

**AFRL CALL FOR RESEARCH**

**1. Research Title:** Transient Computational Fluid Dynamics Modeling of a Direct Injected Heavy Fuel Engine

**2. Individual Sponsor:**

Dr Gregory Minkiewicz (937) 255-1878  
AFRL/RQTI Bldg 18D, Room 133  
1950 Fifth Street  
WPAFB, OH 45433-7251  
Greg.Minkiewicz@wpafb.af.mil

**3. Academic Area/Field and Education Level:** Mechanical Engineering, Aerospace Engineering, Applied Physics, Combustion Sciences (BS, MS and/or Ph.D. level)

**4. Objectives:** The proposed thesis topic aims to understand the flow physics and combustion associated with an internal combustion engine in order to convert a spark ignition engine to run on heavy fuel.

**5. Description:** The Office of the Secretary of Defense, OSD is directing its Services to use a single battle space fuel for its air, ground, and sea propulsion systems. Using a single battle space fuel would save billions of dollars per year. The single battle space fuel would be JP-8/diesel fuel. Presently two, key, unmanned aerial systems (UAS) use aviation fuel; these are the USAF's Predator and the US Army's Shadow-200. This topic deals with how to convert the gasoline based internal combustion engines from avgas to heavy fuel (JP-8/diesel). Presently, the approach to convert these engines to heavy fuel is to use direct fuel injection into the engine's combustion chamber. The physics of the problem consists of how to inject the fuel, evaporate it, mix it with the air and achieve combustion all within 20 milliseconds – an order of magnitude less than a “blink-of-the-eye”! Unsteady computation fluid dynamics with combustion modeling is essential to understand the fuel injection/combustion phenomenon. Recent work at Wright-Patterson AFB consists of the development of small scale engine components necessary to make direct fuel injection possible. These include small fuel injectors, fuel pumps, electronic control systems, and turbochargers. In addition, a test lab was established to obtain experimental data to quantify engine performance. Recent research projects include students from the University of Dayton, Ohio State University, the University of Cincinnati, Wright State University, and AFIT.

**6. Research Classification/Restrictions:** U.S. Citizens only. The research falls under 6.1, Basic Research classification. However, some aspects, in particular those dealing with specific engine configurations and performance parameters, are FOUO with ITAR restrictions.

**7. Interest in Summer USAFA Cadet:** No

**8. Eligible Research Institutions:**

Universities (DAGSI)     AFIT     USAFA