

1. **Research Title:** Micro-Structured Devices for Nanoparticle Toxicity Screening
2. **Individual Sponsor:** Name: Saber Hussain, PhD  
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3. **Academic Area/Field and Education Level:** Materials Science and Engineering, Chemical Engineering (working toward M.S. or Ph.D.)
4. **Objectives:** Design and validate microstructure-based *in vitro* models, such as microfluidic devices, to better replicate whole organs for advanced toxicity screening purposes.
5. **Description:** Man-made nanoparticles (NPs) are being applied in numerous aerospace technologies, with yet unknown health risks associated with unintentional exposure. Currently employed methods for investigating health risks due to NP exposure suffer many limitations, including a lack of physiological relevance and the inability to mimic *in vivo* behavior. Therefore, advanced *in vitro* models that aim at mimicking whole organs are critical for accurate predicative modeling of nanotoxicological concerns. Microstructure design, shear flow and mechanical flexure have been shown to facilitate the ability for synthetic devices to mimic whole organ responses. The key phases of the project will include a review of currently employed microfluidic approaches, design of a novel, advanced *in vitro* approach for NP toxicity testing, and validation through the generation of meaningful toxicological data following NP exposure.
6. **Potential Commercial Impact and Industry Involvement:** The impact of this technology is to lessen the use of animal models for toxicity testing, thus reducing cost and ethical concerns and increasing throughput. These capabilities are useful and relevant in a broad range of industries where toxicity and health risks due to NP exposure are a concern.
7. **Research Classification/Restrictions:** This research is considered Unclassified.
8. **Interested in Summer USAFA Cadet (Avg Cost for USAF Cadet for 33 days ~ \$4000):**  
 Yes                      No
9. **Eligible Research Institutions:** Select all that apply.  
 X Universities (DAGSI)      X AFIT                      X USAFA