2nd Joint Coordination Meeting

November 12-21, 2024

Fall Virtual Meeting

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JOINT COORDINATION MEETING SCHEDULE

November 12-14 and November 19-21, 2024 – Virtual

SCHEDULE

Time (EST)	Tuesday 11/12	Wednesday 11/13	Thursday 11/14
10:00 am - 12:00 pm	1 hour: New member orientation and virtual attendance instruction 1 hour: Opening coordination	**Forum:** Emerging Applications	WG/TG sessions 3 and 4 *AM Testing* *Sandwich*
Break			
1:00 pm - 3:00 pm	Opening Coordination (continued)	WG/TG sessions 1 and 2 *Crashworthiness* *Joint Statistics*	WG/TG sessions 5 and 6 *AM D&A* *PMC Data Review*

Time (EST)	Tuesday 11/19	Wednesday 11/20	Thursday 11/21
10:00 am - 12:00 pm	**Mini Tutorial:** *Equivalency Process & Best Practices*	WG/TG sessions 9 and 10 *AM Guidelines* *PMC M&P*	WG/TG Sessions 13 and 14 *AM M&P* *PMC Damage Tolerance*
Break			
1:00 pm - 3:00 pm	WG/TG sessions 7 and 8 *CMC Testing* *PMC Design*	WG/TG sessions 11 and 12 *PMC Guidelines* *Supportability*	Closing Coordination

D&A = Design and Analysis
M&P = Materials and Processing

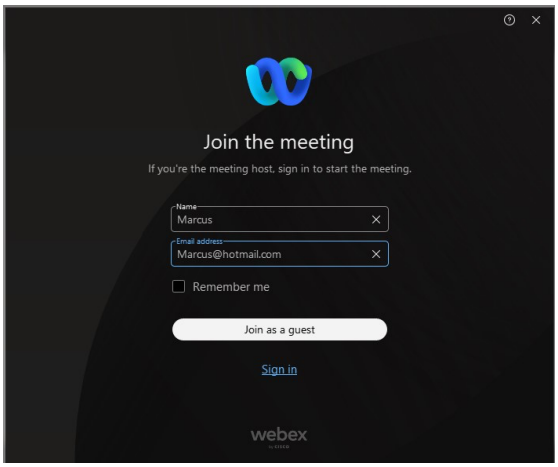
CONNECTING VIRTUALLY

All Meetings Held Virtually

Link	https://wichitastateuniversity.webex.com/wichitastateuniversity/j.php?MTID=m4ed93e891d461edf216170c342e47e96
Meeting Number	Access code: 2559 022 0820 Password: fall2024
Mobile device	1-650-479-3208 Access code: 2870 744 2310 Password: 32552024

Meetings will be hosted on Webex with the login information above. WebEx Breakout Sessions will be utilized and instructions are in following pages.

Joining a Meeting



- To **Join** the meeting, click on the link provided to you.
- Enter your First/Last Name and Email.
- *Please enter your name and contact so we can keep track of attendees/participants*

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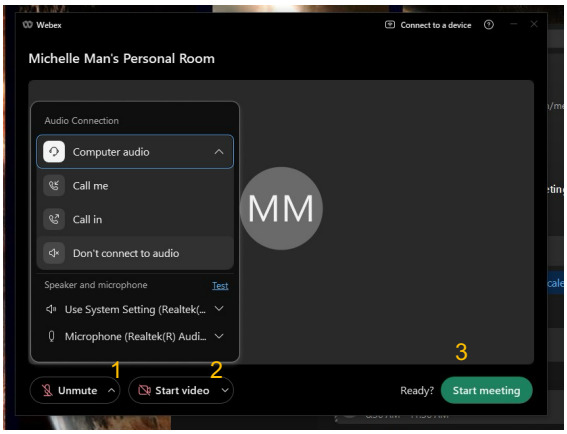
Calling Into a Meeting



- Make sure you are muted (1) and video is disabled(2).
- Both icons should be red.
- Select the computer audio if you would like to via your computer
- When joining with a phone use the audio option to select the Call-In or call me option.
- Then select (3) Join meeting

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General Guide and Reminders

- Join the meeting 5-10 minutes early
- All attendees will be muted upon entering.
- Please disable video. This will reduce bandwidth use and provide a smoother experience.
  - You may enable video when speaking.
- Use the raise hand or chat/comment function if you have comments or questions (unless noted otherwise by speaker).

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JOINING AND NAVIGATING A BREAKOUT SESSION

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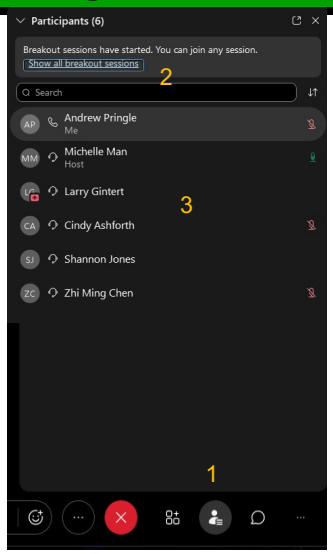
Joining a Breakout Session



- Click on the **Participants** (1) icon
  - 2 – Show all breakout sessions. Select this (see next slide)
- 3 – Shows the list of participants in the *Main* meeting

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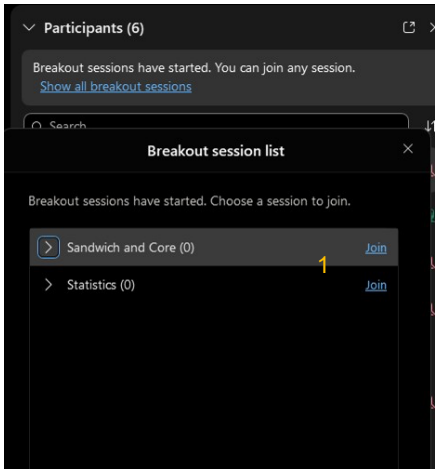
Joining a Breakout Session



- After selecting “Show all breakout sessions” the list of available sessions will pop up
- Select your desired session
- Join (1)

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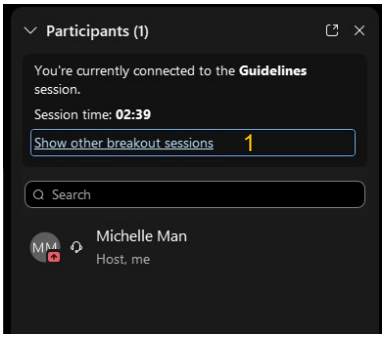
Navigating a Breakout Session



- If you wish to join another meeting, Select (1) – Show other breakout sessions
- You should be able to **Join** a group of your choosing.

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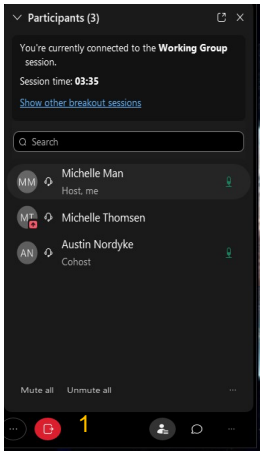
Leaving a Breakout Session



- The meeting host/moderator will announce when the breakout session is ending.
- To return to the main meeting, select (1) – 'door' icon
- You will now leave the session and return to the main meeting.

