

1. **Research Title:** Design Optimization Methods for Additively Manufactured Property Gradients
2. **Individual Sponsor:** List the AFRL research topic sponsor's contact information

Dr. Philip Buskohl, AFRL/RXAS
AFRL/RXA, 2179 12th Street
Wright-Patterson AFB, OH 45433
philip.buskohl.1@us.af.mil

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

Mechanical Engineering, Applied Math, Electrical Engineering, Physics, Materials Science, or related field (MS or PhD)

4. **Objectives:** Develop design optimization tools to predict optimal geometries and/or graded material properties to fully leverage the additive manufacturing capabilities and/or demonstrate the performance of novel search methods on informative design problems.
5. **Description:** Advances in additive manufacturing (AM) techniques have significantly broadened the realizable design space for complex geometries and material property distributions, such as gradients in stiffness, permittivity and coefficient of thermal expansion. This spatial patterning capability of AM promises to extend and reshape the performance envelope of current designs based on traditional manufacturing methods, however advances in computational design optimization tools are needed to fully leverage AM. To address this need, this project call seeks proposals with innovative advances in search algorithms and/or demonstrations of an optimization method on novel design problems, which will inform the formulation of effective objective functions and the limitations of the method. Potential key challenges to address include navigation of non-convex design spaces with limited function evaluations, construction of methods that leverage all available understanding of the problem physics and search history, and novel sampling methods to leverage the mismatch in computational cost between different physics simulations (i.e. mechanical/low vs electromagnetic/high). Design methods that incorporate uncertainty in material properties or geometry into the optimization algorithm and/or demonstrate the dependence of the search path on uncertainty are also desired.
6. **Research Classification/Restrictions:** Unclassified and unrestricted. Eligible for Public release.

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) NOTE: Topics submitted to DAGSI must be approved for public release. Need PA Approval #

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