



Federal Aviation
Administration

FAA / CAAs “Composite Meeting”

- High Energy Wide Area Blunt Impact -
(HEWABI Safety Awareness)

Larry Ilcewicz

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FAA Composite Team

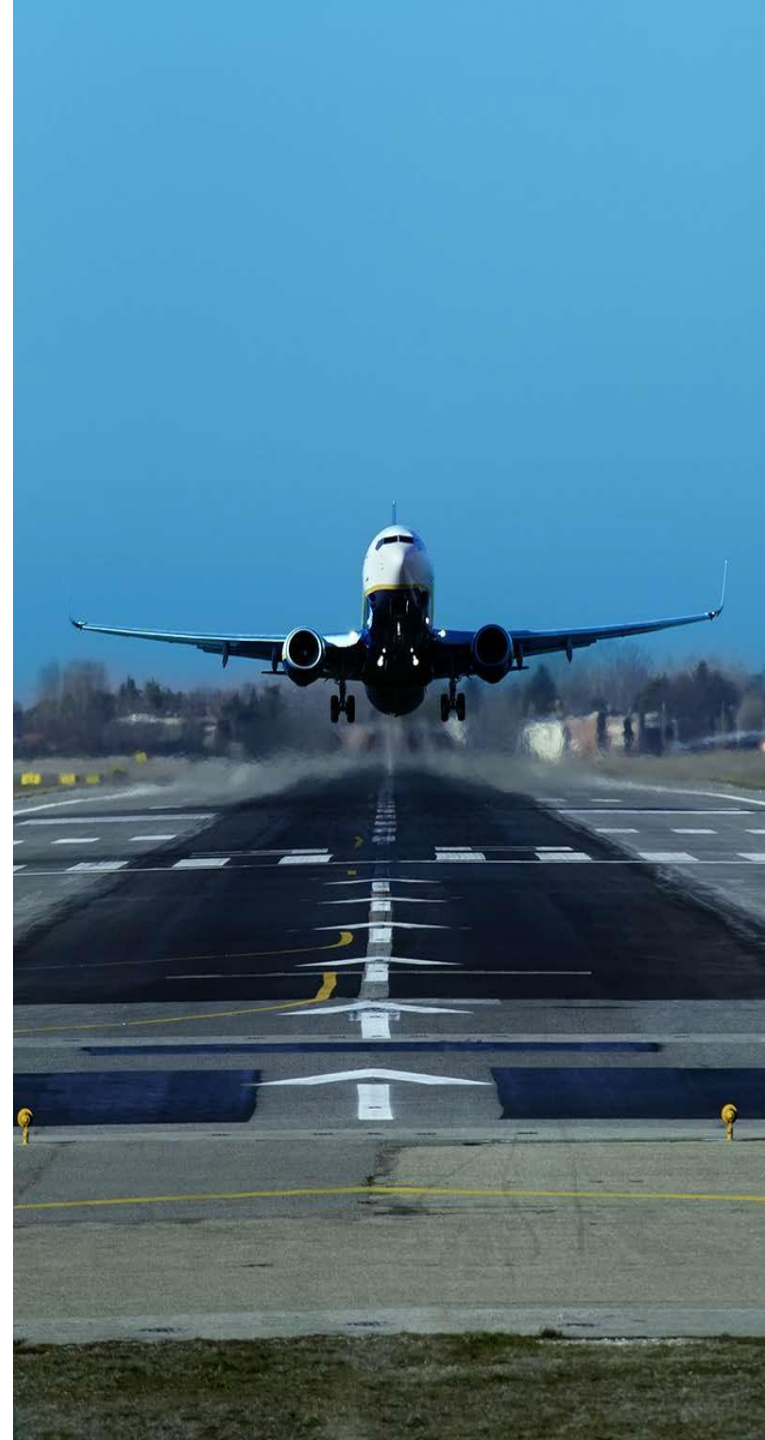
Singapore, Singapore

September 01-04, 2015

High Energy, Wide Area, Blunt Impact of Composite Aircraft Structure

by L. Ilcewicz, R. Jones,
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and A. Lewis (Boeing)