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COMPOSITE MATERIALS HANDBOOK 17

JOINT COORDINATION AGENDA

NEW MEMBER ORIENTATION / VIRTUAL ATTENDANCE INSTRUCTIONS

Tuesday, Nov 12, 2024	**10:00 am – 11:00 am**

- Introducing CMH-17 Organization – Michelle Man
  - Our Mission
  - The Coordination Group
  - What does the Secretariat do?
  - Websites we use
- Participating in CMH-17 – Cindy Ashforth, FAA
  - Handbook Goals
  - How to get involved
  - FAA Guidance Philosophy and Role of CMH-17
- Continue with Open Coordination Meeting

OPENING COORDINATION AGENDA

Tuesday, Nov 12, 2024	**11:00 am – 12:00 pm / 1:00 pm – 3:00 pm**

11:00-11:15	Welcome, Larry Ilcewicz and John Tomblin
11:15-12:00	Secretariat Update, Michelle Man
1:00-1:15	JGWG Updates (Goals, Vision & Mission. etc.), Carl Rousseau and Rick Cole
1:15-2:55	WG Updates, WG Chairs
2:55-3:00	Closing

FORUM

Wednesday, Nov 13, 2024	**10:00 am – 12:00 pm**

- **FAA Introduction**
  (CMH-17 Knowledge Transfer [Tutorials and Case Studies] for Advanced High-Rate Mfg./Product Scaling),
  Larry Ilcewicz, FAA (20 Minutes)
- **Thermoplastic Fuselage Structure Product Readiness**
  Jan Waleson, GKN/Fokker (60 Minutes)
- **Technology Development for Hi-Rate Composite Aircraft Manufacturing (HiCAM)**
  Randy Wilkerson, The Boeing Company, Technical Fellow
  Michel van Tooren, Collins Aerospace, Senior Technical Fellow (40 Minutes)

EQUIVALENCY PROCESS & BEST PRACTICES MINI TUTORIAL

Tuesday, November 19, 2024	**10:00 am – 12:00 pm**

Part 1

- Introduction of myself and NIAR – 5 minutes
- Introduction of Material Qualification and NCAMP – 10 minutes
- Introduction of Equivalency Process – 10 minutes
- Test Matrices and Conformity Process for Equivalency – 15 minutes
- Equivalency Statistics – 10 minutes
- Question and Answer – 5 minutes
- Switch over to Greg and Teodor.

Part 2

- Introduction and overview of the presentation (with the call-out to the specific regulatory guidance) - 3 min
- Equivalency result scatter - 3 min
- Pathway to the equivalency: Lilium example and test matrix - 5 min
- An example of Lilium's equivalency strategy - 5 min
- De-risking and Keys to a successful equivalency campaign - 5 min
- Test panel prep – 5 minutes
- Testing specifics – 10 minutes
- Measurements and conditioning – 5 minutes 9. Evaluating results – 5 minutes
- Conclusion and questions

CLOSING COORDINATION AGENDA

Thursday, Nov 21, 2024	**1:00 pm – 3:00 pm**

- Secretariate Report Out
- WG and Tutorial Report Out
- Discussion
  - Info on Ballot Voting
  - WG/TG Structure (and new tasks)
- Spring Meeting Planning

COMPOSITE MATERIALS HANDBOOK 17

TECHNICAL WORKING GROUPS

EXECUTIVE LEADERSHIP

CMH-17 HANDBOOK CO-CHAIR

Ms. Cindy Ashforth, FAA
Dr. Ahmet Oztekin, FAA

CMH-17 INDUSTRY LEADER

AM: Mr. Rick Cole, NRC
CMC: Mr. Doug Kiser, NASA
PMC: Dr. Carl Q. Rousseau, Lockheed Martin Aeronautics
PMC: Mr. Stephen H. Ward, Consultant

CMH-17 SENIOR ADVISORS

Dr. Larry Ilcewicz, FAA
Dr. John Tomblin, NIAR

JOINT GROUPS
TECHNICAL WORKING GROUPS

GUIDELINES

Ms. Amanda Bastian, Joby
Mr. Rick Cole, National Research Council Canada
Dr. Carl Q. Rousseau, Lockheed Martin Aeronautics

WG Goal: To keep alignment between the different guidelines working groups that are working 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.

STATISTICS

Mr. Jorge Chavez-Salas, NIAR
Mr. Stefan Kloppenborg,

Analyzes and/or develops statistical procedures for composite materials evaluation and quality control, and provides other statistical support to the Handbook as requested.

Currently, the Statistics Working Group is addressing methodology for setting specification requirement values, and is also considering new, revised, and alternate methods of calculating material basis values. Statistics is working in close coordination with the Data Review Working Group relative to this latter subject.

ENGINE APPLICATIONS

Mr. James Finlayson, Rolls Royce
Dr. Scott Finn, Retired

Charter
Improve the usefulness of CMH17 to the aircraft engine technical community by:

- developing new CMH17 content specific to aircraft engines for both rotating and stationary parts (excluding nacelles and pylons);
- summarizing how existing CMH17 content applies to typical design, materials, manufacturing, maintenance, and certification activities for aircraft engine composite parts;
- documenting industry best practices for the use of composites in aircraft engines; and
- ensuring consistent content across PMC and CMC volumes.

SPACECRAFT

Mr. Jeffrey D. Eichinger, Boeing

Mr. Jeremy Jacobs, NASA Johnson Space Center

The Spacecraft WG 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.

SPECIFICALLY:

- ✓ To develop guidance on the qualification and usage of polymer matrix composites for spacecraft applications.
- ✓ To differentiate development methodologies employed for spacecraft vs aircraft certification.
- ✓ To influence spacecraft certification authorities to mature technical requirements
- ✓ To share “lessons learned” unique to spacecraft development challenges.

ADDITIVE MANUFACTURING
TECHNICAL WORKING AND TASK GROUPS

DATA REVIEW WORKING GROUP

Facilitated by Michelle Man, NIAR

Objectives:
- Develop data table formats including recommended reduced data for presentation.
- Data reduction and draft data tables for the Handbook.
- Work with potential data sources for the Handbook and review documentation/pedigree of potential data sets.
- Maintain data section of the CMH17 AM volume.
- Work with Statistics Working Group to ensure the methods used for data analysis are captured in the Statistics chapter.

DESIGN AND ANAYLSIS WORKING GROUP

Ms. Elisa Buckner, Northrop Grumman
Dr. Sung Park, Northrop Grumman

Objectives:
- Establish design and analysis guidelines, methodologies, and basic engineering requirements to increase first-time success and enable substantiation and predictive capabilities for parts fabricated with polymer based additive manufacturing processes.
- The early focus of the working group will be broad generalizations, followed by details unique to a select number of specific processes.
- When used as intended, this guidance will ensure consistent application of best practices for the design and analysis of products to be manufactured with the stated material and processes.

GUIDELINES WORKING GROUP

Mr. Rick Cole, National Research Council Canada
Dr. Bijan Deris, Boeing

Objectives:
- Provide guidance to AM Working Groups to identify and resolve overlaps and gaps in handbook content.
- Coordinate AM Volume outline / Table of Contents to ensure rational organization of handbook content.
- Prepare introductory and overview content for the AM Volume to establish guidelines for handbook users.

MATERIALS AND PROCESSES WORKING GROUP

Dr. Fei Liang, Gulfstream
Mr. Eric Moyer, Boeing

Objectives:

- Provide an outline critical relating to M&P for polymer AM.
- Outline to encompass all the work completed until now, while leaving room for more complex materials in the future.
- Content completion of outline based on work done to date.
- Identify gaps in current completed work to identify additions for the nth qualification and other areas of research.
- Maintenance of the sections as new qualifications are performed as well as updates to already established quals. Closed feedback loop to accommodate.

TESTING WORKING GROUP

Mr. Joe Costanzo, Boeing
Mr. Brian Kitt, Spirit AeroSystems
Mr. Royal Lovingfoss, NIAR

Objectives:

- Give guidance on appropriate test methods and test conditions for use with AM materials while taking into account, material type, machine capabilities, process information, industry desired data, statistical analysis requirements, and available standards.
- Test standard creation and/or appropriate changes may be necessary by working with applicable industry leaders and standards organizations to ensure the test method is understood, usable, appropriate, and repeatable for use with AM materials.
- Working with other groups of the CMH17 AM community to ensure proposed test methods are applicable for their purposes and can help in harmonizing all aspects that control a data set prior to submission and inclusion into the CMH17 AM volume.

CERAMIC MATRIX COMPOSITES
TECHNICAL WORKING AND TASK GROUPS

DATA REVIEW WORKING GROUP

Dr. Rajiv Naik, University of Connecticut

Vision Statement

To provide the final technical/editorial review of all data prior to review by the full Coordination Group; provide a review of the application of the data documentation requirements to the actual data being supplied; develop formats for data presentation in the handbook; and establish the data documentation requirements for the handbook.

