



NASA SBIR 2009 Phase I Solicitation

A1.11 Diagnosis of Aircraft Anomalies

Lead Center: LaRC

Participating Center(s): AFRC, GRC, SSC

The capability to identify faults is critical to determining appropriate mitigation actions to maintain aircraft safety. This effort is to develop innovative methods and tools for the diagnosis of aircraft faults and failures. It includes the development of integrated technologies, tools, and techniques to determine the causal factors, nature, and severity of an adverse event and to distinguish that event from within a family of potential adverse events. These requirements go beyond standard fault isolation techniques. The emphasis is on the development of mathematically rigorous diagnostic technologies that are applicable to structures, propulsion systems, software, and other subsystems within the aircraft. Technologies developed must be able to perform diagnosis given heterogeneous and asynchronous signals coming from the health management components of the vehicle and integrating information from each of these components.

The ability to actively query health management systems, use advanced decision making techniques to perform the diagnosis, and then assess the severity using these techniques are critical. As an example, the mathematical rigor of the diagnosis and severity assessment could be treated through a Bayesian methodology since it allows for characterization and propagation of uncertainties through models of aircraft failure and degradation.

Both computational and prototype hardware implementations of the diagnostic capabilities are expected outcomes of this effort. Other methods could also be employed that appropriately model the uncertainties in the subsystem due to noise and other sources of uncertainty. The ability to actively query the underlying health management systems (whether they are related to detection or not) is critical to reducing the uncertainty in the diagnosis. As an example, if there is ambiguity in the diagnosis about the type and location of a particular failure in the aircraft structure, the diagnostic engine should be able to actively query that system or related systems to determine the true location and severity of the anomaly. Where possible, a rigorous mathematical framework should be employed to provide a rank ordered list of diagnoses, an assessment of the severity of each diagnosed event, along with a measure of the certainty in the diagnosis. Understanding and addressing the system integration and validation issues are critical components of this effort.