Presented to: Info-Share,
Maintenance Session
Date: April 15, 2015



Outline

High Energy Wide Area Blunt Impact (HEWABI) of Composite Aircraft Structure

- AVS Composite Plan
- Industry awareness & example HEWABI events
- Safety management approach for risk mitigation
- FAA research studies
- FAA policy benchmarking based on Boeing B787 & Airbus A350 HEWABI efforts
- OEM efforts within industry technology transfer for line maintenance and operations



AVS Composite Plan

- **Seven-year plan updated and expanded annually**
- **Three focus areas**
 - Continued Operational Safety (COS)
 - Certification Efficiency (CE)
 - Workforce Education (WE)
- **Priority is assigned to tasks based on issues that pose the greatest safety threats**
 - Safety management principles are used in working with industry



Active AVS Composite Plan Initiatives

Continuous Operational Safety (COS)	Certification Efficiency (CE)	Workforce Education (WE)
COS A: Bonded Structure	CE A: Hybrid F&DT Substantiation	WE A: Composite Manufacturing Technology
- Bonded Repair - Bonding Quality Control	CE B: Bolted Repair	WE B: Composite Structures Technology
- Sandwich Disbond Growth	CE C: Composite QC	WE C: Composite Maintenance Technology
COS B: HEWABI (High-Energy, Wide- Area Blunt Impact)	CE D: Advanced Composite Maintenance	Composite Basics
COS C: Failure Analysis of Composites Subjected to Fire	CE E: Bonded Structure Guidance	Composite DER
<u>Support to future COS Initiatives</u> Aging Composite Aircraft Teardown	CE F: General Composite Structure Guidance	
	Others: Transport Crashworthiness	
	Lightning Protection	
	Fire Safety	
	All: CMH-17 Revision H	

HEWABI with Composite Airframe Structure

Info-Share Meeting, Pittsburg, PA; April 15, 2015



Federal Aviation Administration

FAA/Industry Awareness

- **Impractical and/or impossible for aircraft design & maintenance practices to address all potential damage threats**



- **An integrated proactive approach with operations personnel can mitigate many of these damage threats**

Reasons to be proactive.....

Airport failed to spot jet damage

Manchester Online, UK - Apr 30, 2008

"Absolutely terrifying" flight after ground-crew mistake

Seattle Times, December 28, 2005

Airport focuses on ramp safety after rash of ground mishaps.

Knight-Ridder Tribune Business News Date: 31-JUL-06

Collision on the tarmac leads to panic in mid-air

London Times December 30, 2005

Ramp accidents continue to bedevil an industry that prides itself on its safety

Air Transport World, December 2003





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INDEPENDENT AND LOCALLY OWNED SINCE 1896 | seattletimes.com

“Absolutely terrifying” flight after ground-crew mistake

PLANE MAKES EMERGENCY RETURN TO SEA-TAC
Baggage handlers blamed for gash in jet’s side

BY JENNIFER SULLIVAN
AND MELISSA ALLISON
Seattle Times staff reporters

Alaska Airlines Flight 536 was 20 minutes out of Seattle and

heading for Burbank, Calif., Monday afternoon when a thunderous blast rocked the plane.

Passengers gasped for air and grabbed their oxygen masks as

the plane dropped from about 26,000 feet, passenger Jeremy Hermanns said by phone Tuesday.

“This was absolutely terrifying for a few moments,” said Hermanns, 28, of Los Angeles. “Basically your ears popped, there’s a really loud bang and there was a lot of white noise. It was like

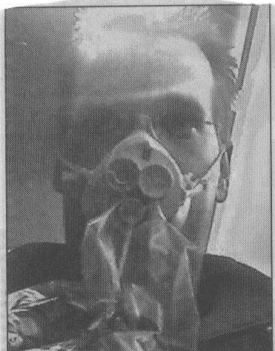
somebody turner in your ear.”

