

HIGH PERFORMANCE COMPUTING MODERNIZATION PROGRAM

RESEARCH PROJECT #: HPCMP-HIP-24-011

Assessment of GPU Solvers, Flight Dynamics Module, and Aeroacoustics Simulations using CREATE-AV Helios for Army Rotorcraft Applications

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 looking for summer interns to contribute to the development and application of the multi-disciplinary rotorcraft simulation software CREATE-AV Helios. The interns will contribute towards the assessment and validation study of the GPU solver and with the development and testing of the flight dynamics module and conduct aero-acoustics simulations on single and multi-rotor configurations to help assess current capabilities.

RESEARCH LOCATION: Moffett Field, CA

PROJECT DESCRIPTION:

Under the guidance of mentors at the Army DEVCOM AvMC Technology Development Directorate, Design, Simulation and Experimentation, in Moffett Field, CA, the interns will gain knowledge in developing and testing new Helios capabilities for rotorcraft applications of interest to the Army. The intern activities will focus on development and testing of GPU capabilities within Helios and assessment of advanced capabilities on problems of interest to the Army FVL program. 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.

Interns will research on three different projects that exploit unique capabilities in Helios. The 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. Interns will share offices with and collaborate directly with our Army senior technical staff. The interns will be challenged to solve real DoD engineering problems with results that could potentially result in technical conference papers.

The first project will be development and assessment of high order numerical algorithms on GPU architectures. A GPU based Cartesian solver ORCHARD has been implemented in Helios. This is a relatively new solver and requires additional validation. The goal of this effort will be to assess the performance of the GPU solvers and help improve the efficiency. The interns will collaborate with their mentor to assess the performance using a variety of test cases intended to fully test and validate the capability in Helios.

The second project will explore the development and testing of the new flight dynamics module. The interns will be collaborating with their mentor and have an opportunity to participate in trim testing and validation for novel multi-rotor concepts, develop methods for simulating aircraft response to small perturbations about the trim conditions, as well as assist with design and coupling of an interface to couple a control system with Helios.

The third project aims to test and develop a workflow to couple NASA's acoustic solver ANOPP2 with the simulation tool Helios for rotorcraft noise prediction.

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

QUALIFICATIONS:

The ideal candidate should be in graduate program, or post-Doctoral program in Aerospace/Mechanical Engineering. A background in the field of rotary wings is preferred but not essential. Familiarity with GPU architectures, Python, Fortran 90, and C++ is useful. Prior software and graphical user interface development experience is favorable.

ACADEMIC LEVEL:

Degree received within the last 60 months or currently pursuing:

- Master's
- Doctoral

DISCIPLINE NEEDED:

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