Goals

- Formulate guidelines and requirements for data submission, data documentation, data analysis, and data review for all CMC data that is submitted for inclusion in the handbook.
- Review the data and the data analysis of data sets that are submitted for inclusion in the handbook.
- Develop formats for data presentation in the handbook and for storage of data in electronic databases.
- Develop and document statistical methods for data pooling and data analysis of CMC data.

DESIGN AND ANAYLSIS WORKING GROUP

Dr. Arun Bhattacharya, Boeing
Mr. Kevin Rugg, Pratt & Whitney

Vision Statement

To be an authoritative source for design, analysis, and verification information for the validation and certification of CMC engineered structures.

Goals

- To provide information on design and analysis certification methods and options, the level of substantiation information required, and formats required in validation and certification processes.
- To specify material property and performance input and validation data needed for design and analysis of CMC components
- To identify test parameters to produce those data, and identify analysis considerations in interpreting such data, and to ensure compatibility with design needs
- To identify approach options for the design and analysis of CMC structures and joints
- To ensure future relevancy of the handbook by maintaining an up to date survey of the current state of the art capabilities within the design, analysis and lifing communities for CMCs

MATERIALS AND PROCESSES WORKING GROUP

Mr. Doug Kiser, NASA
Ms. Leanne Lehman, Boeing

Charter
Improve the usefulness of CMH17 to the aircraft engine technical community by:
developing new CMH17 content specific to aircraft engines for both rotating and stationary parts (excluding nacelles and pylons);
summarizing how existing CMH17 content applies to typical design, materials, manufacturing, maintenance, and certification activities for aircraft engine composite parts;
documenting industry best practices for the use of composites in aircraft engines; and
ensuring consistent content across PMC and CMC volumes.
Goals

- To define the essential elements of information on composition, structure, and processing of CMCs necessary to design, select, fabricate, and utilize CMC structures.
- To specify the methods and procedures to be used in the characterization of ceramic matrix composites and their constituents.
- To provide a comprehensive overview of ceramic matrix composite technology, outlining the history, applications, benefits, ceramic composite systems, methods of fabrication, quality control, and supportability.

TESTING WORKING GROUP

Mr. Matt Opliger, NIAR
Dr. Bob Zhou, GE Aerospace

Vision Statement
To be the primary and authoritative source for recommended/required methods for testing and characterization of CMCs and their constituent materials.

Goals

- To identify appropriate existing consensus standard test methods for CMCs and their constituent materials.
- To assist in the development of appropriate standard test methods for CMCs and their constituent materials, where no such standards exist

POLYMER MATRIX COMPOSITES
TECHNICAL WORKING AND TASK GROUPS

CRASHWORTHINESS WORKING GROUP

Dr. Mostafa Rassaian

The newly formed Working Group will provide the support for the development of a new, self-contained section of the handbook on composite Crashworthiness and Energy Management for vehicle safety certification. The Work Group will also attempt to address the needs of the composites and aeronautics community at large, and to provide a unique forum of discussion for those working in industry, research institutions, and government agencies. Through a close interaction with ASTM Committee D-30, the Work Group will try to develop standards for the characterization of the energy-absorbing characteristics of composite material systems, such as the axial crushing of column-like members and of thin-wall tubular structures, representative of aircraft sub-floors and automotive-sized rails. In general, it will try to present, for the first time in a concise and comprehensive fashion, some recommended design guidelines and practices for the experimental and numerical characterization of the crash resistance of advanced composite structures.

DAMAGE TOLERANCE WORKING GROUP

Dr. Douglas S. Cairns, Montana State University
Mr. Patrick Enjuto, Boeing
Mr. Allen Fawcett, Boeing
Mr. Mike Smeets, Fokker Landing Gear
Dr. Simon Waite, European Aviation Safety Agency (EASA)

Significant Contributors
Mr. DM Hoyt, NSE Composites
Dr. Larry Ilcewicz, FAA

DATA REVIEW WORKING GROUP

Mr. Michael Hempowicz, Toray CMA
Mr. Royal Lovingfoss, NIAR

Establishes data documentation requirements, develops formats for data presentation, and provides the final technical and editorial review of all data prior to inclusion in the Handbook.

Data Review Working Group (DRWG) performs data review according to a set of published procedures that have been developed by the working group To facilitate the data review process, the DRWG has established an electronic voting protocol that allows data reviews between CMH-17 formal meetings. DRWG works closely with NCAMP in order that the data generated by that organization meets the requirements of CMH-17. Future tasks will address data requirements and formats for data presentation for adhesives.

DESIGN

Mr. Patrick Enjuto, Boeing
Dr. Larry Ilcewicz, FAA

The objective of the Design Task Group is to develop an appreciation for the many phases of design from the start of product development through life cycle challenges, including product value assessments of related costs and other performance objectives essential to certifiable applications. This efforts will start with an introduction to Composite Design Criteria, Requirements and Other Constraints as related to design development and structural substantiation. The principles of size and product scaling efforts will be applied resulting in the necessary success criteria to attain product readiness and complete product definition, certification, production and service needs during the product lifecycle.

GUIDELINES WORKING GROUP

Ms. Amanda Bastian, Joby
Dr. Carl Q. Rousseau, Lockheed Martin Aeronautics

Develops and documents generic guidance information and data which is essential for the adequate design, certification or qualification, and production of composite parts and assemblies. The Guidelines Working Group also provides leadership and recommendations regarding the scope, responsibilities, and future direction of the Handbook.

The current focus is on characterization test procedures and philosophy, materials property data, statistical analysis requirements, general design and analysis methodology, design data usage and quality assurance practices.

MATERIALS & PROCESS WORKING GROUP

Dr. Margaret E. Roylance, Nano Tech Labs
Mr. Daniel R. Ruffner

Provides guidelines, descriptions and case studies of material types and processing options for the characterization and fabrication of polymer matrix composite materials.

Current efforts are focused on revising Volume 3, Chapter 5 (Materials & Processes), preparing a new section in Volume 1, Chapter 5, which addresses test planning, and establishing guidelines for qualification of composite materials.

SAFETY MANAGEMENT WORKING GROUP

Ms. Cindy Ashforth, FAA Aircraft Certification Service, Policy & Innovation Division
Dr. Larry Ilcewicz, FAA Aircraft Certification Service, Policy & Innovation Division

The objective of the Safety Management Working Group is to provide the basis for assessing and managing risk by various means to assure and improve aircraft safety. The group is

leading the development of the chapter in Volume 3 - Chapter 17 "Structural Safety Management". Chapter 17 includes considerations, analysis procedures and practical applications of safety management. In addition, the Safety Management Working Group is coordinating current initiatives involving the structural safety task group and efforts by the damage tolerance and disbond & delamination task groups.

SANDWICH WORKING GROUP

Mr. Lawrence A. Gintert, Independent Consultant
Dr. Zhi Ming Chen, The Aerospace Corporation

The Sandwich Working Group is responsible for Volume 6, Structural Sandwich Composites. Volume 6 includes information on core, adhesive, and face sheet materials, and on testing, design, analysis, fabrication, quality control, and supportability of sandwich structure.

Current efforts are focused on developing a long-term approach to data for core and adhesives, updating the volume with new information, and coordinating the content with other volumes of the Handbook.

SUPPORTABILITY WORKING GROUP

Dr. Joseph Rakow, Exponent Failure Analysis Associates
Mr. Stephen Starnes, US Navy

The objective of the Supportability Working Group is to provide the guidelines needed for post-production support of composite structures including inspection, repair, design, facilities, maintenance and disposal. The group is leading the development of two chapters in Volume 3 - Chapter 13 "Defects, Damage and Inspection" and Chapter 14 "Supportability, Maintenance, and Repair" which are intended for inclusion in Revision G of the handbook.

TESTING WORKING GROUP

Dr. Daniel Adams, University of Utah
Mr. John Moylan, Element Materials Technology

Offers descriptive and guidance information relating to the usage of chemical, physical and mechanical test methods for polymer matrix composites and their constituents.