Though the quickly stabilizing passengers spent minutes tearful and in a “sterid” odor of overwhelmed Hermanns said.

“A lot of p

She said Alaska conducted safety briefings with employees at Sea-Tac on Tuesday “to discuss the importance of rapid and thorough reporting of any ground incidents, whether there is apparent aircraft damage or not.”

The airline also is reviewing details from Monday’s incident with the NTSB and working with the agency to ensure aircraft safety, she said.



JEREMY HERMANNS

In a photo taken aboard the plane, Jeremy Hermanns uses an oxygen mask.

An Excellent Safety Message

HEWABI with Composite Airframe Structure

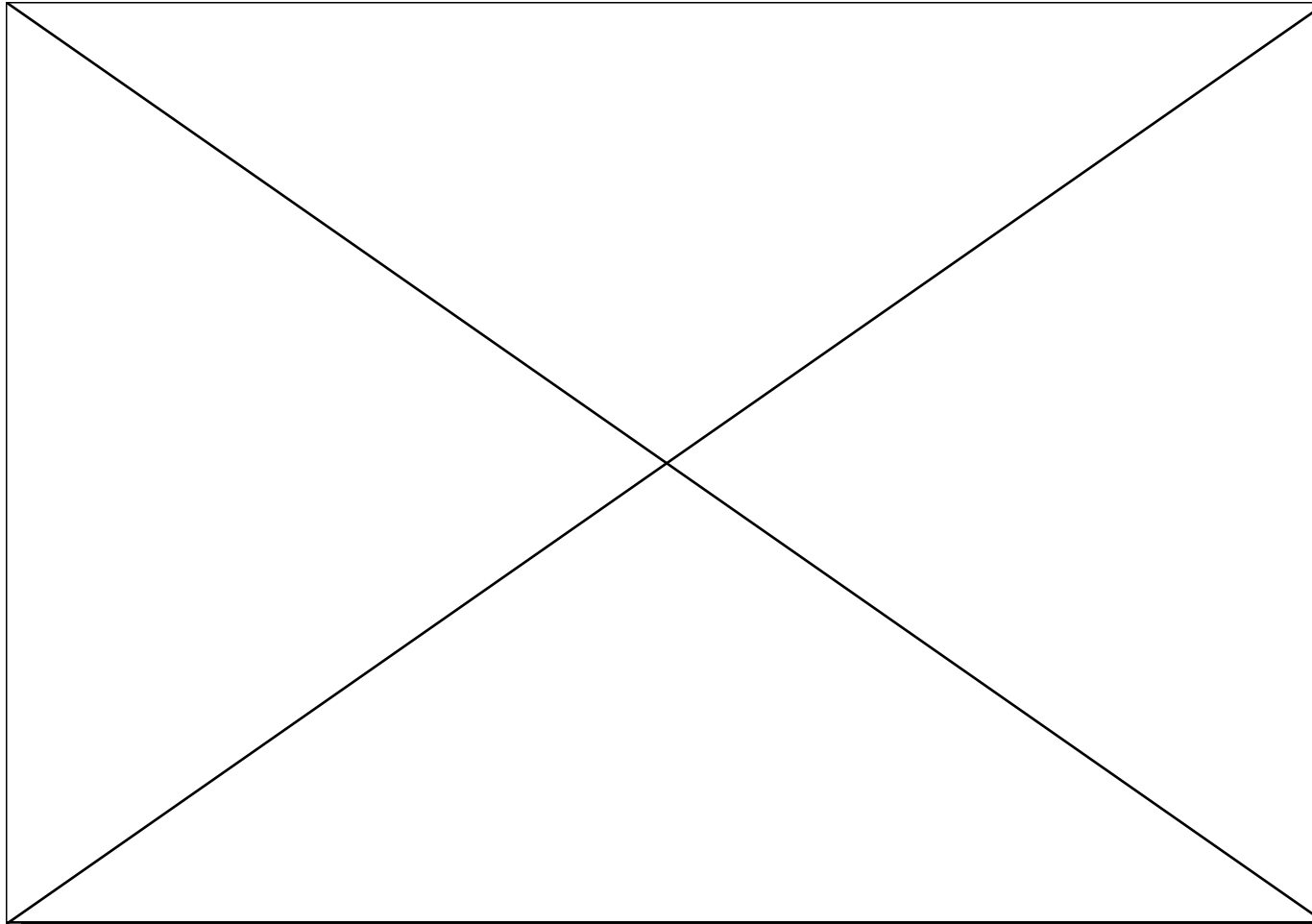
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Our Tenth Anniversary Year Studying a Key Area

