

RQ15-14

1. **Research Title:** Development of Damage Models for Composite Structures
2. **Individual Sponsor:**  
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3. **Academic Area/Field and Education Level:** Mechanical/Aerospace/Civil Engineering – Composite Structural Mechanics (M.S. or Ph.D. level)
4. **Objectives:** The Air Force has been developing cohesive and energy-based modeling techniques over the past several years with some success. The objective of this task is to continue this development in order to accurately capture the physical mechanisms of failure in composite structures and joints. Outcomes of this research will provide reliable assessments of the durability and damage tolerance of current and future composite structures.
5. **Description:** To achieve the objective, the following tasks must be performed:
  - Develop and validate numerical models that accurately predict damage accumulation through z-pin and flock reinforced composite structures under Mode-I, Mode-II, and mixed-mode loading conditions. Various cohesive and fracture based finite element methods should be considered.
  - Develop experimental procedures and formulate rules for using acoustic emission testing to evaluate composite damage accumulation under realistic service conditions (i.e. multi-modal quasi-static loading conditions, impact loading, etc.).
  - Develop and validate emerging numerical tools to overcome the inherent difficulties associated with mesh-based numerical techniques for modeling damage accumulation under high strain rate impact loading.
6. **Research Classification/Restrictions:** This research is unclassified and for public distribution.
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)
  - AFIT (only)
  - USAFA (only)

If you are submitting a topic for the USAFA, please indicate if you are also interested in sponsoring a USAF Cadet in summer of 2014 (Avg Cost for USAF Cadet for 33 days was \$5000)  Yes  No

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