

Composite Safety & Certification Initiatives

Presented at 11/10/04 AMTAS Meeting



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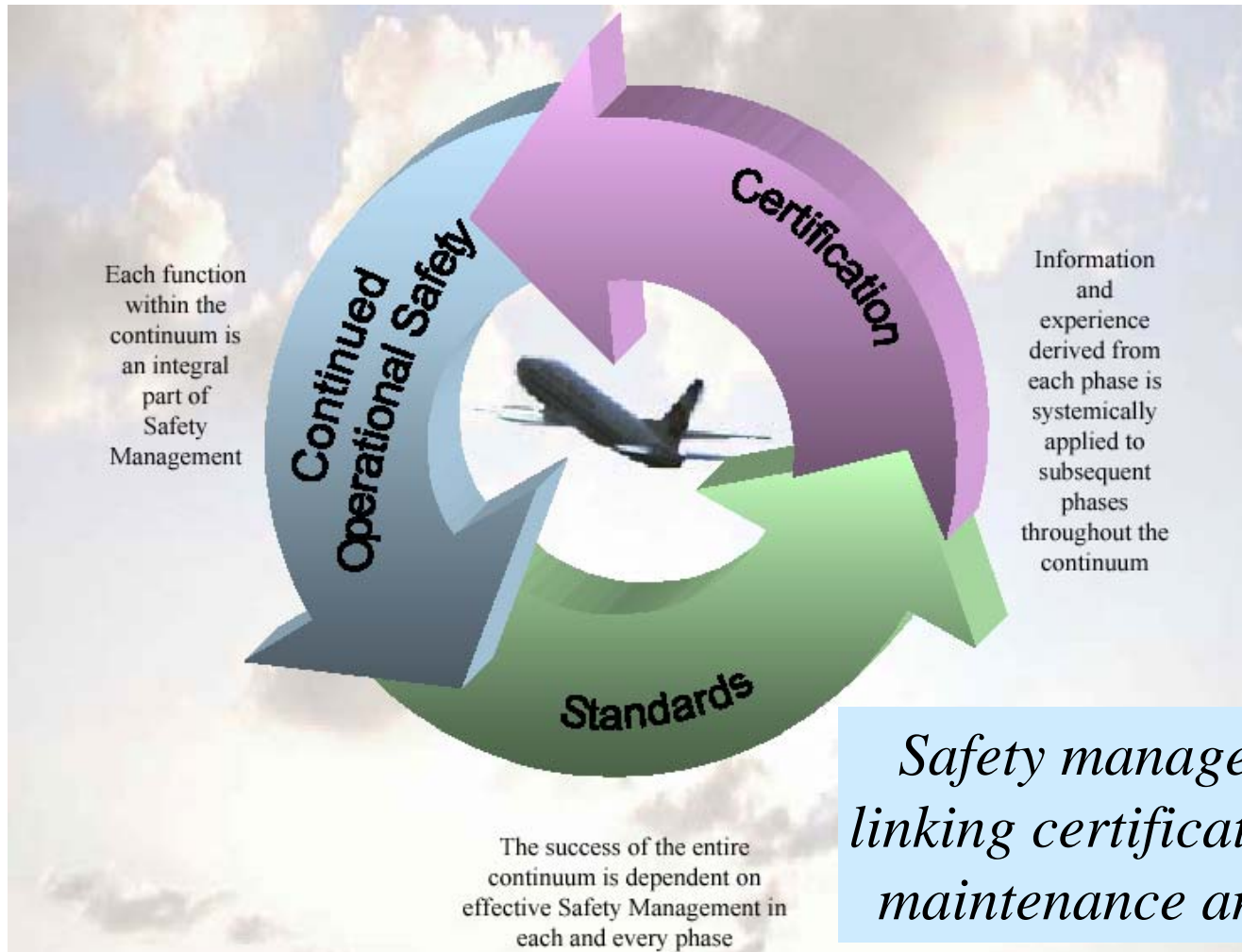
Larry Ilcewicz,
NRS (Composites)

- Background
 - Approach and teammates
 - FAA Center of Excellence
- Technical status
 - Material and process controls
 - Bonded structure
 - Maintenance training
- Summary



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FAA Strategic Plan: Safety Continuum





