

Composite Safety & Certification Initiatives

Presented at 9/16/02 FAA Workshop (Chicago, IL)



FAA

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- Overview
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 - Major milestones
- Material and process controls
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 - Important organizations for shared databases and material & process specs
 - Industry standards versus TSO
- Summary



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Ongoing Composite Safety & Certification Initiatives*

Objectives

- 1) Work with industry, other government agencies, and academia to ensure safe and efficient deployment of composite technologies being pursued for use in 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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FAA Composite Team Members

Represented Group	Team Member Name	FAA Organization Number & Routing
FAA Tech. Center	<i>Curtis Davies</i>	AAR-450 (FAA Technical Center)
	<i>Peter Shyprykevich</i>	AAR-450 (FAA Technical Center)
International	John Masters	AEU-100 (Brussels Aircraft Certification Staff)
Directorates	<i>Lester Cheng</i>	ACE-111 (Small Airplane Directorate)
	<i>Mark James</i>	ACE-111 (Small Airplane Directorate)
	<i>Richard Monschke</i>	ASW-111 (Rotorcraft Directorate)
	Richard Yarges	ANM-115 (Transport Airplane Directorate)
	<i>Hank Offermann</i>	ANM-115 (Transport Airplane Directorate)
	Jay Turnberg	ANE-110 (Engine & Propeller Directorate)
Flight Standards	William Henry	AFS 350 (Aircraft Maintenance Division)
ACOs & MIDOs	Randy Blosser	ANM-100D (Denver ACO)
	Roger Caldwell	ANM-100D (Denver ACO)
	<i>Fred Guerin</i>	ANM-120L (Los Angeles ACO)
	<i>Angie Kostopoulos</i>	ACE-116C (Chicago ACO)
	<i>David Ostrodka</i>	ACE-118W (Wichita ACO)
	Richard Noll	ANE-150 (Boston ACO)
	David Swartz	ACE-115N (Anchorage ACO)
CSTA	<i>Larry Ilcewicz</i>	ANM-115N (CSTA, Composites)

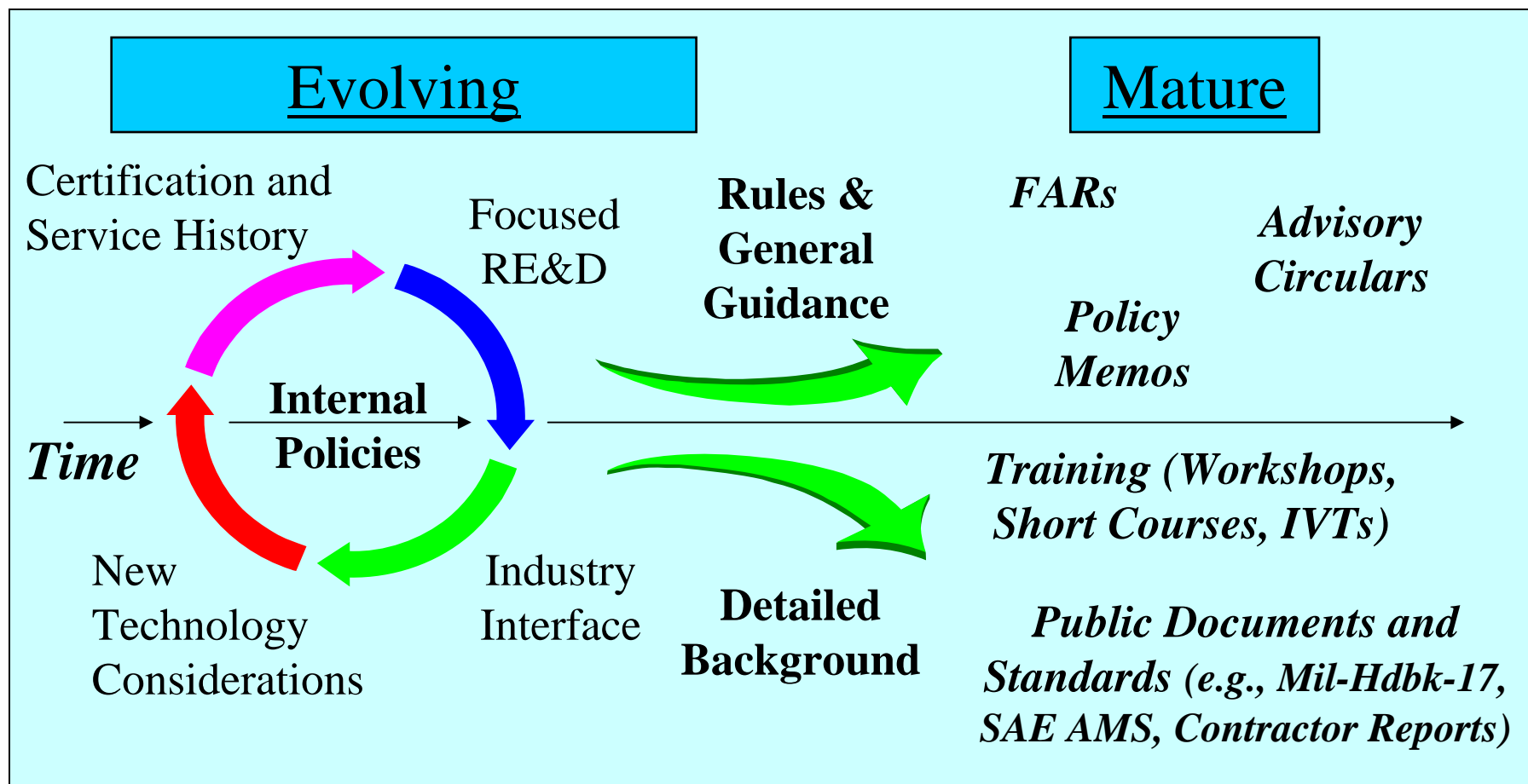
Names in italics are present at the 9/16 to 9/18/02 FAA Workshop

