

Attachment 1 – Research Topic Template

1. **Research Title:** Protection of Composite Structures from Nuclear Effects

2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:** Master level, Nuclear Engineering, CBRND, Materials Science / Materials Engineering
4. **Objectives:** Provide a materials trade space analysis of nano-engineered structural composites for use in shielding from nuclear events allowing for rapid remediation of the composite surfaces, post event.

Optimize the following characteristics of composite:

 1. Provide neutron shielding by thermalization of the neutrons in the composite.
 2. Provide down scattering of the incident burst x-rays.
 3. Provide shielding of electronics inside the structure from HEMP RF radiation.
 4. Provide a durable resin surface that can easily be decontaminated after a nuclear event.

5. **Description:** Electromagnetic and nuclear effects are typically shielded using heavy steel and exotic structural alloys, here we endeavor to replace the heavy structures with light weight composite designs that could be used in shelters and mobile control complexes. The composites should provide sufficient protection from nuclear effects such as X-rays, Gamma radiation, and electromagnetic pulse as to protect electronics and personnel inside the structure. The structures should be easily decontaminated and retain all mechanical properties after these events. Students should be familiar with testing equipment such as Network Analyzer, Scanning Electron Microscope, Tensile Test frames, D-D generators, and FBR sources. The student should have an understanding of electromagnetics, a basic understanding of radiation physics, as well as how to make shielding effectiveness measurements. The project should develop materials and applications that will result in an increase in performance of current and next generation support ground structures and mobile control centers.

6. **Research Classification/Restrictions:** The research will be unclassified. However, specific aspects of the program are FOUO with ITAR restrictions.
7. **Eligible Research Institutions:** Indicate to what organizations this topic should be provided.
 - DAGSI (Wright State University, AFIT, Ohio State University, University of Dayton, Miami University, Ohio University, University of Cincinnati)

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