Polymer Matrix Composites Coordination Meeting

March 2021

Virtual

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VIRTUAL MEETING LINK

Note: All meetings, except the Bonding Tutorial on 3/8 and 3/9 and the Testing Working Meeting on 3/10, will use the link below. Please contact info@cmh17.org if you need invites to these meetings.

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PMC MEETING SCHEDULE

March 2021

For schedule updates, please visit:
https://www.wichita.edu/research/NIAR/Workshops/cmh-17-spring-2021-virtual-meeting.php

WEEK 1

Europe (pm)	EST	PST	MONDAY 1	TUESDAY 2	WEDNESDAY 3	THURSDAY 4	FRIDAY 5
3:00	9:00	6:00					
3:30	9:30	6:30					
4:00	10:00	7:00				M&P/Bonding Process working meeting	Guidelines Ch 10 Bonded and Ch 11 Bolted Joints working meeting
4:30	10:30	7:30					
5:00	11:00	8:00			Testing working meeting		
5:30	11:30	8:30					
6:00	12:00	9:00					
6:30	12:30	9:30					Guidelines Ch 4 Building Block working meeting
7:00	1:00	10:00				Sandwich working meeting	
7:30	1:30	10:30					
8:00	2:00	11:00					
8:30	2:30	11:30					
9:00	3:00	12:00					
9:30	3:30	12:30					

*** Please note meeting times for your local time zone. Due to differences for when the US and Europe change between standard and daylight time, time zones are not aligned over all weeks of the meeting.**

- Public/Main Meeting
- Private/Working Meeting
- Joint Meetings
- Tutorials

WEEK 2

Europe (pm)	EST	PST	MONDAY 8		TUESDAY 9		WEDNESDAY 10		THURSDAY 11	FRIDAY 12
3:00	9:00	6:00				Damage Tolerance working meeting				
3:30	9:30	6:30								
4:00	10:00	7:00		Damage Tolerance working meeting				Supportability SOBR working meeting	Debond/Delam working meeting	Guidelines Ch 7 Design working meeting
4:30	10:30	7:30								
5:00	11:00	8:00	Bonding Tutorial Part 1		Bonding Tutorial Part 2					
5:30	11:30	8:30								
6:00	12:00	9:00					Testing working meeting			
6:30	12:30	9:30								
7:00	1:00	10:00				Crashworthiness working meeting			Spacecraft working meeting	Guidelines Ch 3 Cert, etc working meeting
7:30	1:30	10:30								
8:00	2:00	11:00								
8:30	2:30	11:30								
9:00	3:00	12:00								
9:30	3:30	12:30								

WEEK 3

Europe (pm)	EDT	PDT	MONDAY 15	TUESDAY 16	WEDNESDAY 17	THURSDAY 18	FRIDAY 19
2:00	9:00	6:00					
2:30	9:30	6:30	Coordination				
3:00	10:00	7:00		D30.05 Structures	D30.03 Constituent	Safety Management	Guidelines
3:30	10:30	7:30					
4:00	11:00	8:00			D30.04 Lamina		
4:30	11:30	8:30	PMC Forum	D14.80.01 Task Group		Damage Tolerance	
5:00	12:00	9:00					D30.06 Interlaminar
5:30	12:30	9:30			M&P		
6:00	1:00	10:00		Testing		Crashworthiness	
6:30	1:30	10:30					Debond/Delam
7:00	2:00	11:00					
7:30	2:30	11:30					
8:00	3:00	12:00			Data Review		
8:30	3:30	12:30					

WEEK 4

Europe (pm)	EDT	PDT	MONDAY 22	TUESDAY 23	WEDNESDAY 24	THURSDAY 25	FRIDAY 26
2:00	9:00	6:00					
2:30	9:30	6:30				Coordination	Executive
3:00	10:00	7:00	Spacecraft	D30.09 Sandwich	Supportability		
3:30	10:30	7:30					
4:00	11:00	8:00					
4:30	11:30	8:30					
5:00	12:00	9:00			D30.02 Research	D30 Main	
5:30	12:30	9:30	Statistics	Sandwich	D30.91 Planning		
6:00	1:00	10:00			D30.92 Awards		
6:30	1:30	10:30					
7:00	2:00	11:00	D30.01 Editorial	Core Task Group	D30.90 Exec	Engine Applications	
7:30	2:30	11:30					
8:00	3:00	12:00					
8:30	3:30	12:30					

WEEK 5

Europe (pm)	EDT	PDT	MONDAY 29	TUESDAY 30	WEDNESDAY 31	THURSDAY 1	FRIDAY 2
3:00	9:00	6:00					
3:30	9:30	6:30	Statistics Tutorial Part 1	Statistics Tutorial Part 2	Statistics Tutorial Part 3		
4:00	10:00	7:00					
4:30	10:30	7:30					
5:00	11:00	8:00					
5:30	11:30	8:30	Certification Tutorial Part 1	Certification Tutorial Part 2	Certification Tutorial Part 3		
6:00	12:00	9:00					
6:30	12:30	9:30					
7:00	1:00	10:00					
7:30	1:30	10:30					
8:00	2:00	11:00					
8:30	2:30	11:30					
9:00	3:00	12:00					
9:30	3:30	12:30					

POLYMER MATRIX COMPOSITES
COMPOSITE MATERIALS HANDBOOK 17
TECHNICAL WORKING AND TASK GROUPS

BONDED JOINT TASK GROUP (under Guidelines)

Mr. Rick Cole, NRC Aerospace
Dr. Carl Q. Rousseau, Lockheed Martin Aeronautics

BONDING PROCESSES TASK GROUP (under Materials & Processes)

Mr. Howard Creel, 3M

CERTIFICATION TASK GROUP (under Guidelines)

Dr. Simon Waite, European Aviation Safety Agency (EASA)
Ms. Cindy Ashforth, FAA Aircraft Certification Service, Policy & Innovation Division

A new CMH-17 Chapter to present certification guidance and identify issues of concern when using composite materials and showing compliance with Design, Production, and Continued Airworthiness Requirements. This recognizes the integrated link between all activities in accordance with Safety Management principles.

COMPOSITES FOR SPACE WORKING GROUP

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.

CORE TASK GROUP (under Sandwich)

Dr. Susan Daggett, Absolute Value, LLC.
Mr. Shannon Jones, Bell Helicopter Textron

CRASHWORTHINESS WORKING GROUP

Mr. Allan Abramowitz
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 TASK GROUP (under Safety Management)

Simon Waite – EASA
Mike Smeets – GKN Fokker Landing Gear
Allen Fawcett – NSE Composites
Patrick Enjuto – Boeing Commercial Airplanes
Doug Cairns – Montana State University

DATA REVIEW WORKING GROUP

Mr. Curtis R. Davies, Federal Aviation Administration - Materials and Structures
Dr. John S. Tomblin, Wichita State University, National Institute for Aviation Research

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.

DISBOND AND DELAMINATION TASK GROUP (under Safety Management)

Dr. Ronald Krueger, NIA/NASA LaRc
Ms. Lisa McHugh, Northrop Grumman

The Disbonding and Delamination is a Task Group under Safety Management. The group will determine an overall strategy for the handbook to address disbonding and delamination. The task group will examine methodologies needed to assure through-thickness integrity of bonds and laminations in polymer matrix composites. The group will review the existing document to assure that the sections related to delamination and disbonding are up-to-date. The group will inherit maintenance responsibility for sections on bonded joints written by the Joints WG. Appropriate interfaces will be made with existing groups to address identified gaps, in particular a strong interface will be created with the Damage Tolerance Task Group. The creation of new sections may be recommended if the current outline does not meet the needs of the strategic approach.

ENGINE APPLICATIONS WORKING GROUP

Mr. Scott Finn, GE Aviation
Mr. Larry Foster, Pratt & Whitney

GUIDELINES WORKING GROUP

Dr. Carl Q. Rousseau, Lockheed Martin Aeronautics
Mr. Stephen H. Ward, Collins Aerospace

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

Dr. Larry Ilcewicz, FAA Aircraft Certification Service, Policy & Innovation Division
Ms. Cindy Ashforth, 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. Melanie Violette, Federal Aviation Administration
Dr. Zhi 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.

STATISTICS WORKING GROUP

Dr. Elizabeth Clarkson, Wichita State University, National Institute for Aviation Research
Mr. Curtis R. Davies, Federal Aviation Administration - Materials and Structures

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.

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).

SAE AMS - P-17 COMMITTEE

SAE AMS P-17 POLYMER MATRIX COMPOSITES

Shannon Jones, Chair **Margaret Roylance, Vice-Chair**

SAE AMS P-17, Polymer Matrix Composites, is a technical committee in SAE's Aerospace Materials Systems Group with the responsibility to develop and maintain material specifications and other SAE technical reports for composite materials, including prepregs, reinforcing fibers and fabrics, matrix resins, adhesives, and core materials. The committee works in conjunction with related bodies such as the Composite Materials Handbook-17 (CMH-17), ASTM Committee D30 on Composite Materials, the National Center for Advanced Materials Performance (NCAMP), the Performance Review Institute (PRI), and regulatory authorities such as FAA and EASA.

The objectives of AMS P-17 are to:

- *Develop Aerospace Material Specifications (AMS) for the procurement of polymer matrix composites, sandwich construction, bonded structures, and associated materials used in structural applications. When applicable, ensure the material specification is tied to the CMH-17 Database.*

- *Document best practices for processing and fabrication of end products from polymer matrix composites, sandwich construction, and bonded structures.*

- *Provide a forum for the exchange of technical information related to polymer matrix composites.*

- *Further the adaptation of industry sponsored material specifications through coordination with CMH-17, PRI, NCAMP, and associated organizations.*

- *Coordinate with CMH-17 Materials and Processing Working Group in the preparation of material specifications for all new materials to be included in the CMH-17 Handbook.*

- *Establish a system to ensure material specifications are controlled. Coordinate with PRI P-17 Qualified Products Group (QPG) to ensure the maintenance of Qualified Products Lists for appropriate specifications.*

COORDINATION AND JOINT MEETING AGENDAS

PMC COORDINATION

MONDAY, MARCH 15th 9:30 – 11:00 am ET

- **Introduction (10 minutes)** –Secretariat Update (Rachael Andrulonis)
- **Working Group Updates - Status of Sections, Challenges, Plans for This Meeting**
  - COMPOSITES FOR SPACECRAFT
  - CRASHWORTHINESS
  - DAMAGE TOLERANCE TASK GROUP
  - DATA REVIEW
  - DISBOND/DELAMINATION TASK GROUP
  - ENGINE APPLICATIONS
  - GUIDELINES
  - MATERIALS & PROCESSES
  - SAFETY MANAGEMENT
  - SANDWICH
  - STATISTICS
  - SUPPORTABILITY
  - TESTING

PMC FORUM

MONDAY, MARCH 15th 11:30 am – 3:00 pm ET

- **Automating Handbook Processes**, Curt/Cindy/Rachael (45 Minutes, incl. 15 minute Discussion)
    - Advantages in timely release of new content for our expanding user community
    - Specific requirements for automation through the handbook lifecycle
    - Release options under consideration
    - Proposed implementation timeline

- **Existing Aerospace Product Needs Considered Short-term** (90 minutes)

- **Longer-term Advanced Product Needs: Aerospace and Other Industries** (45 minutes)

POLYMER MATRIX COMPOSITES WORKING GROUP AGENDAS

COMPOSITES FOR SPACECRAFT

Monday, March 22, 2021, 7-9 AM (Pacific), 10-12 PM (Eastern),

INDUSTRY UPDATES

Public domain info on important space & launch vehicle milestones since the last meeting

PRESENTATIONS ON NEW CONTENT FOR YP

10-15 minute presentations followed by 5-10 minutes of discussion

Presenters: Will Guin, Stephanie Svetlik-Haley

- **19.7 Structural Substantiation**
  - **19.7.1 Definitions**
  - **19.7.2 Design Value Development**
  - **19.7.3 Analysis Supported by Test**
  - **19.7.4 Considerations for Spacecraft Qualification**
  - **19.7.5 Workmanship Verification**

DISCUSSION ON YELLOW PAGES RESULTS (IF NECESSARY)

- **19.3 Durability and Damage Tolerance (First Cycle Results)**
- **19.4 Spacecraft Sandwich Structure Unique Design Considerations**
  - **19.4.3 Cryogenic Sandwich Structural Design Complexities (First Cycle Results)**
  - **19.4.4 Design Substantiation Testing and Analysis (Second Cycle Results)**

CRASHWORTHINESS

Crashworthiness Working Meeting Agenda

TUESDAY, MARCH 9th 1:00 – 4:00 pm ET

- Topics to consider for future CMH-17 releases (Mostafa)
  - CMH-17 Testing, Vol 1 Section 7.8 (Dan, Mostafa)
  - CMH-17 CW, Vol 3 Chapter 16 (Mostafa)

- CMH-17 Guidelines content development (Mostafa)
  - NASA ACP HEDI methods to incorporate into Vol 3 Sections 8.8, 8.9 and 8.10 (Mostafa, Alan, Mike)

- Standalone reports to release via NASA TM (Mike)
- Stanchion assembly design & testing as moving up building block (Dan, Kevin)
- C-channel test data comparison drop tower vs. NASA sled (practice runs) and future sled testing going forward (Mike, Dan)
- AIAA Scitech-22 call for abstracts (Mostafa)

8:15A Meeting Adjourned

Crashworthiness Public Meeting Agenda

THURSDAY, MARCH 18th 1:00 – 3:00 pm ET

Review of 2020 July virtual meeting action items (Mostafa)

- Recap of CW virtual side meeting of March 9, 2021 (Mostafa)
- CMH-17 YP inputs for Summer 2020 cycle 2 (V1sec7.8 & V3C16) (Dan/Mostafa)
- C-channel with end features design update and path forward (Dan/Erin/Kevin)
- C-channel crush test summary results (Dalton)
- C-channel sled testing update (Mike/ Rudy)

- Analysis team presentations of c-channel blind predictions:
  - LS-DYNA: MAT54 (Gomez/Aswini)
  - LS-DYNA: MAT58 (Byar)
  - LS-DYNA: MAT219 (Reza)
  - LS-DYNA: MAT261 (Byar)
  - LS-DYNA: MAT297 (Xiao)
  - LS-DYNA: Modified Ladeveze (Anantharaju)

- ABAQUS: Abaqus Ladevèze – ABQ_DLR_UD (Waimer)
- ABAQUS: CZone (Adams/Blessing)
- VPS (PAM-CRASH): Waas-Pineda- implementation (Francesco)
- RADIOSS (Juan Pedro Berro)

8:15A Recap/ Next meeting

****

DAMAGE TOLERANCE TASK GROUP

THURSDAY, MARCH 18th 11:30 – 12:30 pm ET

1. Welcome, Introduction
2. Review of Working Meeting
3. Approve Content for Yellow Pages
4. Presentations and Discussion
    a. Transport Aircraft Composite Aging (Al Fawcett)
5. Adjourn

****

DATA REVIEW

Wednesday March 17, 3:00 – 4:00 pm ET

1. **Introduction and Welcome** – John Tomblin, Curt Davies

2. **Approve July 2020 meeting minutes –** Curt Davies

3. **Overview of DRWG Content in CMH-17 –** Rachael Andrulonis

4. **Data set update -** Rachael Andrulonis
    a. Voting procedure review
    b. Data set review schedule

5. **Toray Data Set Status –** Michelle Man

6. **Overview of T700/TC1225 Data Set for Submission to CMH-17** – Vincent Tanoto

7. **NCAMP Qualification Programs – update and tentative CMH-17 submission dates**
    a. Repair materials - T650/53201- PW
    b. Adhesive materials
    c. Core data
    d. Ceramic matrix composites → CMC Data Review Working Group
    e. Polymer additive materials → AM Coordination Group

8. **Other business**
    a. Fracture Properties in Volume 2
    b. Core data requirements
    c. Digitization of data

d. Data sampling requirements review

9. **Agenda Item Review-** Rachael Andrulonis

10. **New business**

****

DISBOND/DELAMINATION TASK GROUP

Working Meeting, Thursday 3/11/2021 10:00am EST

The meeting will focus on CMH-17 content development with respect to Sandwich Face Sheet/Core Separation.

