RQ18-18

1. **Research Title:** Morphing and Shape Adaptable Aircraft Structures
2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:** Aerospace or Mechanical Engineering (MS or Ph.D. level).
4. **Objectives:** Design morphing and shape adaptable aircraft structures
5. **Description:** Conventional aircraft is generally designed and optimized for a single mission. It also uses a discrete control surface system (e.g., ailerons or flaps) that suffers from aerodynamic inefficiency due to non-smooth outer mold lines and gaps/holes that can create unwanted vortices and flow separations. For the last couple of decades, planform and camber morphing structures have demonstrated great potentials to balance competing economic and flight performance requirements in aircraft design, and in some instances attain performance beyond traditional capabilities. For example, DARPA MAS program demonstrated multi-mission capabilities and, most recently, AFRL Variable Camber Compliant Wing (VCCW) demonstrated enhanced maneuverability that can decrease structural weight, reduced drag, reduced noise, and maximized mission range by more than 10%. AFRL is interested in exploring shape adaptable morphing aircraft design technologies that enable to (a) change the state of a vehicle from large planform shape morphing and (b) maneuvering without using a discrete control surface system (e.g., ailerons or flaps) from conformal camber morphing. Research opportunities exist in developing advanced enabling technologies such as morphing structures and mechanisms, control laws, planforms that are more inherently synergistic with VCCW, hybrid system, engineered material, and fabrication. The topics of research includes but is not limited to: (1) morphing / Shape adaptable mechanism design methodology (e.g. mathematics, computational simulation, kinematics); (2) enabling shape-changing structures (e.g. conventional mechanisms, compliant mechanism, tensegrity structures); (3) enabling materials and actuators (e.g. flexible/corrugated materials, meta materials, smart materials, bistable mechanisms, novel hybrid actuators; (4) novel wing mechanism/structure design methodologies such as topology optimization; and more.
6. **Research Classification/Restrictions:** None.
7. **Eligible Research Institutions:** Indicate to what organizations this topic should be provided.

   ☐ **DAGSI** (Wright State University, AFIT, Ohio State University, University of Dayton, Miami University, Ohio University, University of Cincinnati)