



NASA SBIR 2008 Phase I Solicitation

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

Lead Center: LaRC

Participating Center(s): ARC, GRC

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.

In order to provide early detection of these processes and hazards, new sensing and diagnostic capabilities to support nondestructive evaluation (NDE) systems are needed, as well as associated computational techniques and maintenance methods. 'Virtual' inspection methods are being sought for composite materials. 'Virtual' inspections would include modeling the changes in critical material properties as indicators of material aging and then quantifying the levels of detectability of these material properties with a particular NDE technique. This computational tool should accurately model the interaction between the changes in the material properties and the probing energy of a particular NDE technique to allow the development of the inspection parameters needed for application on a particular structure. 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.