Currently, sections on failure modes, matrix test methods, prepreg characterization, tensile testing, damage tolerance testing, multi-axial testing, strain measurement, glass transition temperature, void volume analysis, and density determination are being prepared or rewritten (Volume 1, Chapters 4, 5 and 6).

WORKING GROUP AND SESSION AGENDAS
(LISTED CHRONOLOGICALLY)

PMC CRASHWORTHINESS

Wednesday, Nov 13, 2024 1:00 pm – 3:00 pm

- Opening Discussion
- Post Rev. H Tasks
- AAM Vehicle Crashworthiness Update (Joseph) – Tentative
- PDFA Methods Applications for Aircraft Crashworthiness…, NASA Tech Memo (Mike)

JOINT STATISTICS

Wednesday, Nov 13, 2024 1:00 pm – 3:00 pm

Item	Speaker	Time
Call to order and introductions	S. Kloppenborg	10 min
Review of minutes from Scottsdale meeting	S. Kloppenborg	5 min
Update on Vol 7 (AM) statistics content	S. Kloppenborg	5 min
Statistics Tasking	--	--
P24-073: Improved computational flowchart	J. Chavez-Salas	5 min
P24-074: Improved clarity of Mod CV transform for diagnostic tests	J. Chavez-Salas	5 min
P24-077: Improved accuracy of Normal A- and B-Basis factors	S. Kloppenborg	5 min
New SPC Task Group	B. Langston	20 min
New Equivalency Task Group	S. Kloppenborg	20 min
Bayesian methods	L. Jones	10 min
The future structure of the Statistics WG	S. Kloppenborg	15 min
Adjourn	--	--

AM TESTING

Thursday, Nov 14, 2024 10:00 am – 12:00 pm

- Discussion and review of Shear Test Section.
- Discussion and review of Introduction Sections.
- Discussion and review of CTE Section.

PMC SANDWICH

Thursday, Nov 14, 2024	**10:00 am – 12:00 pm**

- Introductions and Agenda Review - 5 min
- Sandwich WG Mission - 10 min
- Volume 6 Evolution - 15 min
- Volume 6A Outline and Proposed Task Groups- 15 min
- Proposed Initial TGs and Leaders – 15 min
- Initial Tasks Planning (pending approval)- 25 min
    - TG Scope of Effort
    - Proposed Meeting Frequencies/Formats
    - Quarterly Status Update Meetings
- Feedback/Discussion - 20 min
- Next Steps Planning/Wrap-up - 10 min

AM DESIGN & ANALYSIS

Thursday, Nov 14, 2024	**1:00 pm – 3:00 pm**

- YP Negative Vote Reconciliation on 11.1 and 11.2
- Discuss on section 11.3 Design
- Introductory discussion Chapter 12 Maintainability and Supportability
  Discuss Chapter 13 Applications and Lessons Learned for next YP ballot

PMC DATA REVIEW

Thursday, Nov 14, 2024	**1:00 pm – 3:00 pm**

- **Introduction and Welcome** – Royal Lovingfoss, Michael Hempowicz
- **Overview of Data Review Working Group (DRWG)**
    - DRWG Voting Members – Voting Group Expectations
    - DRWG Data Source Data Submittal – Data Confidentiality – Data Approval Process
- **Data Review Schedule**
    - Data in Ballot/ Review/ Upcoming
        - Victrex AE 250 T-071 AS4 12k Unitape- Negative in work
        - Toray 3900-2C/T800s Grade 145 Unitape
        - Hexcel 8552 AGP 370 8HS
    - Available Datasets
    - Additional Datasets
- **Old/ New Business**

CMC TESTING

Tuesday, November 19, 2024	**1:00 pm – 3:00 pm**

- Introductions
- Vision and Goals
- Overview of CMC Testing WG Sections (Volume 5, Part C, Chapters 8-15)
- Review and Discuss:
    - Finished Sections Requiring Changes and/or Balloting
    - Sections Currently being Worked
    - Future Plans

PMC DESIGN

Tuesday, November 19, 2024	**1:00 pm – 3:00 pm**

- Brief overview of Rev. H advancements/publishing status, Ilcewicz, Enjuto
- Identify all existing proposals for future development, Ilcewicz (15 Min.)
- Proposal to update Sec. 7.2.2.2 – 7.2.2.4 to include a prototype phase in "Product Development" Design Phases 1 to 3, Ilcewicz, Seaton (25 Min.)
- Status/recruiting Sec. 7.2.3: Integrated Product Teams, Gintert, Stenne (15 Min.)
- Status Example Design Process (Sec. 7.2.5.1 Transport Aircraft), Rush (10 Min.)
- Joint Design/Spacecraft WG on case studies, Ilcewicz, Jacobs (40 Min.)
    - Discuss proposed options (Outcomes from joint planning meetings)
    - Active IPT design discussions on the next steps forward (for purposes of member recruiting)
- Closure/actions (5 Min.)

AM GUIDELINES

Wednesday, Nov 20, 2024	**10:00 am – 12:00 pm**

- Working Group Overview - Mission, Membership, Rhythm
- Vol. 3 Rev H and Vol. 5 Rev. B Submissions
- Review Current WG Scope and Discuss Whether Expanded Scope is Desired
- Review Chapter Outline and Status of Planned Sections
- 2024 Working Group Plans
- Summary & Actions

PMC MATERIALS & PROCESSING

Wednesday, Nov 20, 2024	**10:00 am – 12:00 pm**

Margaret Roylance and Dan Ruffner 10:00a – 10:35a ET

The M&P Working Group is directly responsible for content in Volume 3: Chapter 5 on Materials and Processes for Polymer Matrix Composites, Chapter 6 on Quality Control of Production, and Chapter 18 on Environmental Management. M&P additions and changes in Rev H occurred exclusively in Chapter 5.

Quick Review of New Non-bonding M&P Content for Rev H
Thank you, authors and reviewers!

- Resin Matrix Chemistries - Howard Creel
- Shelf Life and Out-time - Nathan Collins
- Updated Chapter 5 Outline - Margaret Roylance

New M&P Content Beyond Rev H - Need authors and reviewers!

Previously Established Interests

1) **Tutorial on Shared Databases**
   Margaret Roylance/Beth Clarkson/Brad Tipton (Agenda Item 17-04)
   There is a three-page outline of potential content. The practice of including elevated temperature wet tests in equivalency exercises has been proposed.

2) **Nested Qualification Statistics Expansion** Shannon Jones
   The specific statistics used to analyze nested designs are not extensively covered in the literature; the handbook needs some more specific guidance.

Already Proposed New Initiatives

3) **Shelf Life Out-Time** - Additional content?
4) **Lot Testing** - Adding and/or setting aside coupons, other content?
5) **Specification Acceptance Values v Allowables** – Need additional guidance
6) **Heat surveys** – Composites (coordinate with BPTG content on bonding)
7) **Process Control/Traveler Coupons** - Composites (coordinate with BPTG)
8) **Complete Review & Reorganize Chapter 5** – Many changes since last done

New M&P Initiative Suggestions/Proposals for New Content?

P-17 Task Group Meeting
Shannon Jones and Margaret Roylance 10:35a - 11:00a ET

The P-17 Task Group is convened in the M&P Working Group to focus on generating new AMS material specifications for composite materials with data published in Volume 2, and then continued support/change management of these specifications. In comparison, the corresponding SAE group has multiple additional responsibilities, including hundreds more

similar, already existing composite and bonding AMS specifications which are not directly associated with CMH-17.

The associated SAE P-17 QPG is responsible for surveying and monitoring the material manufacturers for the Volume 2 published materials. This includes ensuring that materials being manufactured to the above P-17 AMS specifications are comparable to those which produced the test data published in Volume 2. Continued change management is then required to maintain this provenance.

Together this system allows procurement of the composite materials that produced the data published in Volume 2 using industry available specifications.