- Content development for Vol 3H
    - 8.7.5 *Other linear elastic fracture mechanics-based methods* (Christian Berggreen)
        - 8.7.5.1 *Virtual Crack Extension method* - VCE
        - 8.7.5.2 *Crack Surface Displacement Extension method* - CSDE
    - Finalize content for approval by the Guidelines WG and submittal to Yellow Pages after the March 2021 meeting
    - This new content will be posted to the Disbond/Delam TG Member Forum prior to the meeting. Please review and familiarize yourself with the material before the meeting so we can have a productive discussion
- Content development for Vol 6A
    - Discuss status of new test methods for face sheet core separation and inclusion in chapter 2 (Dan Adams)
        - Single Cantilever Beam (SCB) Test
            - ASTM test standard for static testing
            - ASTM guide for fatigue testing
            - Guide for specimen sizing
        - Mixed-Mode Bending (S-MMB) Test
    - Discuss other specimen configurations of interest to industry (Christian Berggreen)
    - Discuss other items of interest

Last minute changes will be posted to the CMH-17 Member Forum!

Disbond/Delamination TG – Friday 3/19/2021 2:00pm EDT

- Approval of minutes of the virtual meeting 7/16/2020 meeting in Wichita, KS
- Overview of existing content in CMH-17 Vols. 1 and 3
- Update on action items for next handbook revision

- Revise and update existing content for upcoming Volume 1H
    - Discussion of Yellow Page voting on Vol. 1 section 6.8.6
    - In coordination with Testing WG
- Revise and update existing content for upcoming Volume 3H
    - Discussion of Yellow Page voting on Vol. 3 sections 8.7.3.2 and 8.7.6
    - In coordination with Guidelines WG
- Add fracture toughness data to CMH-17 Volume 2
- Add new chapter on testing and analysis for sandwich face sheet/core disbonding to Volume 6A
    - Summary of recent activities
    - Technical Details will be discussed in the working meeting 3/11/2021 at 10am EST.

- New Business
- Adjourn

Last minute changes will be posted to the CMH-17 Member Forum!

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ENGINE APPLICATIONS

Thursday, 25 March 2021, 2:00 – 3:00 pm ET

2:00-2:10 Introduction & Short Recap of January CMC Meeting

2:10-2:25 Review Draft Charter Statement & Discuss Scope of WG

2:25-2:35 Determine Meeting Cadence & Invitees

2:35-2:50 Discuss Initial Tasks

2:50-3:00 Summary

GUIDELINES

V3 Ch10, Ch11 Joints Working Meeting Agenda

Friday, 5 March 2021, 10:00am – 12 noon ET

V3 Ch10 Bonded Joints		
Rousseau	Current status of v3ch10 overall, and v3ch10.4 and 10.7	10:00am
Cole	Current status of v3ch10.1, 10.2, 10.3, 10.5, and 10.6	10:15am
V3 Ch11 Bolted Joints		
Ward	Current status and latest 2020 YP1 updates; Discussion of blank subsections	10:30am
Composite Lugs		
Steggall-Murphy	TxV Aero Composites thermoplastics lugs presentation	11:00am
New Business		
Rousseau	Cocuring definitions (for the FINAL time!)	11:45am
All	TBD	11:55am
Adjourn		noon

GWG V3 Ch4 BBT Working Meeting Agenda

Friday, 5 March 2021, 12:30pm – 3:00pm ET

V3 Ch4.3		
Enjuto	Current status and 2021 YP plans	12:30pm
V3 Ch4.4, 4.5.1		
Ward	Current status and latest 2020 YP1 updates 2021 YP plans	1:30pm
V3 Ch4.5.2		
Pomerleau	Bombardier case study; 2021 YP plan	2:00pm
New Business		
All	TBD	2:30 pm
Adjourn		3:00pm

GWG V3 Ch7 Design Working Meeting Agenda

Friday, 12 March 2021, 10:00am – 12:30pm ET

V3 Ch7 Design		
Ilcewicz	• Background and current strategies for Chapter 7 updates • Current status and latest 2020 YP2 updates (Sections 7.1 and 7.2) • Industry recommendations for Sections 7.1.1.X, 7.1.2.X • New Figure 7.2 and related Section 7.2 updates • Industry recommendations for Sections 7.2.1.X, 7.2.2.X, 7.2.3.X • 2021 YP plans (7.1.1.X, 7.1.2.X, 7.2.1.X, 7.2.2.X, 7.2.3.X, 7.4, 7.5 and 7.6) • Other aerospace industry reviews of existing Chapter 7 updates (Including Pre-March 15 PMC Forum Discussions) *Note: All above bullets will take roughly 15 minutes, with the final going 30 minutes and potentially expanding under new business (note that certification-related discussions can continue into the afternoon if appropriate for V3, Chapter 3)*	10:00am

New Business		
All	TBD	noon
Adjourn		12:30pm

GWG V3 Ch3 Cert & Ch8 Analysis Working Meeting Agenda

Friday, 12 March 2021, 1:00pm – 3:00pm ET

V3 Ch3 Certification		
Waite	Current status and latest 2020 YP1 updates/plans	1:00pm
V3 Ch8 Analysis		
Krueger	Current status and latest v3ch8.7.3.2 / 8.7.6 2020 YP2 updates 2021 YP plans	1:30pm
Park	Current status and latest v3ch8.8-8.10 2020 YP2 updates 2021 YP plans	2:00pm
New Business		
All	TBD	2:45pm
Adjourn		3:00pm

Guidelines Working Group Main Meeting Agenda

Friday, 19 March 2021, 10:00 – 11:30 am ET

Rousseau	Call to Order	10:00 am
Rousseau	Approval of Summer 2020 GWG WG Minutes	10:05am
Yellow Page Review – status from working meetings		
Ward	V1 ch1.4.1 Roadmaps YP1 – 1 negative	10:10am
Ward	V1 ch2.1.1 YP1 – 0 negatives	
Waite	V3 ch3 Cert YP1 – 1 negative	
Ward	V3 ch4.4 BB YP1 – 1 negative	
Ward	V3 ch4.5 BB YP1 – 1 negative	
Ward	V3 ch11 Bolted Joints YP1 – 1 negative	
Rousseau	V3 ch10.4.3 Bonded Joints YP2 – 0 negatives	
Cole	V3 ch10.5.4.1 Bonded Joints YP1 – 0 negatives	
Cole	V3 ch10.6 Bonded Joints YP1 – 0 negatives	
Ilcewicz	V3 ch7/7.1/7.2 Design YP2 – TBD negatives	
Krueger	V3 ch8.7.3.2/8.7.6 Fracture Analysis YP2 – TBD negatives	
Park	V3 ch8.8-8.10 PDA YP2 – TBD negatives	
Old Business and Open AIs – status from working meetings		
Rousseau	V1 Ch1 Definitions revision to be consistent with new D30, CMH17 work	10:40am
Rousseau	**[09-10]** Adhesive Data inclusion in Handbook (defer to Rev J) • Status of FAA/NIAR and D14.80 D5656 RR projects ○ AFRL has fabricated/shipped coupons, testing underway	10:45am
New Business		
All	Open forum for post-Rev-H handbook additions to GWG chapters	10:50am
Adjourn		11:30am

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MATERIALS & PROCESSES

CMH-17 Materials and Processes Working Group, SAE P-17 Composites Task Group, PRI P-17 Qualified Product Group (QPG), and CMH-17 Bonding Process Task Group

- The M&P Working Group will meet jointly with the Bonding Process Task Group on Thursday March 4, 2021 from 10 am to noon EDT for a working meeting on new bond process content for Volume 3 Chapter 5.
- The M&P Working Group general meeting will be held on March 17, 2021 for two hours from 12:30 to 2:30 pm EDT. At that meeting we will review other new content for Revision H of Chapter 5 (details below) and an update on P-17 and QPG-17 activities. The new CMH-17 Bonding Tutorial will take place in two sessions, on Monday March 8 and Tuesday March 9, 2021 from 11 to 1 pm EDT.

M&P/Bonding Process Task Group Working Meeting

Thursday March 4, 2021 10 am to noon EDT

30 min	Overview and general business	Creel/Roylance
30 min	Section 5.9.1 General considerations	Ruffner
15 min	section 5.9.2 Substrates and Adhesives	Franks
15 min	Section 5.9.8 Bond Quality	McHugh, Cole
15 min	Section 5.9.4 Assembly Processes	McHugh, Thomas
30 min	Section 5.9.3 Surface Preparation	Grace
15 min	Wrap-up and next steps	Creel

Vol 3 Section 5.9 Assembly Processes for Bonded Joints		Status	21 YP 1	21 YP 2
5.9.1	General Considerations	Draft	X	
5.9.2	Substrates and Adhesives	Draft	X	
5.9.3	Surface Preparation for Secondary Bonding	YP Comments		
5.9.4	Assembly Processes for Secondary Bonding	Draft		X
5.9.5	Co-curing	Complete		
5.9.6	Cobonding	Complete		
5.9.7	Multi-stage Bonding	Complete		
5.9.8	Adhesive Bond Quality	Draft		X

A summary of the new bonding content, status and schedule for Yellow Pages is shown in the Table below.

General M&P Working Meeting
Thursday March 17, 2021 12:30 to 2:30 pm EDT

Hour 1 12:30 to 1:30 pm
Introduction and approval of minutes - 10 minutes
New Outline for Volume 3 Chapter 5 for Rev H – 5 minutes
Review of new content for Section 5.11 - 45 minutes
Manufacturing Process Modeling and Control provided by Anoush Poursartip
This content has been posted on the M&P Forum for review
After Working Group review it should be ready for Yellow Pages

Hour 2 1:30 to 2:30 pm
P-17 and QPG-17 update – 30 minutes
Continue discussion of new content for Rev H – 30 minutes

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SAFETY MANAGEMENT

Thursday March 18th, 10:00 – 11:00 am ET

- 5 Minutes….Welcome and Familiarization *Larry Ilcewicz*
- 10 Minutes...FAA Composite Plan Update *Cindy Ashforth*
- 10 Minutes….Open Safety Management Tasks *Larry Ilcewicz*
- 30 Minutes...Update on Section 17.5 Composite Structural Engineering Technology Training Content Development *Charlie Seaton & Larry Ilcewicz*
- 5 Minutes…. Wrap up and Closure *Larry Ilcewicz*

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SANDWICH

General Meeting - Tuesday 3/23 12:30 – 1:30 PM Eastern Time

- Introductions and Roll Call (5 min)
- Administrative – Chairmanship Discussion – Thank you Dr. Violette! (5 min)
- Working Group General Meeting Updates – Protocol for Content (10 min)
  - Existing content for which Sandwich WG is responsible (Volume 6)
  - Emerging New Content for Volume 6
  - Maintenance of Volume 6 Content
  - Outreach and training
- Review of Previous Meeting Minutes and Agenda Items Status (10 min)
- Discussion of New Content under Development (15 min)
- Core Data Task Group Plans and Status (5 min)
- Schedule of WG Activities (5 min)
- Wrap-up/Action Items (5 min)

Working Meeting - Thursday 3/4 1:00 – 2:30 PM Eastern Time

- Overview of Volume 6 Rev A Content under Development (80 min)
  - Chapter 6 Fall 2019 YP status (Zhi)
  - Summer 2020 YP Results (Outline Revision, Chs 1,4 and 8 (New!))
  - Chapter 1 updated introduction to strengthen damage tolerant design and sandwich disbond considerations
  - Chapter 2 updated draft – feedback and Yellow Pages preparation
  - Chapter 3 updates; Core Data – New content under development
  - Chapter 4 Design and Analyses – Improved introduction section discussing damage tolerant design and sandwich disbond considerations; improved damage tolerance subsection, new content for disbond analyses tools
  - Chapter 5 inputs from NASA ACP program?
  - Chapter 7 Supportability updated draft submitted; list of content moving from V3
  - Chapter 8 (NEW) Sandwich Structures Case Studies
- Core Data Task Group Coordination – Plans for Working Meeting 3/23 – 2pm – 3pm (10 min)

Status of Agenda Items

- **09-10 Set up requirements for adhesive data for Rev. H (Joint with Data Review, Guidelines, M&P, Testing)**
  This item is actively being worked by the Adhesive Bonding Task Group (Agenda Item 16-01, assigned to Data Review), led by Howard Creel. Interested Sandwich

WG members are encouraged to participate in the Task Group. Further coordination between the groups is required. Item remains open.

