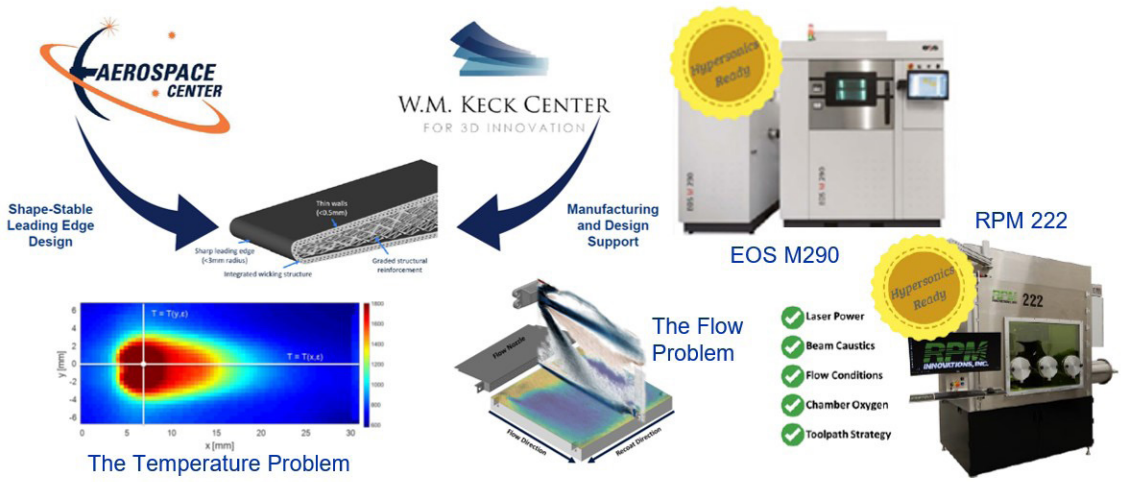
PROJECT SUMMARY 5542.002.002

High-Temperature Applications Using Additive Manufacturing, Phase 2: *Task 2b - Advanced Thermal Management Schemes for Next-Generation High-Velocity Vehicles*



System guidelines of key process (LPBF and DED) metrics such as temperature and flow need to be created for successful part production relevant to high-speed applications.

PROBLEM

As manufacturing technologies and materials evolve, not all service bureaus are prepared to support the latest material challenges, part designs, and productivity required to deliver components to our nation's supply chain. A service bureau that has been operating using older laser powder bed fusion (LPBF) equipment with a successful track record of delivering steel parts may not be a good candidate to produce parts made of high-temperature materials unless system upgrades or newer systems are adopted. National supply chain procurement personnel need to know the guidelines to ensure that a service bureau is ready and able to produce high-temperature, repeatable, and reliable components regardless of machine type or original equipment manufacturer (OEM).

OBJECTIVE

The objectives of this effort is to 1) create an additive manufacturing design guideline specifically around machine parameters (laser power, scan speed, gas flow, oxygen content, etc.) to best define the requirements needed to successfully produce components using high- temperature materials; 2) characterize the spectral emissive and temperature behavior of high-temperature materials to enable optimal and fact-based AM processing; and 3) support the University of Texas at El Paso (UTEP) – Aerospace Center in the design and manufacturing of shape-stable, leading-edge, high-temperature components.

AMERICA MAKES TECHNOLOGY DEVELOPMENT ROADMAP

This project aligns to: PROCESS

ASTM PROCESS CATEGORY
Powder Bed Fusion
Directed Energy Deposition

EQUIPMENT
EOS M 290, RPM 222, AconityMIDI+, SLM 280, Renishaw 500Q

MATERIAL
Metal Alloys

TECHNICAL APPROACH

UTEP's Keck Center will establish machine readiness metrics for LPBF (laser powder bed fusion) and L-DED (laser-direct energy deposition) by evaluating key process metrics and tolerance determination of subsystems like laser beam, optics and scan system, chamber flow, sensors such as oxygen and temperature, and key system motors and drives. Along with system parameters and metrics, the Keck Center will develop a data package of materials used in high-temperature applications to establish a knowledge base of thermal emissive behavior for fact-based processing utilizing a multi-wavelength pyrometry system for material measurement and sensor calibration. From this collected data, design guideline data as well as a component design demonstration will be provided. Also, a collaborative effort between UTEP's Aerospace Center and the Keck Center will provide the design for AM and part fabrication related to the thermally managed, and shape-stable leading edge heat pipe using both the Keck Center's existing knowledge in AM and new knowledge developed during the project.

PROJECT START DATE

April 2023

EXPECTED END DATE

February 2025

EXPECTED DELIVERABLES

- Design guide data
- Fabricated component of demonstrated design
- Final project report

FUNDING

$10,582,407 total project budget
($9,150,000 in public funding/$1,432,407 in private funding)

PROJECT PARTICIPANTS

Project Principal:
The University of Texas at El Paso (UTEP) - W.M. Keck Center

Other Project Participants:
The University of Texas at El Paso (UTEP) - Aerospace Center

Public Participants:
U.S. Department of Defense