1. **Research Title**: Mechanical strengthened interfaces of 3D-Printable Multifunctional Solid State Batteries
2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level**
Materials Engineering, Chemical Engineering, Mechanical Engineering, and/or Aerospace Engineering (MS or PhD level)
4. **Objectives:** The objective of this project is to investigate novel approaches for mechanical strengthening of the electrochemical interfaces in multifunctional solid state batteries through modeling & simulation and/or laboratory experiments. Deposition of the multifunctional battery layers shall be through 3D printing manufacturing techniques, and tested and evaluated for electrochemical and mechanical performance.
5. **Description:** There is a growing need for more electric power to support current and future needs, without necessarily having the luxury of affecting the component run-time, weight or volume. This need spans across many industries, particularly in automotive and aerospace applications. Multifunctional batteries have been recently gained attention as a potential integrated solution to closely-couple the energy storage device with the structure. However, one of the primary challenges with this technology is how to maintain high electrochemical performance throughout the battery cell during mechanical loading as it is flexed to conform to the structure. Issues with maintaining good electrical connectivity are only exacerbated at the electrode/electrolyte and current collector interfaces. Another challenge is how to maintain high safety and reliability to avoid short-circuiting the cell during repeated mechanical loading and flexure of the cell. Solid state Li batteries may address the latter challenge by removing the flammable liquid electrolyte and replacing with a solid separator. The objective of this project is to investigate approaches for strengthening the electrochemical interfaces through modeling & simulation and/or laboratory experiments. Novel 3D-printing mask-less deposition techniques, such as aerosol jet or ink jet, can provide intimate contact between layers and the ability to functionally engineer the cell layers for flexible and/or structural use. Characterization of the battery shall occur through electrochemical and mechanical measurements to demonstrate the improved interfaces for high performance multifunctional operation during repeated cycling.
6. **Research Classification/Restrictions:** Unclassified/ Open to U.S. Citizen only
7. **Eligible Research Institutions:** All DASGI