Ongoing 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*



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Technical Thrust Areas

Advancements depend on close integration between areas

Material Control, Standardization
and Shared Databases

Structural Substantiation

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

Bonded Joint
Processing Issues

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



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Advanced Material
Forms and
Processes

Damage Tolerance and Maintenance Practices

- Critical defects (impact & mfg.)
- Bonded structure & repair issues
- Fatigue & damage considerations
- Life assessment (tests & analyses)
- Quantitative NDE/Service POD
- Equivalent levels of safety

Flammability &
Crashworthiness

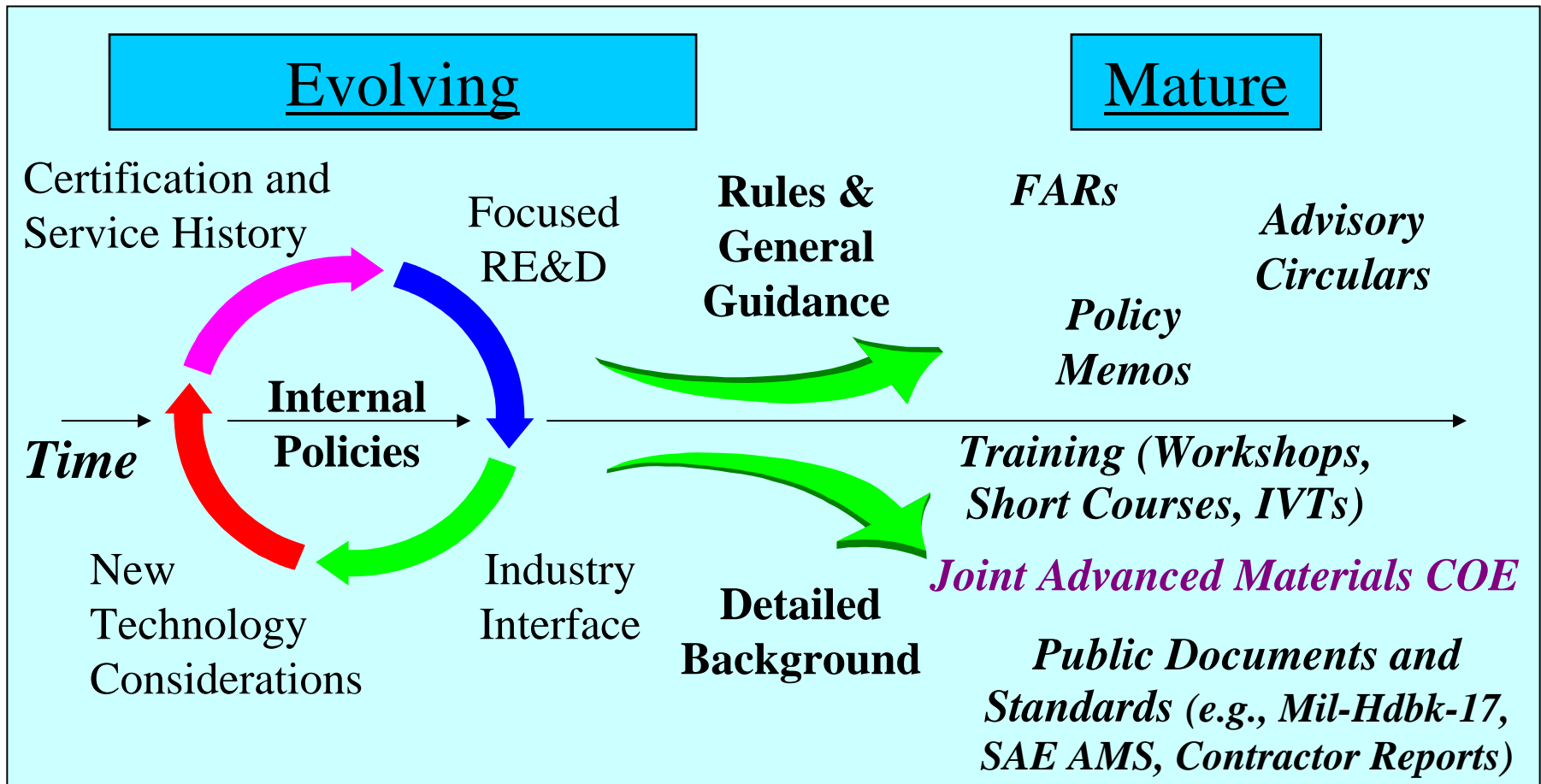
*Support from cabin
safety research groups*

