NASA SBIR 2007 Phase I Solicitation

A1.01 Mitigation of Aircraft Aging and Durability-related Hazards

Lead Center: GRC

Participating Center(s): ARC, LaRC

The mitigation and management of aging and durability-related hazards in future civilian and military aircraft will require advanced materials, concepts, and techniques. NASA is engaged in the research of materials (metals, ceramics, and composites) and characterization/validation test techniques for mitigation of aging and durability issues and to enable advanced material suitability and concepts. Proposals are sought for innovations in these mitigation technologies:

- Development of moisture-resistant resins and new surface treatments/primers. Novel chemistries are sought to improve the durability of aerospace adherends with potential use on subsonic aircraft. This research opportunity is focused on the development of novel chemistries for coupling agents, surface treatments for adherends and their interfaces, leading to aerospace structural adherends with improved durability. Work may involve chemical modification and testing of adherends, coupling agents, surface treatments or combinations thereof and modeling to predict behavior and guide the synthetic approaches. Examples of adhesive characteristics to model and/or test may include, but are not limited to, hydrolytic stability of the interfacial chemistry, moisture permeability at the interface, and hydrophobicity of coupling agents and surface primers. Examples of adherends to model and/or test include carbon fiber/epoxy composites used in structural applications on subsonic aircraft, and aluminum, as well as their respective surface treatments.

- Concepts for autonomous self-healing of composite aerospace structures. NASA is interested only in passive approaches, i.e., approaches that do not require sensors or external energy to activate the healing process. Desired performance objectives include improved compression-after-impact performance and retarded/arrested damage growth. To be competitive with lightweight traditional (non-healing) aerospace structures, self-healing concepts must not introduce extensive passive weight, such as a reservoir tank of resin, etc.

- Test techniques to fully characterize aging history and strain rate effects on thermoset and/or thermoplastic resins as well as on advanced composites manufactured of such resins and reinforced with 3D fiber preforms such as the triaxial braid used in advanced composite fan containment structures.

Technology innovations may take the form of tools, models, algorithms, prototypes, and/or devices.