

Advanced Methods for Manufacturing

Dirk Cairns-Gallimore

DOE Federal Manager: AMM program

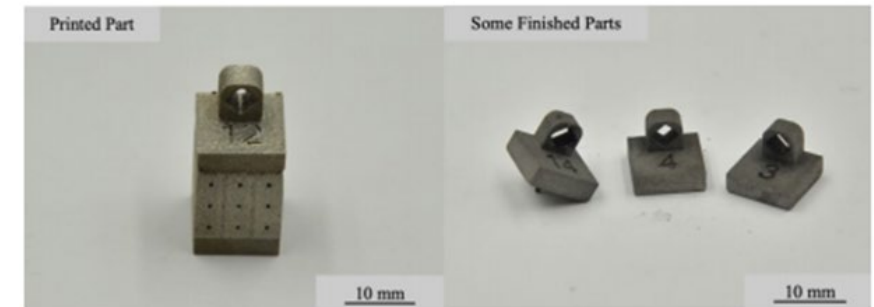
Advanced Methods for Manufacturing (AMM)

Vision

- To improve and demonstrate the methods by which nuclear equipment, components, and plants are manufactured, fabricated, and assembled by utilizing 'state of the art' methods

Goal

- Accelerate innovations to reduce cost and schedule for new nuclear plant construction
- To make fabrication of nuclear power plant (NPP) components faster, less expensive, and more reliable



Dissolvable support structures (University of Pittsburg)



SMR Reactor Pressure Vessel (EPRI)
One-half lower head: Forge and electron beam weld



Factory and Field Fabrication Techniques

High Speed & High Productivity Welding
Welding technologies for large weldments and fabrications

Dissimilar Materials Joining
Robotics and advanced automation



Modular Manufacturing

Fabricated forgings
Factory fabrication of piping systems

PM-HIP



Advances in Manufacturing Processes

Additive Manufacturing of metals
Surface engineering

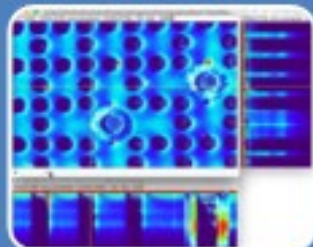
Metamorphic Manufacturing
Advanced sensors



Improved Concrete Inspection, Acceptance, and Construction Methods

Advances and innovation in high strength concrete and rebar
NDE and field inspection for first time quality assurance and repair

Improved methods to facilitate the curing of concrete



New Advanced Manufacturing Technologies for Qualification and Certification to Accelerate Licensing

Advanced Manufacturing Methods Qualification approaches
Verification and validation technologies
Advanced Manufacturing Codes and Standards

Big data
Digital Thread and Digital Twin



Advanced Integrated Fuel System Concepts

Advanced thermal processing approaches

Integrated manufacturing methods

NEET-1 FOA Technical Focus Areas

Eligible to Lead: University or National Laboratory
(Up to 3 years and \$1,000,000)

NEET 1.1 MODULAR ADVANCED MANUFACTURING APPROACHES

- Pre-fabrication and pre-assembly approaches for manufacturing technologies can dramatically improve the competitiveness of new reactor designs.
- AMM program sought proposals that can enhance the economics and flexibility of the advanced manufacturing technologies:
 - develop and mature manufacturing technologies that facilitate modular designs and the construction thereof.
 - enhancement of the modular manufacturing technologies, including decreased necessity of field modifications.
 - Example: emerging powder metallurgy techniques for fabricating nuclear components offer many benefits, including part consolidation, reduced requirements for field fabrication and welding, and the potential replacement of forging for pressure vessels.

