MUREP High-Volume Manufacturing and Supply Chain Management (MUREP High Volume)

Title: Consortium for High-volume Additive Manufacturing of Aerospace Heat Exchanger and Talent Development
Institution: California State University, Northridge
City/State: Northridge, CA
PI: Bingbing Li

Summary:
The Autonomy Research Center for STEAHM (ARCS), a NASA-sponsored center for convergence research at California State University, Northridge (CSUN), in partnership with Honeywell Aerospace, Castheon Inc, NASA Jet Propulsion Laboratory (JPL), ASTM International Additive Manufacturing Center of Excellence (AM CoE), SimInsights, University of California Los Angeles (UCLA), and Los Angeles Piece College, proposes a Consortium for High-volume Additive Manufacturing of Aerospace Heat Exchanger and Talent Development to address the challenges of high-volume manufacturing and supply chain management of aircraft heat transfer equipment. We will leverage the multidisciplinary teams of specialized scientists and engineers with extensive experience to fundamentally alter the manufacturing methods to develop the super alloys by nanoparticles self-dispersion, generatively design, additively manufacture, nondestructively inspect, and functionally deliver the heat exchanger into aerospace applications. Heat exchangers play a crucial role in mission-critical aviation and aerospace applications. They are vital to the optimal performance of jet engines; essential to the accurate functioning of aircraft electronics; and key to a satellite's ability to perform a multitude of functions without overheating.

The Consortium will leverage ARCS's unique student talent and its access to JPL personnel and facilities, and its strong partnership with Honeywell Aerospace, Castheon, ASTM AM CoE, SimInsights, UCLA, LA Piece College, to conduct convergence research to:

1. Develop robust super alloys by nanoparticles self-dispersion to improve the performance of heat exchanger.
2. Identify best practices of the generative design for additive manufacturing (AM).
3. Laser power bed fusion (LPBF) AM manufacturing.
4. NDE inspection of AM production parts for aerospace applications.
5. AI-powered Augmented Reality (AR) training for metal AM.

As a Hispanic and Asian American and Native American Pacific Islander Serving Institution, CSUN is a large comprehensive university, with an enrollment of 38,551 students in Fall 2021. However, on average only 2 faculty and 20 students are engaged in NASA-related research activities annually. The Consortium for High-volume Additive Manufacturing of Aerospace Heat Exchanger and Talent Development will meet NASA MUREP's and CSUN's technical, educational, and workforce goals through four innovations:

1. Pioneering and institutionalizing a Convergence Research model (1 of NSF 10 Best Ideas) that involves deep interdisciplinary integration of the projects
2. Engaging 10+ undergraduate/graduate students per year in NASA research

3. Leveraging CSUN's Innovation Incubator and NSF-funded I-Corps Program to commercialize research products
4. Executing a Commercial Plan growing a thriving ecosystem of multi-organization strategic partnerships (NASA center, large industry, ASTM standard organization, small business, R1 universities, community colleges,).

Broadly, the Consortium activities will develop faculty and student knowledge and skills through:

- Engagement in NASA-related research.
- Professional development in team science, commercialization, and research.
- Curriculum enhancement in the engineering college' senior courses.

While we acknowledge that our goals are ambitious, the PI and External Advisory Committee members have unique hands-on experiences leading large scale projects and have accomplished transformational goals.