General Business

Welcome & Introductions
Virtual sign in sheet(s)
Review and approval of the minutes

Status update of P-17 Specification Activities

- Discussion on carbon fiber slash sheets on prepreg specifications
- MIL-STD-1587 revision draft review
- WiP Review
- Five Year Document Review Status
- Coordination of data review and specification generation
- New business
- P17 QPG highlights

Looking Forward

- Need volunteers to support adapting new AMS composite material specifications to support materials with data published in Volume 2
- Will the handbook publish data for adhesives and/or core?
- Will any CMH published adhesive and/or core data correspond directly with the current Volume 2 approach for composites?
- How can issues similar to composites (procurement of the material directly represented by the data published in V2) best be handled for new materials?
- Additional suggestions/proposals for P-17 TG support of procurement of Volume 2 published materials using industry specifications?

Bonding Process Task Group
Molly Stone and Lisa McHugh 11:00a to 12:00p ET

Bonding Process Task Group (BPTG) Meeting

The Bonding Process Task Group (BPTG) is convened in the M&P Working Group to generate new structural adhesive bonding process content for the handbook.

Meeting Objectives: Introduce new tasks and associated timelines. Create BPTG roster and recurring meeting schedule.

Quick Review of New Bonding Process Content for Rev H
Thank you, authors and reviewers!

Section	Title	Primary Author(s)
5.9	Introduction	Howard Creel
5.9.1	General Considerations	Dan Ruffner
5.9.2	Adhesive and Substrate Selection	Chad Franks
5.9.3	Surface Preparation for Secondary Bonding	Ashley Tracey, Will Grace, Jim Mazza, Kara Storage
5.9.4	Application and Assembly Processes for Secondary Bonding	Scott Leeman, Molly Stone
5.9.5	Cocuring	Dan Ruffner
5.9.6	Cobonding	Dan Ruffner
5.9.7	Multi-stage Bonding	Dan Ruffner
5.9.8	Bond Quality Assurance	Lisa McHugh, Molly Stone
5.9.9	Considerations for a Bonding Process Specification	Lisa McHugh, Molly Stone
5.9.10	Bonded Joint Certification	Chad Franks, Lisa McHugh, Molly Stone

Looking Forward
The need for new/additional bond process content is already established for the following areas:

- Cure monitoring and heat survey guidance
- Process control tools
- Amine blush testing
- Bond surface characterization methods and application

New BPTG Initiative Suggestions/Proposals for New Content? Volunteers?

PMC GUIDELINES

Wednesday, Nov 20, 2024	**1:00 pm – 3:00 pm**

Rousseau	Call to Order	1:00pm
Bastian	Approval of Spring 2024 GWG WG Minutes	1:05pm
Yellow Page Review – none for PMC GWG this cycle		
Old Business and Open AIs		
Bastian	Post-Rev-H PMC GWG Issues (need champion names): • Younger/New Member Outreach, Scott L, Steve K had volunteered • 'Editorial' Review of PMC-GWG v1-v3 volunteers to work with Michele on review • Bonded Joints, Shared Database Tutorials as a future part of CMH-17 • Joint Guidelines meetings with CMC and AM guidelines	1:10pm
Ballocchi	Seats/Interiors TG Status of SAE ARP-6337 Rev B update, and next steps	1:40pm
New Business		
All	• Future role and scope of PMC GWG? Merge with JGWG? Sections absorbed by PMC Design and Analysis WG? • Stress methods support for V6?	2:15pm
All	Topics to Elevate to PMC Coordination	2:45pm
Adjourn		3:00pm

SUPPORTABILITY

Wednesday, Nov 20, 2024	**1:00 pm – 3:00 pm**

- Introductions and Supportability WG Overview – 10 min
- Revision H content observations for Ch14 and Status of Publication – 20 min
- SoBR TG2 Initiative - Case Study #2 – 40 min
    - Scope and Team assignments
    - Content discussion
    - Timeline Planning
- Other Post-Rev H Planning – 40 min
    - Discussion of Tasking Topics
    - Development of Proposals and Team Identification
- Next Steps Planning/Wrap-up - 10 min

AM MATERIALS & PROCESSING

Thursday, Nov 21, 2024	**10:00 am – 12:00 pm**

- Introductions (15min)
- Review Chapter 4 & Chapter 5 Proposed Update to Table of Contents (20 min)
- Review summary for SLS content in AM handbook (40 min)
- Review proposal for pellet based extrusion terminology and content (20 min)
- Review current Chapter 4 & 5 terminology list (15 min)
- Review M&P Chapter/Section progress tracker (if time allows)

PMC DAMAGE TOLLERANCE

Thursday, Nov 21, 2024	**10:00 am – 12:00 pm**

Intro + Rev H Status (10 minutes)

Post-Rev H Topics and Priorities (50 minutes)

- Review of topics
- Identify and prioritize tasking initiatives

F44.30 Harmonization (30 minutes)

- EASA (Melanie/Simon) + FAA (Angie and/or Bob)
- Identify gaps in CMH-17 for Part 23, Appendix to 20-107C?

LEF Usage with Impact Damage (30 minutes)

- Waruna regarding impact damage scaling effects with respect to fatigue scatter/LEF.
- NSE/Fawcett> Discuss need for LEF for impact damage that is based on severe/conservative damage design criteria (also relates to relationship among categories of damage and residual strength curve).
- Bonded joints and out-of-plane loads should be considered (as related to impact damage)

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COMPOSITE MATERIALS HANDBOOK 17

YELLOW PAGE RESULTS

RESULTS OF YELLOW PAGE VOTING

AM SPRING YP1 RESULTS

Volume	Section	Title	Affirmative	Affirmative with Comment	Negative	Abstain	Total
7	1.5	SCOPE	15	4	2	0	21
7	1.6	USE OF THE DOCUMENT AND LIMITATIONS	17	3	2	1	23
7	1.9	CMH-17 VOLUME 7 CHAPTER 1 SECTION 1.9 DEFINITIONS	18	3	0	2	23
7	2.1	INTRODUCTION TO NON-METALLIC AM DESIGN AND DEVELOPMENT	17	5	0	0	22
7	2.2	SOURCES OF VARIABILITY	20	1	0	1	22
7	4.1	PROCESS AND MANUFACTURING INTRODUCTION	14	3	3	3	23
7	5.3.4	CRITERIA FOR SOFTWARE CHANGE LEVEL SELECTION	15	3	1	4	23
7	8.4.1	STATISTICAL METHODS FOR MATERIAL EQUIVALENCE AND ACCEPTANCE	15	5	1	4	25

CMC SPRING YP1 RESULTS

Volume	Section	Title	Affirmative	Affirmative with Comment	Negative	Abstain	Total
5	13.7	COMPRESSION TESTING	10	5	1	0	16
5	13.12	INTERLAMINAR FRACTURE TOUGHNESS	7	7	2	0	16

AM SPRING YP2 RESULTS

Volume	Section	Title	Affirmative	Affirmative with Comment	Negative	Abstain	Total
7	1.5	SCOPE	16	6	0	2	24
7	1.6	USE OF THE DOCUMENT AND LIMITATIONS	17	3	1	3	24
7	8.2.5	Structured vs Unstructured Data	21	0	0	3	24
7	8.2.6	Statistically-Based Material Allowables	17	3	1	3	24
7	8.2.7	Modified CV	18	0	2	4	24
7	9.8	Tensile Testing	14	5	2	3	24
7	11.1	Design and Analysis	14	3	3	4	24

CMC SRPING YP2 RESULTS

Volume	Section	Title	Affirmative	Affirmative with Comment	Negative	Abstain	Total
5	6.1.3.2	Attachments to non-CMC components	13	5	2	2	22
5	13.14	Creep Testing	17	1	1	3	22

