

Delta Qualification Innovation (DQI) for Ti-6Al-4V Laser Powder Bed Fusion



EOS M290 Laser Powder Bed Fusion (LPBF).

PROBLEM

Additive manufacturing (AM) machines and materials qualification are major barriers to broad AM adoption. Generating the requisite data and models requires significant resources to produce statistically significant data. This qualification process requires generating test coupons under a controlled process and testing and analysis of the resulting data. These processes are then “frozen” with no changes to key process variables allowed. Standard-based guidance does not exist for requirements when a process change is needed. This greatly inhibits the agility of AM processes to respond to changes in the technology or supply base, allowing only one path to implement change to a qualified process — a total requalification, which may cost more than \$3M per machine/material combination and take several years.

OBJECTIVE

This project will demonstrate a delta qualification approach for statistical equivalency of static allowable data and develop a statistical database and framework that provides A/B basis allowables. Specimens will be fabricated at a new supplier through the application of a geometry-driven approach that leverages existing Joint Metal Additive Database Definition (JMADD) data.



**AMERICA MAKES
TECHNOLOGY
DEVELOPMENT
ROADMAP**

This project aligns to:



PROCESS

**ASTM PROCESS
CATEGORY**
Powder Bed Fusion

EQUIPMENT
EOS M290

MATERIAL
Ti-6Al-4V

TECHNICAL APPROACH

Northrop Grumman Corporation (NGC) will develop material and process specifications and a process control document leveraging its previous data. The delta qualification build layout and test matrix will then be generated to guide test sample builds. These builds will be fabricated on an EOS M290 machine at Oerlikon and Castheon. Major process and parameter changes will be incorporated into the test matrix. All build samples will be tested and characterized. Finally, the data collected will be used to generate A/B basis allowables and actively maintained via a data management plan.

PROJECT START DATE

May 2023

EXPECTED END DATE

May 2025

EXPECTED DELIVERABLES

- Conventional test matrix and test plan
- Cite standards and material/process specifications used on project
- Powder reuse strategy
- Statistically based mechanical property curve (B-basis)
- Final report

FUNDING

\$1,397,073 total project budget

(\$900,000 public funding/\$497,073 private funding)

PROJECT PARTICIPANTS

Project Principal:

Northrop Grumman Corporation (NGC)

Other Project Participants:

3Degrees

Castheon

National Institute for Aviation Research (NIAR)

Oerlikon

Pinnacle X-Ray Solutions

Public Participants:

U.S. Department of Defense