HIGH PERFORMANCE COMPUTING MODERNIZATION PROGRAM RESEARCH PROJECT #: HPCMP-HIP-25-033

CREATE-AV Helios Validation Study for Unsteady Rotorcraft Flows

About CCDC AvMC:

Technology Development Directorate (TDD) is the rotorcraft aeromechanics research branch under the U.S. Army Combat Capabilities Development Command (CCDC). TDD is home to researchers, scientists and engineers who are working to execute critical technology discovery and development programs, including Future Vertical Lift. Our center is located at the NASA Ames Research Center and is a leading research group in the field of rotorcraft aeromechanics.

RESEARCH LOCATION: Moffett Field, CA

PROJECT DESCRIPTION:

This project will contribute to ongoing validation and verification efforts for CREATE-AV Helios rotorcraft CFD simulation tool, including analysis of hub flows and small-scale multi-rotor aircraft.

The intern activities will focus on testing and validation of flow solvers within Helios and assessment of advanced capabilities on problems of interest to the Army FVL program. Past experience has shown that interns using Helios can pick up the code within a week or two and complete CFD/CSD calculations relevant to both the Army TDD organization as well as to their graduate studies.

The proposed summer intern projects will all use state-of-the-art high-fidelity CREATE modeling and simulation software tools. The projects involve the investigation of real-life practical engineering problems that are important to the mission of our Army laboratory. Student interns will share offices with and research directly with our Army senior technical staff. The student interns will be challenged to solve real DoD engineering problems with results that could potentially result in technical conference papers.

Summer interns will research on two different projects that exploit unique capabilities in Helios.

1). The intern will simulate the coaxial hub test case from the "5th Rotor Hub Flow Prediction Workshop" using Helios. They will determine the best grid resolution, overlap conditions for overset meshes, and solver configuration for accurate flow and drag predictions. Finally, they will compare their results with previous simulations and experimental measurements, evaluating the performance and reliability of the solvers used.

2). The intern will use Helios to simulate a multi-rotor unmanned air vehicle, including using the Helios trim module to determine the trim solution using both rotor speed and blade pitch control. High-fidelity simulations will be first conducted, followed by mid-fidelity simulations using a reduced-order model. For multi-rotor cases where multiple trim solutions exist, the intern will explore finding the optimal trim solution using various optimizer algorithms.

These two projects are scoped for completion in 10 weeks and are intended provide enough material for a professional quality publication suitable for presentation at a major aerospace conference. In addition, the Army TDD laboratory is co-located at the NASA Ames Research Center, which offers interns the opportunity to participate in many NASA programs, including those involving educational outreach and facility tours.

ANTICIPATED START DATE:

June 2025 – Exact start dates will be determined at the time of selection and in coordination with the selected candidate.

QUALIFICATIONS:

The ideal candidate should be a junior/senior level undergraduate, in a graduate program, post-master's or post-doctoral in aerospace/mechanical engineering, computer science, applied mathematics, or another STEM related field with emphasis on modeling and simulation. A background in the field of rotary wings is preferred but not essential. Experience in mesh generation, as well as commercial CFD and CA tools is favorable.

ACADEMIC LEVEL:

Degree received within the last 60 months or currently pursuing:

- Bachelor's
- Master's
- Doctoral

DISCIPLINE NEEDED:

- Computer, Information, and Data Sciences
- Engineering
- Mathematics & Statistics
- Science & Engineering-related