Objective: Develop and demonstrate avionics packaging materials that are low mass; and provide radio frequency (RF) and radiation attenuation, and excellent thermal heat sink properties for use in Submarine Launched Ballistic Missile (SLBM) systems.

Description: Avionics package enclosures provide structural integrity, endo- and exo-atmospheric environmental protection (e.g., thermal, radiation), and Circuit Card Assembly (CCA) attach points, thermal relief paths, and structural stability. Package enclosures used in this program provide passive cooling during flight. Advanced materials could reduce mass and improve thermal management properties. Since the end products have a long shelf life, known or potential outgassing of compounds and material integrity over multiple decades would need to be assessed.

Existing electronics enclosures and materials utilize available materials, machining techniques, what would be considered now as loose mechanical tolerances to accommodate wire wrapped CCAs, large feature size components, and a multi-layered approach to materials that provide different attributes to enclosure needs that are either bolted on or attached via adhesive materials. A multitude of new materials development technologies, such as advanced composites and 3D printing, enable the use of advanced materials and production techniques that reduce lifecycle cost and further attenuate environments. Elimination of multi-step manufacturing processes utilizing lightweight materials that provide the package enclosure with the required material properties could reduce program costs and reduce missile weight.

Material attributes include:

- High thermal conductivity or thermal heat sink capability (min. of 147 W/m-C)
- RF shielding (target of 80dB at 10MHz)
- X-ray radiation shielding (target 5% transmission for Photon Attenuation at 5 KeV)
- Strength to withstand and operate through missile launch and flight environments (e.g., acceleration, shock, vibration, vacuum, thermal)
- Retention of properties for decades when utilized as package enclosure material
- No outgassing of noxious elements or compounds or particles
- Ability to remain fully operational through short duration (<60 minutes) space radiation environments described in MIL-STD 1089
- Assessment of limiting factors or concern areas
- Assessment of cost, reliability, size, and weight (target mass 20% reduction vs traditional fabrication)

Phase I: Develop a concept and assess its feasibility based on concept formulation, development, and possible validation. Develop approaches and recommendations for the design and fabrication of avionics packaging using new materials and processes for use in SLBM systems. Conduct a feasibility assessment for the proposed solution showing advancements in contrast to existing devices packaging approaches. Address, at a minimum, the capabilities listed in the Description. Document, in a Phase II plan, the design and feasibility assessment for Phase II consideration.
PHASE II: Develop and validate a prototype (not necessarily hardware). Design and fabricate avionics test packages, including internal circuitry to test operational effectiveness of enclosure. Conduct testing to exercise the designs in relevant environments and collect performance data, which may be used to characterize the capabilities of the design.

PHASE III DUAL-USE APPLICATIONS: Manufacture, demonstrate, and integrate the end product Avionics Package into the missile and submarine systems. Provide support in transitioning the technology for Navy use in SSP. Support the Navy with certifying and qualifying the system for SSP use. (Note: Navy SSP will provide the assets and test support as Government Furnished Equipment (GFE) and Services.)

REFERENCES:

KEYWORDS: Strategic Missiles; Materials Development; Electronics Enclosures; Production Techniques; Shielding; Attenuation