



NASA SBIR 2011 Phase I Solicitation

A1.05 Sensing and Diagnostic Capabilities for Degradation in Aircraft Materials and Structures

Lead Center: LaRC

Participating Center(s): AFRC, ARC, GRC

Many conventional nondestructive evaluation (NDE) and integrated vehicle health management (IVHM) techniques have been used for flaw detection, but have shown little potential for much broader application. One element in NASA's effort to ensure the integrity of future vehicles is research to identify changes in fundamental material properties as indicators of material aging-related hazards before they become critical. For example, composites can exhibit a number of micromechanisms such as fiber buckling and breakage, matrix cracking and delaminations as precursor to failure. For complex metallic components an inability to determine residual stress state limits the validity of predictions of the fatigue life of the component.

To further these goals, NDE and IVHM technologies are being sought for the nondestructive characterization of age-related degradation in complex materials and structures. Innovative and novel approaches to using NDE technologies to measure properties related to manufacturing defects, flaws, and material aging. Measurement techniques, models, and analysis methods related to quantifying material thermal properties, elastic properties, density, microcrack formation, fiber buckling and breakage, etc. in complex composite material systems, adhesively bonded/built-up and/or polymer-matrix composite sandwich structures are of particular interest. Other NDE and IVHM technologies being sought are those that enable the quantitative assessment of the strength of an adhesive region of bonded joints and repairs or enable the rapid inspection of large area structures. The anticipated outcome of successful proposals would be both a Phase II prototype technology for the use of the developed technique and a demonstration of the technology showing its ability to measure a relevant material property or structural damage in the advanced materials and structures in subsonic aircraft.