RQ 20-41

1. **Research Title:** Weapons Bay Shear Layer Physics Quantified with High Fidelity Computational Fluid Dynamics

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

Dr. Ryan F. Schmit AFRL/RQVI
2145 5th Street, Bldg 24c, Rm 213
WPAFB, OH 45433-7333
Ryan.Schmit@us.af.mil

3. **Academic Area/Field and Education Level:** Aerospace and/or Mechanical Engineering (MS or Ph.D. level)

4. **Objectives:** Develop high fidelity Computational Fluid Dynamics (CFD) model of a weapons bay cavity shear layer to aid in the understand of the underlying physics.

5. **Description:** Shear layer dynamics can play a significant role in determining the cause of store separation anomalies from weapons bays. Understanding the physics that governs the shear layer development over a weapons bay cavity is not thoroughly understood. Current experimental methods cannot provide the spatial and temporal accuracy to quantify the governing shear layer physics. High fidelity CFD can obtain the spatial and temporal accuracy to develop a better cavity shear layer model. The Aerospace Vehicles Division is attempting to develop a model that can predict the spatial and temporal flow dynamics inside a cavity and an accurate shear layer model is a critical piece of this effort. Proposed work would be primarily computational:
   (1) Develop CFD solutions of a relevant weapons bay cavity.
   (2) Investigate the cavity shear layer parameters, e.g. entrainment, convection velocity, growth rate, etc. in order to support engineering model development. For example in Rossiter's equation the ratio of convection velocity to freestream is assumed constant in both time and space, this is known to be incorrect but no accepted parameterization is currently available.
   (3) Compare the results with relevant experimental and/or theoretical data.

6. **Research Classification/Restrictions:** This research is unclassified, with intent to publish in the open literature.

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

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