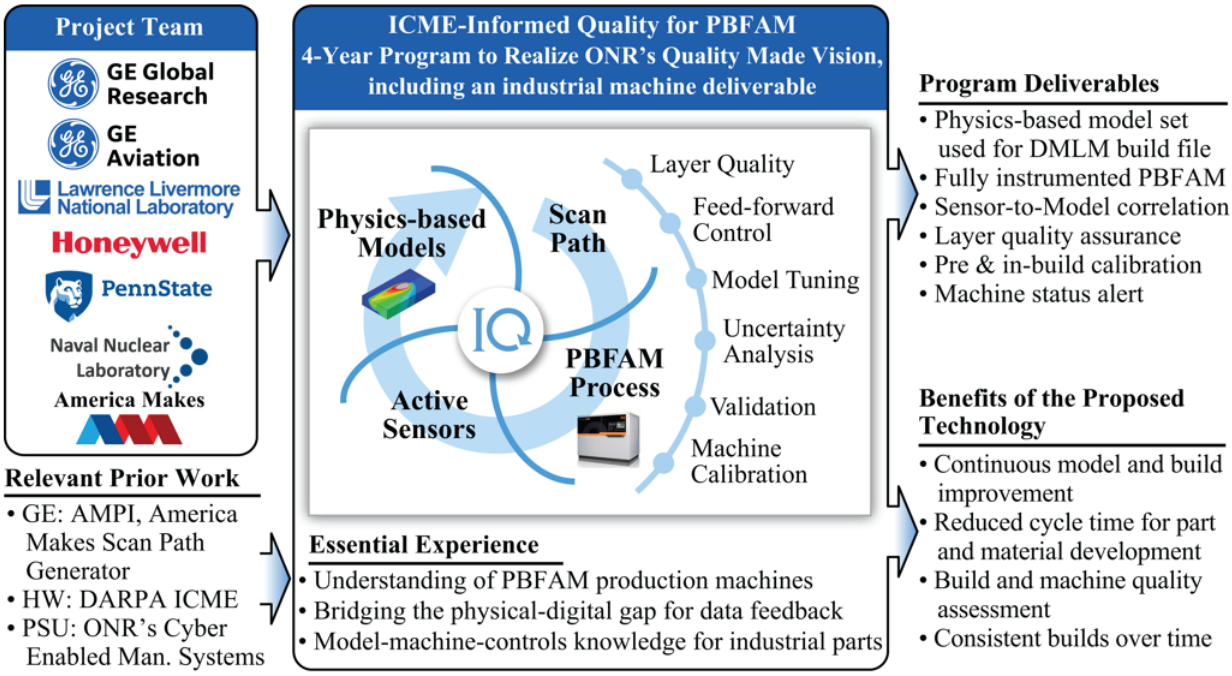
ONR Quality Made – Informed Quality



An industrialized and intelligent metal powder bed fusion additive manufacturing system that links on-machine sensor output with physics-based models to provide greater process control over a complex part geometry.

PROBLEM

Powder bed fusion additive manufacturing (PBFAM) is ideally suited for new novel parts or for applications involving low volume, out-of-production, or long lead time components. To increase adoption for production on a larger number of components, two challenges must be met: qualifying material and parts in a timely manner, and maintaining a consistent build process throughout the entire geometry.

OBJECTIVE

The goal of this program is to generate an optimized scan file for a PBFAM machine environment to create high quality parts. The proposed effort plans to establish an Integrated Computational Materials Engineering (ICME) Informed Quality System for PBFAM machines, where the combination of models, sensors, analytics, and controls yields a smarter machine capable of converging to better solutions while minimizing design and build iterations. This is accomplished by drawing from existing efforts conducted by the team members to develop and mature a suite of AM software and hardware technologies. The technologies used are being assessed for inclusion in an industrial additive machine to be delivered to the US Navy.

AMERICA MAKES TECHNOLOGY DEVELOPMENT ROADMAP

This project aligns to:

PROCESS

ASTM PROCESS CATEGORY: Powder Bed Fusion

EQUIPMENT: Powder Bed Fusion AM Machine

MATERIAL: IN 625

TECHNICAL APPROACH

Through the creation of an intelligent and interconnected suite of models, scan path strategies, sensors, and controls, the Informed Quality program provides the tools to print parts consistently with desired resolution and properties, while reducing development cycle time. Leveraging existing developments in ICME models, in-process sensors, and advanced control systems, the demonstration and deployment of the Informed Quality technologies are to be completed on a commercial additive printer to better enable adoption.

The development effort builds on TRL3+ Modeling and Simulation methods from GE Research (GER), Honeywell, and Lawrence Livermore National Laboratory (LLNL) with on-machine sensors from The Pennsylvania State University and GE, providing an integrated analysis of part and process. The effort uses Intelligent Feed-Forward control strategies developed by LLNL to reduce defects and maintain material quality for a complex part. The design and prototype of an additive system and integrated sensors are being developed by GER, with GE Aviation providing a primary means of transitioning the results of this effort into an industrial manufacturing environment.

PROJECT START DATE

July 2018

EXPECTED END DATE

April 2020

EXPECTED DELIVERABLES

- Software suite to provide corrected and compensated scan files for robust material and part characteristics
- Demonstration of the technology on a relevant Navy complex part
- Delivery of a commercial additive printer incorporating the capabilities developed on this program delivered to a US Navy site

FUNDING

$9M total project budget

PROJECT PARTICIPANTS

Project Principal:
GE Global Research

Other Project Participants:
Lawrence Livermore National Laboratory
Pennsylvania State University
America Makes
Honeywell
GE Aviation

Public Participants:
U.S. Department of Defense

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