1. **Research Title:** Data Science Based Approaches for Modeling Electronics, Devices, and Systems with Control Applications.

2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level**
Electrical Engineering and Computer Science/Data Analytics and Electronics (MS or PhD level)
4. **Objectives:** Identify and research model reduction strategies for electronic, power and thermal components that have high accuracy but with reduce computational time for real-time control and health monitoring. Current approaches for accurate modeling are not suited for real-time prediction as they require significant computational resources and lengthy run times. Conceive and develop strategies that leverage an off-line/on-line decomposition of tasks to formulate reduced order models (ROMs). These models will enable rapid prediction, inversion, and design and uncertainty quantification of complex control, high level system coordination, power flow, and electrical/thermal component in gas turbine systems.

5. **Description:** As engine turbomachinery complexity increases, demands for reconfigurability, high efficiency, improved maintainability, and adaptation to high power extraction require engine controls with look-ahead (state) predictive capability, ability to efficiently approximate nonlinear terms, and provide accuracy guarantees. Leveraging sensor data and statistical techniques are key technologies that can provide solutions to these technical gaps. It has been demonstrated that computational statistics, machine learning, and related techniques that can access large data sets and learn without explicit programming can capture a large percentage of the requirements for accuracy for complex component and system models while reducing execution time by one or more orders of magnitude. Researchers should seek to develop a machine learning (ML)/computational statistics (CS) based reduced-order model for PHM and controls. During the duration of the investigation, it is expected to select an Artificial Intelligence (AI) machine learning methodology for prototype development of a Reduced Order Model (ROM) for control of high-power electrical component energy flows. The methodology could include but not limited to identifying existing ROMs or deploy new ROMs for use in engine control, determine the pros and cons of the ROMs identified, select the best ROMs, determine appropriate test case, and demonstrate ROMs on the chosen test case.

6. **Research Classification/Restrictions:** Open to U.S. citizens only. Some aspects of this research may include ITAR restrictions.

7. **Eligible Research Institutions:** **DAGSI** (All DAGSI Universities).