NEET-1 FOA Technical Focus Areas

NEET 1.2 NEW ADVANCED MANUFACTURING TECHNOLOGIES FOR QUALIFICATION AND CERTIFICATION TO ACCELERATE LICENSING

- Major opportunities for AMM processes and digital workflows to develop and support validated qualification routes moving beyond code case approvals.
- Applications are sought for:
 - developing or utilizing enabling technologies through combinatorial fabrication-modeling and digital to allow designers, manufacturers, and the supply chain to interact to enable increased data accuracy and accelerated qualification of a final product.
 - Specific attention to lessons-learned from other industries as justification for the proposed approach(es), will be crucial for successful proposals.
 - Developing new digital thread and digital twin visualization and planning technologies is also included.
 - Proposals focusing on a specific aspect of a new qualification or licensing approach should clearly justify future integration for a complete strategy.

NSUF-1.2 FOA Technical Focus Area

- Irradiation testing of AMM materials and components to demonstrate performance
 - ❖ Specific irradiation effects on fabrication parameters will be considered
- This funding supports the preparation and analysis of the AMM materials and samples, but it does not fund new AMM materials research and development activities

Planning for irradiation testing

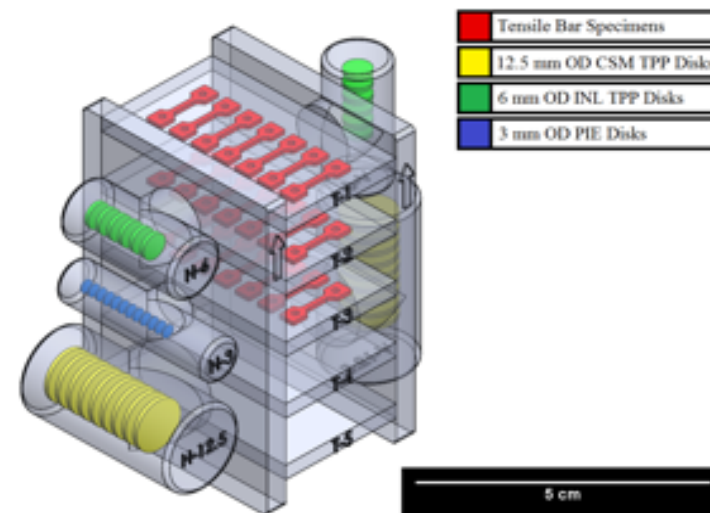


Figure 1. Test article and test specimen sample locations.

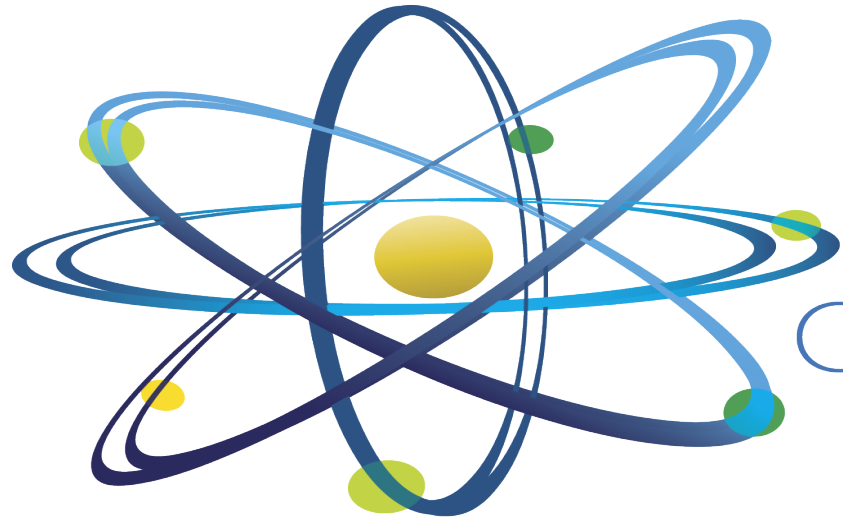
Summary of Expectations

- The technologies developed will decrease the cost of manufacturing and fabrication of components for nuclear power plants or improve the cost and schedule for construction times.
- The development of products and components will be able to gain acceptance by the appropriate regulatory or standard-setting bodies.
- Specific products should be capable of being **deployed** in commercial nuclear power plants.

Contact Information

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Questions?



Clean. **Reliable. Nuclear.**