Evaluation of Novel Carbon Nano Tube Materials for Defeating Counter UxS Methods by Enabling EMI/RFI/ESD Shielding

Objective

• Onboard instrumentation of UxV systems across all domains suffers from lack of EMI/RFI/ESD protection. This presents 2 major vulnerabilities:
  – UxV own electromagnetic filed might adversely affect the onboard command and control (C2) links and sensitive payloads
  – The EW and counter UxV methods not only block the communication capabilities but also lead to the fatal burn out of onboard instrumentation

• The need for novel methods of protecting onboard microelectronics is urgent and can be provided by the integration of carbon-based nanomaterials.

• Traditional increase of the thickness of metal foils used in protection layers violates SWAP constraints and defeats other advances including the onboard intelligence.

Technical Approach

• Design and fabricate novel carbon nanotube (CNT) patterns to be integrated into small unmanned systems to enable EMI protection of onboard instrumentation of UxV systems.

• Explore the achievable levels of EMI protection due to novel properties of CNT fabric and various methods of its fabrication and integration onboard:
  – Design a practical guide for generating the CNT patterned structures that will act as EMI shield.
  – Experimentally verify the benefits of EMI protection. Explore achievable levels of EMI protection suitable for integration onboard of small UxV.
  – Develop a fabrication procedure that integrates CNT-based EMI shield into limited volume conformal shapes of UxV.

Deliverables

• The experimental setups and the measurement protocols description that verify:
  – the choice of the CNT material and the engraving pattern
  – the achievable levels of RF energy attenuation as function of chosen CNT engraving or composite pattern,
  – a parameterized mathematical model that designs the EMI protective shield as the function of “hostile” signal (power & frequency) and the desired characteristics of the EMI shield.

• A detailed procedure that outlines the integration steps; from raw materials to limited volume conformal shapes of UxV.

• Comparative map of the RF anechoic vs the open field experimental results.