- **13-01: Set up requirements for core data (Joint w/ Guidelines and Testing)**
  The group needs to engage Data Review and Statistics before data gets published. Core data will be published in Vol. 6A not Vol 2. ***Susan Daggett, Shannon Jones***
- **13-04: Review content in Volumes 3 & 6, identify areas that need additional content**
  Larry Gintert has created a file that has not been shared with everyone yet. The information will be shared first with other working groups who are responsible for Vol.3 content and the planned updates for Revision H. Intent is to close out this item soon.
- **13-05: Update Volume 6 Chapter 2 with new sandwich testing techniques/ standards *(Susan, Tracy)***
  This item is being actively worked and remains open.
- **13-07: Update Volume 6 Chapter 6 with current and evolving inspections techniques:**
  Susan created content and received comments since the Charleston meeting. ***Stephanie*** independently created content that needs to be integrated. Item remains open.
- **13-08: Add information on CTE behavior to Volume 6 (Tracy):**
  Tracy Colwell stepped back from CMH-17. ***Stephanie*** is ready to submit content to Vol 3H for Spacecraft sandwich. Spacecraft have some unique challenges related to CTE.
- **14-02: Add a chapter on testing and analysis for sandwich face sheet/core disbonding (Joint with Damage Tol TG and Disbond/Delamination TG)**
  Content is being written. Modified outline established for Volume 6 Chapter 4.
- **17-02: Review content in Chapter 7 and refresh as needed. (Joe, Margaret)**
  Joe Spangler, Margaret Zalewska have been working on this item. Current draft sent has been posted on the Sandwich Forum for review and comment. Needs coordination with rewrite of Rev H damage tolerance sections and related content identified to be moved to Volume 6.
- **No new agenda items**

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STATISTICS

MONDAY, MARCH 22nd 12:30 – 1:30 pm ET

Statistics WG

CMH-17
COMPOSITE MATERIALS HANDBOOK

Task Definition/Discussion	Responsible	Time Allotment
Review agenda and finalize schedule	Elizabeth Clarkson - NIAR	5
Review last meeting minutes and approve	Elizabeth Clarkson - NIAR	5
Review of comments to Yellow Pages	Elizabeth Clarkson - NIAR	30
Questions and Comments from AM and CMC statistics WG	Elizabeth Clarkson - NIAR	30
New Business	Anyone	?

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SUPPORTABILITY

Wednesday, March 24, 2021, 10:00 – 12:00 pm ET

Discussion Topic	Speaker	Time
Introduction to CMH-17 Supportability WG, current status and goals for Rev. H	Ilcewicz/Starnes/Rakow	15 Minutes
Summary of Major SoBR Accomplishments (two cycles since 2020 Summer Meeting)	Gintert	25 Minutes
Case study Status and Planning (Purpose and details of the case studies)	Gintert	15 Minutes
Remaining Section Schedules • Design and Repair Substantiation (including Interdependences – summary section) • Repair analyses (Integrated with supporting data) • Other Sections not addressed in Chapter 14 • Final Chapter 14 Consistency Updates	Gintert, Ilcewicz	10 Minutes
Repair Analysis Strategies, Progress and Plans	Forness, Ward, Bakuckas, Kress, Gintert, Desai, Stenne	45 Minutes
Summary and Wrap-up	Ilcewicz/Starnes/Rakow	10 Minutes

SoBR Working Meetings Held Wed. March 10, 2021 (Next April 21, 2021)
Detailed discussions of all active Chap. 14 & case studies (Preparing content for YP) will have already occurred on March 10, 2021 (FIVE HOUR WORKING MEETING)

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TESTING

TUESDAY, MARCH 16th 1:00 – 3:00 pm ET

Agenda Item	Section	Topic	Editor Presenter	Comments
Procedural	N/A	Open/Close	Moylan/Adams	
Procedural	N/A	Approval of minutes from previous meeting	Moylan/Adams	
Announcement	N/A	Status of ASTM Standards, SAE activity, ISO activity, Misc. CMH-17 Notes	TBD	
		Review of Yellow Page Comments and Negatives, Chapters 4, 6, and 7	Moylan and Adams	Detailed review in working meetings, summary at open meeting.
	Vol 1, Ch 4, 6 ,7	Outline for New Adhesive Characterization Testing Content	John Moylan	•New Outlines for Chapters 4, 6 and 7 will be reviewed. What has been submitted to YP, what is planned and what is open.
11-10 and 09-10, 11-08 and 14.01	Vol 1	Update Chapter 6	Dan Adams, Rick Cole	Update
11-09	7.4.2	Update Notched Compression Section	Dan Adams	Update
11-09	7.4.3	Damage Tolerance Tests: Review and add quasi-static indentation	Dan Adams	Update
11-07	7.8, 6.8.5, 6.8.6	New Dynamic Testing Content	Mostafa Rassaian, Ron Kruger	Update

PMC VOLUME TRACKER
AS OF 12/2020

Volume	Chapter	Working Group Responsibility	AI	CH	Year Assigned	Planned Revisions for Vol 1 - 3 Rev H / Vol 6 Rev A	Actual / Planned YP for Next Rev
		EXEC	02-15	0	2002	Develop the CMH-17 SOP	
		Secretariat	05-12	0	2005	Propose a trial section with revision dates, post on exec forum	
		M&P + Guidelines + Stats	17-04	0	2017	Develop content for a shared database tutorial	
		EXEC		0	2020	Develop Post Rev H Handbook format, content, WGs, etc	
VOLUME 1	**CHAPTER 1 GENERAL INFORMATION**	G Guidelines		1	2015	1.7.1.2 Laminae and laminates – revised	SLC 3/2015
				1	2015	1.8 Defintions – revised (applies to all PMC volumes)	SLC 3/2015, SLC 3/2017
				1	2018	1.8 Defintions – revised	Fall 2018
				1	Mar-19	1.8 Defintions – will reballot 4 definitions	Spring 2019
				1	Mar-19	Review Intro paragraphs before final publishing	
				1	Oct-19	Update Roadmaps	Summer 2020 YP1
	CHAPTER 2 GUIDELINES FOR PROPERTY TESTING OF COMPOSITES	G Guidelines		2		Complete chapter revision	Fall 2018
				2	Mar-19	Update to address comments from Fall 2018 YP ballot	Spring 2019
		P Spacecraft		2	Oct-19	Update to address comments from Spring 2019 YP ballot	Fall 2019 YP 1
				2	Jul-20	Update 2.1.1 to address comments from Fall 2019 YP ballot	Summer 2020 YP1
	CHAPTER 3 EVALUATION OF REINFORCEMENT FIBERS	T Testing		3	Mar-19	Remove outdated sections	Spring 2019
				3	Mar-19	Needs review of "dated" material	Fall 2019 YP 1

CHAPTER 4 MATRIX CHARACTERIZATION	T Testing		4	Mar-19	Update 4.1 to add adhesive characterization	Spring 2019
			4	Mar-19	Remove outdated sections	Spring 2019
			4	Mar-19	Needs review of "dated" material	Summer 2020 YP1
			4	Oct-19	Discussion of ASTM D14 test methods Identified ~ 16 adhesive characterization test methods to add.	Summer 2020 YP2
CHAPTER 5 PREPREG MATERIALS CHARACTERIZATION	T Testing	15-03	5	2015	Section 5.4 PREPREG PHYSICAL AND CHEMICAL PROPERTIES	Wichita 11/2017
			5	Mar-19	Remove outdated sections	Spring 2019
			5	Jul-20	Minor edits to chapter	Summer 2020 YP1
CHAPTER 6 LAMINA, LAMINATE, AND SPECIAL FORM CHARACTERIZATION	T Testing	15-03	6	2015	Section 6.6 THERMAL/PHYSICAL PROPERTY TESTS	Wichita 11/2017
			6	Mar-19	Update moisture conditioning sections	Spring 2019
	P Spacecraft		6		6.6 Thermal/Physical Property Tests	Fall 2019 YP 1
			6		6.3.3 Accelerating conditioning times	Fall 2019 YP 1
			6	Jul-20	6.2 Lamina, Laminate, and Special Form Characterization - Specimen Preparation	Summer 2020 YP1
			6	Jul-20	6.3 Lamina, Laminate, and Special Form Characterization - Conditioning and Environmental Exposure	Summer 2020 YP1
			6	Jul-20	6.4 Lamina, Laminate, and Special Form Characterization - Instrumentation and Calibration	Summer 2020 YP1
			6	Jul-20	6.5 Lamina, Laminate, and Special Form Characterization - Testing Environments	Summer 2020 YP1
			6	Jul-20	6.6 Lamina, Laminate, and Special Form Characterization - Thermal/Physical Property Tests	Summer 2020 YP1
			6	Jul-20	6.11Lamina, Laminate, and Special Form Characterization - Viscoelastic Properties Tests	Summer 2020 YP1

		11-07	6	2011	Revise Volume 1 Section 6.8.5 Flexure testing	Summer 2020 YP2
	DD Disbond/Delam	11-08	6	2011	Revise Volume 1 Section 6.8.6 Mode III testing	Summer 2020 YP2
	DD Disbond/Delam		6	Mar-19	6.8.6, 6.9.4 Fracture mechanics sections need update	Summer 2020 YP2
			6	Mar-19	Tests to Develop Input Data for Composites Structural Simulation (ACP)	Summer 2020 YP2
CHAPTER 7 STRUCTURAL ELEMENT CHARACTERIZATION	T Testing		7	Mar-19	Update moisture conditioning and bolted joint sections	Spring 2019
	DD Disbond/Delam	11-09	7	2011	Revise Volume 1 Section 7.4.2 and 7.4.3 Notched Laminate testing	Spring 2019
			7		7.3.4 Structural Element Characterization (2 sub-sections)	Fall 2019 YP 1
		11-10	7	2011	Review/revise Volume 1 Chapter 7 bonded joint test methods	Summer 2020 YP2
			7	Jul-20	Add bonding surface preparation test methods	Summer 2020 YP2
			7	Mar-19	7.8 High load rate testing of fastened joints (ACP Content)	Summer 2020 YP2
			7	Mar-19	7.8 ASTM Dynamic Impact Test (ACP)	Summer 2020 YP2
			7	Mar-19	7.8 High rate bonded joint testing – mode 1 (wedge), mode 2 (ENF) (ACP content)	Summer 2020 YP2
			7	Jul-20	Minor chapter cleanup	Summer 2020 YP2
CHAPTER 8 STATISTICAL METHODS	S Statistics		8		General linear statistical models - placement of this section will be in Vol 1 Ch8 per StatsWG meeting in SLC 3/2019	Fall 2018
			8	Mar-19	8.3.7 regression analysis section revision	Spring 2019
			8	Mar-19	8.4.1 Equivalency section revision	Spring 2019
			8	Mar-19	8.4.1 Specification limits section	Spring 2019
			8	Mar-19	8.4.7 add General linear statistical models section (from Rev D)	Spring 2019
			8	Jul-20	8.3.7 regression analysis section revision	Summer 2020 YP1
			8	Jul-20	8.4 Batch Acceptance and Equivalency	Summer 2020 YP1

VOLUME 2	**CHAPTER 1 GENERAL INFORMATION**	G Guidelines		1	2017	1.10 Data Reduction	SLC 3/2017
		D Data Review	09-10	1	2009	Set up requirements for adhesive data for future revision	Rev J Item
	CHAPTER 2 CARBON FIBER COMPOSITES	D Data Review	14-01	2	2014	Add fracture toughness data to CMH-17 Volume 2. Joint activity with Data Review and the Testing WGs as well as ASTM D30.06.	DDTG wants open for Rev J
				2		2.2.1.11 T800SC 24k/3900-2C Unidirectional Tape	Fall 2019 YP 1
				2		2.2.2.11 T830HB 6k/3900-2D Plain Weave Fabric	Fall 2019 YP 1
				2		2.2.2.12 T700S 12k/2511 Plain Weave Fabric	Fall 2019 YP 1
				2	Jul-20	2.2.1.11 T800SC 24k/3900-2C Unidirectional Tape	Summer 2020 YP1
				2	Jul-20	2.2.2.11 T830HB 6k/3900-2D Plain Weave Fabric	Summer 2020 YP1
				2	Jul-20	2.2.2.12 T700S 12k/2511 Plain Weave Fabric	Summer 2020 YP1
				2	Jul-20	4.2.2.4 E-Glass Style 7781/3900-2(1) 8-Harness Satin Weave Fabric (AMS 6891/3) - physical properties only	Summer 2020 YP1
				2	Jul-20	4.2.2.5 E-Glass Style 108/3900-2(1) Plain Weave Fabric (AMS 6891/4) - physical properties only	Summer 2020 YP1
	CHAPTER 3 BORON FIBER COMPOSITES	D Data Review		3			
	CHAPTER 4 GLASS FIBER COMPOSITES	D Data Review		4			
	CHAPTER 5 QUARTZ FIBER COMPOSITES	D Data Review		5			
	APPENDIX A1. CMH-17A DATA	D Data Review		6			

VOLUME 3	**CHAPTER 1 GENERAL INFORMATION**	G Guidelines		1	Mar-19	Review Intro paragraphs before final publishing	
	CHAPTER 2 INTRODUCTION TO COMPOSITE STRUCTURE DEVELOPMENT	G Guidelines		2			No Revision Planned for Rev H
	CHAPTER 3 AIRCRAFT STRUCTURE CERTIFICATION AND COMPLIANCE	G Guidelines	09-08	3	2009	Update Volume 3, Chapter 3 to incorporate 20-107B changes and AMC 20-29	Summer 2020 YP1
	CHAPTER 4 BUILDING BLOCK APPROACH FOR COMPOSITE STRUCTURES	G Guidelines		4		4.6 Statistical methods for BB	SLC 3/2017
				4	Mar-19	4.1 - 4.3 revision (Enjuto, et al)	Summer 2020 YP2
				4	Mar-19	4.3 Analysis correlation vs design criteria, etc Modelling validation. Boeing input	Spring 2021
				4		4.4.2.3 Add historical military a/c BB programs	Summer 2020 YP1
				4		4.5 Add detailed BB plan vs program schedule	Summer 2020 YP1
				4	Mar-19	4.4.X Building Blocks for Analysis Supported by Test (Bombardier Case Study)	Spring 2021
				4	Jul-20	4.4.X Building Blocks for Analysis Supported by Test (Cirrus Case Study)	Spring 2021
	CHAPTER 5 MATERIALS AND PROCESSES - THE EFFECT OF VARIABILITY ON COMPOSITE PROPERTIES	M Materials & Processes		5	2016	5.13 Generic Basis Values and Equivalencies	St Paul 8/2016
				5	2017	5.5.2.5 Long Discontinuous Fiber Reinforced Materials	SLC 3/2017
				5	2018	5.9.1.3 Cocuring	Fall 2018

