FAA STRUCTURAL HEALTH MONITORING RESEARCH PROGRAM

Presented to: 2014 Airlines for America NDT Forum
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Date: September 23, 2014
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Atlantic City, NJ
Structural Health Monitoring (SHM)

• Past
• Present
• Future
SHM - Past

– In 2011, Transport Aircraft Directorate Seattle Sponsored SHM work:
  • Develop an overarching roadmap for SHM:
    – Guide the adoption of SHM in commercial transport aircraft
    – Provide regulatory guidance of SHM use
    – Assess state of SHM
    – Develop guidelines for assessing reliability and maintainability of SHM
SHM - Past

- Work accomplished via an Interagency Agreement with Sandia National Labs at the FAA’s Airworthiness Assurance NDI Validation Center (AANC)
- Work is being coordinated with the Aerospace Industry Steering Committee (AISC) on SHM (SAE G-11SHM)
SHM ROADMAP DEVELOPMENT

• **SHM Industry Survey** – addressed deployment, validation, certification, standardization & cost-benefit

• **SHM Technology Readiness Assessment (database)** – determined the potential adoption of SHM practices and issues affecting the operational performance of an SHM system

• **SHM Sensor Database** - indicates SHM possibilities (candidate technologies) and how to safely integrate them

• **FAA Documents and Precedents Review** – studied ACs, ADs, ARPs, Mil Hndbks, Certification Guidelines, MSG-3, HUMS, etc. to establish an SHM foundation

• Results of this work is documented in a report that is currently in editing and should be published in FY15
SHM PRESENT

• Conduct trial SHM certification & integration activity with an operator which establishes an optimum OEM-airline-regulator process

• Partnered with the AANC, Delta Air Lines and Boeing:
  – Determine most likely SHM candidate to move forward with
  – Pick an application for its use with a cost/benefit that satisfies Delta management
  – Most likely application will be a NDI inspection replacement
  – Determine all flight parameters affecting sensor/system
  – Develop a validation plan
  – Determine most likely applicant to gain FAA approval for use
  – Determine affect to maintenance program of aircraft and develop procedures for use
  – Perform flight test and gather data
  – Validate the effort by following the AISC’s ARP 6461 published in Sept 2013.
SHM PRESENT

- Team selected the Comparative Vacuum Monitoring (CVM) system to find cracks in known hot spots
- Through previous research in the Inspection program, this sensor has flown for over 6 years on several Delta and Northwest Airline Aircraft
- Past testing has given environmental reliability data
- Sandia has performed Probability of Detection analysis
- CVM is in Boeing’s NDT manual as an approved method for use
- Delta/Boeing has selected 737 NG Wing Box fitting cracking problem as application
- Boeing issued a service bulletin as a result of cracking after 21k cycles
- Discussed with FAA Transport Aircraft Directorate, Seattle and Atlanta ACO
SHM PRESENT FY13

• Plan was to install on aircraft by AAR-Indy (MRO) as aircraft are scheduled for 24 day checks—Sept 2013 for approx 70 aircraft (15k cycles)

• First 3 aircraft had cracked fittings—scrapped this idea
SHM FY14 Efforts

• New plan is to install on 737-700 going thru Atlanta for 5 ½ day checks (6k cycles)

• 7 aircraft completed in Feb/March 2014

• Delta is collecting CVM data every 90 days as well as performing required NDI inspection
CVM Install

Federal Aviation Administration

FAA Health Monitoring Research
SHM Future Efforts

• Review CVM project against ARP and determine what has been validated
• Assess FAA rules and determine if adequate for SHM use
• Delta and Boeing developing a list of future SHM applications
• Formal certification of CVM with Delta/Boeing and ACO once adequate data available.
SHM FY14 Efforts - Rotorcraft

• Intent to move to next level of SHM use working with Sikorsky and AANC

• Sikorsky has suggested 2 potential areas of the S-92 that could be possible test sites

• Can we tie the SHM sensors into the HUMS system? Is there a correlation of the HUMS data to the problem areas? This is AISC G-11 committee’s future plans for guidance for Rotorcraft.
SHM Issues

• Many members of the G-11 committee are concerned about SHM/POD.

• Defining a reliability methodology for SHM, is POD valid for SHM

• 1st International SHM Reliability Workshop to be held:
  • April 14-15th, 2015 in Boston
  • IWSHM September 2015 at Stanford
FAA Point of Contact

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