ALL YP COMMENTS CAN BE FOUND AT CMH17.ORG

VOLUME OUTLINE

Updated 04/2024

VOLUME 1 - Rev H Working Draft	PMC Working/Task Group Responsibility
CHAPTER 1 GENERAL INFORMATION	
1.1 INTRODUCTION TO THE HANDBOOK	Guidelines
1.2 OVERVIEW OF HANDBOOK CONTENT	Guidelines
1.3 PURPOSE AND SCOPE OF VOLUME 1	Guidelines
1.4 USE OF THE DOCUMENT AND LIMITATIONS	Guidelines
1.4.1 Roadmaps for use of Volumes 1 - 3	Guidelines
1.4.2 Source of information	Guidelines
1.4.3 Use of data and guidelines in applications	Guidelines
1.4.4 Strength properties and allowables terminology	Guidelines
1.4.5 Use of references	Guidelines
1.4.6 Use of tradenames and product names	Materials & Processes
1.4.7 Toxicity, health hazards, and safety	Materials & Processes
1.4.8 Ozone depleting chemicals	Materials & Processes
1.5 APPROVAL PROCEDURES	Guidelines
1.6 MATERIAL ORIENTATION CODES	Guidelines
1.6.1 Laminate orientation codes	Guidelines
1.6.2 Braiding orientation codes	Guidelines
1.7 SYMBOLS, ABBREVIATIONS, AND SYSTEMS OF UNITS	Guidelines
1.7.1 Symbols and abbreviations	Guidelines
1.7.2 System of units	Guidelines
1.8 DEFINITIONS	Guidelines
CHAPTER 2 GUIDELINES FOR PROPERTY TESTING OF COMPOSITES	
2.1 INTRODUCTION	Guidelines
2.1.1 Building-block approach to substantiation of composite structures	Guidelines
2.1.2 Test levels and data uses	Guidelines
2.2 TEST PROGRAM PLANNING	Guidelines
2.2.1 Overview	Guidelines
2.2.2 Baseline and alternate approaches for statistically-based properties	Guidelines
2.2.3 Issues of data equivalence	Guidelines
2.2.4 Test program type	Guidelines
2.2.5 test method selection	Guidelines
2.2.6 Population sampling and sizing	Materials & Processes
2.2.7 Material and processing variation, specimen preparation and NDE	Guidelines
2.2.8 Material operational limit (MOL)	Guidelines
2.2.9 Material operational limits (MOL)	Guidelines

2.2.10 SPACE ENVIRONMENTAL EFFECTS ON MATERIAL PROPERTIES	Spacecraft
2.2.11 Data normalization	Guidelines
2.2.12 Application specific testing needs	Guidelines
2.3 RECOMMENDED TEST MATRICES	Guidelines
2.3.1 Material screening test matrices	Guidelines
2.3.2 Material qualification and lamina basis values test matrices	Guidelines
2.3.3 Material acceptance test matrices	Guidelines
2.3.4 Alternate material equivalence test matrices	Guidelines
2.3.5 Generic laminate/structural element test matrices	Guidelines
2.3.6 Suggested bonded joint test matrices	Guidelines
2.4 ALTERNATE APPROACHES TO BASIS VALUES	Guidelines
2.5 RESERVED FOR FUTURE USE	Guidelines
2.6 DATA DOCUMENTATION	Guidelines
2.6.1 Data documentation	Guidelines
2.6.2 Test reports	Guidelines
2.7 EVALUATION OF CHANGES MADE TO PREVIOUSLY QUALIFIED MATERIALS	Guidelines
2.7.1 Modification categories	Guidelines
2.7.2 Actions required for each modification category	Guidelines
2.7.3 Implementation	Guidelines
2.7.4 Validation test matrices	Guidelines
2.7.5 Equivalency criteria and data analysis	Guidelines
2.8 EVALUATION OF ALTERNATE PART PROCESSORS OR SITES	Guidelines
2.9 QUALIFICATION OF ADDITIONAL MATERIAL FORMS OR ALTERNATE SOURCE COMPOSITE MATERIALS	Guidelines
2.9.1 Introduction	Guidelines
2.9.2 Goal and approach	Guidelines
2.9.3 Key material or structural performance parameters	Guidelines
2.9.4 General guidance	Guidelines

CHAPTER 3 EVALUATION OF REINFORCEMENT FIBERS

3.1 INTRODUCTION	Testing
3.2 CHEMICAL TECHNIQUES	Testing
3.2.1 Elemental analysis	Testing
3.2.2 Titration	Testing
3.2.3 Fiber structure	Testing
3.2.4 Fiber surface chemistry	Testing
3.2.5 Sizing content and composition	Testing
3.2.6 Moisture content	Testing
3.2.7 Thermal stability and oxidative resistance	Testing
3.2.8 Chemical resistance	Testing
3.3 PHYSICAL TECHNIQUES (INTRINSIC)	Testing
3.3.1 Filament diameter	Testing
3.3.2 Density of fibers	Testing
3.3.3 Electrical resistivity	Testing
3.3.4 Coefficient of thermal expansion	Testing
3.3.5 Thermal conductivity	Testing

3.3.6 Specific heat	Testing
3.3.7 Thermal transition temperatures	Testing
3.4 PHYSICAL TECHNIQUES (EXTRINSIC)	Testing
3.4.1 Yield of yarn, strand, or roving	Testing
3.4.2 Cross-sectional area of yarn or tow	Testing
3.4.3 Twist of yarn	Testing
3.4.4 Fabric construction	Testing
3.4.5 Fabric areal density	Testing
3.5 MECHANICAL TESTING OF FIBERS	Testing
3.5.1 Tensile properties	Testing
3.5.2 Filament compression testing	Testing

CHAPTER 4 MATRIX CHARACTERIZATION

4.1 INTRODUCTION	Testing
4.2 MATRIX SPECIMEN PREPARATION	Testing
4.2.1 Introduction	Testing
4.2.2 Thermoset polymers	Testing
4.2.3 Thermoplastic polymers	Testing
4.2.4 Specimen machining	Testing
4.3 CONDITIONING AND ENVIRONMENTAL EXPOSURE	Testing
4.4 CHEMICAL ANALYSIS TECHNIQUES	Testing
4.4.1 Elemental analysis	Testing
4.4.2 Functional group and wet chemical analysis	Testing
4.4.3 Spectroscopic analysis	Testing
4.4.4 Chromatographic analysis	Testing
4.4.5 Molecular weight and molecular weight distribution analysis	Testing
4.4.6 General scheme for resin material characterization	Testing
4.5 THERMAL/PHYSICAL ANALYSIS AND PROPERTY TESTS	Testing
4.5.1 Introduction	Testing
4.5.2 Thermal analysis	Testing
4.5.3 Rheological analysis	Testing
4.5.4 Morphology	Testing
4.5.5 Density/specific gravity	Testing
4.5.6 Volatiles content	Testing
4.5.7 Moisture content	Testing
4.6 STATIC MECHANICAL PROPERTY TESTS	Testing
4.6.1 Introduction	Testing
4.6.2 Tension	Testing
4.6.3 Compression	Testing
4.6.4 Shear	Testing
4.6.5 Flexure	Testing
4.6.6 Impact	Testing
4.6.7 Hardness	Testing
4.7 FATIGUE TESTING	Testing
4.8 TESTING OF VISCOELASTIC PROPERTIES	Testing

CHAPTER 5 PREPREG MATERIALS CHARACTERIZATION

5.1 INTRODUCTION	Testing
5.1.1 Background	Testing
5.2 PREPREG SAMPLING PLANS AND SPECIMEN PREPARATION	Testing
5.3 CONDITIONING AND ENVIRONMENTAL EXPOSURE	Testing
5.4 PREPREG PHYSICAL AND CHEMICAL PROPERTIES	Testing
5.4.1 Prepreg physical properties	Testing
5.4.2 Prepreg chemical properties	Testing

