

# Composite Damage Tolerance and Maintenance Workshop



Federal Aviation  
Administration

Welcome and Introduction

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Joint FAA Advanced Materials and Structures  
Center of Excellence

Date: July 19-21, 2006



# Welcome and Thanks for Participating

- **Thank you for taking time from your summer activities to support this effort**
- **A quick look at who is here:**
  - Academia 8
  - Manufacturers 46
  - Regulators/Customers 44
  - Other 37



# Logistics

- **Restaurant Guide available on the back table**
- **Restrooms are down the hall from the room, directly across from the restaurant.**
- **All agenda times including break end times will be strictly enforced!!!**



# Comments on Agenda



Wednesday, July 19, 2006

AM

- 1:00 - 1:15 *FAA Composites Overview*
- 1:15 - 1:45 *Training Developments for Critical Composite Maintenance and Repair Issues*
- 1:45 - 2:25 *Composite Damage Tolerance & Maintenance Safety Issues*
- 2:25 - 3:00 *Safety Management*
- 3:00 - 3:15 *Break*

- Curtis Davies (FAA)
- Charles Seaton (Edmonds CC)
- Larry Ilcewicz (FAA)
- Bjorn Backman (Structured Research)

### Session 1: Applications and Service Experiences: Transport Aircraft

- 3:15 - 4:00 *Airbus Composites - Damage Tolerance Methodology*
- 4:00 - 4:45 *Boeing Transport Experience with Composite Damage Tolerance & Maintenance*
- 4:45 - 5:15 *FAA/EASA/Boeing/Airbus Damage Tolerance & Maintenance WG*

- Chantal Fualdes (Airbus)
- Allen Fawcett & Gary Oakes (Boeing)
- Tom Walker (NSE Composites)

Thursday, July 20, 2006

AM

### Session 1: Applications & Service Experiences: Small Airplanes + Rotorcraft

- 8:00 - 8:30 *Staying Ahead Of The Game: Keeping a Composite Airplane Fleet Airworthy*
- 8:30 - 9:00 *Composites in Rotorcraft Industry and Damage Tolerance Requirements*
- 9:00 - 9:10 *Break*

- Paul Brey, Tim Timmerman & Andrew Rokala (Cirrus Design Corp.)
- D.J. Reddy, consultant

### Session 2: Substantiation of Structural Damage Tolerance

- 9:10 - 9:40 *Damage Tolerance Considerations in Composite Aircraft Structure*
- 9:40 - 10:10 *Effect of Damage on Performance of Composite Structures*  
*- Applications to Static and Fatigue Strength Predictions*
- 10:10 - 10:40 *NASA Langley Damage Tolerance Experiences*
- 10:40 - 10:50 *Break*

- Joe Soderquist, consultant
- Christos Kassapaglou, consultant
- Ivantury Raju (NASA)

### Session 3: Structural Test Protocol

- 10:50 - 11:20 *FAA R&D in Composite Sandwich Structures*
- 11:20 - 11:50 *Load Enhancement Factor for Composite Test Spectra*
- 11:50 - 12:20 *FAA Research on Large-Scale Test Substantiation*

- Peter Shyprykevich (FAA)
- Ric Abbott (Abbott Aerospace Composites, LLC.)
- John Tomblin (WSU)



Thursday, July 20, 2006

PM

12:20 - 1:15 Lunch – Sponsored by Wichita State University

#### Session 4: Substantiation of Maintenance Inspection & Repair Methods

1:15 - 1:45 *MRO Repair of Composites, A 20 Year History:*

1:45 - 2:15 *United Airline Composite Maintenance Experiences*

2:15 - 2:45 *Safe Composite Repairs - Substantiation Database Framework*

2:45 - 3:15 *Composites at Airbus - Maintenance & Repairs*

3:15 - 3:30 Break

#### Session 5: Damage/Defect Types and Inspection Technology

3:30 - 4:00 *FAA Inspection Research Activities for Composite Materials*

4:00 - 4:30 *Damage/Defect Types and Inspection - Some Regulatory Concerns*

4:30 - 5:00 *Unified Treatment for Impact - Probabilistic & Deterministic*

Paolo Feraboli (Univ. of Washington), and Hyonny Kim (Purdue Univ.)

