1. **Research Title**: Analysis and optimization of advanced hybrid electric architectures for next generation tactical unmanned aerial systems (UAS)

2. **Individual Sponsor:**

Dr. Michael A Rottmayer, AFRL/RQQE
Building 18G Room 32
1950 Fifth Street
WPAFB, OH 45433-7333
Michael.Rottmayer@us.af.mil

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

4. **Objectives:** The objective is to design and validate a multidisciplinary analysis and optimization tool to help drive the exploration of advanced hybrid electric architectures, based upon mission and air vehicle input requirements and specifications.

5. **Description:** Current and future unmanned aerial system (UAS) operational energy requirements for quiet, extended range and endurance capabilities are leading to technology gaps that cannot be filled with conventional propulsion and power system technology approaches. While hybrid electric architectures are promising to address these technology gaps, they usually suffer from reliability issues and exhibit non-optimal efficiencies. For this reason, AFRL/RQQE has developed a hybrid electric UAS propulsion test bed with a two-pronged goal: (1) utilize the test bed as a collaborative research asset and validation / analysis tool to investigate challenges of integrating complex hybrid electric architectures, and (2) to further the research & development on novel energy optimization methods, system state monitoring techniques, and control architectures for highly reliable and efficient hybrid electric UAS. Leveraging the testbed and AFRL/RQQE's legacy of power management technologies' development, the proposed DAGSI project aims to design a multidisciplinary analysis and optimization tool, which integrates expertise from electrical, mechanical and aerospace engineering, to help drive the exploration of these advanced hybrid electric architectures, based upon mission and air vehicle input requirements and specifications. System optimization studies shall be performed to evaluate for optimal performance, cost and scalability, based upon parallel, series, and other advanced hybrid electric architecture configurations with conventional or distributed propulsion, incorporating such components as high efficiency fuel cells/generators, advanced batteries, supercapacitors, photovoltaics, and/or other technologies. Validation of the optimization tool shall be accomplished through characterization of commercial-off-the-shelf (COTS) components, with a goal of building and testing a representative hybrid electric power and propulsion system with integrated power controls.

6. **Research Classification/Restrictions:** Unclassified/ Open to U.S. Citizen only

7. **Eligible Research Institutions:** All DASGI