NASA SBIR 2005 Phase I Solicitation

A1.04 Automated On-Line Health Management and Data Analysis

Lead Center: ARC

Participating Center(s): AFRC

Online health monitoring is a critical technology for improving air transportation safety in the 21st century. Safe, affordable, and more efficient operation of aircraft requires advances in online health monitoring of vehicle subsystems and information monitoring from many sources over local- and wide-area networks. Online health monitoring is a general concept involving signal-processing algorithms designed to support decisions related to safety, maintenance, or operating procedures. The concept of online health monitoring emphasizes algorithms that minimize the time between data acquisition and decision-making.

This subtopic seeks solutions for online aircraft subsystem health monitoring and prognostics. Solutions should exploit multiple computers communicating over standard networks where applicable. Solutions can be designed to monitor a specific subsystem or a number of systems simultaneously. Resulting commercial products might be implemented in a distributed decision-making environment such as onboard diagnostics and management systems, or maintenance and inspection networks of potentially global proportion.

Proposers should discuss who the users of resulting products would be, e.g., research/test/development, manufacturing; maintenance depots, flight crew, Unmanned Aerial Vehicles/Remotely Operated Aircraft (UAV/ROA) aircraft operators, airports, flight operations or mission control, or airlines. Proposers are encouraged to discuss data acquisition, processing, and presentation components in their proposal. Proposals that focus solely on sensor development should not be submitted to this subtopic. Such proposals should be addressed to sensor development subtopics such as the Flight Sensors and Airborne Instruments for Flight Research subtopic.

Examples of desired solutions targeted by this subtopic follow:

- Real-time autonomous sensor validity monitors;
- Flight control system or flight path diagnostics for predicting loss of control;
- Automated testing and diagnostics of mission-critical avionics;
• Structural fatigue, life cycle, static, or dynamic load monitors;
• Methods and tools for remaining life estimation and prognostics for critical aircraft components;
• Automated nondestructive evaluation for faulty structural components;
• Electrical system monitoring and fire prevention;
• Architectures for online monitoring, including architectures that exploit wireless communication technology to reduce costs;
• Model-reference or model-updating schemes based on measured data, which operate autonomously;
• Proactive maintenance concepts for aircraft engines, including engine life-cycle monitors;
• Predicting or detecting any equipment malfunction;
• Middleware or software toolkits to lower the cost of developing online aircraft health monitoring applications; and
• Innovative solutions for harvesting, managing, archiving, and retrieving aircraft health data.