CMH-17
COMPOSITE MATERIALS HANDBOOK

Composite Materials Handbook-17

Introduction & Overview, Highlights from Expanded Volumes

SAMPE 2009
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Outline

- What is the Composite Materials Handbook?
  - Mission and Vision Statements
- History (timeline)
- CMH-17 Organization and Working Group Responsibilities
- Approval Procedures
- Structure of the Handbook

Vol. 1	Polymer Matrix Composites: *Guidelines for Characterization of Structural Materials*
Vol. 2	Polymer Matrix Composites: *Material Properties*
Vol. 3	Polymer Matrix Composites: *Materials Usage, Design and Analysis*
Vol. 4	Metal Matrix Composites
Vol. 5	Ceramic Matrix Composites
Vol. 6	Structural Sandwich Composites (Initial Release)

- Release Status
- Website
- Commercial Publication
- How to Get Involved in CMH-17
- Meetings

What is the Composite Materials Handbook?

CMH-17
COMPOSITE MATERIALS HANDBOOK

CMH-17 Mission

The Composite Materials Handbook organization creates, publishes and maintains proven, reliable engineering information and standards, subjected to thorough technical review, to support the development and use of composite materials and structures.

CMH-17 Vision

The Composite Materials Handbook will be the authoritative worldwide focal point for technical information on composite materials and structures.

Goals to Support CMH-17 Mission

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COMPOSITE MATERIALS HANDBOOK

- To periodically **meet with experts** from the field to discuss critical technical issues for composite structural applications, with an emphasis on increasing overall product efficiency, quality and safety.
- To provide comprehensive, practical **engineering guidance** that has proven reliable for the design, fabrication, characterization, test and maintenance of composite materials and structures.
- To provide **reliable data**, linked to control of processes and raw materials, thereby being a comprehensive source of material property basis values and design information that can be shared within the industry.
- To provide a resource for composite material and structure **education** with examples, applications and references to supporting engineering work.
- To establish **guidelines** for use of information in the Handbook, identifying the limitations of the data and methods.
- To provide guidance on references to proven **standards and engineering practices**.
- To provide for **periodic updates** to maintain the all-inclusive nature of the information.
- To provide **information** in formats best-suited for user needs.
- To serve the needs of the **international composites community** through meetings and dialogue between member industries, which use teamwork and the diverse member engineering skills to provide information for the handbook.

History

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2009-10 Release of Rev G – CMH-17 Handbooks

2006 Transition from Army to FAA as Primary Sponsor
Established Roadmap to New Composite Materials Handbook
"Release G"

2004 Joint Meetings with CACRC, SAE-P17

2002 MIL-HDBK-17B Vol. 1F, 2F, 3F, 4A, 5
Commercial Publication through ASTM

1999 MIL-HDBK-17B Vol. 2E,Vol 4

1998 Joint Meeetings with ASTM D-30

1997 MIL-HDBK-17B Vol. 1E,3E

1996 CMC Coordination Group Formed

1993 MMC Coordination Group Formed

1990 First PMC Data Set Approved

1988 MIL-HDBK-17B Vol. 1 Release

1986 Secretariat Added

1978 Coordination Group Formed

1971 MIL-HDBK-17A Plastics for Aerospace Vehicles

1959 MIL-HDBK-17 Plastics for Air Vehicles

1943 ANC Bulletin 17 Plastics for Aircraft

MIL-17 to CMH-17 Transition

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- U.S. Army no longer supports military handbooks
- The FAA is the primary sponsor of the handbook
- Requirement to post free copies on DoD archive site no longer holds
- The CMH-17 organization (non-profit) will hold the copyright to the handbook and data
- Name and logo change to “Composite Materials Handbook 17 (CMH-17)”
- Website: http(s)://www.cmh17.org

