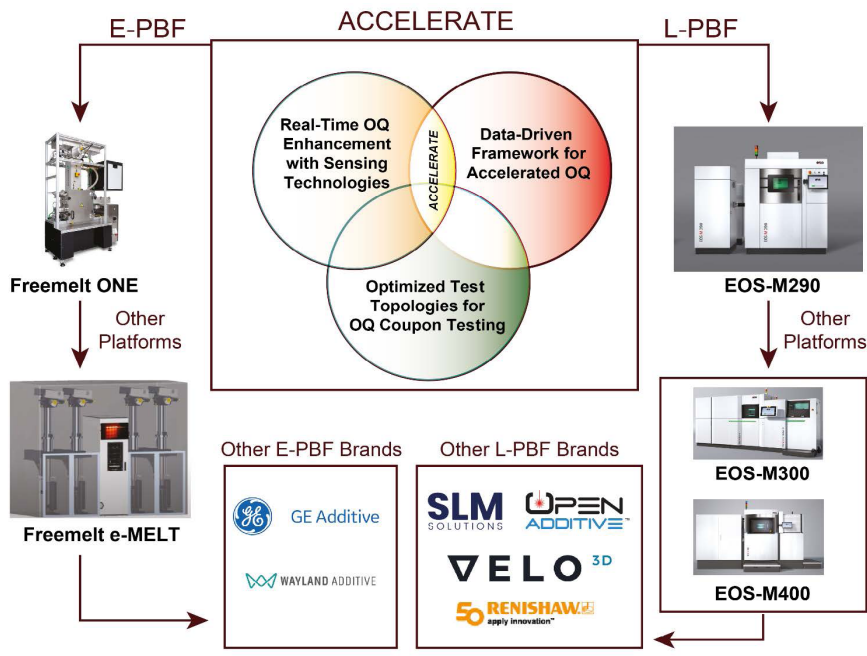


Accelerating Control and Certification: Enhancing Laser-PBF and Electron Beam-PBF Operation Quality via Real-time Analytics, Technological Integration, and Experimental Platforms for a Resilient Supply Chain (ACCELERATE)



Developing the ACCELERATE framework for compatibility: E-PBF and L-PBF, various platforms, diverse brands.

PROBLEM

Metal additive manufacturing (AM) has revolutionized industrial sectors, notably aerospace applications, by enabling intricate and efficient production of customized metal components. However, the validation and qualification process, especially operational qualification (OQ), presents a significant challenge as it involves rigorous verification and validation of processes and procedures such as machine calibration, statistical validation via mechanical testing, process failure mode and effect analysis (PFMEA), powder feedstock control, facility and machine peripheral controls, software configuration and version control, operator training, and more. This complexity makes it both costly and time-intensive.

OBJECTIVE

The team aims to establish a reliable OQ framework for electron beam power bed fusion (E-PBF) and L-PBF, in line with the Air Force's specifications, DoD Instruction 5000.93. To achieve this, the action plan involves collecting and analyzing relevant OQ data, refining the OQ testing process, and setting up a data-driven framework for post-build sample analysis. This comprehensive approach should provide guidance and valuable insights to the Air Force, Air Force Research Laboratory (AFRL), and Department of Defense (DoD), to help them make informed decisions and reduce time and money spent on the OQ.



**AMERICA MAKES
TECHNOLOGY
DEVELOPMENT
ROADMAP**

This project aligns to:



PROCESS

**ASTM PROCESS
CATEGORY**
Powder Bed Fusion

EQUIPMENT
EOS M290, EOS M300,
EOS M400, Freemelt ONE
Electron Beam, Freemelt
e-MELT Electron Beam

MATERIAL
Ti-6Al-V4
Grade 5

TECHNICAL APPROACH

Building on insights derived from data analysis and stakeholder engagement, the project team will construct a comprehensive OQ framework that addresses both E-PBF and L-PBF technologies. This framework is designed for compatibility and seamless integration across diverse platforms and brands. Beyond mere guidelines, it will encompass precise procedures and best practices for the OQ of platforms responsible for producing end components, particularly for Air Force hardware applications. Through the presentation of a well-structured methodology, the proposed OQ framework will facilitate a comprehensive assessment and validation of the reliability, safety, and performance of E-PBF and L-PBF systems. It will serve as an asset for industry adopters, regulatory agencies, and other relevant stakeholders. Ultimately, its accessibility will accelerate the adoption and widespread integration of E-PBF and L-PBF systems thereby enhancing the mission readiness for the Air Force and boosting the U.S. supply chain robustness.

PROJECT START DATE

March 2024

EXPECTED END DATE

March 2026

EXPECTED DELIVERABLES

- Development of a data-driven operational qualification (OQ) schema, addressing existing gaps and leveraging EOS experience and data for popular alloys
- Demonstration pathways to validate the qualification schema, involving different machine types, software versions, and operators
- Technology transition of qualification requirements and data to U.S. Air Force and supply chain partners
- Final written technical report and technical data package

FUNDING

\$1,333,000 total project budget

(\$666,500 public funding/\$666,500 private funding)

PROJECT PARTICIPANTS

Project Principal:

Texas A&M University (TAMU) Engineering Experiment Station (TEES)

Other Project Participants:

Addiguru
Beehive Industries
EOS
University of Michigan

Public Participants:

U.S. Department of Defense