

Multiscale, Multiphysics, Multifidelity Modeling of Aircraft Power and Thermal Systems

1. **Research Title:** Multiscale, Multiphysics, Multifidelity Modeling of Aircraft Power and Thermal Systems
2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level**
Aerospace/Mechanical/Electrical/Computer/Materials/Chemical Engineering (MS or Ph.D.)
4. **Objectives:** Develop computational methods, tools and models for design and performance-analysis of aircraft power and thermal management systems.
5. **Description:** Cross-domain, advanced physics based modeling and simulation tools have been identified by the Air Force as game changers that can significantly reduce development and deployment cycle time for acquisition. Our group is developing an integrated power and thermal (P&T) modeling workspace to explore the multi-dimensional P&T trade space. Aircraft P&T systems demand both static and dynamic response and include technologies that represent physical phenomena across a wide range of spatial and/or temporal scales involving multi-physics coupled interactions. Our research includes development of computational methods, numerical formulations and software with the intent of developing and supporting an integrated and unifying modeling framework. Specific areas of interest for thesis topics are: dynamic modeling of multiphysics and multifidelity P&T systems; thermodynamic analysis of aircraft power and thermal systems; multiscale modeling of heat transfer and thermal energy storage and molecular modeling of interfacial transport properties. Modeling approaches that link molecular simulations with macroscale fluid properties; integrate multifidelity models in dynamic simulations and co-simulate P&T multiphysics models are also of interest. The DAGSI project will complement active in-house research in modeling of aircraft P&T systems and the students will have an opportunity to collaborate with ongoing modeling and experimental research at AFRL .
6. **Research Classification/Restrictions:** This research will be unrestricted and the results will be in the public domain. However to facilitate close collaboration between AFRL and the student, frequent visits to WPAFB will be required. The student and the faculty member are therefore required to be US citizens or permanent residents.

7. Eligible Research Institutions:



DAGSI (Wright State University, AFIT, Ohio State University, University of Dayton, Miami University, Ohio University, University of Cincinnati).