5:00 - 5:15 Closure (review tomorrow's breakout sessions)

- Jim Epperson (Nordam)
- Eric Chesmar (United Airlines)
- Mike Borgman & John Welch (Spirit)
- Roland Thevenin (Airbus)

- Dave Galella (FAA)
- Simon Waite (EASA)
- John Halpin (JCH Consultants), Keith Kedward (UCSB),

Friday, July 21, 2006

AM

#### Session 6: Technical Breakout Sessions

8:00 - 10:00 *Substantiation of Structural Damage Tolerance*

*Structural Test Protocol*

*Substantiation of Maintenance Inspection & Repair Methods*

*Damage/Defect Types and Inspection Technology*

10:00-10:20 Break

#### Session 7: Technical Breakout Summaries and Workshop Recap

10:20-10:45 *Brainstorm subjects desired at 2007 Workshop*

10:45 - 11:45 Technical Breakout Summaries

*Substantiation of Structural Damage Tolerance*

*Structural Test Protocol*

*Substantiation of Maintenance Inspection & Repair Methods*

*Damage/Defect Types and Inspection Technology*

11:45-12:00 *Recap/Actions/Closure*

- Tom Walker (NSE) and Larry Ilcewicz (FAA)
- John Tomblin (WSU) & Peter Shyprykevich (FAA)
- Gary Oakes (Boeing) & Mike Borgman (Spirit Aero)
- Curtis Davies (FAA) & Larry Gintert (Concurrent Tech. Inc.)

- Kristin Strole (WSU)

- Tom Walker (NSE) and Larry Ilcewicz (FAA)
- John Tomblin (WSU) & Peter Shyprykevich (FAA)
- Gary Oakes (Boeing) & Mike Borgman (Spirit Aero)
- Curtis Davies (FAA) & Larry Gintert (Concurrent Tech. Inc.)
- Larry Ilcewicz & Curtis Davies (FAA)

