



Infrastructure Assurance and Non-Destructive Inspection

Background

The genesis of Sandia National Laboratories' Infrastructure Assurance and Non-Destructive Inspection Department was the Federal Aviation Administration (FAA) Aging Aircraft Program. The AAP was created in response to the Aloha Airlines accident in 1988 when part of the fuselage separated in flight due to widespread fatigue damage. The FAA program is being renamed "Continued Airworthiness Assurance" to reflect the on-going need as fleets age and composites become mainstream.

Sandia's Hangar at the Albuquerque International Airport



The department's capabilities, originally developed for aviation-related programs, are being widely applied to other critical infrastructure issues involving metals and composites



Description

Sandia National Laboratories (SNL) was selected to create and operate the FAA's Airworthiness Assurance Non-Destructive Inspection Validation Center (AANC) to help solve the national problem of understanding aging fleets' airworthiness. As civil and military fleets continue to age and aircraft evolve from all-metallic to composite structures, the continued airworthiness assurance problem grows more complex.

Sandia leases a hangar at the Albuquerque International Airport (ABQ) where the department keeps entire aircraft (including Boeing 737, 747, and DC-9 among others), aircraft sections, specially designed and manufactured test articles, and laboratory facilities. The department works routinely with government, academia, and private industry, both domestic and international. Initially, the program's focus was the structural integrity of civilian aircraft, but the work has expanded to include military and other government aircraft as well as aircraft systems. The department also supports general aviation concerns. Research emphasizes improved methods to reliably detect cracks, voids, weak bonds, and disbonds in both metal and composite structures.

Expertise

The Infrastructure Assurance and Non-Destructive Inspection Department provides the following expertise:

- Non-destructive inspection (NDI)
- Structural health monitoring (SHM) and sensor development
- Structural repair
- Composites and advanced materials
- System safety
- Risk assessment
- Aircraft maintenance
- Aviation operations
- Instrumentation and field testing
- Hardware/mechanical and system design
- Non-structural systems, such as wiring
- Reliability and probabilistic analysis
- Technology transfer
- Formal process development and validation

Our work has evolved to include in-situ SHM and associated sensor design and evaluation. A broad range of NDI technologies is being evaluated for applications to metallic and composite structures. These include thermal imaging, robotic scanners, pulsed eddy current and phased-array eddy current, and ultrasonics. Our work also includes related composite structure design, structural mechanics testing, and damage-tolerance assessments, as well as manufacturing issues and self-healing composite structures.

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Sandia developed composite doubler repairs for massive metal structures and structural health monitoring for oil and mining industries



DC-9 Wing Tee Cap Inspection: Sandia developed a new process that decreased technician time from 800 to 80 hours, increased probability of crack detection, and eliminated confined space entry

Benefits

The work provides the following benefits:

- Support for FAA rulemaking, directly affecting flight safety
- Rapid technology development and transfer from the lab to the field
- Probability of detection rigorously generated at specified confidence levels for various technologies under field conditions
- Rapid infusion of advanced materials into aerospace and other infrastructure applications
- An *honest broker* with no profit motive tied to any technology



Sandia developed an advanced ultrasonic technique to verify mission-ready status of the Space Shuttle

Additional Applications

Sandia's skills and experience gained through aviation work also apply to military and civilian structures and infrastructure, including highway bridges, heavy machinery, and the Space Shuttle. The department created and implemented the only non-NASA-developed NDI tool that has been used to certify every orbiter for flight readiness in the post-Columbia era.



Sandia's expertise was used to verify stiffness of bonded automotive bodies using advanced NDI

Customers

Sponsorship for the AANC and other departmental work has expanded beyond the FAA to include all DoD agencies, the US Coast Guard and US Forest Service, Boeing, Lockheed-Martin, civilian airlines, the Department of Energy, Exxon Mobil, US automobile manufacturers, and numerous other private industry groups. Programs routinely include government and private industry partners worldwide. Over 200 government and private industry agencies have used the department's expertise and facilities.

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.



SAND2007-2565P

