

Aging Aircraft Inspection Systems Research

The Aviation Safety Research Act of 1988 directed the FAA to develop technologies and conduct data analysis for predicting the effects of aircraft design, testing, wear, and fatigue on the life of aircraft and on air safety.

It also expanded the research mission of the FAA to include research to improve maintenance technology and the detection of cracking, delamination, and corrosion of aircraft structures. Pursuant to this Act, the FAA developed the National Aging Aircraft Research Program (NAARP) of which the Inspection Systems Research is a major program area.

Program Infrastructure. The FAA's Inspection Systems Research is conducted largely at two major centers that were established to specifically support the inspection needs of the NAARP. One center, called the Center for Systems Reliability (CASR) was established in 1990 at Iowa State University to develop new and innovative inspection methods to solve the unique inspection challenges facing commercial aviation. The other center is the Airworthiness Assurance Nondestructive Inspection (NDI) Validation Center (AANC) which was established in 1991 at Albuquerque International Airport for the FAA by Sandia National Laboratories. The purpose of the AANC is to provide the FAA with a capability to conduct independent inspection and maintenance validation, reliability and technology transfer activities to facilitate the use of improved practices into the industry. Both CASR and the AANC serve to make up a significant part of the FAA's Airworthiness Assurance Center of Excellence managed for the FAA by Iowa State and Ohio State Universities.



Program Objectives. Inspection System Research will be conducted that will develop and/or validate and document inspection systems and repair practices that will better enable the aviation community to maintain the commercial aging fleet safely and more cost effectively. Improved practices will reduce the number of inspection preventable failures and the associated loss of life and revenue that may accompany these failures.

Program Approach. To achieve the objectives above, research carried out within this program area is organized under eight major task areas as described below:

Crack Detection. This research is directed at improving the sensitivity and reliability of techniques to detect and characterize small, inter-layer, and obscured cracks characteristic of widespread fatigue. Technologies of current general interest include dual probe ultrasonic imaging, pulsed eddy current (shown in the photograph), superconducting quantum interference devices (SQUIDs), and advanced electromagnetic sensors for widespread fatigue damage assessment. In addition to advanced technologies, several validation studies will be conducted on traditional inspection methods such as liquid penetrant and sliding probe eddy current to assess reliability and determine where improvements can be accomplished. For automated inspections, signal processing techniques are also being explored.



NDI for Composites and Disbond Detection. This research is developing noninvasive techniques to detect and characterize disbonding and understrength bonds in skin splices and developing noninvasive techniques to detect and characterize flaws in composite structures. Technologies of current interest include thermal wave imaging, oblique incidence ultrasonic scanning, and an automated tap tester. A project to design, build, and validate a set of universal composite standards for honeycomb and laminate inspections is also underway. Finally, a reliability study to assess the effectiveness of the tap test will be conducted.

Corrosion Detection. This research is focused on developing noninvasive techniques to detect and quantify corrosion in skin splices and other airframe structures. Technologies of current interest include magneto-optic eddy-current imaging (MOI) and pulsed eddy current. A corrosion experiment is currently underway to assess state of the art NDI methods for finding corrosion in lap splices.

Visual Inspection. This task area will quantify the reliability associated with the visual inspection of aircraft, identify areas where visual processes can be improved, and identify methods for enhancing the reliability of the visual inspection process. A current study will assess how written job card descriptions affect the performance of an inspector while conducting a visual inspection.

Composite Repair of Metal Aircraft. This effort will focus on validating the use of composite reinforcements and patches to specific and generic airframe applications. Use of patches is expected to provide safer, more cost effective repairs than those using traditional metal means.

NDI for Rotorcraft. This research will focus on evaluating the special needs associated with the inspection of rotorcraft. One current example deals with finding small amounts of corrosion in thin gauge aluminum.



NDI for Commuter Aircraft. This research will focus on developing better inspections for generic kinds of damage found in commuter type aircraft. On-going research is focussing on crack detection in multi-layer stack-ups and hidden area corrosion.

Maintain AANC Infrastructure and Quick Response. It is imperative that the FAA maintain an independent validation capability for new and emerging inspection and repair practices. A significant resource of the AANC is its collection of full-scale NDI test beds, smaller well-characterized sample defect library, and testing protocols that allow the center to conduct the independent validation and reliability studies required to support the NAARP. The FAA is committed to providing necessary resources to keep the AANC as versatile and responsive as possible.

To find out more about the Aging Aircraft Inspection Systems Research, contact:

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