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



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FAA Approach to Composite Safety and Certification Initiatives





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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)
	Richard Monschke	ASW-111 (Rotorcraft Directorate)
	Richard Yarges	ANM-115 (Transport Airplane Directorate)
	Hank Offermann	ANM-115 (Transport Airplane Directorate)
	Jay Turnberg	ANE-110 (Engine & Propeller Directorate)
Flight Standards	William Henry	AFS 350 (Aircraft Maintenance Division)
ACOs, MIDOs & CMOs	Randy Blosser	ANM-100D (Denver ACO)
	Roger Caldwell	ANM-100D (Denver ACO)
	Mark Freisthler	ANM-120S (Seattle ACO)
	Fred Guerin	ANM-120L (Los Angeles ACO)
	Angie Kostopoulos	ACE-116C (Chicago ACO)
	David Ostrodka	ACE-118W (Wichita ACO)
	Richard Noll	ANE-150 (Boston ACO)
	Dick Vaughn	ANM-108B (Seattle CMO)
	David Swartz	ACE-115N (Anchorage ACO)
CS&TA	Larry Ilcewicz	ANM-115N (CS&TA, Composites)

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



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Important Teammates

- NASA has been a leader for composite applications
 - Significant research support since 1970/1980s
 - AA587, A300-600 accident investigation
- Partnerships with industry are essential, e.g., Mil-17, SAE P-17, CACRC, ASTM, SAMPE, AGATE, SATS, RITA, SAS/IAB/AACE

~~NASA~~



Training
 Standardization
 Shared databases
 Engineering guidelines



- FAA Joint Advanced Materials Center of Excellence (JAMCOE)
 - Univ. of Washington (Edmonds C.C., Washington State Univ., Oregon State Univ.)
 - Wichita State Univ. (Univ. Of Delaware, Tuskegee Univ., UCLA, Northwestern, Purdue)



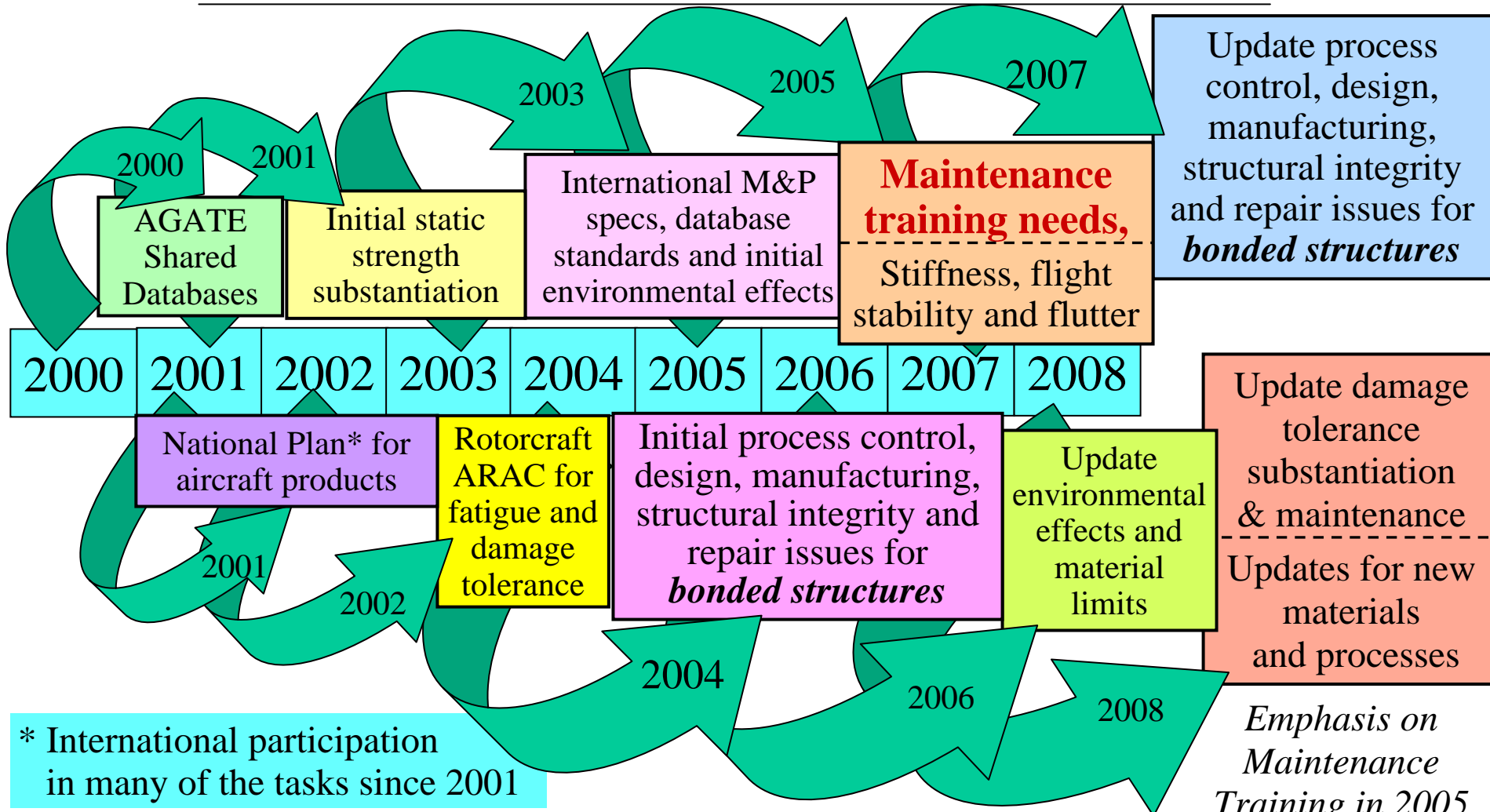
Current AMTAS Support to Composite Safety & Certification Initiatives