The CMH-17 Group Organization

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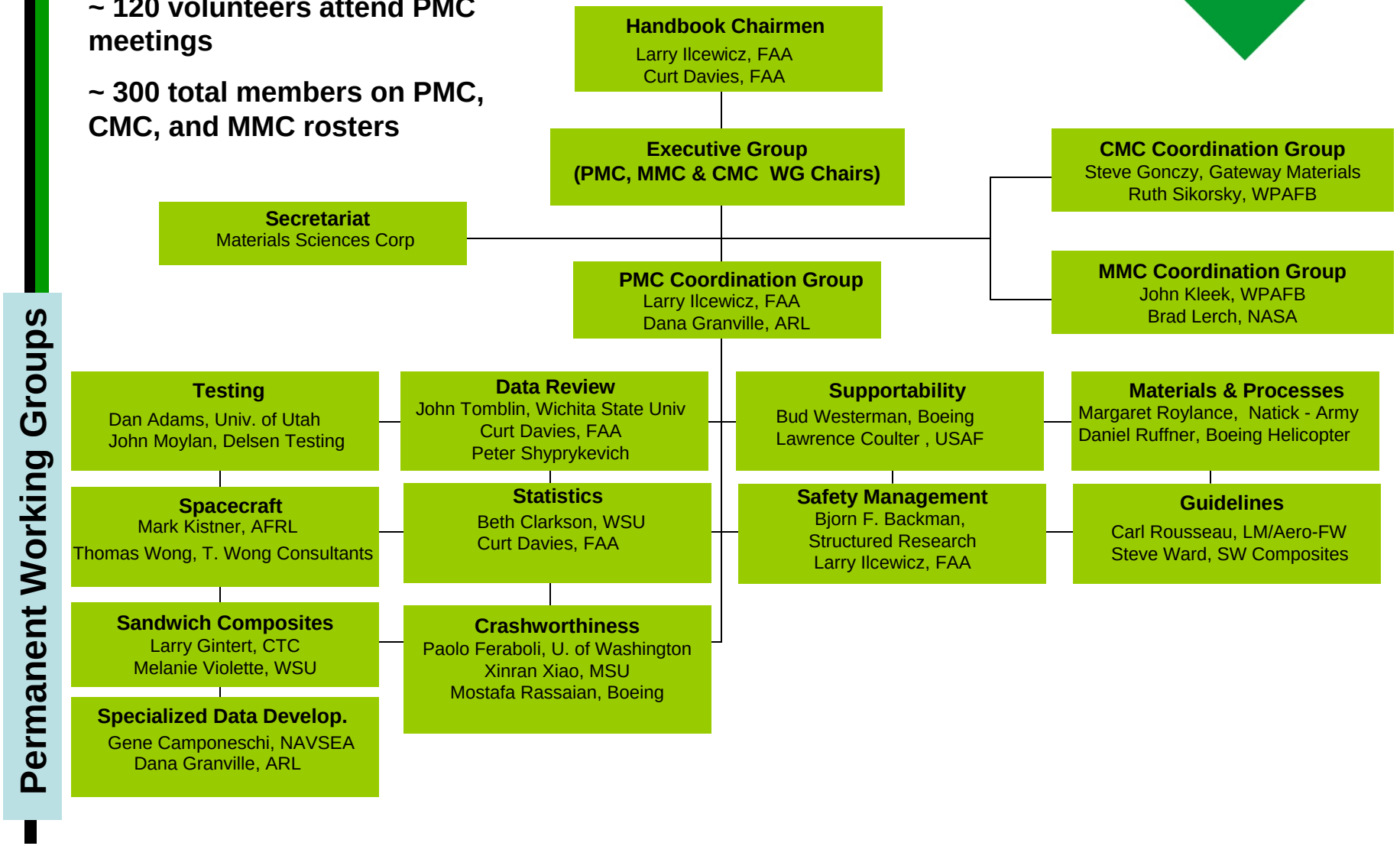
COMPOSITE MATERIALS HANDBOOK

~ 120 volunteers attend PMC meetings

~ 300 total members on PMC, CMC, and MMC rosters



Activities and Focus of the Working Groups

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Working Group	Goal	Responsibility (Rev. G)
Guidelines	To develop and document generic guidance information and data which is essential for the adequate design, certification or qualification, and production of composite parts and assemblies.	Vol. 1, Ch. 1 Vol. 1, Ch. 2.1-2.3 Vol. 2, Ch. 1.1,1.2, Ch. 1.6 Vol. 3, Ch. 1-4, 7-11
Materials & Processes	To provide guidelines, descriptions and case studies of material and processing options for the characterization and fabrication of polymer matrix composite materials	Vol. 1, Ch. 1.4.6, 1.4.7, Ch. 2.2.6 Vol. 2, Ch. 2, 3, 5-10, Vol. 3, Ch. 5-6,17
Data Review	• To provide the final technical/editorial review of all data prior to review by full coordination group • To provide a review of the application of the data documentation requirements to the actual data being supplied • To develop formats for data presentation in the handbook • To establish the data documentation requirements for the handbook	Vol. 1, Ch. 2.4 Vol. 2, Ch. 1.3, 1.4, Ch. 4, Ch. 6-2, 10.2, 10.4

Activities and Focus of the Working Groups

CMH-17
COMPOSITE MATERIALS HANDBOOK

Working Group	Goal	Responsibility (Rev. G)
Statistics	Analyzes and/or develops statistical procedures for composite material evaluation and quality control, and provides other statistical support to the Handbook as directed by the Guidelines Working Group. The Statistics working group spans the three coordination groups with co-chairs for metal matrix and ceramic matrix composites.	Vol. 1, Ch. 8
Testing	To offer descriptive and guidance information relating to the usage of chemical, physical and mechanical test methods for polymer matrix composites and their constituents. • Inform the reader of advantages and shortcomings of the various methods used in the industry • Provide a basis for test method selection • To identify specific test methods to be used when data is submitted to CMH-17 for consideration for inclusion in Volume 2 of the handbook	Vol. 1, Ch. 3-7
Supportability	To provide useful guidelines in the design of repairs for composite structures. The group is in the process of finalizing the Supportability chapter.	Vol. 3, Ch. 14