CHAPTER 6 LAMINA, LAMINATE, AND SPECIAL FORM CHARACTERIZATION

6.1 INTRODUCTION	Testing
6.2 SPECIMEN PREPARATION	Testing
6.2.1 Introduction	Testing
6.2.2 Traceability	Testing
6.2.3 Test article fabrication	Testing
6.2.4 Specimen fabrication	Testing
6.3 CONDITIONING AND ENVIRONMENTAL EXPOSURE	Testing
6.3.1 Introduction	Testing
6.3.2 Fixed-time conditioning	Testing
6.3.3 Equilibrium conditioning	Testing
6.4 INSTRUMENTATION AND CALIBRATION	
6.4.1 Introduction	Testing
6.4.2 Test specimen dimensional measurement	Testing
6.4.3 Load measurement devices	Testing
6.4.4 Strain/displacement measurement devices	Testing
6.4.5 Temperature measurement devices	Testing
6.4.6 Data acquisition systems	Testing
6.5 TESTING ENVIRONMENTS	Testing
6.5.1 Introduction	Testing
6.5.2 Laboratory ambient test environment	Testing
6.5.3 Non-ambient testing environment	Testing
6.6 THERMAL/PHYSICAL PROPERTY TESTS	Testing
6.6.1 Introduction	Testing
6.6.2 Extent of cure	Testing
6.6.3 Glass transition temperature	Testing
6.6.4 Density	Testing
6.6.5 Cured ply thickness	Testing
6.6.6 Fiber volume (V_f) fraction	Testing
6.6.7 Void volume (V_v) fraction	Testing
6.6.8 Moisture/diffusivity	Testing
6.6.9 Dimensional stability (thermal and moisture)	Testing
6.6.10 Thermal conductivity	Testing
6.6.11 Specific heat	Testing
6.6.12 Thermal diffusivity	Testing
6.6.13 Outgassing	Testing
6.6.14 Absorptivity and emissivity	Testing
6.6.15 Thermal cycling	Testing
6.6.16 Microcracking	Testing
6.6.17 Thermal oxidative stability (TOS)	Testing

6.6.18 Flammability and smoke generation	Testing
6.7 ELECTRICAL PROPERTY TESTS	Testing
6.7.1 Introduction	Testing
6.7.2 Electrical permittivity	Testing
6.7.3 Dielectric strength	Testing
6.7.4 Magnetic permeability	Testing
6.7.5 Electrical property tests - electro-magnetic interference (EMI) shielding effectiveness	Testing
6.7.5.1 Coupon testing	Testing
6.7.5.2 Enclosure testing	Testing
6.7.6 Electrostatic discharge	Testing
6.8 STATIC UNIAXIAL MECHANICAL PROPERTY TESTS	Testing
6.8.1 Introduction	Testing
6.8.2 Tensile properties	Testing
6.8.3 Compressive properties	Testing
6.8.4 Shear properties	Testing
6.8.5 Flexural properties	Testing
6.8.6 Fracture toughness	Damage Tolerance/Testing
6.9 UNIAXIAL FATIGUE TESTING	Testing
6.9.1 Overview	Testing
6.9.2 Fatigue test key parameters	Testing
6.9.3 Fatigue strength test methods	Testing
6.9.4 Fatigue fracture toughness	Testing
6.10 MULTIAXIAL MECHANICAL PROPERTY TESTING	Testing
6.11 VISCOELASTIC PROPERTIES TESTS	Testing
6.11.1 Introduction	Testing
6.11.2 Creep and stress relaxation	Testing
6.12 FORM-SPECIFIC MECHANICAL PROPERTY TESTS	Testing
6.12.1 Tests unique to filament winding	Testing
6.12.2 Tests unique to textiles composites	Testing
6.12.3 Tests unique to thick-section composites	Testing

CHAPTER 7 STRUCTURAL ELEMENT CHARACTERIZATION

7.1 INTRODUCTION	Testing
7.2 SPECIMEN PREPARATION	Testing
7.2.1 Introduction	Testing
7.2.2 Mechanically fastened joint tests	Testing
7.2.3 Bonded joint tests	Testing
7.3 CONDITIONING AND ENVIRONMENTAL EXPOSURE	Testing
7.3.1 Introduction	Testing
7.3.2 General specimen preparation	Testing
7.3.3 Bonded joints	Testing
7.3.4 Damage characterization specimens	Testing
7.3.5 Sandwich Structure	Testing
7.4 NOTCHED LAMINATE TESTS	Testing
7.4.1 Overview	Testing

7.4.2 Notched laminate tension	Testing
7.4.3 Notched laminate compression	Testing
7.4.4 Notched laminate test methods for CMH-17 data submittal	Testing
7.5 MECHANICALLY-FASTENED JOINT TESTS	Testing
7.5.1 Definitions	Testing
7.5.2 Bearing Tests	Testing
7.5.3 Bearing/by-pass evaluation	Testing
7.5.4 Fastener pull-thru resistance	Testing
7.5.5 Bearing/mechanical joint test methods for CMH-17 data submittal	Testing
7.6 BONDED JOINT TESTS	Testing
7.6.1 Overview	Testing
7.6.2 Adhesive characterization tests	Testing
7.6.3 Bonded joint characterization tests	Testing
7.7 DAMAGE CHARACTERIZATION	Testing
7.7.1 Overview	Testing
7.7.2 Damage resistance	Testing
7.7.3 Damage tolerance tests	Testing

CHAPTER 8 STATISTICAL METHODS

8.1 INTRODUCTION	Statistics
8.1.1 Overview of methods for calculating statistically-based properties	Statistics
8.1.2 Computer software	Statistics
8.1.3 Symbols	Statistics
8.1.4 Statistical terms	Statistics
8.2 BACKGROUND	Statistics
8.2.1 Statistically-based design values	Statistics
8.2.2 Basis values for unstructured data	Statistics
8.2.3 Basis values in the presence of batch-to-batch variability	Statistics
8.2.4 Batches, panels, and confounding	Statistics
8.2.5 Sample size guidelines for determining basis values	Statistics
8.3 CALCULATION OF STATISTICALLY-BASED MATERIAL PROPERTIES	Statistics
8.3.1 Guide to computational procedures	Statistics
8.3.2 Subpopulation compatibility - structured or unstructured	Statistics
8.3.3 Detecting outliers	Statistics
8.3.4 Equality of variances	Statistics
8.3.5 Computational procedures for basis values using the pooling across environments method (Figure 8.3.1(a))	Statistics
8.3.6 Computational procedures for basis values using the single point method (Figure 8.3.1(b))	Statistics
8.3.7 Calculation of basis values for structured data using regression analysis	Statistics
8.3.8 Exploratory data analysis	Statistics
8.3.9 Acceptable grouping of environmental conditions for pooling	Statistics
8.3.10 Guidelines for applying experience and judgment to statistical results	Statistics
8.3.11 Examples	Statistics
8.4 STATISTICAL METHODS	Statistics

8.4.1 Tests for determining equivalency between an existing database and a new dataset for the same material	Statistics
8.4.2 Alternate material statistical procedures	Statistics
8.4.3 Confidence intervals for the coefficient of variation	Statistics
8.4.4 Modified coefficient of variation approach	Statistics
8.4.5 Statistical procedures for process control	Statistics
8.4.6 Average stress-strain curves and bearing load-deformation curves	Statistics
8.4.7 General linear statistical models	Statistics
8.5 STATISTICAL TABLES AND APPROXIMATIONS	Statistics
8.5.1 Quantiles of the F-distribution	Statistics
8.5.2 Quantiles of the χ^2 distribution	Statistics
8.5.3 Upper-tail quantiles for the t-distribution	Statistics
8.5.4 Two-tail probabilities for the t-distribution	Statistics
8.5.5 Upper-tail probabilities for the standard normal distribution	Statistics
8.5.6 Critical values for the k-sample Anderson-Darling test at the a = 0.05 significance level	Statistics
8.5.7 Critical values for the MNR outlier test	Statistics
8.5.8 One-sided B-basis tolerance factors, V_B, for the Weibull distribution	Statistics
8.5.9 One-sided A-basis tolerance factors, V_A, for the Weibull distribution	Statistics
8.5.10 One-sided B-basis tolerance factors, k_B, for the normal distribution	Statistics
8.5.11 One-sided A-basis tolerance factors, k_A, for the normal distribution	Statistics
8.5.12 Ranks, r_B, for determining nonparametric B-basis values	Statistics
8.5.13 Ranks, r_A, for determining nonparametric A-basis values	Statistics
8.5.14 Nonparametric B-basis values for small sample sizes	Statistics
8.5.15 Non-parametric A-basis values for small sample sizes	Statistics
8.5.16 Critical values for approximate confidence limits on the coefficient of variation	Statistics
8.5.17 One-sided tolerance factors for acceptance limits on mean values, for normal distribution	Statistics
8.5.18 One-sided tolerance factors for acceptance limits on individual values, for normal distribution	Statistics
8.5.19 Upper and lower tail quantiles for two-sided t-distribution	Statistics

