NASA SBIR 2009 Phase I Solicitation

A1.02   Sensing and Diagnostic Capability for Aircraft Aging and Damage

Lead Center: LaRC

Participating Center(s): AFRC, ARC, GRC, MSFC

Many conventional nondestructive evaluation (NDE) techniques have been used for flaw detection, but have shown little potential for much broader application. One element in NASA's contribution to solving the problem of aging and damage processes in future vehicles is research to identify changes in fundamental material properties as indicators of material aging-related hazards before they become critical. Degraded and failing fiber composites can exhibit a number of micromechanisms such as fiber buckling and breakage, matrix cracking, and delamination.

Methodologies are being sought that allow engineers, using advanced modeling tools to predict the remaining useful life of components, the ability to make use of nondestructive evaluation (NDE) data more effectively. One proposed methodology would be an automated means of processing NDE data to extract defect characteristics (i.e. crack length and depth, or delamination size and location) and map these directly to a computer aided drafting model of the component being inspected. This model (which now contains defect information) could then be used by engineers to perform structural analysis on the component. A successful proposal should demonstrate the performance of the methodology proposed by using the data from at least one conventional NDE technique (i.e. Thermography, Ultrasonics, etc.) and a standard CAD drawing file format.

Additionally, actual NDE technologies are also being sought for the nondestructive characterization of age-related degradation in complex composite materials. Innovative and novel approaches to using NDE technologies to measure properties related to material aging (i.e. thermal diffusivity, elastic constants, density, microcrack formation, fiber buckling and breakage, etc.) in complex composite material systems, adhesively bonded/built-up and/or polymer-matrix composite sandwich structures. The anticipated outcome of successful proposals would be a both Phase 2 prototype NDE technology for the use of the developed technique to characterize age-related degradation and a demonstration of the technology showing its ability to measure a relevant material property in a carbon fiber/epoxy composite used for structural applications on subsonic aircraft.