- Focused research based on identified needs
 - Characterization of bond surface preparation
 - Reliability-based damage tolerance design
 - Aeroservoelasticity of composite structures
- Training development and standardization
 - Industry standards in composite maintenance training to support the needs of expanding applications
 - Practical basis for *continuous education*, as well as a working knowledge for 2-year, 4-year and graduate degrees



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Milestones for Composite Safety and Certification Policy, Guidance and Training





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Background in Composite Material Control, Standardization and Shared Databases

- Mil-Handbook-17 has pursued standardization and shared databases for some time - first PMC data set approved in 1990
- NASA/FAA/Industry AGATE efforts accelerated the need for FAA policy on shared material qualification databases
 - 1 Multi-batch material qualification to generate the database & set specs.
 - 2 Equivalency (“mini-qualification”) sampling to show new users process the material to fall within the database population (also covers changes)
 - 3 Apply database to your product and continuously control the material
- Mil-Handbook-17 initiatives and AGATE experiences led to a need for FAA guidance on M&P specs – AC in 2003
 - Linked with material control and shared databases
 - SAE P-17 is developing AMS for composite prepreg
- WSU NIAR is developing related composite training

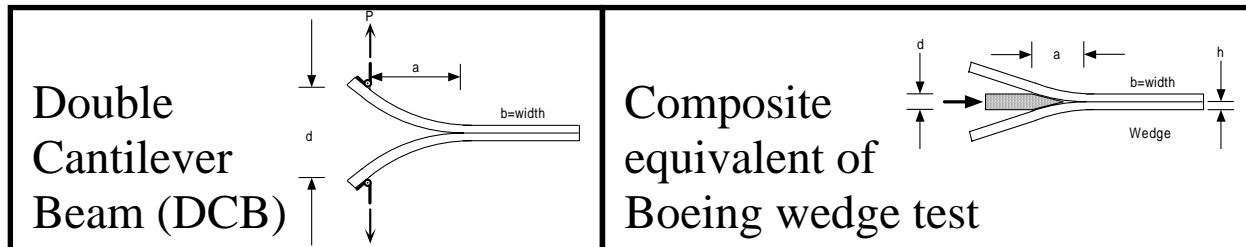




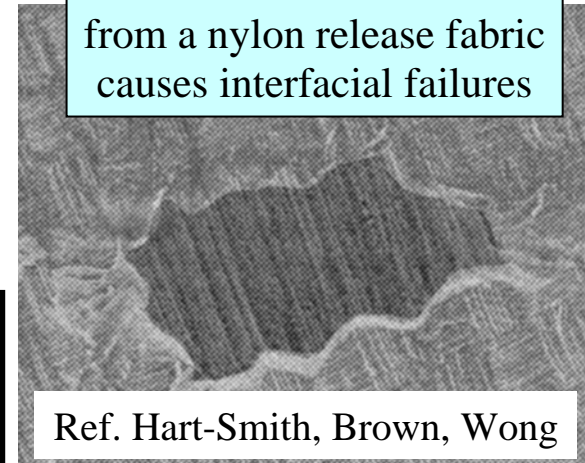
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FAA Research at UCSB*: Bonding Surfaces Previously Subjected to Removable Layers

- Improper use of removable layers led to Airworthiness Directives
- Removable plies or layers that leave chemical contamination on bonding surfaces include release fabrics and release films
 - Surface abrasion (grit blasting) will not guarantee the elimination of contaminants and potential, undesirable adhesion (interfacial) failures
 - Ongoing efforts to establish standard terminology for removable plies and update product labels & technical literature to warn of potential bonding problems
- UCSB tests to evaluate bond integrity



Chemical contamination from a nylon release fabric causes interfacial failures



Ref. Hart-Smith, Brown, Wong

* University of California at Santa Barbara (Bardis and Kedward)



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2004 Bonded Structure Initiative

Objectives for Workshops & Follow-on Report(s)

Primary objective

Collect & document technical details that need to be addressed for bonded structures, including critical safety issues and certification considerations

Secondary objectives

- 1) *Give examples of proven engineering practices*
- 2) *Identify needs for engineering guidelines, shared databases and standard tests & specs*
- 3) *Provide directions for research and development*



