RQ21-85

1. **Research Title:** Goal-oriented adaptive methods for air vehicle design
2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:** Aerospace or Mechanical Engineering / Computational Physics and Numerical Analysis (BA/BS, MS or Ph.D. level).
4. **Objectives:** To develop goal-oriented adaptive analysis methods for transient, coupled-physics phenomena and assess their application within processes for air vehicle design.
5. **Description:** The ability to quickly evaluate an air vehicle design realization during optimization is critical for the effectiveness of the design process overall. High-fidelity computational, coupled-physics analyses are an important tool for evaluating design objectives, but their relatively high cost can limit or prevent their early and widespread application in air vehicle design optimization. Goal-oriented adaptive methods seek to significantly reduce analysis time by reducing problem complexity while preserving predictive quality for outputs-of-interest (e.g. goals for design optimization). Goal-oriented adaptive methods that are of interest under this topic include mesh adaptation, h-p-r adaptation, space-time adaptive methods as well as supporting technologies such as error estimation. Of particular interest, is the extension of such methodologies to include transient (time-marching and time-spectral) phenomena with multidisciplinary couplings. Research areas under this topic may include:
    a. Error estimation and adaptivity for transient, multidisciplinary processes.
    b. Error estimation and adaptivity for internal flows with impacts from inflow / outflow boundary conditions.
    c. Methods for formalizing the optimal application of goal-oriented adaptive methods within design optimization. (what level of accuracy should one seek to achieve for a given design realization?)
6. **Research Classification/Restrictions:** Unclassified
7. **Eligible Research Institutions:** All DAGSI Universities.