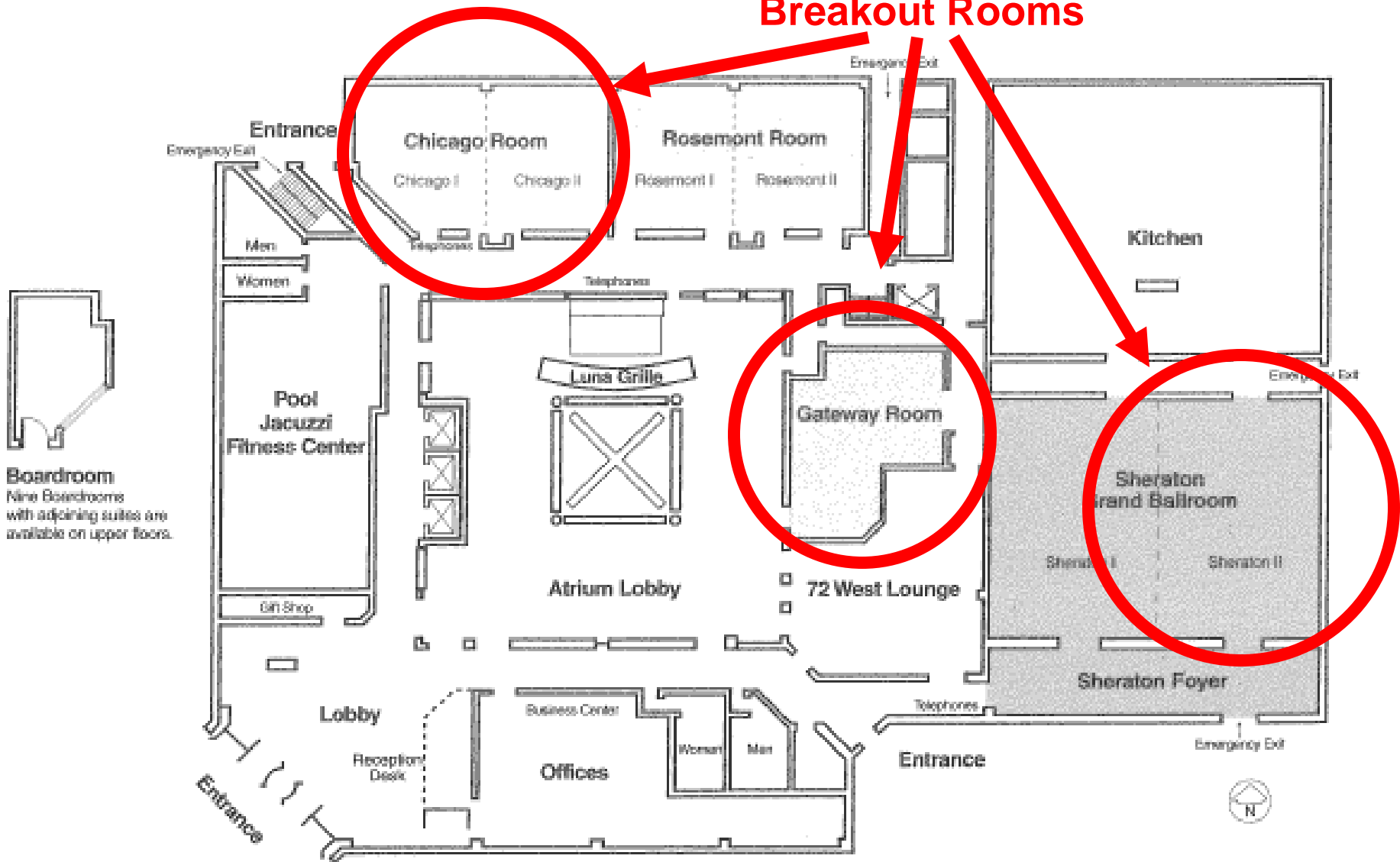


# Discussion on Subject Areas

- **On Friday Morning**

- Participants are assigned a room.
- We will divide into four groups to allow better discussion on each subject area
  - Substantiation of Structural Damage Tolerance
    - Tom Walker (NSE) and Larry Ilcewicz (FAA)
  - Structural Test Protocol
    - John Tomblin (WSU) & Peter Shyprykevich (FAA)
  - Substantiation of Maintenance Inspection & Repair Methods
    - Gary Oakes (Boeing) & Mike Borgman (Spirit Aero)
  - Damage/Defect Types and Inspection Technology
    - Curtis Davies (FAA) & Larry Gintert (Concurrent Tech. Inc.)
- You have a colored strip on your badge this identifies you as member of a particular group and which room
  - Green                      Sheraton II
  - Purple                      Gateway
  - Blue                         Chicago I
  - Red                         Chicago II
- These discussions will be summarized when the workshop reconvenes.

# Breakout Rooms





**This activity sponsored by**

**JAMS**

**JOINT ADVANCED MATERIALS & STRUCTURES CENTER OF EXCELLENCE**

# JAMS-CoE Member Schools

- **The joint center consists of two groups and includes ten institutions**

- **AMTAS (Advanced Materials for Transport Aircraft Structures)**

- Director, Dr. Mark Tuttle
- University of Washington, Lead
- Washington State University
- Oregon State University
- Edmonds Community College



- **CECAM (Center for Composite and Advanced Materials)**

- Director, Dr. John Tomblin
- Wichita State University, Lead
- Northwestern University
- Purdue University
- Tuskegee University
- University of Delaware
- University of California at Los Angeles



# CoE Technical Focus Areas

- **Structural Substantiation**
- **Damage Tolerance and Durability**
- **Bonded Joints Processing Issues**
- **Maintenance Practices**
- **Material Standardization and Shared Databases**
- **Advanced Material Forms and Processes**
- **Cabin Safety and Crashworthiness**
- **Life Management of Materials for Improved Aircraft Maintenance Practices**
- **Nanotechnology for Composite Structures**