	S Statistics	09-14	5	2009	Additional verbiage in support of analyzing nested design - Rev H	Spring 2021
			5	2013	5.4.2 Resin (add thermoplastics)	Summer 2020 YP2
		13-02	5	2013	Prepare a new M&P content on Bonding:	
			5	2020	5.9.1 General considerations plus 5.7.8 Adhesive bonding	Summer 2020 YP2
			5	2020	5.9.2 Substrates and adhesives	Spring 2021
			5		5.9.3 Surface Preparation	Fall 2019 YP 2
			5	2020	5.9.3 Surface Preparation	Spring 2021
			5	2020	5.9.4 Assembly processes for secondary bonding plus 5.7.9 Prebond moisture	Spring 2021
			5	2013	5.9.5 Cocuring	Summer 2018
			5	2020	5.9.8 Adhesive bond quality plus 5.7.10 Adhesive bond quality	Spring 2021
			5	2013	Thermoplastics "bonding"? Nothing specific for Rev H	
			5	Mar-19	General discussion of AFP processes; description of closed-loop control (ACP content)	Summer 2020 YP2
			5	Mar-19	General discussion of process simulation; current capabilities and limitation (ACP content / Anoush P)	Summer 2020 YP2
			5	Mar-19	Discussion of elements of DFM, applications, validation examples (ACP content)	Summer 2020 YP2
CHAPTER 6 QUALITY CONTROL OF PRODUCTION MATERIALS AND PROCESSES	M Materials & Processes		6	Mar-19	Surface preparation – process monitoring and automation; secondary bonding inspection (ACP content)	Spring 2021
			6	Mar-19	Surface preparation – process monitoring and automation; secondary bonding inspection (ACP content) - *copy to Chapter 5*	Spring 2021
CHAPTER 7 DESIGN OF COMPOSITES	G Guidelines		7	2017	Chapter 7 section 7.4.4.2 changes	Spring 2019
			7	Mar-19	Guidelines for the current composite design process SMWG	
			7	Jun-20	Updated Outline for Sections 7.1, 7.2 and 7.6 (Including: A) Design Requirements, Criteria and Constraints, B) IPT, C) Technology Readiness Criteria and D) Design Cost Models)	Summer 2020 YP2
			7	Jun-20	7.1 Update	Spring 2021

			7	Jun-20	7.2 Update	Spring 2021
			7	Jun-20	7.6 Update	Spring 2021
CHAPTER 8 ANALYSIS OF LAMINATES	G Guidelines		8	Jul-18	8.2.5, add backing out E11 from multiple Exx data - Hendrix - from DRWG minutes Charleston meeting	Spring 2019
		05-06	8	2005	Hybrid structure design and analysis	close once v3ch7 reballot passes. No content for v3ch8.
			8		8.2.5 Determining lamina moduli from laminate moduli test data	Fall 2019 YP 1
	DD Disbond/Delam		8	Mar-19	8.7.3.2 Delamination/disbonding arrest	Summer 2020 YP2
	DD Disbond/Delam	14-03	8	2014	8.7.6 Add a section on cohesive zone modeling for disbonding/delamination analysis.	Summer 2020 YP2
	DD Disbond/Delam			Jul-20	8.7.5 add CSDE fracture method for sandwich disbond usage	Spring 2021
	DD Disbond/Delam			Jul-20	8.7.5 add Other linear elastic fracture mechanics based methods	Spring 2021
	DD Disbond/Delam	14-04	8	2014	8.7.X Add a chapter on disbonding/delamination arrest methods such as stitching, Z-pinning and rivets. Joint activity with DTWG	Hold for Rev J
			8	Mar-19	8.8 General progressive damage failure criteria (ACP content)	Spring 2021
			8		8.8.? Progressive damage modelling (Steve Russell)	Spring 2021
			8	Mar-19	8.8? ACP input on robust analysis methods Verification and Validation	Spring 2021
	C Crashworthiness		8		8.9 Dynamic progressive damage methods for impact modelling	Spring 2021
	C Crashworthiness		8	Mar-19	8.9? High Energy Dynamic Impact (ACP)	Fall 2021
CHAPTER 9 STRUCTURAL STABILITY ANALYSES	G Guidelines		9	Mar-19	Update chapter with non-normalized industry data, additional plate buckling eqns and refs	Spring 2019
			9		Additional plate and stiffened panel buckling info (Enjuto/Mabson)	Spring 2021

	CHAPTER 10 DESIGN AND ANALYSIS OF BONDED JOINTS	G Guidelines	11-04	10	2011	Revise Volume 3 Chapter 10 Bonded Joints analysis	NA
				10	2014	Chapter 10 Bonded Joints Outline	Miami 8/2014
				10	2015	10.1 & 10.2	SLC 3/2015
				10	2011	Full chapter to YPs	Spring 2019
				10		10.2 Design and Analysis of Bonded Joints - Introduction	Fall 2019 YP 1
				10		10.4.1 Metallic Adherend Bonded Joint Analysis	Fall 2019 YP 2
				10		10.5.2 Bonded Joint Certification Issues - Aircraft, Static Strength	Fall 2019 YP 2
				10		10.5.4 Bonded Joint Certification Issues – AIRCRAFT, Damage Tolerance	Fall 2019 YP 1
				10		10.6 Bonded Joint Certification Issues / QUALIFICATION ISSUES – NON-AIRCRAFT	Fall 2019 YP 1
				10		10.7 Derivation of Elastic-Perfectly-Plastic Shear Bondline Stress	Fall 2019 YP 2
				10		10.4.3 Durability	Summer 2020 YP1
				10		10.5.4 Bonded Joint Certification Issues	Summer 2020 YP1
				10		10.6 Non-aircraft cert - new paragraph	Summer 2020 YP1
				10		10.8 Bonded Joint Cert example (Fawcett, et al)	
			19-01	10	Mar-19	Future tutorial on Bonded Joints	
	CHAPTER 11 DESIGN AND ANALYSIS OF BOLTED JOINTS	G Guidelines	11-05	11	2011	Revise Volume 3 Chapter 11 Bolted Joints analysis	NA
				11	2011	95% content	Summer 2020 YP1
				11	2011	Full content	Spring 2021
VOLUME 3	**CHAPTER 12 DAMAGE RESISTANCE, DURABILITY, AND DAMAGE TOLERANCE**	DT Damage Tol.		12	2015	12.3, Design Development and Substantiation - revision	Wichita 10/2015
				12	2013	12.4.6 Probability of detection - revision	Wichita 12/2013

	12	2014	12.5	Miami 8/2014
	12	2017	12.6.2 Design issues and guidelines	Wichita 11/2017
	12	2015	12.6.4 Analysis Methods – revised	SLC 3/2015
	12	2017	12.7.4 Analysis Methods – Residual Strength	Wichita 11/2017
	12	2017	12.8.4 Thermal loads in a business jet horizontal stabilizer (designed by Fokker)	Wichita 11/2017
	12	2017	12.8.5 General aviation (KC-100, KAI)	Wichita 11/2017
	12	2018	12.6 - Durability and Damage Growth under Cyclic Loading	Fall 2018
	12	2018	12.6.1 - Influencing factors	Fall 2018
	12	2018	12.6.2 - Design issues and guidelines	Fall 2018
	12	2018	12.6.3 - Test issues	Fall 2018
	12	2020	12.X? ARAC Extension Bonding Content	Fall 2021
---	12	Mar-19	12.2 Rules, requirements and compliance for aircraft	---
	12	Mar-19	12.2.X Application of Probabilistic Methods	Spring 2021
	12	Mar-19	12.2.X Categories of Damage	Summer 2020 YP2
	12	Mar-19	12.2.X Flights with Known Damage and Defects	Summer 2020 YP2
---	12	Mar-19	12.3 Design development and substantiation	---
	12	Mar-19	12.3.X Categories of Damage	Summer 2020 YP2
	12	Mar-19	12.3.X Damage Threat Assessment	Spring 2021
	12	2020	12.3.X Relationship Among Categories of Damage	Spring 2021
---	12	Mar-19	12.4 Inspection for defects and damage	---
	12	Mar-19	12.4.X Maintenance Inspection Technology	Spring 2021
	12	Mar-19	12.4.X Composite Aging	Spring 2021
---	12	Mar-19	12.5 Damage resistance	---
	12	Mar-19	12.5.X Categories of Damage	Spring 2021
---	12	Mar-19	12.6 Durability and damage growth under cyclic loading	---
	12	Mar-19	12.6.X Repeated Load Tolerance	Spring 2021
	12	Mar-19	12.6.X Composite Aging	Spring 2021
	12	Mar-19	12.6.3 Revise to update weibull shape factor data and discussion to incorporate NIAR data and results	Spring 2021
---	12	Mar-19	12.8 Application examples	---
	12	Mar-19	12.8.X Hybrid Issues for Composite-Metal Assemblies (Bombardier Case Study)	tbd
	12	2020	12.8.X Embraer case study	Summer 2020 YP1
	12	2020	12.8.X Cirrus case study	tbd
	12	2020	12.8.X Warsaw Institute Aviation case study	tbd

CHAPTER 13 DEFECTS, DAMAGE, AND INSPECTION	DT Damage Tol.

	13	Mar-19	13.2.1 Nondestructive inspection	Spring 2021
	13	Mar-19	NDI Capabilities Handbook will be referenced (ACP content; Rusty Jones)	Spring 2021

CHAPTER 14 SUPPORTABILITY, MAINTENANCE, AND REPAIR	R Supportability

	14	2016	complete chapter reorganization	St. Paul (2016)
	14	2016	14.1 – 14.5, 14.8, 14.9 updated	St. Paul (2016)
	14	2016	4.12 (Repair Case Studies) added, including introduction and 1st case study	St. Paul (2016)
	14	2017	Initial work on Sec 14.6 (Composite & Metalbond Structure Repair)	SLC (2017)
	14	2017	Parts of 14.6.2 Prerequisites for Repair	SLC (2017)
	14	2017	14.6.3 Repair Design and Processing + 14.6.4 Repair Quality Assurance (with CACRC refs)	SLC (2017)
	14	2017	Most remaining parts of 14.6.2 Prerequisites for Repair	Wichita (2017)
	14	2018	14.6.2.7 - Contact and non-contact materials	Fall 2018
	14	2018	14.6.3.2.3.4 - Example of a bolted repair	Fall 2018
	14	2018	new outline for Section 14.6.4 (Repair Substantiation)	Fall 2018
13-09	14	2013	Create Volume 3 content for best industry practices in composite bonded repair design development and structural substantiation	NA
	14	Mar-19	Significant coordination with V3/Ch10 (Bonded) and V3/Ch11 (Bolted) Analyses	NA
	14	Mar-19	Initial work on Sec 14.6.4 (Repair Substantiation)	Spring 2019
	14	Mar-19	14.6.4 Building block planning considerations	Fall 2019 YP 1
	14	Mar-19	14.6.3.2.5 Sandwich structure repairs	Fall 2019 YP 2
	14	Mar-19	14.12 Case Studies	Fall 2019 YP 2
	14	Oct-19	Complete Sec 14.6.4 (Interdependencies Section)	Summer 2020 YP2
	14	Mar-19	Case Studies #2, #3, #5 & #6 (maybe #4 and #9 in Spring 2021)	Summer 2020 YP2
	14	Jun-20	Complete Sec 14.6.3 Repair Design and Processing	Summer 2020 YP2
	14	Jun-20	Complete Sec 14.7 Repair Analysis	Spring 2021

			14	Jun-20	Consolidate Chapter 14 - Collapse Outline & Relocate New Content	Spring 2021
			14	Mar-19	Complete Chapter 14 Review and Final YPs	Spring 2021
CHAPTER 15 THICK-SECTION COMPOSITES	SD Specialized Data		15			No Revision Planned for Rev H
CHAPTER 16 CRASHWORTHINESS AND ENERGY MANAGEMENT	C Crashworthiness	09-07	16	2009	Crashworthiness Task Group to focus on systems/vehicles level	NA
			16	2016	Section 16.2 - Numerical Round Robin Results	St Paul 8/2016
		09-04	16	2009	16.4.2 Crashworthiness Roadmap; Provide overview/roadmap of use of analysis and test to support crashworthiness of large structures	Summer 2020 YP2
			16		16.1 revision	Summer 2020 YP2
			16		16.2 revision	Summer 2020 YP2
			16		16.3 revision	Summer 2020 YP2
			16		16.4 revision	Summer 2020 YP2
			16	Mar-19	16.1.5 High Energy Dynamic Impact (ACP) - modelling strategies and best practices	Fall 2021
CHAPTER 17 STRUCTURAL SAFETY MANAGEMENT	SM Safety Mgmt		17	Mar-19	17.7 Structural Safety Awareness Course Structure - Outline	Spring 2019
			17	Mar-19	17.7 Structural Safety Awareness Course Structure - Complete	Spring 2021
			17	Mar-19	FAA Guidance Ref. Structural Mods Involving Composites	TBD
			17	Mar-19	Technology Readiness Guidelines	TBD
			17	Jun-20	CSET Sections 17.7.1 through 17.7.2.3	Summer 2020 YP2
			17	Jun-20	Section 17.6.2 (cross-reference to Repair Case Study 1, 14.6.2)	Summer 2020 YP2
			17	Jun-20	CSET Sections 17.7.2.4 through 17.7.4.5	Summer 2020 YP2
			17	Jun-20	CSET Sections 17.7.3.1 through 17.7.3.9	Spring 2021
			17	Jun-20	CSET Sections 17.7.5.1 through 17.7.6.4	Spring 2021
			17	Jun-20	17.7 Structural Safety Awareness Course Structure - Complete	Fall 2021

			17	Jun-20	New 17.4.7 to 17.4.9 (Intros to: IPT, Innovation/Design Constraint, Technology Readiness, under 17.4 Structural Safety Assessment Procedure)	Spring 2021
			17	Jun-20	New 17.5.6 Economic Challenges (under 17.5 Structural Safety Mgmt. Procedure)	Spring 2021
CHAPTER 18 ENVIRONMENTAL MANAGEMENT	M Materials & Processes		18			No Revision Planned for Rev H
CHAPTER 19 SPACECRAFT GUIDELINES	P Spacecraft		19	Mar-19	**19 Launch Vehicles and Spacecraft**	**YP Ready ECD**
			19	Mar-19	19.1 Life Cycle Considerations	Fall 2019 YP 1
			19	Mar-19	19.2 Material Selection	Fall 2019 YP 1
			19	Mar-19	19.3 Durability & Damage Tolerance	Summer 2020 YP1
			19	Mar-19	19.4 Spacecraft Sandwich Structure Unique Design Considerations	Spring 2019
			19	Mar-19	19.4.1 Requirements and Policies	Spring 2019
			19	Mar-19	19.4.2 Managing Moisture and Internal Pressure in Spacecraft Sandwich Structure	Spring 2019
			19	Mar-19	19.4.3 Cryogenic Sandwich Structural Design Complexities	Summer 2020 YP1
			19	Mar-19	19.4.4A Analysis and Design Substantiation (Move Content & Delete)	Summer 2020 YP2
			19	Mar-19	19.4.4B Analysis And Test Methods for Structural Capability of Sandwich Structure	Summer 2020 YP2
			19	Mar-19	19.5 EMI/EMC	Spring 2019
			19	Mar-19	19.6 Structural Redundancy/Fracture Critical Structures	Spring 2019
			19	Mar-19	19.6.1 Considerations for Non-redundant Structures	Summer 2020 YP2
			19	Mar-19	19.7 Design Substantiation	Spring 2019
			19	Mar-19	19.7.1 Definitions	Spring 2021
			19	Mar-19	19.7.2 Design Value Development	Spring 2021
			19	Mar-19	19.7.2.1 Material Property Databases	Spring 2021
			19	Mar-19	19.7.3 Analysis Supported by Test	Spring 2021
			19	Mar-19	19.7.4 Workmanship Verification	Spring 2021

