1. **Research Title:** Machine Learning Approaches in Computational Fluid Mechanics

2. **Individual Sponsor:** List the AFRL research topic sponsor's contact information

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3. **Academic Area/Field and Education Level:** Aerospace Engineering (MS/PhD level), Applied Mathematics (MS/PhD Level)

4. **Objectives:** The objective of this research is the exploration of Machine Learning (ML) approaches in Computational Fluid Dynamics (CFD). Some areas of particular interest are: (1) Development of ML-based or corrected turbulence models, (2) Convergence acceleration via ML approximations, (3) Development of ML based rapid aerodynamic prediction capability based on parametric computational simulations, (4) ML assisted grid generation, and (5) ML based characterization of solver performance.

5. **Description:** Machine learning (ML) approaches have become commonplace in many technical fields, however, their exploration, adoption, and exploitation in the areas of computational fluid dynamics (CFD), fluid modeling, and aircraft design is still an area of emerging research. Promising initial efforts have demonstrated the methods effectiveness in expanding the accuracy of Reynolds Averaged Navier Stokes (RANS) methodologies to flows for which such methods typically exhibit poor performance. While such methods have shown initial promise, a challenge remains in determining proper methods for infusing computational and experimental training data while satisfying physical constraints. Others have begun to apply similar techniques to multifidelity approximation of flows, CFD solver convergence acceleration, and reduced order modeling. Application of such techniques could hold promise in reducing computational expense of standard CFD approaches, reducing man-in-the-loop demands in mesh generation, providing for rapid aerodynamic estimates by providing a framework for assimilating large amounts of computational parametric data, expanding validity of physical models, and assisting in solver characterization among other possibilities.

6. **Research Classification/Restrictions:** Unclassified.

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

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