Activities and Focus of the Working Groups

CMH-17
COMPOSITE MATERIALS HANDBOOK

Working Group	Goal	Responsibility (Rev. G)
Composites for Space	Addresses the special concerns related to the application of polymer matrix composites in a space environment, including the introduction of additional physical property measurements into the handbook. In addition, the group will encourage the inclusion of material property data of interest to the spacecraft community	Vol. 1, Ch 2.2.10
Specialized Data Development	Deals with the issues that arise in non-traditional forms of composite materials including textiles, 3-D reinforcements, and thick section composites. In addition, the group deals with the particular technical issues related to non-aerospace applications	Vol. 1, Ch. 6.12, Vol. 3, Ch. 15
Sandwich	Responsible for the creation of a Structural Sandwich Composites Volume. The group is reviewing and revising the material in MIL-HDBK-23. New sections may be created to reflect technology changes since the last revision of MIL-HDBK-23	Vol. 6

Activities and Focus of the Working Groups

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Working Group	Goal	Responsibility (Rev. G)
Crashworthiness	Provide the support for the development of a new chapter on composite Crashworthiness and Energy Management for vehicle safety certification. The Crashworthiness Working Group will also attempt to address the needs of the composites and vehicle safety community at large, and to provide a unique forum of discussion for those working in industry, research institutions, and government agencies. The group will try to present recommended design guidelines and practices for the experimental and numerical characterization of the crash resistance of advanced composites.	Vol. 3, Ch. 13
Safety Management	Responsible for managing the elements of vehicle structural safety, which include requirements, design criteria, quality control, damage considerations, inspection, education and continuous service data monitoring throughout a vehicle's life cycle. Safety management relies on integration of the efforts by design, manufacturing, maintenance and operations disciplines. It is also driven by service experience and an international mandate to improve safety statistics as future fleets of a given vehicle type expand. The Safety Management WG currently has three Task Groups: • Structural Safety • Debonding and Delamination • Damage Tolerance	Vol. 1, Ch. 6.8.6 Vol. 3, Ch. 12, Ch. 16

Approval Procedures

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Working Group internally makes writing assignments and generates a draft. May iterate within group until acceptable

Sections submitted to Secretariat for inclusion in Yellow Pages

Yellow pages go to all “members” for technical comment

Secretariat tries to resolve comments. May make editorial changes.

Yellow pages go to Coordination. Final technical comments may be resolved at meeting. If not accepted, return to WG for revision.

