

AMNOW Challenge for Digital Thread Analysis for Build Improvements- Phase 2

1.0 Introduction

As Metal Additive Manufacturing is advancing from primarily a prototyping process to being used in serial production, the process and material data generated are critical to parts qualification. The National Center for Defense Manufacturing and Machining (NCDMM) through their AMNOW Program seeks to leverage artificial intelligence and data analytics to a significant data set of Additive Manufacturing (AM) digital thread data to discover trends and insights into the repeatability and predictability of the Laser Powder Bed Fusion (LPBF) process. These data sets encompass over thirty-six (36) 316L powder AM builds of parts and eight hundred (800) coupons, collected across three (3) machine models, six (6) machines, three (3) facilities, and two (2) heat treatments and other post processes.

Phase 1 of this AMNOW Metals Challenge (ASOW-154) covers the digital thread data analysis to create insights, detect anomalies, and predict properties and changes. This effort is to build upon those findings to improve the outcome of two final AMNOW program builds.

2.0 Scope/Project Objectives

NCDMM is engaging with select AMNOW Metals Challenge Phase 1 Project Agreement Holders (PAH) to continue maturing their efforts in applying digital analytics and artificial intelligence to AM. The PAH will leverage the insights gathered during Phase 1 to collaborate with three (3) parts suppliers to improve the outcome of the final two (2) AMNOW builds and test results.

In AMNOW Metals Challenge Phase 2, PAH is to:

- a) Share information and collaborate directly with NCDMM parts suppliers.
- b) Use insights from AMNOW Metals Challenge Phase 1 to improve the results of the final two (2) AMNOW builds.
- c) Deliver up to 10-page summary report and 30-minutes presentation with key findings, analysis, recommendations for improvement, predictions of build results, and comparison of actual results.

3.0 Applicable Documents and Data Provided

The following documents contain requirements and practices to be followed in executing this ASOW. In case of conflict, the order of precedence is: 1) Project Agreement 2) This ASOW, 3) Documents referenced in this ASOW, 4) Referenced ATDP, 5) Documents referenced in the applicable ATDP. Applicable documents are the same as ASOW-154, with ASOW-154 provided for completeness.

<u>Document #</u>	<u>Document Name</u>	<u>Version</u>
ASOW-154	AMNOW Challenge for Digital Thread Analysis	Current

4.0 Requirements

PAH is responsible for the execution of all of the following activities, including the acquisition of any equipment or software and management of their personnel and subcontractors.

4.1 Kick Off Meeting

- 4.1.1** Attend a web Kick Off meeting to introduce PAH and NCDMM personnel, discuss desired project outcomes and address any issues or questions. Additional data from subsequent builds may be available.

4.2 Share Initial Findings with Suppliers

- 4.2.1** Attend a web conference with each of three AMNOW AM builder to present the insights gathered from Phase 1 data analysis.
- 4.2.2** Provide written improvement recommendations to the AM Builders applicable to the final two parts and coupon builds. Reach agreement with each AM Builder of improvement recommendation(s) to be implemented.

4.3 Collaborate on the Approach

- 4.3.1** Continue discussions with AM Builder through multiple web conferences to discuss potential ways to achieve mutually agreed upon desired improvements.

4.4 Predict

- 4.4.1** Update and utilize algorithms created under Phase 1 to predict key results of the final two (2) builds. Present finds to NCDMM during a web conference.

4.5 Analyze Build Data

- 4.5.1** Download and analyze digital thread data of the final two (2) builds employing Phase 1 algorithm. Identify any anomalies or defects. Note: PAH will be required to execute AMNOW certification of destruction/deletion of data upon project completion.

4.6 Compare Predictions

- 4.6.1** Compare predictions versus actual build data results, noting any differences. Develop hypothesis for the differences or failures.

4.7 Report Findings

- 4.7.1** Findings will be compiled in a 10-page (or less) summary report including recommendations for further process, data, or analytical improvements. Summary report may be published on the America Makes Digital Storefront or equivalent.
- 4.7.2** Compile and present a summary to the Evaluation Board of findings suitable for 30 minutes, including reserved time for questions.
- 4.7.3** Compile and present summary of findings (15-30 minutes) suitable for public review during an America Makes event. Presentation must be submitted to NCDMM for approval and to obtain US Army approval for release. This may also be published on the America Makes Digital Storefront or equivalent.

5.0 Coordination Meetings

PAH shall participate in the following coordination meetings, at a mutually convenient time:

- 5.1.1** (4.1.1) Kick-off – 1 hr. Web meeting
- 5.1.2** (4.2/4.3) Collaborative Web meetings with up to three of the following suppliers: Penn United, ATI, or Innovative 3D Manufacturing – five to seven 1 hr. Web meetings
- 5.1.3** (4.7.2) PAH Final Presentation of findings to Evaluation Board – 30 Min Web meeting
- 5.1.4** (4.7.3) PAH Final Presentation of findings at America Makes Event – 30 Min Web or in-person meeting

Deliverables

Line Item	SOW Reference	Title of Deliverable	Data Rights
1	4.1.1	Kickoff Meeting	Limited
2	4.6.1	Submit summary report	Unlimited
3	4.7.2	Presentation of findings to Evaluation Board	Unlimited
4	4.7.3	Presentation of findings at America Makes event	Unlimited

6.0 Version History

Version	Description of Change	Approval	Date
A	Initial Release	A.Totin	7 FEB 2022