But we also have some spies present who shall remain nameless



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FAA Approach to Composite Safety and Certification Initiatives





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Technical Thrust Areas

Advancements depend on close integration between areas

~~NASA~~

Material Standardization
and Shared Databases

Structural
Substantiation

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

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

Damage Tolerance and
Maintenance Practices

- Critical defects
- Bonded repair issues
- Fatigue & damage considerations
- Quantitative NDE
- Equivalent levels of safety

Bonded Joint
Processing Issues

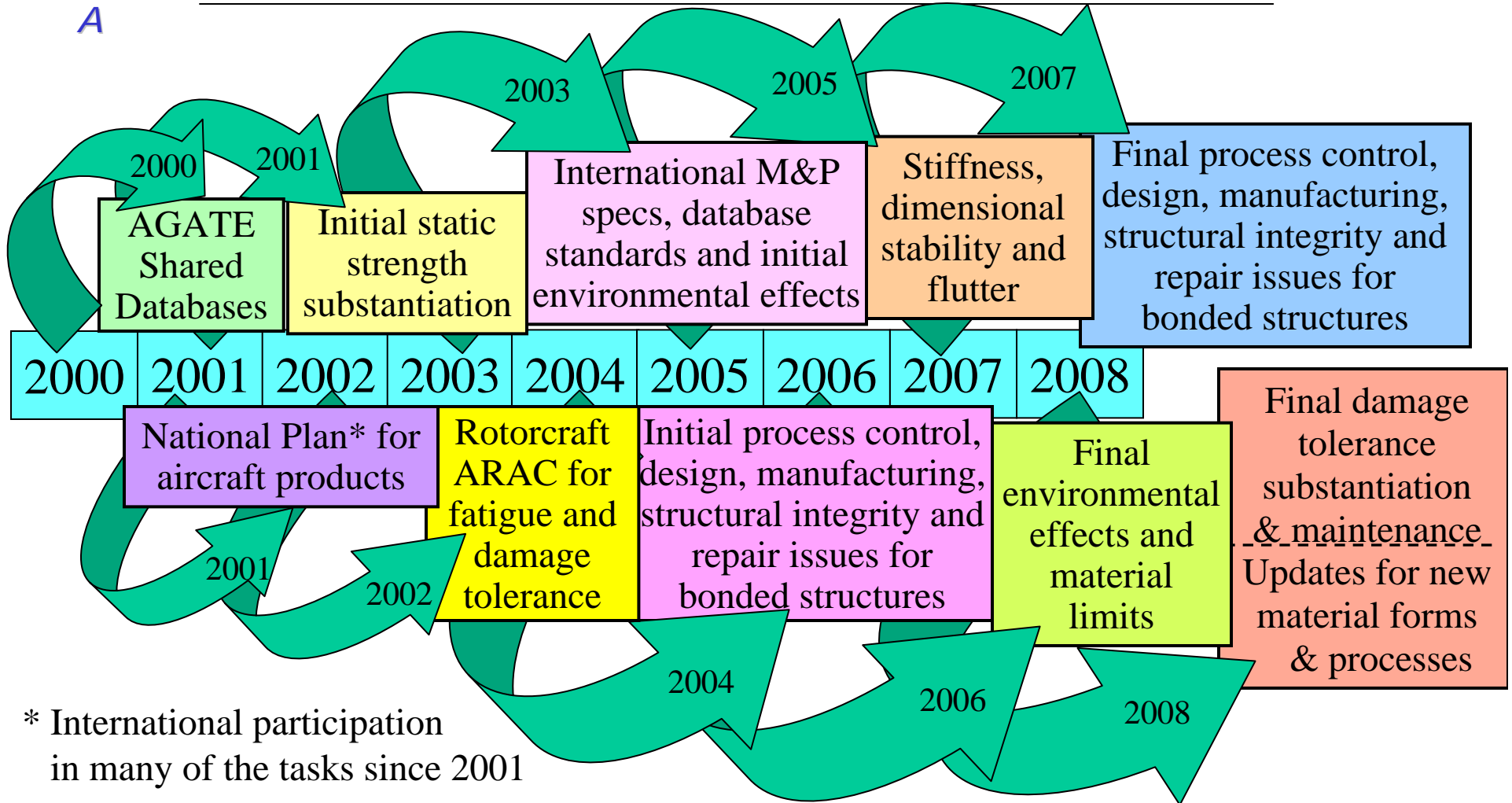
Advanced Material
Forms and
Processes

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



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Milestones for Composite Safety and Certification Policy, Guidance and Training





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Long-term Plans for Composite Safety and Certification Initiatives

A multi-year plan has been developed and implemented

- Initially based on recent general aviation applications
- Input for rotorcraft and transport aircraft applications over the last 2 years
- Will be continuously reviewed and updated in public forum (e.g., Mil-Handbook-17, national conferences, “town meetings” and FAA seminars & workshops - **input requested**)
- To be continuously integrated with FAA strategic and business plans
- Continued support by NASA, other government agencies, and industry are critical to future efforts



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Progress to Date in Composite Safety and Certification Initiatives

Milestones achieved to date

- FAA policy/training for base material qualification and equivalency testing for shared databases*
- Policy/training for static strength substantiation based on small airplane certification experiences
- New rule & AC for damage tolerance and fatigue evaluation of composite rotorcraft structure have been drafted
- New AC on acceptance guidance for material procurement and process specifications is nearly complete*
- Research in material control, bonded joints, environmental effects, sandwich panel damage tolerance and repair*

* FAA Technical Center reports exist for detailed background on engineering practices



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Importance of Stabilizing Composite Materials for Safety and Efficiency