				19	Mar-19	19.7.5 Structural Substantiation Approach (Building Block Management)	Spring 2021
				19	Mar-19	19.8 Composite Overwrapped Pressure Vessels	Spring 2019
VOLUME 6	**CHAPTER 1 GENERAL INFORMATION**	SW Sandwich		1	Mar-19	Review Intro paragraphs before final publishing	
				1		Expand DT intro discussion	Spring 2021
				1		Expand sandwich intro disbond discussion	Spring 2021
	CHAPTER 2 GUIDELINES FOR PROPERTY TESTING	SW Sandwich	13-05	2	2013	Update Volume 6 Chapter 2 with new sandwich testing techniques/ standards	Fall 2021
		T Testing	18-01	2	2018	Volume 6 Chapter 2 - Provide test method descriptive text to accompany tables currently in chapter	Spring 2021
				2		Add sandwich disbond test methods	2022
	CHAPTER 3 MATERIAL DATA	SW Sandwich	03-07	3	2003	Obtain Pin/Insert Data for Chapter 2	Fall 2021
			13-01	3	2013	Set up requirements and data tables for core data	2022
				3		Add Kevlar hex core data	2022
				3		Add DIAB foam core data	2022
	CHAPTER 4 DESIGN AND ANALYSIS OF SANDWICH STRUCTURES	SW Sandwich		4	2015	Section 4.12, Finite Element Modeling of Sandwich Structure – revised	SLC 3/2015
			13-04	4	2013	Review content in Volumes 3 & 6, identify areas that need additional content regarding design features, manufacturing processes, field repairs, durability and damage tolerance of sandwich structure.	
		P Spacecraft	13-08	4	2013	Add information on CTE behavior to Volume 6	

	DD Disbond/Delam	14-02	4	2014	Add a chapter on testing and analysis for sandwich face sheet/core disbonding. Joint activity with Damage Tolerance and Sandwich Includes disbond analysis tools and examples	2022
			4		Update chapter outline	Summer 2020 YP1
			4		Update Intro to Sandwich Design	2022
			4		Expand DT discussions	2022
			4		New content for orthotropic facesheet wrinkling	2021
			4		Update other design/analysis equations from isotropic to orthotropic layups	2022
CHAPTER 5 FABRICATION OF SANDWICH STRUCTURES	SW Sandwich		5		Discussion of process simulation; predicting core crush, refer to Vol. 3, Chap. 5 (ACP); maybe move to V6 Chapter 4	
	M Materials & Processes					
CHAPTER 6 QUALITY CONTROL	SW Sandwich	13-07	6	2013	Update Volume 6 Chapter 6 with current/evolving inspection techniques	Fall 2019 YP 2
					Chapter 6 update	Summer 2020
CHAPTER 7 SUPPORTABILITY	SW Sandwich	13-03	4	2013	Review Volume 3 (Ch. 12 - 14) for content that should move to Volume 6. (Joint w/ DT, Supportability?)	closed Fall 2019
		17-02	7	2017	Review and recommend updates; Need to coordinates with Supportabiltiy WG and V3 Chapter 14	2021
CHAPTER 8	SW Sandwich		8		Chapter outline	2021
			8		Sandwich structural case studies - design, analysis, testing	2021
			8		Sandwich structure in-service issues	2021

PMC WORKING OUTLINE

CMH-17 OUTLINE AND PROGRESS REPORT

Abbreviations:

Status

- ✓ Approved by Coordination Group
- d Draft
- f Reserved for future use
- m Modification of previously approved document underway
- p Partially completed and approved
- r Under review by Coordination Group
- =1 Same as Volume 1

Working Groups

- C Crashworthiness
- D Data Review
- DD Disbond/Delam
- DT Damage Tol.
- G Guidelines
- M Materials & Processes
- P Spacecraft
- R Supportability
- S Statistics
- SD Specialized Data
- SM Safety Mgmt
- SW Sandwich
- T Testing
- X/Y X writes with review by Y
- X-Y X and Y share responsibility

VOLUME 1 - Rev H Working Draft	Status	Working Group Responsibility
CHAPTER 1 GENERAL INFORMATION		
1.1 INTRODUCTION TO THE HANDBOOK	✓	G
1.2 OVERVIEW OF HANDBOOK CONTENT	✓	G
1.3 PURPOSE AND SCOPE OF VOLUME 1	✓	G
1.4 USE OF THE DOCUMENT AND LIMITATIONS	✓	G
1.4.1 Roadmaps for use of Volumes 1 - 3	✓	G
1.4.2 Source of information	✓	G
1.4.3 Use of data and guidelines in applications	✓	G
1.4.4 Strength properties and allowables terminology	✓	G
1.4.5 Use of references	✓	G
1.4.6 Use of tradenames and product names	✓	M
1.4.7 Toxicity, health hazards, and safety	✓	M
1.4.8 Ozone depleting chemicals	✓	M
1.5 APPROVAL PROCEDURES	✓	G
1.6 MATERIAL ORIENTATION CODES	✓	G
1.6.1 Laminate orientation codes	✓	G
1.6.1.1 Stacking sequence notation	✓	G
1.6.1.2 Ply percentage notation	✓	G
1.6.2 Braiding orientation codes	✓	SD
1.7 SYMBOLS, ABBREVIATIONS, AND SYSTEMS OF UNITS	✓	G
1.7.1 Symbols and abbreviations	✓	G
1.7.1.1 Constituent properties	✓	G
1.7.1.2 Laminae and laminates	✓	G
1.7.1.3 Subscripts	✓	G
1.7.1.4 Superscripts	✓	G
1.7.1.5 Acronyms	✓	G
1.7.2 System of units	✓	G
1.8 DEFINITIONS	✓	G

CHAPTER 2 GUIDELINES FOR PROPERTY TESTING OF COMPOSITES

2.1 INTRODUCTION	✓	G
2.1.1 Building-block approach to substantiation of composite structures	✓	G
2.1.2 Test levels and data uses	✓	G
2.1.2.1 Structural complexity levels	✓	G
2.1.2.2 Data application categories	✓	G
2.1.2.3 Test program definition	✓	G
2.2 TEST PROGRAM PLANNING	✓	G
2.2.1 Overview	✓	G
2.2.2 Baseline and alternate approaches for statistically-based properties	✓	G
2.2.3 Issues of data equivalence	✓	G
2.2.4 Test program type	✓	T/G
2.2.5 test method selection	✓	G
2.2.5.1 Unidirectional lamina properties from laminates	✓	G
2.2.6 Population sampling and sizing	✓	M
2.2.6.1 Sample size selection	✓	M
2.2.6.2 Batch quantity effects on ANOVA	✓	M
2.2.7 Material and processing variation, specimen preparation and NDE	✓	G
2.2.7.1 Materials and material processing	✓	G
2.2.7.2 Specimen preparation and NDE	✓	G
2.2.8 Material operational limit (MOL)	✓	G
2.2.8.1 Moisture absorption and conditioning factors	✓	G
2.2.8.2 Moisture diffusivity	✓	G
2.2.8.3 Moisture equilibrium content	✓	G
2.2.8.4 Moisture conditioning and test environment	✓	G
2.2.8.5 Hot wet testing - report moisture content at failure	✓	G
2.2.8.6 Steam pressure delamination	✓	G
2.2.9 Material operational limits (MOL)	✓	G
2.2.9.1 MOL overview	✓	G
2.2.9.2 MOL considerations for high temperature composite systems	✓	G
2.2.10 SPACE ENVIRONMENTAL EFFECTS ON MATERIAL PROPERTIES	✓	P
2.2.10.1 Introduction	✓	P
2.2.10.2 Atomic oxygen	✓	P
2.2.10.3 Micrometeoroid Debris	✓	P
2.2.10.4 Ultraviolet radiation	✓	P
2.2.10.5 Charged particles	✓	P
2.2.11 Data normalization	✓	G
2.2.12 Application specific testing needs	✓	G
2.3 RECOMMENDED TEST MATRICES	✓	G
2.3.1 Material screening test matrices	✓	G
2.3.1.1 Initial phase of mechanical property screening	✓	G
2.3.1.2 Recommended additional phases of mechanical property and producibility screening studies	✓	G
2.3.1.3 Additional mechanical property screening for high-temperature material systems	✓	G
2.3.1.4 Fluid sensitivity screening	✓	
2.3.2 Material qualification and lamina basis values test matrices	✓	G
2.3.2.1 Material batches	✓	G

2.3.2.2 Constituent test matrix	✓	G
2.3.2.3 Uncured prepreg test matrix	✓	G
2.3.2.4 Lamina test matrices	✓	G
2.3.2.5 Alternate approaches for lamina basis values	✓	G
2.3.2.6 Filament-wound materials test matrix	✓	G
2.3.3 Material acceptance test matrices	✓	G
2.3.3.1 Prepreg materials	✓	G
2.3.3.2 Liquid molding materials	✓	G
2.3.4 Alternate material equivalence test matrices	✓	G
2.3.5 Generic laminate/structural element test matrices	✓	G
2.3.5.1 Introduction	✓	G
2.3.5.2 Suggested unnotched laminate strength test matrix	✓	G
2.3.5.3 Suggested open-hole laminate strength test matrix	✓	G
2.3.5.4 Suggested filled-hole laminate strength test matrix	✓	G
2.3.5.5 Overview of mechanically-fastened joint testing	✓	G
2.3.5.5.1 Failure modes	✓	G
2.3.5.5.2 Bearing/bypass interaction effects	✓	G
2.3.5.5.3 Effects of thickness/gaps/shimming	✓	G
2.3.5.5.4 Shear-out strength	✓	G
2.3.5.6 Suggested mechanically-fastened joint test matrices	✓	G
2.3.5.6.1 Suggested joint bearing test matrices - static loading	✓	G
2.3.5.6.2 Suggested joint bearing test matrices - fatigue loading	✓	G
2.3.5.6.3 Suggested bearing/bypass test matrix	✓	G
2.3.5.6.4 Suggested fastener pull-through strength test matrix	✓	G
2.3.5.6.5 Suggested fastener-in-composite qualification test matrices	✓	G
2.3.5.6.5.1 Overview	✓	G
2.3.5.6.5.2 Fastener shear tests	✓	G
2.3.5.6.5.3 Fastener tension tests	✓	G
2.3.5.6.5.4 Fastener pull-thru tests	✓	G
2.3.5.6.5.5 Bearing tests	✓	G
2.3.5.7 Suggested bonded joint test matrices	✓	G
2.3.5.8 Suggested damage characterization test matrices	✓	G
2.3.6 Suggested bonded joint test matrices	✓	G
2.3.6.1 Adhesive qualification	✓	G
2.3.6.2 Bonded joint system test matrices	✓	G
2.4 ALTERNATE APPROACHES TO BASIS VALUES	✓	G
2.5 RESERVED FOR FUTURE USE	✓	G
2.6 DATA DOCUMENTATION	✓	G
2.6.1 Data documentation	✓	G
2.6.2 Test reports	✓	G
2.7 EVALUATION OF CHANGES MADE TO PREVIOUSLY QUALIFIED MATERIALS	✓	G
2.7.1 Modification categories	✓	G
2.7.2 Actions required for each modification category	✓	G
2.7.3 Implementation	✓	G
2.7.3.1 Category 1, "No Impact"	✓	G
2.7.3.2 Category 2, "Unknown"	✓	G

2.7.3.3 Category 3, "Change"	✓	G
2.7.4 Validation test matrices	✓	G
2.7.4.1 Fiber - New line	✓	G
2.7.4.2 Fiber - Precursor relocation	✓	G
2.7.4.3 Fiber - Relocation	✓	G
2.7.4.4 Fiber - Major online equipment	✓	G
2.7.4.5 Fiber-Process change	✓	G
2.7.4.6 Fiber - Raw material (precursor) change	✓	G
2.7.4.7 Fiber - Sizing change	✓	G
2.7.4.8 Fiber - Fabric weaver change	✓	G
2.7.4.9 Resin - Ingredient change	✓	G
2.7.4.10 Resin - Ingredient source change	✓	G
2.7.4.11 Resin- Ingredient Line or equipment change	✓	G
2.7.4.12 Resin - Process change	✓	G
2.7.4.13 Resin - Equipment change - New design	✓	G
2.7.4.14 Resin- Equipment change - Similar design	✓	G
2.7.4.15 Resin - Relocation	✓	G
2.7.4.16 Prepreg - New line	✓	G
2.7.4.17 Prepreg - Process or equipment	✓	G
2.7.4.18 Prepreg - Relocation	✓	G
2.7.5 Equivalency criteria and data analysis	✓	G
2.7.5.1 Effects of coefficient of variation.	✓	G
2.7.5.2 Assumptions.	✓	G
2.7.5.3 Use of engineering judgment in equivalency analysis	✓	G
2.8 EVALUATION OF ALTERNATE PART PROCESSORS OR SITES	✓	G
2.9 QUALIFICATION OF ADDITIONAL MATERIAL FORMS OR ALTERNATE SOURCE COMPOSITE MATERIALS	✓	G
2.9.1 Introduction	✓	G
2.9.2 Goal and approach	✓	G
2.9.3 Key material or structural performance parameters	✓	G
2.9.4 General guidance	✓	G
2.9.4.1 Change in prepreg supplier and production line (licensed production)	✓	G
2.9.4.2 New fabric weave	✓	G
2.9.4.3 New tape grade	✓	G
2.9.4.4 New fiber	✓	G
2.9.4.5 New or changed resin	✓	G
2.9.4.6 New source prepreg supplier using a different fiber and resin system	✓	G
2.9.5 Evaluation criteria	✓	G
CHAPTER 3 EVALUATION OF REINFORCEMENT FIBERS		
3.1 INTRODUCTION	✓	T
3.2 CHEMICAL TECHNIQUES	✓	T
3.2.1 Elemental analysis	✓	T
3.2.2 Titration	✓	T
3.2.3 Fiber structure	✓	T

