RQ19-48

1. **Research Title: Distributed Modular Supervisory Control Architecture for Next Generation Integrated Propulsion Systems**

2. **Individual Sponsor:**

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3. **Academic: Area/Field and Education Level**
Mechanical and Aerospace Engineering, MS or PhD level

4. **Objectives:** Design and develop supervisory control architectures so that the controlled plant behaves according to given specifications

5. **Description:** The proposed research focuses on development of optimal decision and control algorithms for supervisory control of aircraft propulsion, thermal, and power systems.

- The key to recognizing functional integration is the realization that the dynamics of the subsystem components (of the vehicle) are interdependent. Thus, the phrase *'integrated control'* implies control system design which considers the interactions between various subsystems.
- The *global supervisory control* objectives are met by judicious combinations of local subsystem and nonlocal observations taking advantage of various forms of communication exchanges between distributed controllers..
- A *hierarchical supervisory control* architecture can be used to oversee the interactions between subsystems and increase control integration. We refer to this control scheme is an integrated, distributed, hierarchical control system, the development of which is critical for the continuing evolution of aircraft design and capability.
- The *modular supervisory control architecture* composed of a set of non-communicating local controllers, in which one controller is assigned for each module or subsystem having its own sensing and acting capabilities. The hierarchical supervisory control architecture consists of multilevel controllers assigned to detail low-level and abstract high-level models of the plant
- *The functionality of the supervisory controller is to coordinate the operation or the activities of the vehicle subsystems. The continuously varying control system of each vehicle subsystem interacts with its own local controller for intelligent control and health monitoring.*
- *Artificial Intelligence* (AI) in the supervisory control architecture enables the display of behavior of each subsystem. It may be used to 'select behavior" of each subsystem to be applied' in different parts of the network – it is expected each system are connected through databus, fiber optics, or short-range wireless networks. Artificial Intelligence / Machine Learning can be used to recommend or make decisions based on the data coming from individual subsystems.

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

7 **Eligible Research Institutions:**

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