectives

• **Exploit the benefits of Additive Manufacturing**
  – Producing components with: Powder Bed Fusion, Binder Jetting, and Directed Energy Deposition AM technologies
  – Complex components required for performance gains
  – Obsolete and high value / lead-time components
  – Next gen plant components - SMR, LFR, …
  – Prototypes, mockups, jigs / fixture, tooling, etc.

• **Enable AM for key nuclear applications**
  – Material development & testing for in reactor use
  – Supporting the development of codes and standards

• **Development Needs:**
  – Additional material development and testing to support the development of code & standards
  – Cost effective, large scale equipment
  – AM suppliers with Nuclear programs
Component Development Efforts

- **Prototype components for advanced reactors and concept components**
  - AM design, manufacturing and testing

- **AM to enable performance gains**
  - Microchannel Heat Exchangers
  - Hydrogen Igniters
  - Impellers
  - Fuel Support Structures

- **Replacement Parts**
  - Developing reverse engineering / commercial dedication process for high value / high lead-time components
    - 3D laser scanning →
    - 3D model →
    - AM sand molds →
    - traditional casting
AM Materials Development

• Utilizing laser powder bed fusion AM technologies
• Currently the nuclear industry has limited irradiation performance information for AM materials
• 316L and Ni Alloy 718 material testing
  – Produced AM block and micro-tensile test specimens
  – Completed post-irradiation examination (PIE) at Westinghouse Churchill laboratory
• Zr development and AM feasibility
  – Collaborated with ATI, EOS and EWI to produce AM material
  – Currently irradiating specimens at MIT
  – DOE NSUF funding was awarded for PIE
• Thimble Plugging Device (TPD) selected as the first component to place in a commercial reactor
  – Currently completing manufacturing qualification
  – Targeting 2018 delivery
Hot Isostatic Pressing (HIP) & Diffusion Bonding Development Efforts
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• **NEER Project (Innovate UK-funded effort)**
  – Focused on reusable tooling, HIP development and demonstration of nuclear components, and UK supply based development
  – Producing demonstration components
    • Reactor Vessel Internals (RVIs): Quickloc Upper Support Assembly
    • Control Rod Drive Mechanisms (CRDMs): Guide Funnel Extension
    • Valves: 4” Motor Operated Gate Valve Body and Bonnet

• **Producing multiple prototypes / mockups for next generation plants**

• **Development Needs:**
  – Additional material testing to expand ASME code
  – Large scale HIP capabilities
Advanced Welding Development Efforts
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• **Collaborating on welding development efforts**
  – Hot wire laser welding (HWLW)
  – Hybrid laser GMAW
  – Laser and diode laser cladding
  – Partial vacuum electron beam (EBW)
  – Spray processes

• **Using emergent welding technologies to solve welding issues and reduce manufacturing costs**
  – RCP, RVI and CRDM cost reduction opportunities
  – Module fabrication
  – Weld distortion reduction and modeling

• **Development Needs:**
  – High efficiency, defect free welding processes
    • Reduce component and module fabrication time
  – Process automation and in-process inspection
Advanced Manufacturing Development Opportunities

• Collaboration with industry, universities and national labs on advanced manufacturing technology development efforts
  – Pursue external funding

• Coordination of nuclear advanced manufacturing technology, material and codes and standards development efforts
  – Nuclear advanced manufacturing roadmap development
  – Technology prioritization
  – Stakeholder involvement

• Development of advanced manufacturing suppliers with quality programs and nuclear culture

• Workforce development: design / manufacturing engineering, technology specialists, technicians,....
Questions?