NASA SBIR 2015 Phase I Solicitation

H13.01 Advanced NDE Modeling and Analysis

Lead Center: LaRC

Participating Center(s): ARC, JSC

Technologies sought under this SBIR include near real-time large scale nondestructive evaluation (NDE) and structural health monitoring (SHM) simulations and automated data reduction/analysis methods for large data sets. Simulation techniques will seek to expand NASAâ€™s use of physics based models to predict inspection coverage for complex aerospace components and structures. Analysis techniques should include optimized automated reduction of NDE/SHM data for enhanced interpretation appropriate for detection/characterization of critical flaws in space flight structures and components. Space flight structures will include light weight structural materials such as composites and thin metals. Future purposes will include application to long duration space vehicles, as well as validation of SHM systems.

Techniques sought include advanced material-energy interaction simulation in high-strength lightweight material systems and include energy interaction with realistic damage types in complex 3-D component geometries (such as bonded/built-up structures). Primary material systems can include metals but it is highly desirable to target composite structures. NDE/SHM techniques for simulation can include ultrasonic, laser, micro-wave, terahertz, eddy current, infra-red, backscatter X-Ray, X-ray computed tomography and fiber optic. It is assumed that all systems will have high resolution high volume data. Modeling efforts should be physics based and account for variations between material aging characteristics and induced damage such as micrometeoroid impact. Examples of damage states of interest include delamination, microcracking, porosity, fiber breakage. Techniques sought for data reduction/interpretation will yield automated and accurate results to improve quantitative data interpretation to reduce large amounts of NDE/SHM data into a meaningful characterization of the structure. Realistic computational methods for validating SHM systems are also desirable. It is advantageous to use co-processor configurations for simulation and data reduction. Co-Processor configurations can include graphics processing units (GPU), system on a chip (SOC), field-programmable gate array (FPGA) and Many Integrated Core (MIC) Architectures. Combined simulation and data reduction/interpretation techniques should demonstrate ability to guide the development of optimized NDE/SHM techniques, lead to improved inspection coverage predictions, and yield quantitative data interpretation for damage characterization.

Phase I Deliverables - Feasibility study, including demonstration simulations and data interpretation algorithms, outlining the proposed approach to develop a given product (TRL 2-4), and describing any models and algorithms developed/utilized. Plan for Phase II including proposed verification methods.

Phase II Deliverables - Software of proposed product, report including detailed description of algorithms and models, along with full report of development and test results, including verification methods (TRL 5-6). Opportunities and plans should also be identified and summarized for potential commercialization.Â Â