

## AFRL CALL FOR RESEARCH

**1. Title:** *Development of High Work High Efficiency Low Pressure Turbine Technologies.*

**2. Individual Sponsor:**

Dr. Rolf Sondergaard  
AFRL/RQTT  
1950 Fifth Street  
WPAFB, OH 45433  
Rolf.Sondergaard@wpafb.af.mil

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

**4. Objectives:** The objectives of this proposed 3-year DAGSI project is to conduct research related to the development of active boundary layer and secondary flow control technologies for very high work, high efficiency low pressure turbines (LPTs). The study will include the development and use of computational tools for LPT aerodynamic design and flow prediction, development and modeling of flow control technologies applicable to LPT flows, design and implementation of closed loop control systems, and experimental validation of LPT and flow control behavior and performance. Experiments will be conducted using the Air Force Research Laboratory Propulsion Directorate turbine cascade facilities and DoD computational resources.

**5. Description:** The LPT in a gas turbine engine can account for up to 30% of the overall engine weight and contributes significantly to engine part count and cost. Increasing the loading (and therefore the work output) of individual LPT blades can therefore significantly reduce engine weight and cost. However increased blade loading can result in reduced efficiency, reduced tolerance to off design operating conditions, and enhancement of undesirable secondary flows. Improved modeling capabilities combined with innovative flow control methodologies offer the opportunity to develop very highly loaded LPT designs that the efficiency, robustness, and wide operating range required for use in a practical gas turbine engine. This project will involve the design and modeling of high work LPTs with integrated flow control strategies for both primary and secondary flows. Experimental verification and validation of the flows will be used to drive improvements in the computational modeling capability.

**6. Research Classification/Restrictions:** U.S. Citizens only. The bulk of this research will fall under the 6.1 basic research classification. Some aspects, in particular those dealing with specific engine configurations and performance parameters, will be FOUO and may have ITAR restrictions.

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

**8. Eligible Research Institutions:**

Universities (DAGSI)     AFIT     USAFA