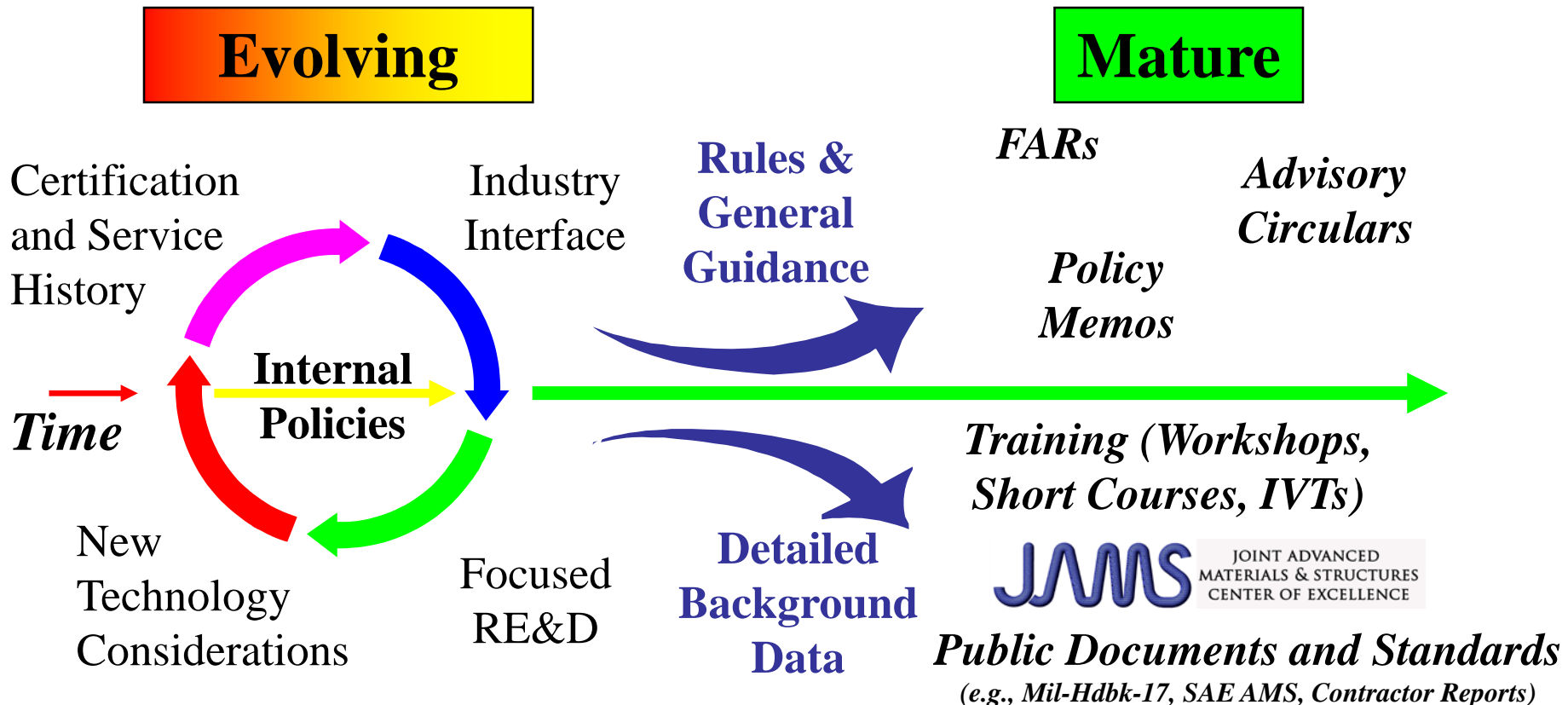


# Composite Safety & Certification Initiatives Objectives

- 1) Work with industry, other government agencies, and academia to ensure safe and efficient deployment of composite technologies used in existing and future aircraft
- 2) Update policies, advisory circulars, training, and detailed background used to support standardized composite engineering practices

