AFRL CALL FOR RESEARCH

1. **Research Title:** "Longer Length Carbon Nanotubes for Electric Power Applications"

2. I**ndividual Sponsor:**

Dr. Paul Barnes
AFRL/PRPG
1950 Fifth Street
Building 18 Room 233A
Wright Patterson AFB, OH 45433
paul.barnes@wpafb.af.mil

Kevin Yost
AFRL/PRPG
1950 Fifth Street
Building 18 Room 233A
Wright Patterson AFB, OH 45433
kevin.yost@wpafb.af.mil

3. Academic Area/Field and Education Level: Physics, Chemistry, Electrical/Mechanical/ Materials/Chemical Engineering, Nanoscience, Nanotechnology (MS or Ph.D. level)

4. Objectives: Develop high current capability for long length bundled carbon nanotubes and determine the mechanical and electrical properties of the "composite" wire**.**

5. **Description:** Carbon nanotubes have recently been demonstrated to possess a variety of potentially useful mechanical, thermal, and electrical properties. A carbon nanotube is essentially a graphitic sheet rolled over which forms a single cylinder made only of carbon atoms. The carbon nanotube is basically a single molecule made up of a hexagonal array of covalently bonded carbon atoms. There are two types: single wall carbon nanotubes (SWNT) which consist of one cylinder and multi-wall carbon nanotubes (MWNT) which consists of several concentric graphene cylinders. The initially determined properties of the carbon nanotubes may be particularly relevant to power applications of commercial and military interest. However, the length of the carbon nanotubes is severely restricted and properties are often specified in terms of a single fiber which is not applicable to power applications. The intent of this DAGSI topic is to explore methods of making longer lengths of nanotubes (a few centimeters) which are either fabricated as bundles or allow the carbon nanotubes (CNT) to be readily bundled. Only in bundled form can the CNT potential for power applications be realized. Further these bundles must be characterized to determine the electrical, mechanical, thermal, etc. properties relevant for incorporation of the CNT into power applications.

Initial research can include identifying approaches and determining the best method to deposit long lengths of carbon nanotubes (CNT) compared to present efforts. The approach must be conducive to bundling the CNT together such that, ultimately, with sufficient length an appropriate electrical conductor for winding coils is possible. Initial mechanical and electrical characterization of the CNT bundle is expected.

Further efforts can include fabricating short lengths of the CNT bundle verifying the effectiveness of the process. Extend the length that a fuller evaluation of the properties of the bundle can be assessed.

Military applications include armature windings of compact, lightweight generators, magnets, and electrical power conversion components. Commercial applications include the same in addition to power cables and transformers.

6. **Research Classification/Restrictions:** MCTL

7. **Eligible Research Institutions:**

[X] Universities (DAGSI) [X] AFIT [X] USAFA