REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT #: AFRL-RHD-23-04

End-to-End Modeling of Directed Energy Bioeffects

PROJECT DESCRIPTION: Across the DoD, models are used to predict an outcome or effect from the first-order fundamental physics level up to higher mission or campaign-level engagements. Modeling a directed energy bioeffects response can involve modeling the directed energy emission, atmospheric propagation, energy-tissue deposition, and the resultant biological impact. Each step in the chain of events requires a separate model, different hardware/software environments, and different physics/model expertise to configure. A new end-to-end model environment was recently developed to answer these challenges and could serve as an effective way to integrate physics-level bioeffects into networks of models with components developed by external collaborators. The scope of this research project is to integrate an atmospheric scintillation and attenuation model with a laser-retina bioeffects model to predict thermal injury under a range of atmospheric effects as a first step in exercising the new end-to-end model environment.

ACADEMIC LEVEL: Bachelor's, Master's, PhD

DISCIPLINE NEEDED:

- Computational Mathematics
- Physics
- Scientific Computing and Informatics

RESEARCH LOCATION: Virtual or In-Person at JBSA-Fort Sam Houston, San Antonio, Texas

RESEARCH MENTOR: Chad Oian, MS
Mechanical Engineering University of Texas at San Antonio, 2018

Chad Oian is a research engineer in the Air Force Research Laboratory's Bioeffects Division. He has worked as a computational physics and simulation researcher for eight years on the in-house modeling and simulation team. He transitioned to civil service through the Palace Acquire program in 2018 after completing a M.S. in mechanical engineering focusing on continuum mechanics modeling of laser-induced neuronal inhibition. His other research areas include laser safety tool development, vision effects modeling, and expanding multi-physics capabilities in the area of directed energy bioeffects. *Photo courtesy of the U.S. Air Force Research Laboratory.*