*\* Efforts started in 1999 to address issues associated with increasing composite applications*

# FAA Approach to Composite Safety and Certification Initiatives



# Technical Thrust Areas

*Advancements depend on close integration between areas*

Material Control, Standardization  
and Shared Databases

## Structural Substantiation

- Advances in analysis & test building blocks
- Statistical significance
- Environmental effects
- Manufacturing integration

FAA and NASA  
R&D is currently  
active in most  
of these areas



**NASA**

## Damage Tolerance and Maintenance Practices

- Critical defects (impact & mfg.)
- Bonded structure & repair issues
- Fatigue & damage considerations
- Life assessment (tests & analyses)
- Accelerated testing
- NDI damage metrics/service POD
- Equivalent levels of safety
- Training standards

Bonded Joint  
Processing Issues

Advanced Material  
Forms and  
Processes

Flammability &  
Crashworthiness

*Support from cabin  
safety research groups*

*Significant progress, which has relevance to all aircraft products, has been gained to date*



# FAA Composite Team Members

Represented Group	Team Member Name	FAA Organization Number & Routing
FAA Tech. Center	Curtis Davies	AAR-450 (FAA Technical Center)
	Peter Shyprykevich	AAR-450 (FAA Technical Center)
International	John Masters	AEU-100 (Brussels Aircraft Certification Staff)
Directorates	Lester Cheng	ACE-111 (Small Airplane Directorate)
	Mark James	ACE-111 (Small Airplane Directorate)
	Charles Harrison	ASW-111 (Rotorcraft Directorate)
	Ian Won	ANM-115 (Transport Airplane Directorate)
	Jay Turnberg	ANE-110 (Engine & Propeller Directorate)
Flight Standards	Rusty Jones	AFS 309 (Aircraft Maintenance Division)
ACOs, MIDOs & CMOs	Roger Caldwell	ANM-100D (Denver ACO)
	Mark Freisthler	ANM-120S (Seattle ACO)
	Ed Garino	ACE-117A (Atlanta ACO)
	Fred Guerin	ANM-120L (Los Angeles ACO)
	John Harding	ANM-108B (Seattle CMO)
	Angie Kostopoulos	ACE-116C (Chicago ACO)
	David Ostrodka	ACE-118W (Wichita ACO)
	Richard Noll	ANE-150 (Boston ACO)
	David Swartz	ACE-115N (Anchorage ACO)
CS&TA	Larry Ilcewicz	ANM-115N (CS&TA, Composites)

*Not intended to be inclusive. More team members are encouraged and currently needed.*

**CSTA and STS Advisors:**  
 Al Broz, Robert Eastin,  
 John Howford, Terry Khaled,  
 Steve Soltis, Dave Walen,  
 Chip Queitzsch

# Important Teammates

- **NASA has been a leader for composite applications**
  - Significant research support since 1970/1980s
  - AA587, A300-600 accident investigation
  - NCAMP support to material standardization
- **Partnerships with industry have been essential**
  - Examples: Mil-17, SAE P-17, CACRC, ASTM, SAMPE, AGATE, SATS, RITA, SAS/IAB/AACE



Training  
Databases  
Standardization



Engineering guidelines



- **DOD and DARPA research**
- **EASA and other foreign research/standardization**



# Past Accomplishments of FAA Composite Team

- **Pro-active efforts under Composite Safety & Certification Initiatives (CS&CI) started in 1999**
  - Progress releasing policy & guidance (*at least 1/yr. since 1999*)
  - Early emphasis on material & process control (*2000-2003: AGATE shared databases, equivalency sampling, AC23-20*)
  - Policy on static strength substantiation (2001) and bonded structures (2005)
  - *Draft rule & AC for rotorcraft fatigue & damage tolerance (2002)*
- **Future CS&CI are resource limited**
  - Some transfer of existing guidance to other aircraft products
  - *Technical emphasis on damage tolerance & maintenance*
  - *Voices from the field want near-term emphasis on “training”*
  - Continue using industry resources in composite standards orgs.

# Again Welcome and Thank You for Your Participation

