Potential New Projects

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- **Nano/Plasma-Enhanced Adhesive and Repair Systems with Greater Durability**

- **Higher Service Temp Nano-Modified BMI Resins for Reduced Variability and Multiplicity of Materials**

- **Increased Durability (Reduced Microcracking) for VaRTM Processed Composite Parts**

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Nano/Plasma-Enhanced Adhesive and Repair Systems with Greater Durability

- **Benefits**:

  - Caution and conservatism have been associated with the applications of adhesive bonding because of past histories of problems in service, particularly with metal-bond structure.

  - A reliable and enhanced bonding system that employs a combination of nano-additives in the adhesives for enhanced durability, and a plasma approach to surface treatment can lead to

    a. greater reliability, quality, and performance to reduce the current fastener systems relied on for much of the aircraft primary structure;

    b. provide an improved bonded repair material.

- **Technologies involved:**
  - Hybrid nano-modified (CNTs and r-CNFs) adhesives with enhanced wetting and adhesion capability and mechanical performance;
  - Plasma approach for the surface treatment of substrate

Higher Service Temp Nano-Modified BMI Resins for Reduced Variability and Multiplicity of Materials

- **Benefits:**
  - Thermal surveys of the 787 identified “hot spots” such as wheel wells (hot brakes), propulsion system (engine heat), fuselage (duct burst scenarios). Multiple materials are employed as protection schemes. In some cases *the variability or uncertainty in modeling the max temperature introduces conservatism and multiplicity in material choices*.
  - A higher service temperature BMI and enhanced thermoxidative stability would have benefits in reduced performance uncertainty and simplified designs (with resultant materials inventory reduction).

- **Technologies Involved:**
  - A kind of graphitic nanofiber-polymer brush materials (GNF-PBs) will afford the resulting nano-modified commercial BMI higher in-service temperature and enhanced thermoxidative stability for long term exposure applications

Increased Durability (Reduced Microcracking) for VaRTM Processed Composite Parts

- Benefits:
  - VaRTM has become a process for composites that increasingly holds promise for lower costs and higher production rates.
  - VaRTM resins frequently suffer microcracking (MC) due to the complexity of the preform geometry (increased likelihood of resin-rich pockets or interstices).
  - Elimination of MC by addition of CNTs and/or CNFs can enhance service durability.

- Technologies Involved:
  - A reactive nano-matrix with both functionalized CNTs and reactive graphitic nanofibers for VaRTM process is expected to reduce microcracking by nascent crack tip bridging and reduced delta-CTEs.