RQ19-17

1. **Research Title:** High Capacity Cathode Materials Functionalized with Carbon for Lithium-based Batteries
2. **Individual Sponsor:**

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

Chemistry, Chemical or Materials Engineering (BA/BS, MS or PhD level)

4. **Objectives:** Investigate the use of highly conductive carbon nanostructures with high energy density carbon-based cathode materials for stable lithium-based batteries.
5. **Description:** The successful development of lightweight, high capacity and safe batteries will benefit various Air Force electronic applications including aircraft, spacecraft, UAVs, and portable soldier power. Despite significant funding and research efforts, only incremental improvements have been realized for lithium-based batteries with traditional chemistries. The use of high energy density carbon-based cathode active materials in combination with highly conductive carbon nanostructures has the potential to result in lithium-based batteries that exceed Air Force performance requirements by significantly reducing battery weight and/or significantly increasing the amount of available stored energy. Focused research efforts are needed to improve the reversibility of these types of cathodes and to understand both the theoretical and practical lithium intercalation limits. The proposed investigation will utilize a combination of computational chemistry, innovative laboratory experimentation and novel processing techniques to address these uncertainties. The modification of the cathode materials through coatings and functionalization may also be performed. Ultimately, efforts are directed toward the development of prototype 3D batteries and scalable technologies.
6. **Research Classification/Restrictions:** U.S. Citizens only
7. **Eligible Research Institutions:** DAGSI