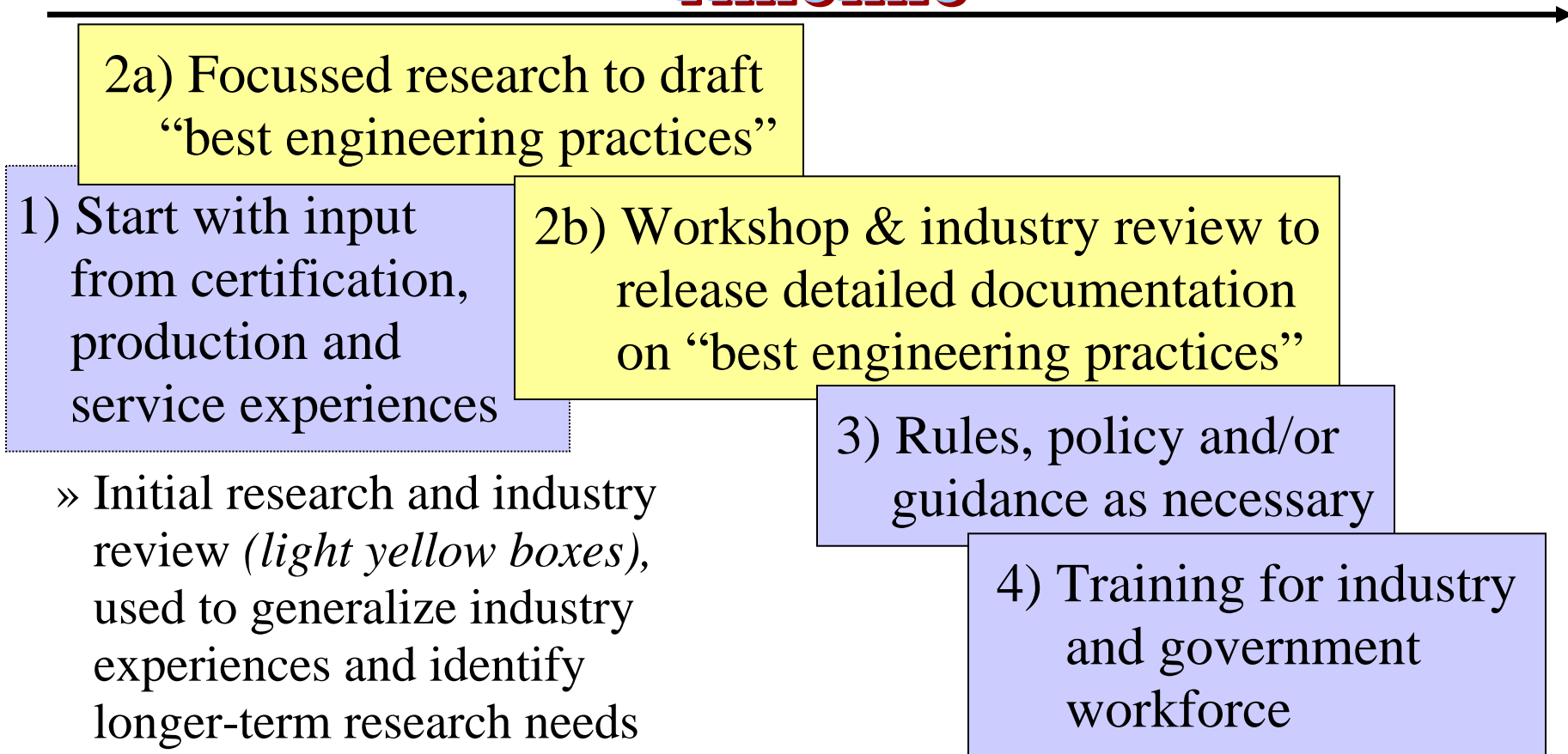
- Stable source of raw material is needed for continued safe and reliable use of composites in aircraft products
- Consistent engineering practices are needed to support requirements essential for base material control
 - Qualification data used as the statistical basis for equivalency (for new users and changes) and QC acceptance requirements
 - Documentation and databases for each unique material
 - Property drift (including upward shifts) minimized
- Databases and specs shared throughout industry will improve the efficiency of suppliers, users and regulators



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Approach Used to Stabilize Composite Materials

Timeline





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FAA Workshops on Key Characteristics for Composite Material Control

This workshop was intended to provide a forum where industry and government can discuss the most efficient ways to achieve composite material control

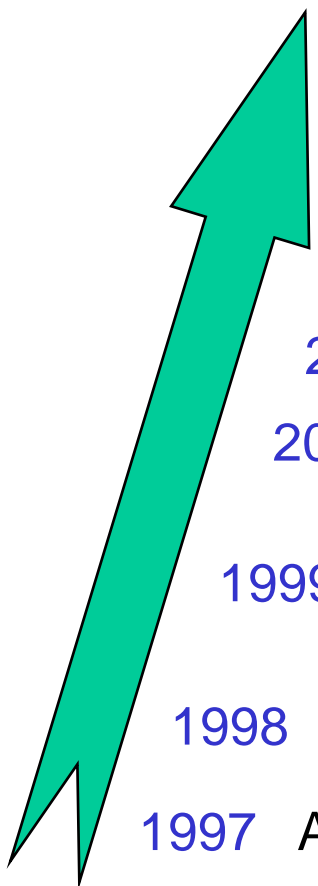
**We hope to reach general agreement
on what is important to safety**

**We expect some confusion/disagreement,
which relates to specific engineering details
and the scope of shared information being sought**



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Synopsis of Progress in Composite Material Control



2003 SAE P-17 M&P spec efforts begin and FAA releases AC 23-20 (Acceptance Guidance on M&P Specs for PMC Systems)



2002 M&P spec guidelines and recommendations documented with the help of industry (DOT/FAA/AR-02/109 and /110)

2001 WSU Report converted to FAA Document (DOT/FAA/AR-00/47)

2000 WSU Report, initial FAA policy and training on material qualification and equivalency testing for shared databases

1999 FAA/NASA/NIST work to stabilize AGATE method & develop acceptance criteria for equivalency & QC

1998 Chartered Mil-Handbook-17 Data Utilization WG



1997 AGATE material initiative (Tomblin)





Current Work

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- Prepreg fabric
 - Work on material procurement spec justified by industry recommendations from last year's workshop
 - 2002 prepreg tape process spec work is still valid
 - Same teammates as involved in 2002 prepreg tape work
- Liquid resin molding (LRM)
 - Work on material procurement and process specs justified by industry recommendations from last year's workshop
 - New teammates selected based on past experiences with LRM
 - Valuable insights derived from prepreg teammates experiences
 - Resin handling/mixing and dry fabric handling*
 - Resin impregnation*
 - Cured composite requirements*



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What Should/Can Be Shared Within the Composite Industry?

