

AFRL CALL FOR RESEARCH

1. **Research Title:** *Time Accurate CFD Simulations of Scramjet Engines for Control System Development*

2. **Individual Sponsor:**

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

4. **Objectives:** Generate time-accurate solutions of a hydrocarbon-fuelled scramjet combustor to evaluate engine transients for control system development. Solutions could be used to determine the best location for instrumentation and what is the appropriate instrumentation to be used (i.e., pressure, temperature, heat flux, etc.).

5. **Description:** To date, very little effort has been applied to generate time-accurate CFD solutions of scramjet engine transients. With significant interest in developing control systems for these types of engines, however, there is a research opportunity in this area. Engine transients of interest include initial starting of the engine, fuel-flow rate changes, fuel-phase transition, fuel staging, ram/scram transition, and vehicle maneuvers. Some of these transients occur very quickly (on the order of milliseconds), while others are very slow (on the order of seconds). Both of these extremes present unique challenges for time-accurate CFD solutions. Additionally, chemical reactions and the size of a scramjet engine further complicate the problem. With current computer resources, it is believed that such solutions are possible and could be compared to some experimental data for validation. Initial areas of interest would include the short duration transients such as ignition, unstart, and rapid changes in fuel flow rate, and fuel staging.

6. **Research Classification/Restrictions:** U.S. Citizens only; potential for ITAR.

7. **Eligible Research Institutions:**

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

AFIT

USAFA (only)