RQ21-63

1. **Research Title:** Analysis and Development of Inlet Systems for Gas Turbine Engines
2. **Individual Sponsor:**
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3. **Academic Area/Field and Education Level:** Aerospace Engineering, Mechanical Engineering (MS or Ph.D. Level)
4. **Objectives:** Future aerospace systems will span a wide range of speed and size classes. Each aircraft concept places a unique set of requirements on the integration of a high-performance inlet to feed air to the gas turbine engine. In our research group we seek to combine low-cost experimental testing with modern computational analysis to gain a better understanding of the flow field and enable advanced inlet concepts through a design, analyze, build, and test methodology.
5. **Description:** This research area covers the design and analysis of inlet systems for subsonic through supersonic applications. Aerodynamics of separated flow in diffusing internal ducts and shockwave boundary layer interactions are featured prominently in unsteady and three-dimensional configurations. Practical approaches to the use of computational fluid dynamics, which enable the minimum fidelity required for successful prediction of total pressure recovery and flow distortion, are needed to evaluate new inlet systems and explore aerodynamic flow control. This includes the use of hybrid RANS/LES techniques to compute unsteady characteristics of the distorted flow field at the fan/compressor interface.
   Topics of interest include:
   (1) efficient simulation of supersonic inlets, including modelling of boundary layer bleed and inlet starting procedures,
   (2) hybrid RANS/LES of inlet systems with a focus on prediction of peak unsteady inlet distortion,
   (3) novel flow control approaches applied to inlet flow fields,
   (4) effects of forebody integration as well as off-design speed and incidence on inlet performance,
   (5) experimental approaches to generate flow distortions which mimic the downstream influence of various components of the inlet system,
   (6) statistical approaches for the reduction of computational and experimental data related to post-processing engine-face distortion patterns,
   (7) systems-level analysis of gas-turbine installation effects on aircraft and/or engine performance.
6. **Research Classification/Restrictions:** Unclassified.
7. **Eligible Research Institutions:** All DAGSI Universities.

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