3.2.4 Fiber surface chemistry	✓	T
3.2.5 Sizing content and composition	✓	T
3.2.6 Moisture content	✓	T
3.2.7 Thermal stability and oxidative resistance	✓	T
3.2.8 Chemical resistance	✓	T
3.3 PHYSICAL TECHNIQUES (INTRINSIC)	✓	T
3.3.1 Filament diameter	✓	T
3.3.2 Density of fibers	✓	T
3.3.2.1 Overview	✓	T
3.3.2.2 ASTM D3800, Standard Test Method for Density of High-Modulus Fibers	✓	T
3.3.2.3 Recommended procedure changes to Section 6.4.4.4.1 (helium pycnometry) for use in measuring fiber density	✓	T
3.3.2.4 Density test methods for CMH-17 data submittal	✓	T
3.3.3 Electrical resistivity	✓	T
3.3.4 Coefficient of thermal expansion	✓	T
3.3.5 Thermal conductivity	✓	T
3.3.6 Specific heat	✓	T
3.3.7 Thermal transition temperatures	✓	T
3.4 PHYSICAL TECHNIQUES (EXTRINSIC)	✓	T
3.4.1 Yield of yarn, strand, or roving	✓	T
3.4.2 Cross-sectional area of yarn or tow	✓	T
3.4.3 Twist of yarn	✓	T
3.4.4 Fabric construction	✓	T
3.4.5 Fabric areal density	✓	T
3.5 MECHANICAL TESTING OF FIBERS	✓	T
3.5.1 Tensile properties	✓	T
3.5.1.1 Filament tensile testing	✓	T
3.5.1.2 Tow tensile testing	✓	T
3.5.1.3 Fiber properties from unidirectional laminate tests	✓	T
3.5.2 Filament compression testing	✓	T
CHAPTER 4 MATRIX CHARACTERIZATION		
4.1 INTRODUCTION	✓	T
4.2 MATRIX SPECIMEN PREPARATION	✓	T
4.2.1 Introduction	✓	T
4.2.2 Thermoset polymers	✓	T
4.2.3 Thermoplastic polymers	✓	T
4.2.4 Specimen machining	✓	T
4.3 CONDITIONING AND ENVIRONMENTAL EXPOSURE	✓	T
4.4 CHEMICAL ANALYSIS TECHNIQUES	✓	T
4.4.1 Elemental analysis	✓	T
4.4.2 Functional group and wet chemical analysis	✓	T
4.4.3 Spectroscopic analysis	✓	T
4.4.4 Chromatographic analysis	✓	T
4.4.5 Molecular weight and molecular weight distribution analysis	✓	T
4.4.6 General scheme for resin material characterization	✓	T
4.5 THERMAL/PHYSICAL ANALYSIS AND PROPERTY TESTS	✓	T
4.5.1 Introduction	✓	T

4.5.2 Thermal analysis	✓	T
4.5.3 Rheological analysis	✓	T
4.5.4 Morphology	✓	T
4.5.5 Density/specific gravity	✓	T
4.5.5.1 Overview	✓	T
4.5.5.2 Recommended procedure changes to Sections 6.4.4.2, 6.4.4.3 and 6.4.4.4 (D792, D1505 and helium pycnometry) for use in measuring cured resin density	✓	T
4.5.5.3 Density test methods for CMH-17 data submittal	✓	T
4.5.6 Volatiles content	✓	T
4.5.7 Moisture content	✓	T
4.6 STATIC MECHANICAL PROPERTY TESTS	✓	T
4.6.1 Introduction	✓	T
4.6.2 Tension	✓	T
4.6.2.1 Introduction	✓	T
4.6.2.2 Specimen preparation	✓	T
4.6.2.3 Test apparatus and instrumentation	✓	T
4.6.2.4 Tensile test methods for CMH-17 data submittal	✓	T
4.6.3 Compression	✓	T
4.6.3.1 Introduction	✓	T
4.6.3.2 Specimen preparation	✓	T
4.6.3.3 Test apparatus and instrumentation	✓	T
4.6.3.4 Limitations	✓	T
4.6.3.5 Compressive test methods for CMH-17 data submittal	✓	T
4.6.4 Shear	✓	T
4.6.4.1 Test methods available	✓	T
4.6.4.2 Torsion specimen preparation	✓	T
4.6.4.3 Iosipescu shear specimen preparation	✓	T
4.6.4.4 Test apparatus and instrumentation	✓	T
4.6.4.5 Limitations	✓	T
4.6.4.6 Shear testing methods for CMH-17 data submittal	✓	T
4.6.5 Flexure	✓	T
4.6.5.1 Introduction	✓	T
4.6.5.2 Specimen preparation	✓	T
4.6.5.3 Test apparatus and instrumentation	✓	T
4.6.5.4 Flexural test methods for CMH-17 data submittal	✓	T
4.6.6 Impact	✓	T
4.6.7 Hardness	f	T
4.7 FATIGUE TESTING	✓	T
4.8 TESTING OF VISCOELASTIC PROPERTIES	✓	T
CHAPTER 5 PREPREG MATERIALS CHARACTERIZATION		
5.1 INTRODUCTION	✓	T
5.1.1 Background	✓	T
5.2 PREPREG SAMPLING PLANS AND SPECIMEN PREPARATION	✓	T
5.3 CONDITIONING AND ENVIRONMENTAL EXPOSURE	✓	T
5.4 PREPREG PHYSICAL AND CHEMICAL PROPERTIES	✓	T
5.4.1 Prepreg physical properties	✓	T
5.4.1.1 Resin content	✓	T

5.4.1.1.1 Destructive measurements	✓	T
5.4.1.1.2 Nondestructive measurements	✓	T
5.4.1.2 Fiber content or fiber areal weight	✓	T
5.4.1.3 Volatile Content	✓	T
5.4.1.4 Resin flow	✓	T
5.4.1.5 Gel time	✓	T
5.4.1.6 Moisture content	✓	T
5.4.1.7 Surface tack	✓	T
5.4.1.8 Drape	✓	T
5.4.1.9 Percentage of Cure	✓	T
5.4.1.10 Insoluble Content	✓	T
5.4.1.11 Differential scanning calorimetry	✓	T
5.4.1.12 Rheology	✓	T
5.4.1.13 Dynamic mechanical analysis	✓	T
5.4.1.14 Retesting of physical properties	✓	T
5.4.2 Prepreg chemical properties	✓	T
5.4.2.1 High pressure liquid chromatography (HPLC)	✓	T
5.4.2.2 Fourier transform infrared spectroscopy	✓	T
CHAPTER 6 LAMINA, LAMINATE, AND SPECIAL FORM CHARACTERIZATION		
6.1 INTRODUCTION	✓	T
6.2 SPECIMEN PREPARATION	r	T
6.2.1 Introduction	r	T
6.2.2 Traceability	r	T
6.2.3 Test article fabrication	r	T
6.2.4 Specimen fabrication	r	T
6.3 CONDITIONING AND ENVIRONMENTAL EXPOSURE	r	T
6.3.1 Introduction	r	T
6.3.2 Fixed-time conditioning	r	T
6.3.3 Equilibrium conditioning	r	T
6.3.3.1 Accelerating conditioning times	r	T
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8.3.3.1 The maximum normed residual	✓	S
8.3.4 Equality of variances	✓	S
8.3.4.1 Levene's test for equality of variances	✓	S
8.3.4.2 The F-test for equality of means	✓	S
8.3.5 Computational procedures for basis values using the pooling across environments method (Figure 8.3.1(a))	✓	S
8.3.5.1 Preparation of data	✓	S
8.3.5.2 Outliers within each material batch and environmental condition	✓	S
8.3.5.3 Between-batch variability within each environmental condition	✓	S
8.3.5.4 Outliers within each condition	✓	S
8.3.5.5 Pooling of data	✓	S
8.3.5.5.1 Basis values using pooled coefficient of variation method	✓	S

8.3.5.5.1.1 Calculation of tolerance factors	✓	S
8.3.5.5.1.2 Calculation of reduction factors	✓	S
8.3.5.5.1.3 Calculation of basis values	✓	S
8.3.5.5.2 Basis values using pooled standard deviation method	✓	S
8.3.6 Computational procedures for basis values using the single point method (Figure 8.3.1(b))	✓	S
8.3.6.1 Preparation of data	✓	S
8.3.6.2 Outliers within each material batch	✓	S
8.3.6.3 Between-batch variability	✓	S
8.3.6.4 Outliers within the pooled data set	✓	S
8.3.6.5 Statistical distribution models (goodness-of-fit tests) for basis value calculations	✓	S
8.3.6.5.1 Normal distribution	✓	S
8.3.6.5.1.1 Estimating the mean and standard deviation parameters for the normal distribution	✓	S
8.3.6.5.1.2 Goodness-of-fit test for the normal distribution	✓	S
8.3.6.5.2 Two-parameter Weibull distribution	✓	S
8.3.6.5.2.1 Estimating the shape and scale parameters of a Weibull distribution	✓	S
8.3.6.5.2.2 Goodness-of-fit test for the two-parameter Weibull distribution	✓	S
8.3.6.5.3 Lognormal distribution	✓	S
8.3.6.5.4 Selecting among several models	□	S
8.3.6.6 Calculation of basis values for unstructured data	✓	S
8.3.6.6.1 Basis values for the normal distribution	✓	S
8.3.6.6.2 Basis values for the two-parameter Weibull distribution	✓	S
8.3.6.6.3 Basis values for the lognormal distribution	✓	S
8.3.6.6.4 Nonparametric basis values	✓	S
8.3.6.6.4.1 Nonparametric basis values for large samples	✓	S
8.3.6.6.4.2 The Hanson-Koopmans method for small samples	✓	S
8.3.6.7 Calculation of basis values for structured data using Analysis of Variance (ANOVA)	✓	S
8.3.6.7.1 One-way ANOVA computations based on individual measurements	✓	S
8.3.6.7.2 One-way ANOVA computations based on summary statistics	✓	S
8.3.6.7.3 The ANOVA table for a one-way model	✓	S
8.3.6.7.4 Calculation of summary statistics for one-way ANOVA basis values	✓	S
8.3.6.7.5 Calculations for five or more batches	✓	S
8.3.6.7.6 Cases for three or four batches	✓	S
8.3.6.7.7 Cases with two batches	✓	S
8.3.7 Calculation of basis values for structured data using regression analysis	r	S
8.3.7.1 Regression analysis of linear statistical models	✓	S
8.3.7.2 Analysis of variance	✓	S
8.3.7.3 Simple linear regression	✓	S
8.3.7.4 Linear regression with multiple predictor variables	✓	S
8.3.8 Exploratory data analysis	✓	S
8.3.8.1 The quantile box plot	✓	S
8.3.8.2 The informative quantile function	✓	S

8.3.9 Acceptable grouping of environmental conditions for pooling	✓	S
8.3.10 Guidelines for applying experience and judgment to statistical results	✓	S
8.3.10.1 Between-batch variability	✓	S
8.3.10.2 Equality of variances	✓	S
8.3.10.3 Test for normality	✓	S
8.3.11 Examples	✓	S
8.3.11.1 Agate Statistical Analysis Program (ASAP)	✓	S
8.3.11.1.1 ASAP Example 1 – data that fails poolability tests	✓	S
8.3.11.1.2 ASAP example 2 – poolable data	✓	S
8.3.11.2 Single-point analysis using the STAT17 program	✓	S
8.3.11.2.1 STAT17 Example 1 - nonparametric distribution	✓	S
8.3.11.2.2 STAT17 Example 2 – ANOVA	✓	S
8.3.11.3 Example - Linear regression – Problem 1	✓	S
8.3.11.4 Example - Simple linear regression with a random effect – Problem 2	✓	S
8.3.11.5 Example - One-way mixed-model ANOVA: basis values with data from multiple sources – Problem 3	✓	S
8.4 STATISTICAL METHODS	✓	S
8.4.1 Tests for determining equivalency between an existing database and a new dataset for the same material	✓	S
8.4.2 Alternate material statistical procedures	✓	S
8.4.2.1 Comparing two groups of batches	✓	S
8.4.3 Confidence intervals for the coefficient of variation	✓	S
8.4.3.1 Example of CV confidence interval calculation	✓	S
8.4.3.2 Comment on the approximation	✓	S
8.4.4 Modified coefficient of variation approach	✓	S
8.4.4.1 Modification rules	✓	S
8.4.4.2 Modified standard deviation (S*)	✓	S
8.4.4.3 Pooling across environments using the modified CV	✓	S
8.4.4.4 Transformation of data for the Anderson-Darling k-sample test	✓	S
8.4.4.5 Guidelines for use of the modified CV approach	✓	S
8.4.5 Statistical procedures for process control	✓	S
8.4.5.1 Basics of control charts	✓	S
8.4.5.1.1 Purpose of control charts	✓	S
8.4.5.1.2 Two charts are better than one	✓	S
8.4.5.1.3 Types of control charts	✓	S
8.4.5.1.4 Rules for flagging results as being ‘out-of-control’	✓	S
8.4.5.2 x bar chart including batch effect	✓	S
8.4.5.3 s2 chart for the within-batch component of variance	✓	S
8.4.5.4 Test for trend in batch means	✓	S
8.4.6 Average stress-strain curves and bearing load-deformation curves	✓	S
8.4.6.1 Fitting equations	✓	S
8.4.7 General linear statistical models	✓	S
8.5 STATISTICAL TABLES AND APPROXIMATIONS	✓	S
8.5.1 Quantiles of the F-distribution	✓	S
8.5.2 Quantiles of the χ^2 distribution	✓	S
8.5.3 Upper-tail quantiles for the t-distribution	✓	S

8.5.4 Two-tail probabilities for the t-distribution	✓	S
8.5.5 Upper-tail probabilities for the standard normal distribution	✓	S
8.5.6 Critical values for the k-sample Anderson-Darling test at the a = 0.05 significance level	✓	S
8.5.7 Critical values for the MNR outlier test	✓	S
8.5.8 One-sided B-basis tolerance factors, V_B, for the Weibull distribution	✓	S
8.5.9 One-sided A-basis tolerance factors, V_A, for the Weibull distribution	✓	S
8.5.10 One-sided B-basis tolerance factors, k_B, for the normal distribution	✓	S
8.5.11 One-sided A-basis tolerance factors, k_A, for the normal distribution	✓	S
8.5.12 Ranks, r_B, for determining nonparametric B-basis values	✓	S
8.5.13 Ranks, r_A, for determining nonparametric A-basis values	✓	S
8.5.14 Nonparametric B-basis values for small sample sizes	✓	S
8.5.15 Non-parametric A-basis values for small sample sizes	✓	S
8.5.16 Critical values for approximate confidence limits on the coefficient of variation	✓	S
8.5.17 One-sided tolerance factors for acceptance limits on mean values, for normal distribution	✓	S
8.5.18 One-sided tolerance factors for acceptance limits on individual values, for normal distribution	✓	S
8.5.19 Upper and lower tail quantiles for two-sided t-distribution	✓	S

