

RQ15-12

1. **Research Title:** Ultra-Compact Combustion
2. **Individual Sponsor:**  
Dr. Andrew Caswell, AFRL/RQTC  
2130 Eighth Street  
WPAFB, OH 45433-7542  
[andrew.caswell.4@us.af.mil](mailto:andrew.caswell.4@us.af.mil)
3. **Academic Area/Field and Education Level:** Aerospace Engineering / Mechanical Engineering (MS or Ph.D. level)
4. **Objectives:** Research and develop innovative gas turbine combustors with efficient flame holding to improve performance and fuel efficiency as governed by decreased specific fuel consumption, total pressure loss and pollutant emissions. Design, develop, model, test, and characterize the combustion system.
5. **Description:** To meet the gas turbine engine propulsion requirements of future advanced military aircrafts, the engine components must be developed to operate at conditions, well beyond the current day technology. This includes design considerations of weight savings, improved operating characteristics and efficient integration and packaging to meet the performance goals. Combustor component should be designed to deliver the maximum amount of heat release, with fuel economy, while providing low pollutant emissions. Conventional gas turbine combustion systems have inlet guide vanes, diffuser, array of fuel injectors, cooling circuits, heat exchangers, and exit guide vanes. To realize performance gains of increasing the thrust to weight ratio and affordability with increased cost savings, advanced gas turbine combustors needed to be designed, developed and evaluated in parallel with advanced fuel injection, improved fuel-air mixing technologies and efficient front end design of the combustors. The ease of adapting these changes, without unduly altering the current engine flow path is needed. Therefore the purpose of this effort is two-fold: (1) Identifying combustion system improvements based on existing and revolutionary hybrid combustor concepts that can include traditional and nontraditional technologies, and (2) Apply numerical analysis and testing methodology in concurrence for the suggested concepts to assess in depth performance gains or losses and from a perspective of overall combustor performance.
6. **Research Classification/Restrictions:** This research is unclassified and unrestricted.
7. **Interest in Summer USAFA Cadet:** No
8. **Eligible Research Institutions:**

Universities (DAGSI & AFIT)

AFIT  (hly)

USAFA

Public Release Pending