HIGH PERFORMANCE COMPUTING MODERNIZATION PROGRAM

RESEARCH PROJECT #: HPCMP-HIP-24-002

Computational Investigation of Shock-Boundary Layer Interactions on High-Speed Guided Flight Vehicles

About DEVCOM ARL:

The DEVCOM Army Research Laboratory (ARL) is the Army's sole foundational research laboratory strategically placed under the Army Futures Command. ARL focuses on cutting-edge scientific discovery, technological innovation, and transition of knowledge products that offer incredible potential to improve the Army's chances of surviving and winning any future conflicts. The ARL Flight Sciences Branch, located at Aberdeen Proving Ground (APG), MD, studies the flight of guided Army munitions. The branch accomplishes this through Computational Fluid Dynamics (CFD) using DoD HPCMP HPC resources, and through experimentation at the ARL Transonic Experimental Facility at APG, the world's largest free-flight spark shadowgraph range.

RESEARCH LOCATION: Aberdeen Proving Ground, MD

PROJECT DESCRIPTION:

Perform high fidelity Navier-Stokes Computational Fluid Dynamics (CFD) simulations to understand complex flow phenomena and their impact on high-speed guided munition flight. Steady-state and transient simulations will be employed to accurately characterize the aerothermodynamics of flight vehicles at high supersonic and hypersonic speeds.

The intern will undertake high-fidelity, HPC CFD analyses to predict the SBLI regions occurring in the candidate configurations to study the characteristics of the separation zone, aerothermal effects, and unsteadiness. Configurations of study will include generic Army relevant tail-fin vehicles (for fin-to-fin interactions) and canonical configurations with existing wind tunnel experimental data for determination of prediction accuracy. The intern will generate computational meshes, perform CFD simulations and post process analyses using HPCMP resources. Proposed CFD simulations will include Reynolds Averaged Navier-Stokes (RANS) and Wall-Modeled Large Eddy Simulations (WMLES). Post process analyses will include comparison with available experimental data (both intramural and extramural). One aspect of the research is comparing multiple analysis tools (state of the art commercial, DoD, academic solvers), including research-oriented, and more applied analysis and production-oriented tools. This is important to provide insight and determine what specific missing physical models must be added to the production-oriented solvers to provide the required prediction accuracy. The intern will also actively participate in technical meetings with existing collaborations with nation-leading academic researchers in hypersonic aerothermodynamics.

ANTICIPATED START DATE:

May 2024 – Exact start dates will be determined at the time of selection and in coordination with the selected candidate.

QUALIFICATIONS:

Prospective candidates should have a passion in fluid dynamics and have experience performing computational fluid dynamics. Candidates with a Bachelors in aerospace engineering or mechanical engineering with a focus in fluid mechanics are preferred. Candidates should have a fundamental skill set in Unix. Ideal candidates have familiarity of Hybrid RANS/LES, LES, or Direct Numerical Simulations (DNS).

ACADEMIC LEVEL:

Degree received within the last 60 months or currently pursuing:

- Master's
- Doctoral

DISCIPLINE NEEDED:

- Computer, Information, and Data Science
- Engineering
- Science & Engineering-related