HEWABI = High Energy Wide Area Blunt Impact



According to comments on Flightaware:
Occurred March 23 2014,
UPS Boeing 757-200
(N462UP) on Spot 90 at the
Miami International Airport
Repaired by AAR Aircraft
Services Miami, and returned
to flight status on April 13.

The truck belongs to a
catering company. It was
being driven by a female who
was not supposed to be
driving, hence the reason they
jumped out and switched
really quick.

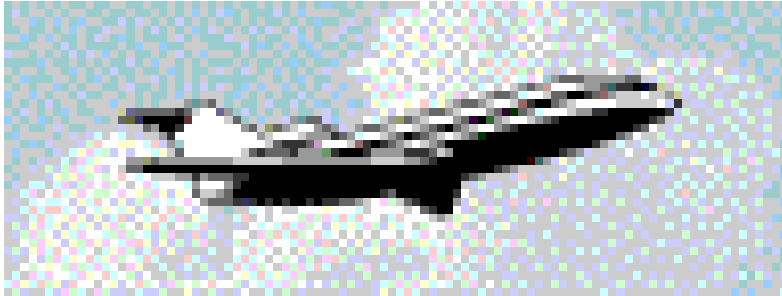
The passenger told security
he was the driver, but once
they reviewed this footage
they saw he clearly wasn't.
They were both fired.

Key HEWABI Issues

- **Significant Impact Events can cause major damage to airframe structures**
 - impacts with service vehicles
 - Impacts with ground structures and other airplanes
- **Composite airframes may not show damage as readily as traditional metallic airframes**
 - less prone to plastic deformation (dents)
- **Awareness & reporting of significant impact events will close potential safety gaps**
 - Safety Management Approach is needed to protect safety
 - Partners: OEM engineering, regulators, line maintenance, operations, other people involved



Memories from Our 1st Composite WG Meeting (2005) Why are We Here???



Because I can't get you to Mil-Handbook-17 or SAE Meetings and you each have key insights that are needed by people in positions to make a safety difference!

Composite HEWABI Initiatives FAA/EASA/Airbus/Boeing Working Group (*starting in 2005 & 2011*)

- Chicago, IL (2006) FAA/CMH-17 Workshop
- Amsterdam, Netherlands (2007) FAA /SAE CACRC Workshop
- Tokyo, Japan (June 2009) FAA /SAE CACRC Workshop
- AC 20-107B (Sept. 2009)
- FAA White Paper (2008) and FAA/EASA research (ongoing since 2009)



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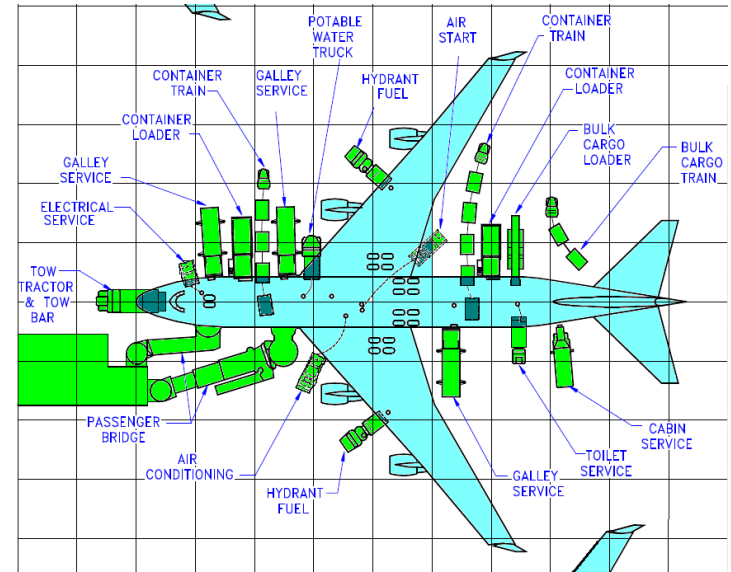
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FAA Technical Paper on Awareness & Reporting of Significant Impact Events Involving Composite Airframe Structures

