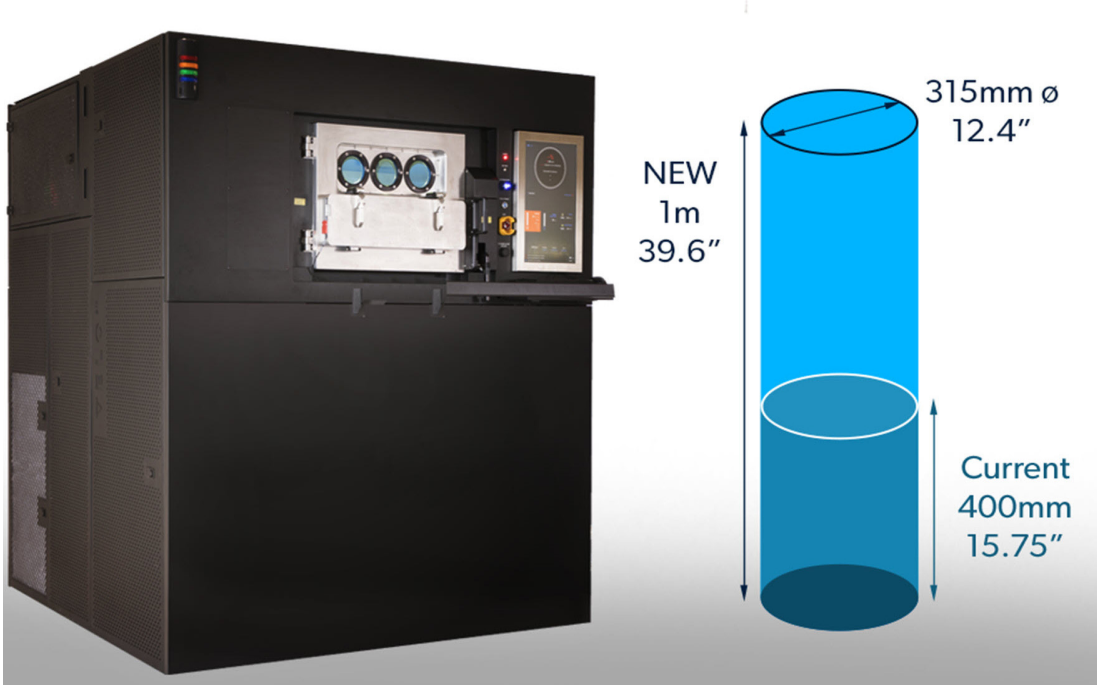
PROJECT SUMMARY 5526

Demonstration of an Approach to Manufacturing Taller AM Parts than Previously Achievable



Velo3D Sapphire 1MZ printer with 1m tall build volume

PROBLEM

Complex internal flow paths have been a strong driver in the growth of metal additive manufacturing, and specifically laser powder bed fusion (LPBF). As the flow paths become more complex and the parts grow in size, however, there are current technology limitations that hinder this growth. Specific shortcomings in the current implementation of LPBF include the inability to print low-angle overhangs without support; the dimensional accuracy and consistency of given geometries, especially in the case of thin walls and tall (i.e. long) builds; and the height of a part that can be built in a single print.

OBJECTIVE

This objective of this project is to address the shortcomings of LPBF in printing low-angle overhangs without support and the manufacturing of taller (up to 1 meter) AM parts in a thin-walled cylinder, leveraging both additive and traditional (welding) manufacturing of Inconel alloy 625 (IN625). Specifically this project seeks to develop and demonstrate low angle (< 45 degrees from the build plane) LPBF print capabilities in IN625; demonstrate the print of a tall (longer than 20 inches) thin-walled cylinder; and develop and demonstrate draft weld procedure specification for IN625 with associated initial mechanical evaluation.

AMERICA MAKES TECHNOLOGY DEVELOPMENT ROADMAP

This project aligns to:

PROCESS

ASTM PROCESS CATEGORY
Powder Bed Fusion

EQUIPMENT
Velo3D Sapphire

MATERIAL
IN625

TECHNICAL APPROACH

Aerojet Rocketdyne is leading the project which includes Velo3D. Aerojet Rocketdyne is designing geometry demonstration samples for fabrication and testing. The team plans to fabricate deliverable samples of IN625 components on a Velo3D Sapphire machine capable of printing 1 meter tall parts and post process accordingly. They also plan to verify consistency of printed material with a pressure test of geometry demonstration samples. Finally, Aerojet Rocketdyne is performing welding trials and drafting the welding specification.

The focus of the project is on three main technical areas:

- Develop and demonstrate low angle printing down to zero degrees without the use of supports;
- Demonstrate printing tall, thin-walled cylinders longer than 20 inches; and
- Develop and demonstrate a draft weld procedure for IN625 with the mechanical evaluation of the weld.

PROJECT START DATE

October 28, 2021

EXPECTED END DATE

March 15, 2024

EXPECTED DELIVERABLES

- Thin walled (0.1 inch) cylinder part-to-length to exceed 20 inches
- CAD model of demonstration samples
- Build layout for samples
- Pressure test data
- Welding trial data and copy of draft standard
- Raw data from testing of samples
- Draft weld procedure specification for IN625 and mechanical evaluation
- Draft design guidelines for Velo3D system
- Final report

FUNDING

$1,125,680 total project budget
($975,680 public funding/$150,000 private funding)

PROJECT PARTICIPANTS

Project Principal:
Aerojet Rocketdyne

Other Project Participants:
Velo3D

Public Participants:
U.S. Department of Defense