Publication

Data Approval Process

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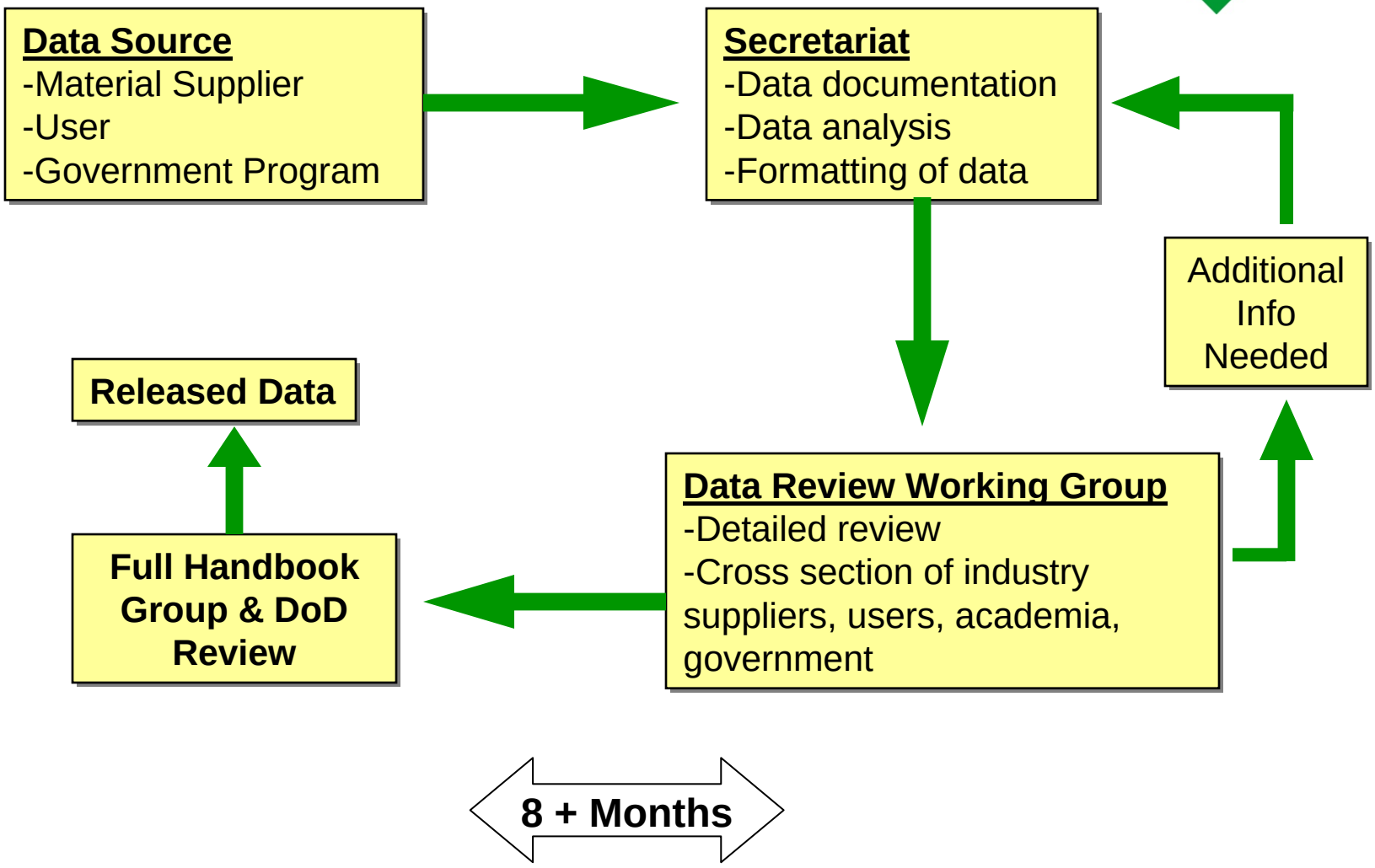

Structure of the Handbook

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COMPOSITE MATERIALS HANDBOOK

- **Vol. 1** Polymer Matrix Composites: *Guidelines for Characterization of Structural Materials*
- **Vol. 2** Polymer Matrix Composites: *Material Properties*
- **Vol. 3** Polymer Matrix Composites: *Materials Usage, Design and Analysis*
- **Vol. 4** Metal Matrix Composites
- **Vol. 5** Ceramic Matrix Composites
- **Vol. 6** Structural Sandwich Composites (Initial Release)

Release Status

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COMPOSITE MATERIALS HANDBOOK

- CURRENTLY AVAILABLE
  - Volumes 1-3 Release F (PMC)
  - Volume 4 Release A (MMC)
  - Volume 5, Initial Release (CMC)

- Group is now working on next revision, target publication dates – 2009 – 2010 (to be released as individual volumes)
  - Between-release versions available to group members as a draft working copy on website
  - Major changes in Volumes 1-3
  - Data added to Volume 4
  - New design chapters in Volume 5
  - New Volume 6

Volume 1: Polymer Matrix Composites

Guidelines for Characterization of Structural Materials

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***Volume 1* documents material characterization data development methodology guidelines adaptable to a wide variety of needs, as well as specific requirements to be met by data published in the handbook**

1. Objectives

2. Guidelines for Property Testing of Composites

- Test Program Planning
- Recommended Test Matrices
- Material Testing for Submission of Data to CMH-17

3. Evaluation of Reinforcement Fibers

4. Matrix Characterization

5. Prepreg Materials Characterization

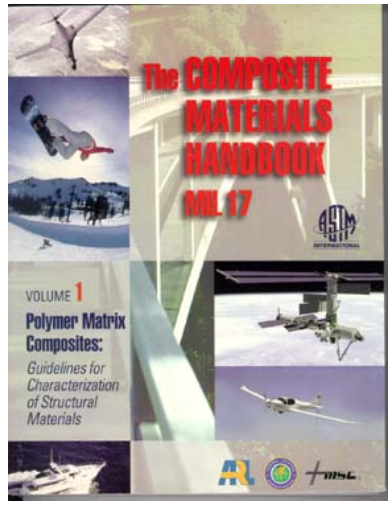
6. Lamina, Laminate and Special Form Characterization

- Thermal/Physical/Electrical Property Tests
- Static Uniaxial Mechanical Property Tests
- Space Environmental Effects on Material Properties

7. Structural Element Characterization

8. Statistical Methods

- Revision of chapter outline
- Major revisions to 8.3 Calculation of Statistically-Based Material Properties
- Flowchart with detailed notation



Volume 2: Polymer Matrix Composites

Material Properties

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***Volume 2* provides a repository of material data. The documented property summaries for material systems provide data meeting the criteria for any of the clearly defined material data classes: robust and reduced A-Basis, robust and reduced B-Basis, mean, interim, and screening.**

