Correlation of Process-Induced Defects and Detectability Models for Monitoring-Guided Inspection of Large-Scale Laser-Wire Additive Manufacturing

Statement of Work (SOW)

The National Aeronautics and Space Administration (NASA), specifically Marshall Space Flight Center (MSFC) has a need for defect characterization and statistical modeling with an independent laboratory to develop detectability models for Large-Scale Laser-Wire Additive Manufacturing (LWAM).

The SOW is as follows:

1. The vendor shall receive all physical LWAM Inconel 625 (IN625) samples and associated raw in-situ monitoring data provided by NASA.
2. The vendor shall have experience in non-destructive evaluation (NDE), statistical modeling, defect characterization, and in-situ monitoring data integration for additive manufacturing.
3. The vendor shall process the raw multi-modal monitoring signals to extract features associated with defect formation.
4. The vendor shall track all samples in preparation for sectioning and characterization.
5. The vendor shall selectively section the large-scale builds into sub-scale coupons to capture varying defect states.
6. The vendor shall perform high-resolution Computed Tomography (CT) scanning and targeted metallography on the samples to capture and validate Lack of Fusion (LOF) defects.
7. The vendor shall develop statistical models to estimate the spatial likelihood of defect formation based on the extracted monitoring features and experimental data.
8. The vendor shall develop Probability of Detection (POD) models aligned with MIL-HDBK-1823A to quantify the defect detection capability of the in-situ monitoring system.
9. The vendor shall provide a report detailing recommendations for targeted, monitoring-guided inspection strategies based on the developed models.
10. The vendor shall grant the Government unlimited rights to all data, reports, and algorithms generated under this SOW.
11. The vendor shall coordinate with NASA MSFC personnel for peer review and co-authorship on any public documentation or journal articles developed from this data prior to external publication.

Shipping

1. Contractor shall ship returned samples to:
   Marshall Space Flight Center
   Central Receiving, Bldg. 4631
   [redacted]
   Huntsville, AL 35812

Deliverables

1. Defect characterization data (CT defect maps and metallography reports).
2. Processed monitoring-derived feature dataset (e.g., CSV, HDF5) and associated extraction scripts.
3. Spatial defect likelihood maps and POD models.
4. Final test report detailing the framework for monitoring-guided inspection.
5. Technical white paper summarizing the methodologies employed.
6. Monthly technical and financial status reports.

Period of Performance

The tasks shall be conducted over the course of approximately six (6) months, with the duration beginning upon initiation of contract award.