

1. **Research Title:** Reusable Thermally Compliant Air Vehicle Structure Design and Analysis
2. **Individual Sponsor:**

Dr. Justin L Clough, AFRL/RQHV
AFRL/RQHV Bldg 65
2790 D STREET
Wright-Patterson AFB, OH 45433-7510
justin.clough.1@us.af.mil
3. **Academic Area/Field and Education Level**
Mechanical Engineering or Aerospace Engineering (MS or Ph.D. level)
4. **Objectives:** The objective is to develop, design, and analyze methodologies for reusable thermally compliant air vehicle structures.
5. **Description:** High speed (Mach 5+) flight imposes a challenging design environment as the structure must withstand high temperatures and steep thermal gradients over the course of a mission. These thermal loads drive large thermal strains that, when not properly relieved, cause structural failure. This results in a need for better understanding and incorporation of applicable thermal compliance into the design; this is especially true when the vehicle mission requires reusability. This research focuses on creating and validating the novel methodology needed for the design and analysis of these vehicle structures. Interest is placed both on low- and high-fidelity models for the early and later stages of design, respectively.

Project Areas of Interest:

- Explore novel design solutions (material selection, joints, geometries, etc.) with sufficient justifying analysis for both the skin of the vehicles as well as the substructure.
 - Low- and high-fidelity analysis methods for repeated low cycle thermal loading both on the global and local scale (i.e., whole vehicle scale or components, respectively).
6. **Research Classification/Restrictions:** U.S. Citizens only. Most aspects of this research fall under the 6.1 basic research classification. Some aspects, in particular those dealing with specific vehicle configurations and performance parameters, are FOUO with ITAR restrictions.
 7. **Eligible Research Institutions:** **DAGSI** (Wright State University, Ohio State University, University of Dayton, Miami University, Ohio University, University of Cincinnati)

Distribution Statement A: Approved for Public Release; Distribution is Unlimited. AFRL-2023-4154