1. General Information
- Definitions
- Material Orientation Codes
- Presentation of Data

2. Fiber Properties

3. Matrix Properties

4. Carbon Fiber Composites
- T700GC 12k/2510 Uni Tape
- T700SC 12k/2510 Plain Weave Fabric
- T300 3k/E765 Plain Weave Fabric
- T300 6k/E765 5-Harness Satin Weave Fabric
- AS4C 3k/HTM45 Plain Weave Fabric
- AS4C 3k/HTM45 8-Harness Satin Weave Fabric

5. Aramid Fiber Composites

6. Glass Fiber Composites
- 7781/2510 Eight-Harness Satin Weave Fabric

7. Boron Fiber Composites
- B4.0/5521 Uni Tape

8. Alumina Fiber Composites

9. Silicon Carbide Fiber Composites

10. Quartz Fiber Composites

Appendix MIL-HDBK-17A Data

Snapshot of Carbon Materials Available in Volume 2

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Volume 3: Polymer Matrix Composites

Materials Usage, Design, and Analysis

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***Volume 3* provides technical guidance on a wide variety of disciplines related to polymer matrix composites, including the use of data for the design and evaluation of composite structures. This volume has recently undergone a major reorganization to increase usability. Four new chapters will be added for the next publication, as well as many additions and revisions throughout.**

1. General Information
2. **Introduction to Composite Structure Development**
3. **Aircraft Structure Certification and Compliance**
4. Building Block Approach for Composite Structures
5. Materials and Processes – The Effects of Variability on Composite Properties
6. Quality Control of Production Materials and Processes
7. **Design of Composites**
8. **Analysis of Laminates**
9. Structural Stability Analyses
10. Design and Analysis of Bonded Joints
11. Design and Analysis of Bolted Joints
12. **Damage Resistance, Durability and Damage Tolerance**
13. **Defects, Damage and Inspection**
14. Supportability
15. Thick Section Composites
16. **Crashworthiness and Energy Management**
17. **Structural Safety Management**
18. Environmental Management

Volume 4: Metal Matrix Composites

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***Volume 4* covers technology and materials for metal matrix composites primarily used in aircraft engine components, spacecraft, and other high temperature applications. Material data include fiber, matrix, and composite material properties.**

1. Guidelines
   - Test Plans for Materials Characterization
   - Corrosion and Corrosion Test Methods
2. Design Guidelines for Metal Matrix Materials
   - Analysis Approaches (continuous fiber MMC)
3. Materials Properties Data
   - 3.1 General Information
   - **3.2 Reinforcement Properties**
     - SCS-6 Fiber
   - **3.3 Properties of Matrix Materials**
   - 3.4 Fiber Coating Properties
   - **3.5 Aluminum Matrix Composite Properties**
   - 3.6 Copper Matrix Composite Properties
   - 3.7 Magnesium Matrix Composite Properties
     - Corrosion Tables
   - **3.8 Titanium Matrix Composite Properties**
   - 3.9 Other Matrix Composites

Appendix A. Typical Pushout Test Data
Appendix B. Raw Data Tables for Matrix Materials
Appendix C. Raw Data Tables for MMC Materials

Volume 5: Ceramic Matrix Composites

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***Volume 5** includes information on relevant, commercially available CMC composite systems describing: system properties and their process methods; testing and characterization methods, mechanical properties and databases and design guidance tailored to CMCs. Material data summaries of six CMC systems are included.*

Part A. Introduction and Guidelines

Part B. Design and Supportability

- Reorganization of this section
- New section on CMCs for Aircraft Turbine Engines
- New section on Design of Attachments for CMCs in Engines

Part C. Testing

- Thermo-Mechanical-Physical Test Methods, revision of this chapter

Part D. Data Requirements and Data Sets

- **CMC Property Data includes SiC/SiC, Carbon/SiC, Oxide/Oxide, SiC/Si3N4**

Appendix A. Derivation of the Residual Strength Reduction Expressions for LCF and Rupture Loadings

Volume 6: Sandwich Composites

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***Volume 6** provides an updated living document describing proper design philosophy and guidance for sandwich composite structures. The primary source for this volume is MIL-HDBK-23.*

1. **General Information**
2. **Guidelines for Property Testing**
3. Material Data
4. **Design and Analysis of Sandwich Structures**
5. Fabrication of Sandwich Structures
6. **Quality Control**
7. **Supportability**

Volume 1, Guidelines for Characterization of Structural Materials

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Chapter	Update
2, Guidelines for Property Testing	Completely revised, includes sampling requirements for *new* data pooling procedures and updated ASTM test methods
5, Prepreg Materials Characterization	Completely updated chapter
6, Lamina, Laminate, and Special Form Characterization	*New* spacecraft testing section, revised sections on out-of-plane tension, fracture toughness and fatigue
7, Structural Element	Revised section on Notched Laminate Tests
8, Statistical Methods	Entire chapter revised to incorporate *new* statistical pooling procedures and modified CV approach including all new examples.