(effort initiated by FAA/EASA/Airbus/Boeing WG)

Not all damaging events (e.g., severe vehicle collisions) can be covered in design & scheduled maintenance

- Safety must be protected for severe accidental damage outside the scope of design by operations reporting
- Awareness and a “No-Blame” reporting mentality is needed
- HEWABI damage requirements (if not covered by design):
 - a) damage is *obvious* (e.g., clearly visual) and *reported* &/or
 - b) damage is *readily detectable* by required pre-flight checks &/or
 - c) the *event* causing the damage is otherwise *self-evident* and *reported* e.g., obvious, severe impact force felt in a vehicle collision



Solution Path for Vehicle Collisions Classified as Category 5 Damage

- **Layers of Safety management needed**
 - Damage resistant structure (to ensure HEWABI criteria are met!)
 - Damage tolerance for significant accidental damage
 - No blame reporting encouraged or mandated
 - Conditional inspection documented
 - Practical NDE to avoid internal access when not practical
- **Provide supporting data on events justified to yield HEWABI damage and the resulting disposition**

1) Impact Event is Reported	Awareness by ground crews, service crews, air crews, and/or ramp personnel
2) Line Maintenance Ensures Proper Evaluation	Line and Dispatch personnel trained to seek skilled disposition assistance
3) Engineering Evaluation & Repair (if necessary)	<ul style="list-style-type: none"> a. Engineers, OEM, technicians, inspectors with proper training b. Allowable Surface Damage Limits do <u>NOT</u> apply c. Initial inspection is to detect <u>MAJOR</u> internal damage



COS B, HEWABI

UCSD
FAA/JAMS

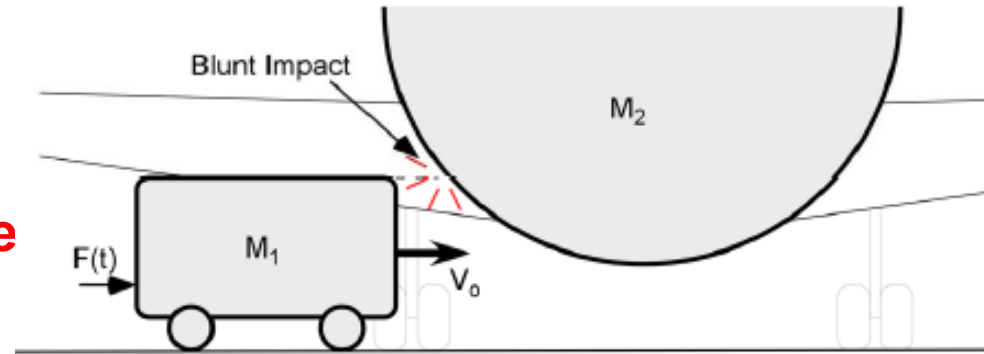
Frame03 - Load 2
Dynamic Test

March 6, 2012
Stroke: 222 mm at 0.5 m/s



FAA/Industry Research at University of California, San Diego (UCSD)