*FAA Reports,
Guidance
& Training*

Presentations at <http://www.niar.wichita.edu/faa/>



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Technical Scope of the Bonded Structures Workshops

Material & Process Qualification and Control

Bonding applications where at least one side of the joint is metal or pre-cured composite

Manufacturing Implementation and Experience

Regulatory Considerations

- Proof of structure: static strength
- Fatigue and damage tolerance
- Design and construction
- Materials and workmanship
- Durability
- Material strength properties & design values
- Production quality control
- Instructions for continued airworthiness
- Maintenance and repair

General aviation, rotorcraft and transport aircraft

Design Development and Structural Substantiation

Commercial and military applications were reviewed

Repair Implementation and Experience



2004 and 2005 Composite Maintenance Training Initiatives

Starting with a Series of Workshops to Bring Industry & Regulators Together on the Issues

- FAA/NRC Workshop in Wash. DC (May 18 & 19, 2004)
Executive review of systematic, repair, NDI & training issues
- Kickoff meeting for FAA research at Edmonds C.C. to evaluate training needs (Nov. 30 – Dec. 2, 2004)
Continuous education (web-based training and short courses for technicians, inspectors and engineers) and 2 to 4 year programs
- FAA Workshop (tentatively set for Chicago in Sept., 2005)
To review Edmonds C.C. efforts in studying available training resources versus the expanding needs and an introductory short course for technicians, inspectors and engineers



2004 and 2005 Composite Maintenance Training Initiatives

- FAA JAMCOE research in 2004/2005 (*Edmonds C.C. with help from Univ. of Washington and Wichita State Univ.*)
 - Details to be coordinated with the CACRC and industry
 - Study to evaluate training needs and available resources
 - Create practical short intro course (with OEM & maintenance expert insights) for technicians, inspectors and engineers
 - Documented study and course materials publicly available
- Edmonds C.C. study and intro course will be reviewed at the 2005 FAA Workshop
- Future activities will expand into specialty areas and standardize composite maintenance training



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Summary

A multi-year plan has been developed and implemented

- Will be continuously reviewed and updated in public forum (e.g., Mil-17, CACRC, national conferences, “town meetings” and FAA seminars & workshops – *your input is requested*)
- New FAA Joint Advanced Materials Center of Excellence will support research, standardization and training

Milestones achieved to date and future plans

- FAA guidance, workshops and detailed engineering practices for material & process specs and shared databases
- 2004 survey, workshop and guidance for bonded structures
- 2005 initiative for composite maintenance training
- AMTAS research started for bonding and damage considerations