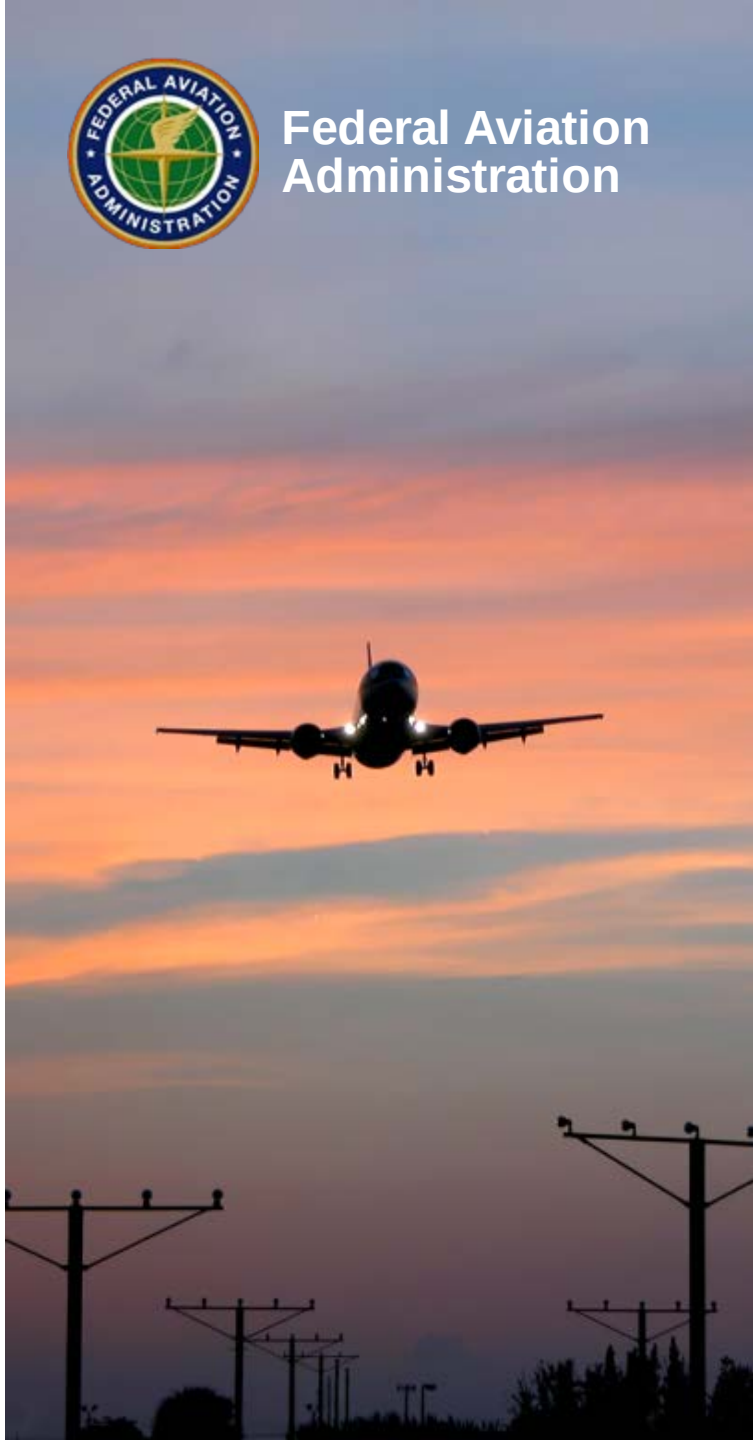
Inspection Challenges

Federal Aviation Administration



Presented to: Composite Workshop

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Design, Manufacturing and Airworthiness

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Composite Inspection

- **Often overlooked and often misunderstood component of repairs, alterations and modifications (RAMs).**
- **Inspections required pre, post and for continued airworthiness of RAMs**
- **Variety of nondestructive inspection techniques with visual as an initial assessment.**

Pre installation of RAMs

- **Pre-existing damage**
- **Pre-existing repairs**
- **Mapping of underlying structure**

Design for Inspection

- **Inspection should be considered when designing a modification.**
- **What and how to inspect prior to installation for both the modification and the structure.**
  - For nonstructural modifications visual and tap test will usually suffice.
- **Inspection during the installation**
  - Was damage induced during cutouts etc.
- **Continued Airworthiness**
  - How to inspect the modification and surrounding structure in service.

Inspection methodology

- **Visual for obvious signs of damage**
  - OEM's typically publish guidance on performing visual inspections citing surface conditions and classifications of damage.
- **Tap Test**
  - Works well on relative thin laminates for disbonds and mapping of underlying structure.
  - Automated tap testers can provide a digital map of the inspection area.

Inspection methodology

- **Ultrasonic Inspection**
  - After visual and tap test most widely utilized methodology on-wing.
  - Very effective on thick laminates
  - Typically pulse echo measuring time of flight
  - With use of C-scan a permanent record can be maintained.
  - Must utilize a calibration standard of same material and thickness.

Other NDI Methodologies

- **Thermography**
  - Not generally appropriate for on wing fuselage inspections
  - Most widely used for moisture ingression
- **Bond Testers**
  - Limited in depth of penetration
- **Interferometry/Shearography**
  - Limited application, particularly for modification and repair

Composite NDI Challenges

- **Lack of trained/qualified inspectors**
  - Most NDI training is focused on metals
  - Lack of opportunity
    - Affects currency
    - Hard to develop confidence
- **One solution**
  - Specific training modules have been developed by an industry working group for NDI of composites
    - Prototype class next week at Delta Airlines
    - Development of proficiency specimens.
- **Inadequate or incorrect procedures**

Questions?

- **How many in the audience have a good understanding of NDI methodologies, their capabilities and limitations?**
- **In your organization does the NDI organization review engineering documents prior to release?**
- **How do we improve the interface between engineering and inspection?**