VOLUME 2 - Rev H	PMC Working/Task Group Responsibility
CHAPTER 1 GENERAL INFORMATION	
1.1 Introduction to the Handbook	Guidelines
1.2 Overview of Handbook Content	Guidelines
1.3 Purpose and Scope of Volume 2	Data Review
1.4 Organization of Data in Volume 2	Data Review
1.5 Presentation of Data	Data Review
1.5.1 Complete Documentation	Data Review
1.5.2 Legacy Data	Data Review
1.5.3 Appended MIL-HDBK-17 Rev A Data	Data Review
1.6 Materials Systems	Data Review/Materials & Processes
1.6.1 Materials system codes	Data Review/Materials & Processes
1.6.2 Index of materials	Data Review/Materials & Processes
1.7 Material Orientation Codes	Guidelines
1.7.1 Laminate orientation codes	Guidelines
1.7.2 Braiding orientation codes	Guidelines
1.8 Symbols, Abbreviations, and Systems of Units	Guidelines
1.8.1 Symbols and abbreviations	Guidelines
1.8.2 System of units	Guidelines
1.9 Definitions	Guidelines
1.10 DATA REDUCTION AND DOCUMENTATION (*sections moved from Volume 1 Section 2.3.7 and 2.4)*	
1.10.1 Introduction	Data Review
1.10.2 Lamina properties from laminates	Data Review
1.10.3 Data normalization	Data Review
1.10.4 Disposition of outlier data	Data Review
1.10.5 Data documentation	Data Review
1.11 MATERIAL TESTING FOR SUBMISSION OF DATA TO CMH-17	Data Review
1.11.1 Introduction	Data Review
1.11.2 Material and process specification requirements	Data Review
1.11.3 Sampling requirements	Data Review
1.11.4 Conditioning requirements	Data Review
1.11.5 Test method requirements	Testing/Data Review
1.11.6 Data documentation requirements	Data Review
1.11.7 Data normalization	Data Review
1.11.8 Statistical analysis	Data Review
1.11.9 Mechanical properties of laminae and laminates	Data Review
1.11.10 Chemical properties	Data Review
1.11.11 Physical properties of laminae and laminates	Data Review
1.11.12 Thermal properties	Data Review
1.12 Data substantiation for use of basis values from CMH-17 or other large databases	Data Review
1.12.1 Equivalency Testing Requirements	Data Review

CHAPTER 2 CARBON FIBER COMPOSITES

2.1 Introduction	Data Review
2.2 Complete Documentation	Data Review
2.2.1 Carbon - Epoxy Prepreg Tape	Data Review
2.2.2 Carbon - Epoxy Prepreg Fabric	Data Review
2.2.3 Carbon - Epoxy Wet-Lay-Up Fabric	Data Review
2.3 Legacy Data	Data Review
2.3.1 Carbon - Epoxy Prepreg Tape	Data Review
2.3.2 Carbon - Epoxy Prepreg Fabric	Data Review
2.3.3 Carbon - Epoxy Wet-Lay-Up Fabric	Data Review
2.3.4 Carbon - Epoxy Resin-Transfer-Molded Fabric	Data Review
2.3.5 Carbon - Bismaleimide Prepreg Tape and Fabric	Data Review
2.3.6 Carbon - Bismaleimide Resin-Transfer-Molded Fabric	Data Review
2.3.7 Carbon - Polyimide Prepreg Fabric	Data Review
2.3.8 Carbon - Thermoplastic Prepreg Tape	Data Review
2.3.9 Carbon - Cyanate Ester Prepreg Tape	Data Review

CHAPTER 3 BORON FIBER COMPOSITES

3.1 Introduction	Data Review
3.2 Complete Documentation	Data Review
3.3 Legacy Data	Materials & Processes
3.3.1 Boron - Epoxy Prepreg Tape	Materials & Processes

CHAPTER 4 GLASS FIBER COMPOSITES

4.1 Introduction	Data Review
4.2 Complete Documentation	Data Review
4.2.1 Glass - Epoxy Prepreg Tape	Data Review
4.2.2 Glass - Epoxy Prepreg Fabric	
4.3 Legacy Data	Data Review
4.3.1 Glass - Epoxy Prepreg Tape and Fabric	Data Review
4.3.2 Glass - Epoxy Wet-Lay-Up	Data Review

CHAPTER 5 QUARTZ FIBER COMPOSITES

5.1 Introduction	Data Review
5.2 Complete Documentation	Data Review
5.3 Legacy Data	Data Review
5.3.1 Quartz - Bismaleimide Prepreg Fabric	Data Review

APPENDIX A1. MIL-HDBK-17A DATA

A1.1 General Information	
A1.2 Introduction	
A1.3 Handbook Test Program	
A1.3.1 Objectives	
A1.3.2 Preimpregnated materials	
A1.3.3 Test panels	
A1.3.4 Test procedures	
A1.3.4.1 Tensile tests	
A1.3.4.2 Compression tests	
A1.3.4.3 Shear tests	

A1.3.4.4 Interlaminar shear	
A1.3.4.5 Flexural tests	
A1.3.4.6 Bearing strength	
A1.3.5 Dry conditioning	
A1.3.6 Wet conditioning	
A1.3.7 Test schedule	
A1.4 Data Presentation	
A1.4.1 Epoxy fiberglass laminates	
A1.4.2 Phenolic fiberglass laminates	
A1.4.3 Silicone fiberglass laminates	
A1.4.4 Polyester fiberglass laminates	
A1.4.5 Boron epoxy laminates	

VOLUME 3 - Rev H Working Draft	PMC Working/Task Group Responsibility

CHAPTER 1 GENERAL INFORMATION

1.1 INTRODUCTION TO THE HANDBOOK	Guidelines
1.2 OVERVIEW OF HANDBOOK CONTENT	Guidelines
1.3 PURPOSE AND SCOPE OF VOLUME 3	Guidelines
1.4 MATERIAL ORIENTATION CODES	Guidelines
1.4.1 Laminate orientation codes	Guidelines
1.4.1.1 Stacking sequence notation	Guidelines
1.4.1.2 Ply percentage notation	Guidelines
1.4.2 Braiding orientation codes	Guidelines
1.5 SYMBOLS, ABBREVIATIONS, AND SYSTEMS OF UNITS	Guidelines
1.5.1 Symbols and abbreviations	Guidelines
1.5.2 System of units	Guidelines
1.6 DEFINITIONS	Guidelines

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HOMEPAGE

The World Wide Web homepage for the handbook is located at http://www.cmh17.org.

The Working Group Web Site is located at https://www.cmh17.org. A password can be obtained through the Secretariat (info@cmh17.org). Any active participant can obtain a password.

Coordination Group approved Proceedings, meeting information, RECIPE and other information are available at the website.

Select Coordination and Working Groups use a separate website for handbook development known as Confluence: https://cmh17.atlassian.net/. Any active participant of one of these groups can obtain an account from the Secretariat.

OBTAINING CMH-17

VOLUME 1 REVISION H (2022), VOLUME 2 REVISION H (2018) and VOLUME 3 REVISION G (2012), Volume 4B (2013), Volume 5A (2017) Volume 6 (2013)

Copies of published versions of CMH-17 Volumes 1, 2, 3, 4, 5 and 6 can be obtained from SAE only. (Link here: https://www.cmh17.org/RESOURCES/Purchase-Handbook) SAE offers a hardcopy version of the five volumes of the handbook (Volumes 1 and 2 – H, 3-G, 4-B, 6). Print and e-book versions are available.

SOFTWARE – CMH17-STATS

The statistical methods included in the Composite Materials Handbook are available in the newly released software - CMH17 STATS. This software (Excel based) is approved for use in CMH-17. For more information or to purchase CMH17 STATS, visit the online store –

https://www.cmh17.org/RESOURCES/Statistics-Software

Updated: 10/26/2022

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AS OF 11/8/2024

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