Volume 2, Materials Properties

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Chapter	Update
4, Carbon Fiber Composites	• HTA 5131 3k/M20 Plain Weave Fabric • T700GC 12k/2510 Unidirectional Tape • T700SC 12k/2510 Plain Weave Fabric • T300 6k/E765 Five-Harness Satin Weave Fabric • AS4C 3k/HTM45 8-Harness Satin Weave Fabric • AS4C 3k/HTM45 Plain Weave Fabric
6, Glass Fiber Composites	7781/2510 Eight-Harness Satin Weave Fabric
7, Boron Fiber Composites	B4.0 208/5521 unidirectional tape

- New data sets analyzed with the latest statistical procedures, including **pooling** across environmental conditions and **modified CV** approach for basis value calculations when appropriate.
- Material and process **specifications** required for Complete Documentation data sets
- **New outline** categorizing materials by documentation and specification requirements

Volume 3,
Materials Usage, Design and Analysis

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Chapter	Update
3, Structural Certification and Compliance	ALL NEW CHAPTER
7, Design of Composites	ALL NEW CHAPTER
8, Analysis of Laminates	ALL NEW CHAPTER
12, Damage Resistance, Durability, and Damage Tolerance	Completely updated chapter with all new sections on Fatigue Damage Onset, Damage Growth under Cyclic Loading, and Analysis Methods
13, Defects, Damage and Inspection	ALL NEW CHAPTER
14, Supportability	Revised chapter, new Section on strain energy release rate interlaminar fracture mechanics
17, Crashworthiness and Energy Management	ALL NEW CHAPTER
17, Structural Safety Management	ALL NEW CHAPTER

Volume 4, Metal Matrix Composites

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COMPOSITE MATERIALS HANDBOOK

Chapter	Update
1, Guidelines	*New* Sections on Testing
2, Design Guidelines for MMCs	*New* Section on Macromechanics
3, Materials Properties	*New* data sections on SCS-6 fibers and SCS-6/Ti-6Al-4V composite material

Volume 6, Sandwich Composites

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COMPOSITE MATERIALS HANDBOOK

Chapter
1, General Information
2, Guidelines for Property Testing
3, Material Data
4, Design and Analysis of Sandwich Structures
5, Fabrication of Sandwich Structures
6, Quality Control
7, Supportability

Completely NEW volume including the most up to date guidance on use of sandwich composite materials and critical sections of MIL-HANDBOOK-23

Member Web Site

- https://www.cmh17.org
  - *Current working draft* of the handbook
  - Available in PDF format
  - Access to working group bulletin boards
  - Contact information for working group chairs
  - Upcoming meeting info including agendas, discussion topics
  - Past meeting documents including presentations, minutes

- **Access -**
  - Meeting Attendees: CMH-17 attendees receive log-in information as part of meeting registration fee (valid for 16 months)
  - By Purchase: Website access can also be purchased directly if attending the meeting is not possible ($250 for 16 months)
  - Access to Volume 2 Annex is currently ITAR restricted (public release planned for Revision G)
    - List of users that have access to ITAR restricted information is updated after each meeting.
    - DD2345 form or copy of gov't ID required for access to ITAR restricted information


Composites Handbook, CMH-17 - Microsoft Internet Explorer
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COMPOSITE MATERIALS HANDBOOK
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General Info. Resources Meetings Members FAQ
Welcome to the Composite Materials Handbook Website.
The site is maintained by the CMH-17 Organization to disseminate information about the organization and to share information on composite materials.
CMH-17
COMPOSITE MATERIALS HANDBOOK
The Composite Materials Handbook provides information and guidance necessary to design and fabricate end items from composite materials. Its primary purpose is the standardization of engineering data development methodologies related to testing, data reduction, and data reporting of property data for current and emerging composite materials. In support of this objective, the handbook includes composite materials properties that meet specific data requirements. The Handbook therefore constitutes an overview of the field of composites technology and engineering, an area which is advancing and changing rapidly. As a result, the document is constantly changing as sections are added or modified to reflect advances in the state-of-the-art.

The Composite Materials Handbook
CMH-17

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(the multi-volume handbook and associated database of material properties), an organization of nearly
ief orientation to the products and process.

Introductory Presentation

For a more complete Handbook procedures, and products, download the slides for an introduction typically given to new members at meetings lobe Acrobat PDF format, and requires the Acrobat Reader 5.0. The file size is 1.73 MB.

