

AFRL CALL FOR RESEARCH

1. Research Title: *System Integration Optimized for Energy Management*

2. Individual Sponsor:

Mitch Wolff
AFRL/RQPE
1950 Fifth Street, Bldg. 18
WPAFB, OH 45433
James.wolff2@wpafb.af.mil

3. Academic Area and Education Level: Mechanical, Aerospace, Electrical Engineering. MS or Ph.D. Level

4. Objectives: Develop advanced experimental or analytical approaches for the accurate assessment of on demand aircraft systems. The research can be directed towards improved bench experimentation, innovative component design/modeling, or fundamental science issues.

5. Description: On demand systems require attention to issues of system integration and energy management for optimal performance and capability. Integrated system modeling and simulation spans a broad range of technical expertise such as thermal management, power generation, power distribution and load management in a highly dynamic environment. Energy conversion is critical in the efficient design of on demand systems. For aircraft applications, the majority of energy conversion takes place in the gas turbine. Therefore, significant opportunities exist for optimizing this process especially consideration of auxiliary systems and how they interface with the hot gas engine sections. Gear boxes and starter/generators are key components of power generation leading to power distribution which is then connected to load management. Methods of storing and dissipating energy such as high-energy density batteries, super-capacitors and heat exchangers are also vital for on demand system optimization which has regenerative energy capability. Underlying these system integration issues is the basic energy management issue of on demand highly dynamic thermal management. Depending upon the on demand energy rates, fundamental assumptions such as thermodynamic equilibrium are violated. Therefore, research into various fundamental non-equilibrium thermodynamics methods such as mesoscopic thermodynamic descriptions of non-equilibrium thermodynamics, quantum thermodynamics, and extended irreversible thermodynamics is being accomplished. From an experimental view, the verification and validation (V&V) process for complex on demand systems of systems needs developed. In addition, hardware in the loop (HIL) system integration optimization for energy management will continue to be pursued. In particular, remote HIL system integration is vital to advancements in aircraft system integration. Finally, research into integrated system health management will continue to be utilized to optimize the complete system.

6. Research Classification/Restrictions: U.S. Citizens only.

7. Interest in Summer USAFA Cadet: Yes

8. Eligible Research Institutions:

Universities (DAGSI)

AFIT USAFA