**Databases and specifications
for material control**

**Databases and specifications
for maintenance/repair**

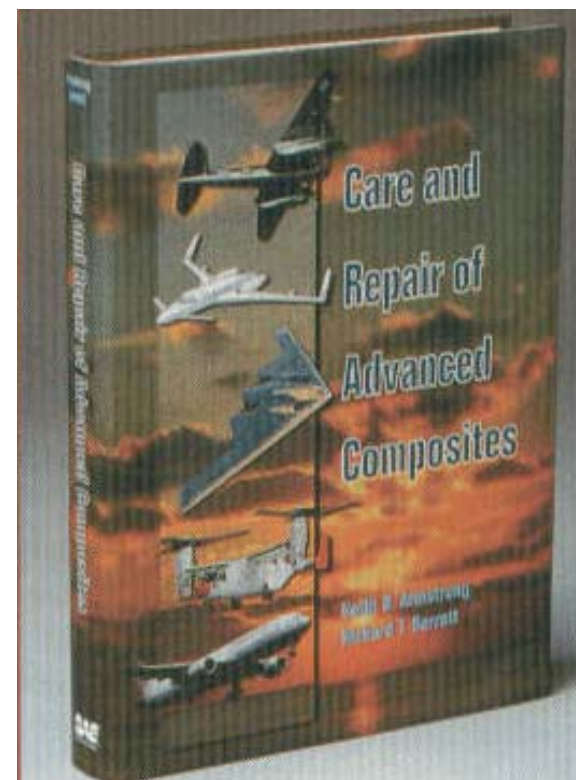
**Non-product-specific
design databases**



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Who Pays the Cost for a Lack of Standardization and Shared Databases?

“Company Specifications: One of the major problems of aircraft repair today is that most airframe and engine manufacturers tend to write their own specifications, especially for adhesives, pre-pregs, potting compounds, and sealants. These are found in the various manuals as ..., and others -- *almost infinitum*. This leads to a vast amount of duplicated testing by suppliers, who may have to test the same batch of material to three or more slightly different requirements and using slightly different test methods.” Page 257 of *Care and Repair of Advanced Composite Materials*, by Keith B. Armstrong and Richard T. Barrett, SAE International, 1998.





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Important U.S. Standards Organizations*

- Mil-Handbook-17 to define/approve database standards and provide overall coordination

- <http://www.mil17.org/>

- Data Utilization Working Group

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- SAE Committee P to establish/approve material and process specifications



- ASTM D30 to establish/approve standard test methods



** Must interface with international standards groups to achieve optimum efficiency*



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Industry Standards vs. FAA Technical Standard Order (TSO)

- Coordination within the FAA suggest a TSO is feasible; however, the needs may outweigh the benefits
 - A TSO for composites would have more controls and requirements, i.e., different than how current TSO are viewed in the industry and FAA
 - Use of SAE, Mil-17 and ASTM as organizations to help define the required specs and database standards were considered essential
 - Use of these organizations for pre-requisite approval of the data and associated specs is also under consideration*
 - Policy, guidance and training will be needed to implement the TSO
- SAE P-17 & Mil-17 efforts may supersede the need for a TSO
 - FAA policy, AC & DOT reports provide a basis for industry standards
 - Considerations for minor to major changes from the draft TSO were added*
 - FAA has decided to closely monitor the efforts of these organizations and if timely progress is achieved the TSO will not be needed



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Summary

- Composite safety & certification initiatives (CS&CI) are progressing with international help
 - Technical areas: material control, structural substantiation, bonded joints, damage tolerance and advanced materials & processes
- Consistent and stable materials are crucial to safe use of composites for expanding aircraft applications
 - New advisory circular will soon be released on acceptance guidance for prepreg material procurement and process specs
 - Detailed guidelines for prepreg tape were released in 2002
 - Draft guidelines for prepreg fabric and LRM will be reviewed and discussed in this workshop
- Future efforts by standards organizations can help facilitate the approval of shared databases and M&P specs