Handbook Volumes

Vol. 1 Guidelines fo uctural Materials, Release F, 17 June 2002

Volume 1 explains the methods by which materials property data should be obtained, and criteria for their acceptance for publication in the Handbook. Data obtained and selected according to Volume 1 is published in Volume 2. The current version is the *F* release, which is available from ASTM.

Vol. 2 Polymer Matrix Composites: Material Properties, Release F, 17 June 2002

Volume 2 contains the actual material property data for polymer matrix composites. The data is arranged in categories depending on the reinforcement class and matrix class. Within a category, the the data is in chronological order (based on when data was submitted). There is also a Volume 2 Annex

Go to Public Site

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The Composite Materials Handbook
Member's Area

Home | General | Documents | Meetings | PMC | CMC | MMC | Executive

Welcome to the *Composite Materials Handbook Member Website.*

This site is intended for the use of CMH-17 Coordination Group members. Its purpose is to expedite the review of CMH-17 documents, and for the use of Working Group committees.

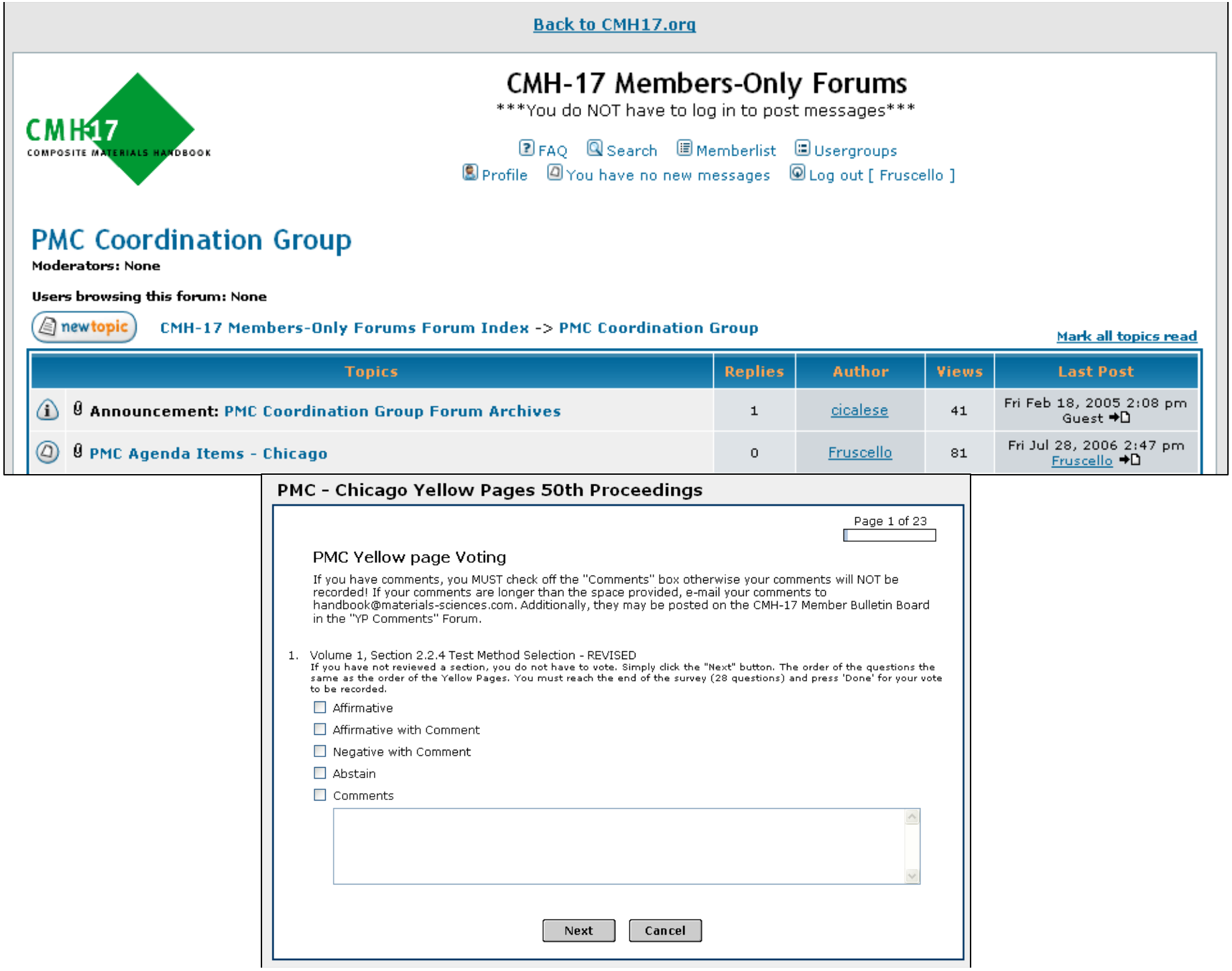
CMH-17 Group Bulletin Boards Index

Composite Handbook Awards: ***View recipients of CMH-17 awards, as well types of awards available. (Updated 9/10/2008)***

Working Drafts Working Drafts for Volumes 1, 2, 3, and 6 have been updated with approved Yellow Pages up to and including the Ottawa *Accelerated* Yellow Pages.

