

RQ15-24

1. Research Title: *Efficient Small Scale Propulsion & Power Systems*

2. Individual Sponsor:

Paul Litke

AFRL/RQTC Bldg 490

1790 Loop Road

WPAFB, OH 45433-7251

paul.litke@wpafb.af.mil

3. Academic Area/Field and Education Level: Engineering Physics, Applied Physics, Mechanical Engineering, Aerospace Engineering, Chemical Engineering, Electrical Engineering (MS and/or Ph.D. level)

4. Objectives: The proposed thesis topic aims to advance the state-of-the-art in small scale propulsion and power systems, utilizing advanced technology to achieve improvements in efficiency, power density, and operability.

5. Description: Emerging propulsion and power needs drive combustion systems towards higher efficiencies and power densities. New approaches are being developed in small scale systems (on the order of tenths to hundreds of kilowatts). Efficient small scale propulsion and power research has focused on the coupling of combustion heat release into useful energy conversion. Research has included optimization of small scale unmanned aerial vehicle propulsion and power systems, including conversion of Otto cycle (spark ignition) engines to heavy fuels, advanced ignition systems, propeller/engine optimization, and development of enabling components and engine concepts for high power density systems. Small scale demonstrations of advanced turbine concepts are also currently being explored including innovative cycles. Other areas of interest include hybrid systems, Diesels with high power density, regenerative and other novel internal and external combustion cycles. A wide variety of research opportunities are available utilizing the Small Engine Research Laboratory, including high speed instrumentation (up to 5 MHz per channel), high speed imaging (up to 1,000,000fps), laser diagnostics, computational tools, and research engines. Recent projects have included plasma ignition studies, engine combustion research using alternative/bio fuels, and hybrid propulsion/power systems.

6. Research Classification/Restrictions: Most aspects of this research fall under the 6.1 basic research classification. However, some aspects and the Pulsed Detonation Research Facility at Wright-Patterson AFB are FOUO with export control/ITAR restrictions.

7. Interest in Summer USAFA Cadet: NO

8. Eligible Research Institutions:

Universities (DAGSI) AFIT USAFA

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