HIGH PERFORMANCE COMPUTING MODERNIZATION PROGRAM

RESEARCH PROJECT #: HPCMP-HIP-24-014

Intra-Global Resilient Battle-space Power Distribution Optimizations for Energy Web Dominance

About AFIT:

The US Air Force Institute of Technology (AFIT) confers accredited graduate and PhD degrees to military and civilian professionals and yields outstanding technical leaders by providing superior education built on defense- and dual-use civilian-focused research. AFIT's cutting edge, applied education and consulting services support DoD and other US Government Agency needs while molding individuals capable of anticipating and providing solutions to requirements and adapting to any contingency or crisis.

RESEARCH LOCATION: Wright-Patterson AFB, OH

PROJECT DESCRIPTION:

Carrying forward prior-year High End Computing (HEC)-enabled analyses, the HIP intern will advance intra- and inter-theater wireless, speed of light, directed energy power transmission performance assessments of great utility to the emergent Defense Advanced Research Projects Agency's Persistent Optical Wireless Energy Relay (POWER) and Tactical RF Energy eXperiments (T-REX) programs, future force projection, and emergency response capabilities. Guided by the mentor, the intern becomes an integral member of a cross-agency team using HEC resources, National Oceanic and Atmospheric Administration weather prediction models, and the DoD Laser Environmental Effects Definition and Reference and High Energy Laser End to End Operational Simulation models to optimize urban, regional, and global wireless power transmission architectures.

CDE's overarching HIP project goals seek to: a) guide the intern to become proficient on use of HEC assets for advanced, worldwide meteorological data arrays and forecasted DE performance analyses based on real-world weather to support power beaming mission planning; and b) foster HIP intern professional growth by introducing the intern to DoD science, engineering, and technology transition. The scoped HIP effort includes a DE laser and RF beaming mission planning concept demonstration based on regional/worldwide 4D Weather Cubes, capturing the impact of realistic atmospheric conditions, including clouds/precipitation, on said energy web concepts. The plan includes substantial orientation of the intern on multi-spectral atmospheric propagation, radiative transfer, and performance simulation tools for DE system assessments-- which will be accomplished via journal articles, AFIT student theses, prior HIP intern research papers, and participation in weekly CDE staff and monthly DARPA meetings. The intern will work closely with the mentors and DARPA colleagues to produce the objective analyses via HEC resources.

The intern will interact daily with several co-mentors, including three seasoned software engineers each of whom has HEC experience. The intern will also have opportunities to exchange ideas with other AFIT faculty and staff as well as PhD/MS students pursuing complementary atmospheric effects and laser research. This interaction will expose the intern to the scientific, collaborative method one applies to pursuits of such broad scale as associated with creating power beaming capabilities / energy web designs based on regional climatologies and forecast, including clouds/fog events. Understanding the science behind the HEC code and data processing offer valuable insight into physics/math-based problems and offer the opportunity to critically assess the results and best methods to display the data to DE professionals.

The intern will attend weekly staff meetings to provide the research staff progress updates and as the summer comes to an end brief the HIP project and results at the AFIT Physics Department Seminar, which is attended by the entire Physics Department's graduate student body and open to all faculty and staff. The intern will tour CDE indoor/outdoor laboratories where experimental atmospheric characterization and effects research, and field tests are conducted to validate DE capability modeling and simulation code. Additionally, effort will be made to arrange a tour of local Wright-Patterson AFB HEC facilities. The intern will have opportunities to network and present their research at various professional forums, including the Directed Energy Professional Society's (DEPS) Annual Symposium.

ANTICIPATED START DATE:

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

QUALIFICATIONS:

The intern must be pursuing a major in Computer Sciences, preferably a Junior or Senior in their studies. Being familiar with MATLAB and Linux are also preferred to maximize the impacts of the internship for both the intern and mentor-guided project.

ACADEMIC LEVEL:

Degree received within the last 60 months or currently pursuing:

- Bachelor’s
- Master’s

DISCIPLINE NEEDED:

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