VOLUME 2 - Rev H	Status	Working Group Responsibility
CHAPTER 1 GENERAL INFORMATION		
1.1 Introduction to the Handbook	✓	G
1.2 Overview of Handbook Content	✓	G
1.3 Purpose and Scope of Volume 2	✓	D
1.4 Organization of Data in Volume 2	✓	D
1.5 Presentation of Data	✓	D
1.5.1 Complete Documentation	✓	D
1.5.1.1 Rev H Data		
1.5.1.1.1 Data set description	✓	D
1.5.1.1.2 Summary tables	✓	D
1.5.1.1.3 Individual data tables - normalized data	✓	D
1.5.1.1.4 Individual data tables - unnormalized data	✓	D
1.5.1.1.5 Individual data tables - notched laminate data	✓	D
1.5.1.1.6 Individual data tables - bearing data	✓	D
1.5.1.1.7 Individual data tables - bearing/bypass data	✓	D
1.5.1.2 Rev G Data		D
1.5.2 Legacy Data	✓	D
1.5.3 Appended MIL-HDBK-17 Rev A Data	✓	D
1.6 Materials Systems	✓	D/M
1.6.1 Materials system codes	✓	D/M
1.6.2 Index of materials	f	D/M
1.7 Material Orientation Codes	✓	G
1.7.1 Laminate orientation codes	✓	G
1.7.1.1 Stacking sequence notation	✓	G
1.7.1.2 Ply percentage notation	✓	G
1.7.2 Braiding orientation codes	✓	G
1.8 Symbols, Abbreviations, and Systems of Units	✓	1
1.8.1 Symbols and abbreviations	✓	1
1.8.1.1 Constituent properties	✓	1
1.8.1.2 Laminae and laminates	✓	1
1.8.1.3 Subscripts	✓	1
1.8.1.4 Superscripts	✓	1
1.8.1.5 Acronyms	✓	1
1.8.2 System of units	✓	1
1.9 Definitions	r	1
1.10 DATA REDUCTION AND DOCUMENTATION (*sections moved from Volume 1 Section 2.3.7 and 2.4)*		
1.10.1 Introduction	✓	D
1.10.2 Lamina properties from laminates	✓	D
1.10.2.1 Methodology	✓	D
1.10.2.2 Tension strength tests	✓	D
1.10.2.3 Compression strength tests	✓	D
1.10.2.4 Other properties	✓	D
1.10.3 Data normalization	✓	D

1.10.3.1 Normalization theory	✓	D
1.10.3.2 Normalization methodology	✓	D
1.10.3.3 Practical application of normalization	✓	D
1.10.4 Disposition of outlier data	✓	D
1.10.5 Data documentation	✓	D
1.11 MATERIAL TESTING FOR SUBMISSION OF DATA TO CMH-17	✓	D
1.11.1 Introduction	✓	D
1.11.2 Material and process specification requirements	✓	D
1.11.3 Sampling requirements	✓	D
1.11.3.1 Additional requirements for B and A data classes	✓	D
1.11.3.2 Data pooling	✓	D
1.11.4 Conditioning requirements	✓	D
1.11.5 Test method requirements	✓	T/D
1.11.6 Data documentation requirements	✓	D
1.11.7 Data normalization	✓	D
1.11.8 Statistical analysis	✓	D
1.11.9 Mechanical properties of laminae and laminates	✓	D
1.11.9.1 Unidirectional properties from laminates	✓	D
1.11.9.2 Strength and strain-to-failure	✓	D
1.11.9.3 Failure modes and locations	✓	D
1.11.9.4 Elastic moduli, Poisson's ratios, and stress/strain curves	✓	D
1.11.10 Chemical properties	f	D
1.11.11 Physical properties of laminae and laminates	✓	D
1.11.11.1 Density	✓	D
1.11.11.2 Composition	f	D
1.11.11.3 Equilibrium moisture content	✓	D
1.11.11.4 Moisture diffusivity	✓	D
1.11.11.5 Coefficient of moisture expansion	✓	D
1.11.11.6 Glass transition temperature	✓	D
1.11.12 Thermal properties	✓	D
1.11.12.1 Coefficient of thermal expansion	✓	D
1.11.12.2 Specific heat	✓	D
1.11.12.3 Thermal conductivity	✓	D
1.11.12.4 Thermal diffusivity	✓	D
1.11.13. Electrical properties	f	D
1.11.14 Fatigue	✓	D
1.12 Data substantiation for use of basis values from CMH-17 or other large databases	✓	D
1.12.1 Equivalency Testing Requirements	f	D
CHAPTER 2 CARBON FIBER COMPOSITES		
2.1 Introduction	✓	D
2.2 Complete Documentation	✓	D
2.2.1 Carbon - Epoxy Prepreg Tape	✓	D
2.2.1.1 T700GC 12k 31E/2510 Unidirectional Tape	✓	D
2.2.1.2 T700 24k/E765 Unidirectional Tape	✓	D
2.2.1.3 AS4 12k/8552 unidirectional tape	✓	D
2.2.1.4 IM7 12k/8552 unidirectional tape	✓	D
2.2.1.5 T650 6k/5320-1 unidirectional tape	✓	D

2.2.1.6 IM7 12k/MTM45-1 unidirectional tape	✓	D
2.2.1.7 HTS40 12k/MTM45-1 unidirectional tape	✓	D
2.2.1.8 AS4 12k/MTM45-1 unidirectional tape	✓	D
2.2.1.9 IM7 / EP2202 unidirectional tape	✓	D
2.2.1.10 IM7 GP 12k/BT250E-6 unidirectional tape	✓	D
2.2.1.11 T800SC 24k/3900-2C Unidirectional Tape	✓	D
2.2.2 Carbon - Epoxy Prepreg Fabric	✓	D
2.2.2.1 T700SC 12k/2510 50C/2510 Plain Weave Fabric	✓	D
2.2.2.2 T300 3k/E765 Plain Weave Fabric	✓	D
2.2.2.3 T300 6k/E765 5-Harness Satin Fabric	✓	D
2.2.2.4 HTA 5131 3k/M20 Plain Weave Fabric	✓	D
2.2.2.5 AS4 3k/8552 Plain Weave Fabric	✓	D
2.2.2.6 HTS40 E13 3k/MTM45-1 Plain Weave Fabric	✓	D
2.2.2.7 T650 3k/5320-1 Plain Weave Fabric	✓	D
2.2.2.8 HTS40/TC250 plain weave fabric	✓	D
2.2.2.9 AS4C 3k/BT250-E Plain Weave Fabric	✓	D
2.2.2.10 T650/EP2202 Plain Weave Fabric	✓	D
2.2.2.11 T830HB 6k/3900-2D Plain Weave Fabric	✓	D
2.2.2.12 T700S 12k/2511 Plain Weave Fabric	✓	D
2.2.3 Carbon - Epoxy Wet-Lay-Up Fabric	✓	D
2.2.3.1 HTA5131 3k/Epocast A/B Plain Weave Fabric	✓	D
2.3 Legacy Data	✓	D
2.3.1 Carbon - Epoxy Prepreg Tape	✓	D
2.3.1.1 T500 12k/976 Unidirectional Tape	✓	D
2.3.1.2 HITEX 33 6k/E7K8 Unidirectional Tape	✓	D
2.3.1.3 AS4 12k/E7K8 Unidirectional Tape	✓	D
2.3.1.4 Celion 12k/E7K8 Unidirectional Tape	✓	D
2.3.1.5 AS4 12k/938 Unidirectional Tape	✓	D
2.3.1.6 Celion 12k/938 Unidirectional Tape	✓	D
2.3.1.7 AS4 12k/3502 Unidirectional Tape	✓	D
2.3.1.8 AS4/3501-6 (bleed) Unidirectional Tape	✓	D
2.3.1.9 AS4/3501-6 (no bleed) Unidirectional Tape	✓	D
2.3.1.10 T300 15k/976 Unidirectional Tape	✓	D
2.3.1.11 IM7 12k/8551-7A Unidirectional Tape	✓	D
2.3.1.12 IM6 12k/3501-6 Unidirectional Tape	✓	D
2.3.1.13 IM7 12k/8552 Unidirectional Tape	✓	D
2.3.1.14 IM7 12k/977-2 Unidirectional Tape	✓	D
2.3.1.15 AS4 12k/997 Unidirectional Tape	✓	D
2.3.1.16 T650-35 12k/976 Unidirectional Tape	✓	D
2.3.1.17 IM7 12k/PR381 Unidirectional Tape	✓	D
2.3.1.18 T800HB 12k/3900-2 Unidirectional Tape	✓	D
2.3.2 Carbon - Epoxy Prepreg Fabric	✓	D
2.3.2.1 T300 3k/934 Plain Weave Fabric	✓	D
2.3.2.2 Celion 3000/E7K8 Plain Weave Fabric	✓	D
2.3.2.3 HITEX 33 6k/E7K8 Plain Weave Fabric	✓	D

2.3.2.4 AS4 3k/E7K8 Plain Weave Fabric	✓	D
2.3.2.5 AS4 3k/3501-6 Plain Weave Fabric	✓	D
2.3.2.6 AS4 3k/3501-6S 5-Harness Satin Weave Fabric	✓	D
2.3.2.7 AS4 6k/3502-6S 5-Harness Satin Weave Fabric	✓	D
2.3.2.8 AS4 3k/3501-6 (bleed) 5-Harness Satin Weave Fabric	✓	D
2.3.2.9 AS4 3k/3501-6 (no bleed) 5-Harness Satin Weave Fabric	✓	D
2.3.2.10 T300 3k/977-2 Plain Weave Fabric	✓	D
2.3.2.11 T300 3k/977-2 8-Harness Satin Weave Fabric	✓	D
2.3.2.12 T650-35 3k/976 Plain Weave Fabric	✓	D
2.3.2.13 T650-35 3k/976 8-Harness Satin Weave Fabric	✓	D
2.3.2.14 T700S 12k/3900-2 plain weave fabric	✓	D
2.3.2.15 AS4C 3k/HTM45 8-Harness Satin Fabric	✓	D
2.3.2.16 AS4C 3k/HTM45 Plain Weave Fabric	✓	D
2.3.3 Carbon - Epoxy Wet-Lay-Up Fabric	✓	D
2.3.3.1 T300 3k/EA9396 8-Harness Satin Weave Fabric	✓	D
2.3.4 Carbon - Epoxy Resin-Transfer-Molded Fabric	✓	D
2.3.4.1 AS4 6k/PR500 5-Harness Satin Weave Fabric	✓	D
2.3.4.2 IM7 6k/PR500 4-Harness Satin Weave Fabric	✓	D
2.3.5 Carbon - Bismaleimide Prepreg Tape and Fabric	✓	D
2.3.5.1 T300 3k/F650 Unidirectional Tape	✓	D
2.3.5.2 T300 3k/F650 8-Harness Satin Weave Fabric	✓	D
2.3.5.3 T300 3k/F652 8-Harness Satin Weave Fabric	✓	D
2.3.5.4 AS4/5250-3 Unidirectional Tape	✓	D
2.3.5.5 T650-35 3k/5250-4 8-Harness Satin Weave Fabric	✓	D
2.3.5.6 T650-35 3k/5250-4 Plain Weave Fabric	✓	D
2.3.6 Carbon - Bismaleimide Resin-Transfer-Molded Fabric	✓	D
2.3.6.1 IM7 6k/5250-4 ATM 4-Harness Satin Weave Fabric	✓	D
2.3.7 Carbon - Polyimide Prepreg Fabric	✓	D
2.3.7.1 Celion 3000/F670 8-Harness Satin Weave Fabric	✓	D
2.3.8 Carbon - Thermoplastic Prepreg Tape	✓	D
2.3.8.1 IM6 12k/APC-2 Unidirectional Tape	✓	D
2.3.9 Carbon - Cyanate Ester Prepreg Tape	✓	D
2.3.9.1 M55J 6k/954-3 Unidirectional Tape	✓	D
CHAPTER 3 BORON FIBER COMPOSITES		
3.1 Introduction	✓	D
3.2 Complete Documentation	f	D
3.3 Legacy Data	f	M
3.3.1 Boron - Epoxy Prepreg Tape	✓	M
3.3.1.1 B4.0/5521 Unidirectional Tape	✓	M

CHAPTER 4 GLASS FIBER COMPOSITES

4.1 Introduction	✓	D
4.2 Complete Documentation	f	D
4.2.1 Glass - Epoxy Prepreg Tape	f	D
4.2.1.1 S-2 Glass/BT250E-6 Unidirectional Tape	✓	D
4.2.2 Glass - Epoxy Prepreg Fabric		
4.2.2.1 E-Glass 7781 Finish 558/2510 8-Harness Satin Weave Fabric	✓	D

4.2.2.2 6781 S-2 Glass/MTM45-1 8-Harness Satin Weave Fabric	✓	D
4.2.2.3 E-Glass 7781/MTM45-1 8-Harness Satin Weave Fabric	✓	D
4.3 Legacy Data	f	D
4.3.1 Glass - Epoxy Prepreg Tape and Fabric	f	D
4.3.1.1 S2-449 43k/SP381 Unidirectional Tape	✓	D
4.3.1.2 S2-449 17k/SP381 Unidirectional Tape	✓	D
4.3.1.3 E-Glass 7781 G-816/PR381 Plain Weave Fabric	✓	D
4.3.2 Glass - Epoxy Wet-Lay-Up	✓	D
4.3.2.1 7781/EA9396 8-Harness Satin Weave Fabric	✓	D

CHAPTER 5 QUARTZ FIBER COMPOSITES

5.1 Introduction	✓	D
5.2 Complete Documentation	f	D
5.3 Legacy Data	f	D
5.3.1 Quartz - Bismaleimide Prepreg Fabric	✓	D
5.3.1.1 Astroquartz II/F650 8-Harness Satin Weave Fabric	✓	D

