
# Large Composite Aircraft - Unidentified Ground Damage: Mitigation

## HEWABI Recap Session
## FAA Montreal Workshop
## Sept 16, 2015

*FAA/Bombardier/TCCA/EASA/Industry Composite Transport Damage Tolerance and Maintenance Workshop*

# Boeing Perspectives

- **Agenda – HEWABI Recap**
  - **Boeing Industry Experiences and Safety Risk Mitigation Efforts**
    - **Customer Concerns**
    - **AMM Approach to Category 5 Damage**
    - **Video**

# High Energy Impact Events

- **Responses to concerns voiced by operators:**
  - **What is different about a composite airplane? (Do I have to do something different than I do for my existing fleet?)**
    - **Aside from how the damage may manifest itself, treat a composite airplane with the same care as for existing fleet**
    - **Metal structure – dents, cracks, distorted fasteners**
    - **Composite structure – cracks (dents often spring back)**
  - **How to differentiate from 'normal' airplane contacts?**
    - **Use practical judgment**
    - **As described in the 787 AMM conditional inspection:**
      a) **An airport jetway that hits the fuselage at more than normal operational speeds or angles**
      b) **Ground Support Equipment that hits the structure at more than 2 mph (3 km/h) or violently shakes the airplane**
      c) **Impact by a blunt, high mass object at low speed**
      d) **NOTE: Impacts which can cause damage to the airplane structure are different from usual contact with the structure made during servicing and maintenance of the airplane.**

# High Energy Impact Events

- **What inspections must be performed?**

- **Examine the structure in the area that you think or know that the impact incident occurred and at the adjacent support structure**

  - **Use visual and instrumented NDI procedures to examine the external area of high energy impact**
  - **Visually examine and instrumented NDI the external surfaces of the airplane in the general area of the impact which includes the nearest support structure**
  - **If you find signs of damage in the skin at the adjacent support structure or in skin below a stiffener, do internal visual and instrumented NDI procedures**
  - **Refer to Boeing if more clarification is necessary**

# High Energy Impact Events

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- **Responses to concerns voiced by operators, continued:**
  - **Why is structural substantiation for these events not a certification requirement?**
    - **Such events are the direct result of human action, occuring on the ground in the ramp or hanger environment**
      - **Reasonable expectation that such events will be reported**
    - **Potential threats present ability to impart nearly unbounded energy**
      - **Severe design penalty to account for all potential damage scenarios**
    - **Regulatory Policy**
      - **Design-in sufficient damage resistance such that Category 5 events are self-evident to the operations personnel involved**
      - **Define a suitable conditional inspection based on available information from the anomalous event**
      - **Provide operator training to ensure events are properly evaluated and dispositioned prior to the next flight**

# High Energy Impact Events

- **787 AMM Chapter 5 Conditional Inspection "Ground Handling Equipment Hits Airplane - Inspection"**
  - **General**
    - **procedure contains the steps to do an inspection after ground handling equipment hits the airplane with high energy**
    - **Listing of types of damage to look for**
  - **Description of High Energy Impact Events**

    **"A high energy impact is when the type, force, or cause is significant with or without the result of damage you can visually see."**

    **"Examples of low velocity, high energy blunt impacts"**
  - **Examine the Airplane Structure**
    - **Examine the structure in the area where the impact occurred, and also at the adjacent support structure**
    - **NDI is necessary if visible indications are seen or not seen**
- **Boeing developed training aids – videos**
  - **Technical video aimed at engineering personnel – to help understanding of what constitutes a high energy wide area blunt impact**
  - **High level video segment – module within ground handling training**

# High Energy Impact Events

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- **Conclusions**
  - **787 composite structure is robust, but not indestructible or impervious to all damage**
    - **Consideration of high energy wide area blunt impact events was made during design development, but not as certification requirement**
  - **Anomolous impact events must be reported & dispositioned prior to further flight, just as they would on a conventional metallic airplane**
  - **The 787 AMM provides a conditional inspection procedure defining inspection requirements**
    - **Boeing-developed training materials aid understanding, differentiation from 'normal' ground handling equipment contact with airplane**