Main Areas

General	**News, Secretariat activities**
Documents	**Downloads of proceedings, presentations, draft working copies, approved sections and other CMH-17 related material. Current outlines and database for section status.**
Meetings	**Information on upcoming meetings.**
PMC	**Polymer Matrix Composites Coordination Group. Links to all PMC working groups**
CMC	**Ceramic Matrix Composites Coordination Group. Links to all CMC working groups**
MMC	**Metal Matrix Composites Coordination Group. Links to all MMC working groups**
Exec	**Executive body for all coordination groups**


Back to CMH17.org
CMH-17 Members-Only Forums
You do NOT have to log in to post messages
FAQ Search Memberlist Usergroups
Profile You have no new messages Log out [Fruscello]
PMC Coordination Group
Moderators: None
Users browsing this forum: None
newtopic
CMH-17 Members-Only Forums Forum Index -> PMC Coordination Group
Mark all topics read
Topics
Replies
Author
Views
Last Post
Announcement: PMC Coordination Group Forum Archives
1
cicalese
41
Fri Feb 18, 2005 2:08 pm Guest
PMC Agenda Items - Chicago
0
Fruscello
81
Fri Jul 28, 2006 2:47 pm Fruscello
PMC - Chicago Yellow Pages 50th Proceedings
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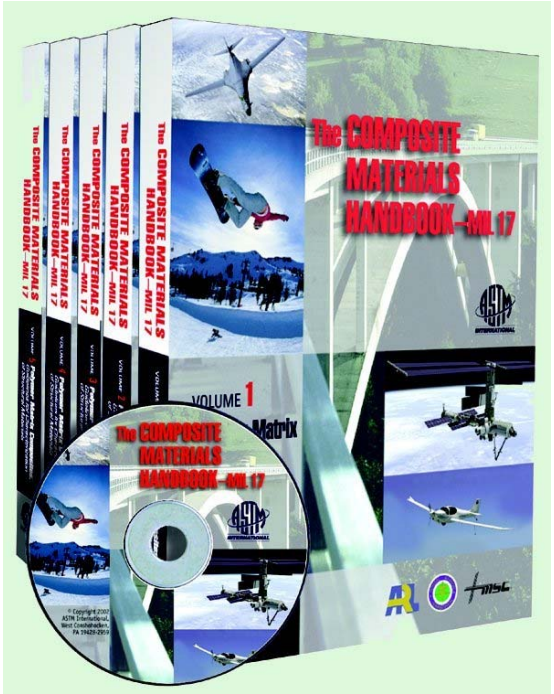
PMC Yellow page Voting
If you have comments, you MUST check off the "Comments" box otherwise your comments will NOT be recorded! If your comments are longer than the space provided, e-mail your comments to handbook@materials-sciences.com. Additionally, they may be posted on the CMH-17 Member Bulletin Board in the "YP Comments" Forum.
1. Volume 1, Section 2.2.4 Test Method Selection - REVISED
If you have not reviewed a section, you do not have to vote. Simply click the "Next" button. The order of the questions the same as the order of the Yellow Pages. You must reach the end of the survey (28 questions) and press 'Done' for your vote to be recorded.
Affirmative
Affirmative with Comment
Negative with Comment
Abstain
Comments
Next
Cancel

Commercial Publication

CMH-17
COMPOSITE MATERIALS HANDBOOK

- ASTM Publishing offers the printed and CD-ROM versions of Volumes 1F, 2F, 3F, 4A, 5
  - $121 per volume
  - $605 for CD-ROM version
  - $715 for bundled version (5 volumes + CD)

- www.astm.org
  - Click on “Books & Journals”
  - Search for “Composite Materials Handbook”



Becoming Involved

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- Get on the mailing list (handbook@materials-sciences.com)
- Attend Meetings
  - Presentations
    - Industry status and practice
    - Technical talks on topics related to material allowables, qualification, and design practice
  - Discussion and debates on current handbook topics
  - Affect the direction of the handbook
    - Particularly looking for inputs from broader range of industries
    - Provide input of user needs and concerns
- Become an active volunteer for one or more of the Working Groups
  - Be a contributor
- Provide data

Meeting Schedule

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- **When**: CMH-17 Coordination Group meets every 8 months (+/- 2 mos)
- **Who**: Joint meetings with NCAMP (*National Center for Advanced Materials Performance*) and ASTM D30
- **Where**: Generally alternating East Coast, West Coast sites
  - Recent Meetings in Dallas, Cocoa Beach, Ottawa and Salt Lake City