

1. **Research Title:** Advanced, Integrated Control, Diagnostics and Health Management for Next Generation Propulsion Systems

2. **Individual Sponsor:**

Dr. Al Behbahani
AFRL/RQTE
2130 8th Street
WPAFB, OH 45433-7251
alireza.behbahani@us.af.mil

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

Mechanical and Aerospace Engineering, MS or PhD level

4. **Objectives:** Engine Life Enhancement with improved control, diagnostics and health management strategies

5. **Description:** The proposed research focuses on issues of control, diagnostics and health management for advanced next generation propulsion systems.

- In the control area we propose Gain Scheduling based control laws for full envelop design based on combination of **quantitative and qualitative stability** of dynamic systems. In this research, knowledge from these ecological principles is extended and applied to design robust controllers for engineering systems.
- In the Diagnostics area, to reduce false alarms and missed detections, we propose to use **adaptive threshold** based on the condition of the engine accounting for the aging process of the engine. Similarly, we also propose a **dynamic threshold** taking the uncertainty of the model into consideration, in the model based diagnostics.
- In the health management area, we propose the concept of **component and path-dependent aging** via robust diagnostic tools. Just like in battery research, it is proposed to investigate the component-path dependent aging process via analytical and computational tools so that improved diagnostics can be achieved.
- **Integrated Flight (Airframe) and Propulsion (Engine) Control and Health Management** is deemed extremely important and In this proposed research, systematic control and health management tasks are developed that judiciously take advantage of the coupling between engine dynamics and flight dynamics so that better control and diagnostics schemes can be designed for extending the life of the engine and airframe.

6. **Research Classification/Restrictions:** Unclassified/None

7. **Eligible Research Institutions:**

DAGSI (All DAGSI Universities). PA Approval #88ABW-2017-3609.