

## Attachment 1 – Research Topic Template

1. **Research Title:** Low Cost Composites Manufacturing
2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level**

Mechanical Engineering (BS or MS level)  
Materials Science and Engineering (BS or MS level)

4. **Objectives:** Perform AFRL in-house research in two primary areas:

The In-house research described below in the 'Description' section will be in support of the Low Cost, Attributable Aircraft Technology (LCAAT) program. LCAAT is a program that is being supported across several organizations in AFRL and AFLCMC. The goal of the LCAAT Fast Track Flight Demo program is the development and flight test of a low cost UAS (not to exceed \$3M) that has high level established goals of:

1. 3,000nm round trip range
2. Strike UAS capable of carrying 2 – GBU-39 (small diameter bombs)
3. Capable of Ma 0.9 sprint

Parallel to the execution of the LCAAT Fast Track Flight Demo program will be the investigation of low cost, but effective manufacturing processes that could be beneficial to future LCAAT spiral efforts. Two manufacturing topics have been identified thus far: low cost, fast responsive tooling; and 3D reinforced composite structures. It is anticipated that a student could assist in the activities briefly described below.

5. **Description:**

- A. **Durability for a new class of composite tooling**

Under the Low Cost, Fast Responsive Tooling effort, it is anticipated that the government will receive delivery of at least two small (1' x 2') tools from two different contractors using two, respective processes. An in-house researcher (student) is desired to assist with tool durability studies. This could include characterization of the tool surface at the beginning and end of the study evaluating tool geometrical compliance to specified tolerances, tool surface quality and possibly tool surface chemical analysis. The in-house researcher will also

be responsible for laying up composite materials on the tools, curing the material and assessing the tool surface quality for continued part lay-up and cure processes. In essence, the in-house researcher will be determining the usable lifetime (# of possible cure cycles) for each tooling concept. The researcher will track cure/test results and finalize findings in a technical report with recommendations for the preferred tooling concept.

**B. 3D reinforced composite analysis of performance**

As a part of the 3D Reinforced Composite Structures project, the government is anticipating delivery of composite test coupons fabricated using different 3D reinforced concepts. An in-house researcher (student) is desired to perform mechanical testing and evaluation of these coupons including but not limited to: tensile, compressive, shear, fatigue and 4 point bend testing of the various 3D reinforced composite concepts. The researcher will analyze test results and finalize the results and recommendations in a technical report.

**6. Research Classification/Restrictions:** All research will be at the unclassified level

**7. Eligible Research Institutions:**

**DAGSI** (Wright State University, AFIT, Ohio State University, University of Dayton, Miami University, Ohio University, University of Cincinnati) NOTE: Topics submitted to DAGSI must be approved for public release. PA Approval Needed

**AFIT (only)**

**USAFA (only)**

If you are submitting a topic for the USAFA, indicate if you are also interested in sponsoring a USAF Cadet in summer 2015 (Average cost for USAF Cadet for 33 days is \$5000)

Yes

No