1. **Research Title:** Basic Research in Energy and Combustion Science

2. **Individual Sponsor:**

Dr. Brent A. Rankin, AFRL/RQTC
1790 Loop Road N.
Wright-Patterson AFB, OH 45433-7801
brent.rankin.1@us.af.mil

3. **Academic Area/Field and Education Level:** Aerospace Engineering / Mechanical Engineering / Chemical Engineering / Chemistry / Physics (MS or PhD level)

4. **Objectives:** Perform basic research or advanced technology development related to the broad areas of energy and combustion science with applications to a range of current and next-generation Air Force propulsion systems such as gas turbine combustors, inter-turbine combustors, augmentors, small-scale engines, and rotating detonation engines.

5. **Description:** Improving fundamental understanding of turbulent combustion in relevant regimes is important for many power generation and propulsion applications with significant impact and broad relevance to a range of national and international grand challenges. The grand challenges include achieving a sustainable energy future through increasing efficiencies of power, propulsion, and transportation systems; attaining a clean environment through managing pollutant emissions; and enhancing national safety and security through pursuing innovative defense technologies. Power and propulsion systems which rely upon turbulent combustion are pervasive across the Department of Defense and Unites States Air Force for applications such as gas turbine combustors, inter-turbine combustors, augmentors, small-scale engines, rotating detonation engines, scramjets, and rockets. The primary purpose of this work involves focusing on one or more of the following areas:
   (a) Investigate fundamental interactions between turbulence and flame structure in relevant configurations and regimes using state-of-the-art experimental or computational methods.
   (b) Identify and explore advanced combustion concepts that enhance ignition under extreme conditions, improve flame stabilization, or minimize thermo-acoustic instabilities using canonical configurations to demonstrate the potential benefits of the concept.
   (c) Evaluate the advanced combustion concepts using relevant experimental configurations operating under relevant conditions such as those being studied at the Air Force Research Laboratory Aerospace Systems Directorate Turbine Engine Division. Specific turbulent reacting flows of interest include but are not limited to bluff-body stabilized flames, swirl stabilized flames, cavity stabilized flames, and detonations.

6. **Research Classification/Restrictions:** Open to U.S. citizens only. Some aspects of this research may include ITAR restrictions.

7. **Eligible Research Institutions:**

DAGSI (All DAGSI Universities).