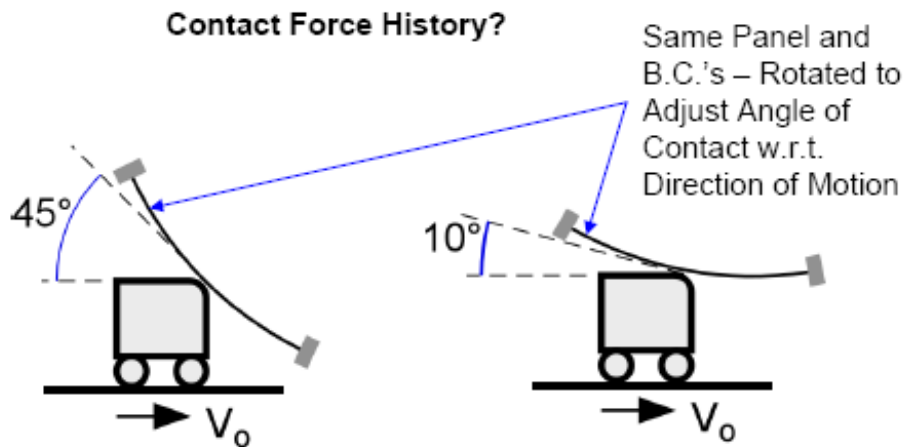
- **FAA active R&D to help bound important variables and worst case scenarios (i.e., most severe internal damage with least exterior visually detectable indications)**



- **Both analysis and tests**

Vehicle collision characteristics (e.g., speed, angle of incident, impactor geometry/material and structural location) important to:

- a) damage severity,
- b) details worth reporting,
- c) possible visual evidence and
- d) identification of practical inspection needs will be noted



Dr. Hyonny Kim, UCSD

High Energy Wide Area Blunt Impact Policy

- **Completed internal FAA reviews/updates for associated FAA Transport Directorate Policy** (Focal: Mark Freisthler)
 - Based on work already performed for Boeing B787 and Airbus A350
 - Responsibility to address all damages that could prove catastrophic
 - Aircraft Maintenance Manual conditional inspections
 - Allowable damage limits in Structural Repair Manuals don't apply
 - Recommends analyses, tests, training content & other risk mitigation
- **2015 release schedule**
 - Public commenting April to May, 2015
 - Final issuance: August, 2015
- **Other FAA HEWABI efforts under COS B**
 - FAA and EASA HEWABI research remains active
 - OEM HEWABI efforts continue for new composite transport fuselage
 - Future HEWABI initiatives includes new CMH-17 content



Additional parts of safety awareness...

- **Impact Event**

- Awareness by ground crews, service crews, air crews, and/or ramp personnel will result in the reporting of significant impact events

- **Report**

- Awareness by Line and dispatch personnel will result in subsequent inspection and evaluation of the structure

- **Evaluation (& Repair if necessary)**

- Awareness by engineers, OEM, technicians, NDI inspectors will result in appropriate assessment (& repair if necessary)
- SRM Allowable Damage Limits do **NOT** apply
- NDI initially looking for **MAJOR** internal damage

~~*"I don't see any damage so it must be OK"*~~

~~*"It's not my job to report it"*~~

~~*"From what I can see, it looks fine"*~~

~~*"Don't worry, it's way over designed"*~~



Boeing Activities

- **Impact and Robustness testing**
 - Small scale
 - Large scale
- **Design Requirements**
- **Verification Testing – Full Size Airplane**
- **Created training with safety awareness message**
 - Airline engineers
 - Ground Handling personnel



Summary

- **FAA AVS Composite Plan has COS items relying on strong industry support**
- **Current COS focus is on bonded structures, with emphasis on repair, and HEWABI**
 - HEWABI policy to be released for OEM engineering guidance
 - Progress in each area provides a good starting point but safety risks demand further actions (bonded repair can be covered in Fall, 2015)
- **Workforce education strategies include continuous updates based on COS & CE**
 - Immediate dissemination of safety knowledge through existing industry contractor and academic partner relationships

Thanks you for your attention



Composite Safety & Certification Meeting - HEWABI Safety Awareness -

- **Thanks for Opportunity.**
- **Questions and/or Thoughts?**
- **Further Discussion.**

