R917-24

Development of High Work High Efficiency Low Pressure Turbine Technologies

1. **Research Title:** Development of High Work High Efficiency Low Pressure Turbine Technologies
2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level**

Mechanical or Aerospace Engineering (MS and/or PhD level – PhD preferred)

4. **Objectives:** The objectives of this proposed 3-year DAGSI project is to conduct research related to the understanding of the flows related to very high work, high efficiency, highly loaded low pressure turbines (LPTs) – i.e. flow stability, separation characteristics, complex endwall flows - and the development of relevant active boundary layer and secondary flow control technologies. 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.

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 design and flow control methodologies offer the opportunity to develop very highly loaded LPT designs that offer 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:** 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. **Eligible Research Institutions:** Indicate to what organizations this topic should be provided

☒ **DAGSI** (Wright State University, AFIT, Ohio State University, University of Dayton, Miami University, Ohio University, University of Cincinnati) NOTE: Topics submitted to DAGSI must be approved for public release. PA Approval # 88ABW-2012-5423

☒ **USAFA** If you are submitted a topic for the USAFA, indicate if you are also interested in sponsoring a USAF Cadet in summer 2017 (Average cost for USAF Cadet for 33 days is $5000)

☒ Yes ☐ No