

1. **Research Title:** Development of mitigation strategies against microbial contaminants associated with materiel

2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:** *Biomedical Engineering, Materials Science or Microbiology* (MS or Ph.D. level)

4. **Objectives:** Develop mitigation strategies for the control of microbial contaminants associated with fuel infrastructure materiel. Strategies may include the development of novel antimicrobial materials (nanoparticles, phage, coatings) and/or the development of sensors. Materials and sensors should target historically troublesome microbial species in fuel systems (*Hormoconis resinae*, *Penicillium*, *Bacillus*, *Pseudomonas*, *Sulfur-Reducing Bacteria*). Strategies should function in both kerosene-based jet fuels (JP-8, JetA) and in simulated tank water bottoms.

Description: Previous research and field observations have shown that microbial contamination of military assets is a persistent problem, particularly in fuel supply systems. Microbial communities inhabiting the fuel tank adhere to the sides of the tank and also form a film at the fuel-water interface. These microbial communities, called biofilms, secrete metabolic enzymes and byproducts that cause corrosion of the fuel tank, biodeterioration of the fuel tank coatings, and degradation of the fuel itself. The overall objective of this project is to develop novel mitigation strategies against biofilms. Mitigation strategies can include antifouling materials targeted at particularly aggressive genera, as well as detection systems that identify the presence of those genera. Antifouling strategies include materials that prevent microbial attachment such as functionalized surfaces or smart coatings. Antifouling surfaces must resist binding by a variety of proteins and microbes and retain their effectiveness long term. Detection strategies could be targeted towards microbes at the genus level, or towards species with specific metabolic activities (e.g., formation of caustic secondary metabolites/enzymes, etc.)

5. **Research Classification/Restrictions:** This research has no restrictions.

6. **Interest in Summer USAFA Cadet (Avg Cost for USAF Cadet for 33 days was \$5000)**

7. **Eligible Research Institutions:** Place an X in all that apply.

Universities (DAGSI)

AFIT (only)

USAFA