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	Status	Working Group Responsibility
CHAPTER 1 GENERAL INFORMATION		
1.1 INTRODUCTION TO THE HANDBOOK	✓	G
1.2 OVERVIEW OF HANDBOOK CONTENT	✓	G
1.3 PURPOSE AND SCOPE OF VOLUME 3	✓	G
1.4 MATERIAL ORIENTATION CODES	✓	G
1.4.1 Laminate orientation codes	✓	G
1.4.1.1 Stacking sequence notation	✓	G
1.4.1.2 Ply percentage notation	✓	G
1.4.2 Braiding orientation codes	✓	SD
1.5 SYMBOLS, ABBREVIATIONS, AND SYSTEMS OF UNITS	✓	1
1.5.1 Symbols and abbreviations	✓	1
1.5.1.1 Constituent properties	✓	1
1.5.1.2 Laminae and laminates	✓	1
1.5.1.3 Subscripts	✓	1
1.5.1.4 Superscripts	✓	1
1.5.1.5 Acronyms	✓	1
1.5.2 System of units	✓	1
1.6 DEFINITIONS	✓	1
CHAPTER 2 INTRODUCTION TO COMPOSITE STRUCTURE DEVELOPMENT		
2.1 INTRODUCTION	✓	G
2.1.1 Why composites are different	✓	G
2.1.2 A different development approach	✓	G
2.1.3 Limitations on this Chapter	✓	G
2.2 BEHAVIOR OF COMPOSITES - MECHANICS	✓	G
2.2.1 Materials terminology and coordinate systems	✓	G
2.2.2 Mechanical properties at the material level	✓	G
2.2.3 Stacking sequence issues	✓	G
2.2.4 Environmental effects	✓	G
2.2.5 Damage effects	✓	G
2.2.6 Variability issues	✓	G
2.2.7 Mechanical properties for design	✓	G
2.3 MATERIAL SELECTION	✓	G
2.3.1 Structural materials	✓	G
2.3.1.1 Fiber types	✓	G
2.3.1.2 Composite material forms	✓	G
2.3.1.3 Resin types	✓	G
2.3.1.4 Fiber forms	✓	G
2.3.1.5 Adhesive types	✓	G
2.3.1.6 Sandwich material types	✓	G
2.3.2 Ancillary materials	✓	G
2.3.3 Material selection considerations	✓	G

2.4 MANUFACTURING PROCESS SELECTION	✓	G
2.4.1 Process steps and options	✓	G
2.4.2 Tooling approaches	✓	G
2.4.3 Quality assurance processes	✓	G
2.4.4 Process selection considerations	✓	G
2.5 STRUCTURAL CONCEPTS	✓	G
2.5.1 Basic construction types	✓	G
2.5.2 Joint types	✓	G
2.5.3 Assembly of detail parts	✓	G
2.5.4 Integration of large composite structures	✓	G
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14.6.4.4.2 Substantiation predominantly by test	✓	R
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15.2.2.1 Unidirectional lamina 3-D properties	✓	SD
15.2.2.2 Oriented orthotropic laminate 3-D properties	✓	SD
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15.3 STRUCTURAL ANALYSIS METHODS FOR THICK-SECTION COMPOSITES	f	SD
5.4 PHYSICAL PROPERTY ANALYSIS REQUIRED FOR THICK-SECTION COMPOSITE THREE-DIMENSIONAL ANALYSIS	f	SD
15.5 PROCESS ANALYSIS METHODS FOR THICK-SECTION COMPOSITES	f	SD
15.6 FAILURE CRITERIA	f	SD
15.7 FACTORS INFLUENCING THICK-SECTION ALLOWABLES (i.e., SAFETY MARGINS)	f	SD
15.8 THICK LAMINATE DEMONSTRATION PROBLEM	f	SD

CHAPTER 16 CRASHWORTHINESS AND ENERGY MANAGEMENT

New Outline and subsections under review	r	C
16.1 OVERVIEW AND GENERAL GUIDELINES	r	C
16.1.1 Section organization	r	C
16.1.2 Principles of crashworthiness	r	C

16.1.3 Composite-related issues	r	C
16.1.4 Terminology	r	C
16.1.5 Existing research and development	r	C
16.1.6 Overview of regulating bodies and safety standards	r	C
16.2 Numerical Round Robin Results	r	C
16.2.1 - LS-DYNA MAT54	r	C
16.2.2 - LS-DYNA MAT 58	r	C
16.2.3 - PAM-CRASH	r	C

CHAPTER 17 STRUCTURAL SAFETY MANAGEMENT

17.1 Introduction	✓	SM
17.1.1 Background	✓	SM
17.1.2 Purpose and scope	✓	SM
17.2 Safety risk management overview	✓	SM
17.2.1 Definitions	✓	SM
17.2.2 Process of safety risk management	✓	SM
17.2.3 Hazard identification and initial safety assessment	✓	SM
17.2.4 Risk analysis and strategies	✓	SM
17.2.5 Risk assessment and mitigation actions	✓	SM
17.3 Structural safety and regulations	✓	SM
17.3.1 Sources of information	✓	SM
17.3.2 Regulations	✓	SM
17.3.3 Guidance documents	✓	SM
17.4 Structural safety assessment considerations	✓	SM
17.4.1 Design	✓	SM
17.4.2 Manufacturing	✓	SM
17.4.3 Maintenance	✓	SM
17.4.4 Operations	✓	SM
17.4.5 Airworthiness requirements	✓	SM
17.4.6 Structural integrity	✓	SM
1.7.4.6.1 Life cycle considerations	✓	SM
17.4.7 Illustration	✓	SM
1.7.4.7.1 Flight 261	✓	SM
17.5 Structural safety management procedure	✓	SM
17.5.1 Describe structure	✓	SM
17.5.2 Identify unsafe conditions and damage threats	✓	SM
17.5.3 Analyze risk	✓	SM
17.5.4 Assess risk	✓	SM
17.5.5 Mitigate risk	✓	SM
17.6 Structural safety management applications	✓	SM
17.6.1 Application: implication of less reliance on OEMs for repaired parts	✓	SM
17.6.2 Application: nonconforming extensive repair involving metal bonding	✓	SM
17.6.3 Application: nonconforming extensive repair involving composite repair	✓	SM
17.7 Structural safety awareness course structure	✓	SM

CHAPTER 18 ENVIRONMENTAL MANAGEMENT

18.1 INTRODUCTION	✓	M
18.1.1 Scope	✓	M
18.1.2 Glossary of recycling terms	✓	M
18.2 RECYCLING INFRASTRUCTURE	✓	M
18.2.1 Recycling infrastructure development models	✓	M
18.2.2 Infrastructure needs	✓	M
18.2.3 Recycling education	✓	M
18.3 ECONOMICS OF COMPOSITE RECYCLING	✓	M
18.4 COMPOSITE WASTE STREAMS	✓	M
18.4.1 Process waste	✓	M
18.4.2 Post consumer composite waste	✓	M
18.5 COMPOSITE WASTE STREAM SOURCE REDUCTION	✓	M
18.5.1 Just-in-time and just enough material delivery	✓	M
18.5.2 Electronic commerce acquisition management	✓	M
18.5.3 Waste minimization guidelines	✓	M
18.5.3.1 Prepreg	✓	M
18.5.3.2 Resin	✓	M
18.5.3.3 Fiber	f	M
18.5.3.4 Curing agents	f	M
18.5.3.5 Autoclaving materials	f	M
18.5.3.6 Packaging materials	f	M
18.5.4 Lightweighting	✓	M
18.6 REUSE OF COMPOSITE COMPONENTS AND MATERIALS	✓	M
18.6.1 Reuse of composite components	✓	M
18.6.2 Machining to smaller components	✓	M
18.7 MATERIALS EXCHANGE	✓	M
18.7.1 Reallocation of precursors	✓	M
18.7.2 Composite materials exchange services	✓	M
18.7.2.1 Care of unused materials	✓	M
18.7.2.2 Packaging	✓	M
18.7.2.3 Documentation of care	✓	M
18.7.2.4 Description of unused materials	✓	M
18.7.2.5 DOD resale restrictions	✓	M
18.8 RECYCLING OF COMPOSITE MATERIALS	✓	M
18.8.1 Design for disassembly and recycling	✓	M
18.8.1.1 Fasteners	✓	M
18.8.1.2 Adhesives	✓	M
18.8.1.3 Hybrid composites	✓	M
18.8.2 Recycling logistics	✓	M
18.8.2.1 Collection and transportation	✓	M
18.8.2.2 Identification of fibers and matrices	✓	M
18.8.2.2.1 Fourier transform infrared spectroscopy	✓	M
18.8.2.2.2 Densitometry	✓	M
18.8.2.2.3 Coding of components	✓	M
18.8.2.2.4 Routing of waste streams	f	M
18.8.3 Processing of composite recyclate	✓	M
18.8.3.1 Size reduction	✓	M
18.8.3.2 Matrix removal	✓	M

18.8.3.3 Fiber reuse	✓	M
18.8.3.4 Products of matrix removal	✓	M
18.8.3.5 Other recycling and processing methods	✓	M
18.8.4 Recycling of waste prepreg	✓	M

CHAPTER 19 LAUNCH VEHICLES AND SPACECRAFT

19.1 LIFE CYCLE CONSIDERATIONTINTRODUCTION	r	P
19.2 MATERIAL SELECTION	r	P
19.3 DURABILITY AND DAMAGE TOLERANCE	r	P
19.4 SPACECRAFT SANDWICH STRUCTURE DESIGN CONSIDERATIONS	✓	P
19.4.1 Requirements and policies	✓	P
19.4.2 Managing Moisture and Internal Pressure in Spacecraft Sandwich Structure	✓	P
19.4.3 Cryogenic Sandwich Structural Design Complexities	r	P
19.4.4 Design Substantiation Testing and Analysis	r	P
19.5 ELECTROMAGNETIC COMPATIBILITY (EMC)	✓	P
19.6 STRUCTURAL REDUNDANCY AND FRACTURE CRITICAL STRUCTURES	✓	P
19.7 DESIGN SUBSTANTIATION	✓	P
19.8 COMPOSITE OVERWRAPPED PRESSURE VESSELS	✓	P
19.8.1 COPV design and fabrication	✓	P
19.8.2 Material allowables development	✓	P

VOLUME 6 Rev A Working Draft	Status	Working Group Responsibility
CHAPTER 1 GENERAL INFORMATION		
1.1 INTRODUCTION TO THE HANDBOOK	✓	SW
1.2 OVERVIEW OF HANDBOOK CONTENT	r	SW
1.3 INTRODUCTION	r	SW
1.4 NOMENCLATURE AND DEFINITIONS	✓	SW
1.4.1 Loads, geometry, and material properties	✓	SW
1.4.1.1 Subscripts	✓	SW
1.4.1.2 Superscripts	✓	SW
1.4.1.3 Assumptions and definitions	✓	SW
1.4.2 System of units	✓	SW
CHAPTER 2 GUIDELINES FOR PROPERTY TESTING		
2.1 INTRODUCTION	✓	SW
2.2 DATA REDUCTION AND PRESENTATION	✓	SW
2.3 EVALUATION OF CORE MATERIALS	✓	SW
2.3.1 Mechanical properties	✓	SW
2.3.2 Environmental effects	✓	SW
2.3.3 Test Methods	✓	SW
2.4 EVALUATION OF CORE-TO-FACE SHEET BONDS	✓	SW
2.4.1 Introduction	✓	SW
2.4.2 Mechanical properties	✓	SW
2.4.3 Environmental effects	✓	SW
2.4.4 Test Methods	✓	SW
2.5 EVALUATION OF FACE SHEET PROPERTIES	✓	SW
2.5.1 Introduction	✓	SW
2.5.2 Mechanical properties	✓	SW
2.5.3 Environmental effects	✓	SW
2.5.4 Test Methods	✓	SW
2.6 EVALUATION OF SANDWICH PANELS	✓	SW
2.6.1 Introduction	✓	SW
2.6.2 Mechanical properties	✓	SW
2.6.3 Environmental effects	✓	SW
2.6.4 Damage resistance	✓	SW
2.6.5 Damage tolerance	✓	SW
2.6.6 Repair	✓	SW
2.6.7 Test Methods	✓	SW
2.7 EVALUATION OF INSERTS AND FASTENERS	✓	SW
2.7.1 Introduction	✓	SW
2.7.2 Mechanical properties	✓	SW
2.7.3 Environmental effects	✓	SW
2.7.4 Test Methods	✓	SW
2.8 EVALUATION OF OTHER FEATURES	✓	SW
2.8.1 Introduction	✓	SW
2.8.2 Mechanical properties	✓	SW

2.8.3 Environmental effects	✓	SW
2.8.4 Test Methods	✓	SW

CHAPTER 3 MATERIAL DATA

3.1 CORES	✓	SW
3.1.1 Description of cores	✓	SW
3.1.2 Core specifications	✓	SW
3.1.3 Honeycomb cores	✓	SW
3.1.4 Cross-banded cores	✓	SW
3.1.5 Corrugated cores	✓	SW
3.1.6 Waffle-type cores	✓	SW
3.1.7 Foam cores	✓	SW
3.1.8 Wood cores	✓	SW
3.1.9 Core properties	✓	SW
3.1.9.1 Estimation of core properties	✓	SW
3.2 FACE SHEETS	✓	SW
3.2.1 Description of face shets	✓	SW
3.2.1.1 Adhesive-bonded pre-fabricated face sheets	✓	SW
3.2.1.2 Co-cured or co-bonded face sheets with adhesive	✓	SW
3.2.1.3 Self-adhesive face sheets	✓	SW
3.2.2 Face sheet properties	✓	SW
3.3 ADHESIVES	✓	SW
3.3.1 Description of adhesives	✓	SW
3.3.2 Adhesive specifications	✓	SW
3.3.3 Adhesive forms/types and uses	✓	SW
3.3.3.1 Resins from self-adhesive face sheets	✓	SW
3.3.3.2 Film adhesives	✓	SW
3.3.3.3 Paste adhesives	✓	SW
3.3.3.4 Liquid resins	✓	SW
3.3.3.5 Foaming adhesives	✓	SW
3.3.4 Adhesive chemistries	✓	SW
3.3.4.1 Epoxy	✓	SW
3.3.4.2 Bismaleimide	✓	SW
3.3.4.3 Phenols	✓	SW
3.3.4.4 Polyester	✓	SW
3.3.4.5 Polyimide	✓	SW
3.3.5 Adhesive properties	✓	SW

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4.1 INTRODUCTION	r	SW
4.2 DESIGN AND CERTIFICATION	r	SW
4.2.1 Basic design principles	r	SW
4.2.2 Design process	r	SW
4.2.3 Aircraft Damage tolerance	r	SW
4.3 CERTIFICATION	r	SW
4.3.1 Introduction to certification issues	r	SW
4.3.2 Approach to certification testing	r	SW
4.3.3 Analysis validation	r	SW

4.3.4 Conformity oversight	r	SW
4.3.5 Nondestructive testing (NDT)	r	SW
4.3.6 Documentation requirements	r	SW
4.3.7 Continued airworthiness	r	SW
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4.5.2 Plate stiffness analysis	r	SW
4.5.3 Combined Transverse and in-plane loadings	r	SW
4.5.4 Face sheet internal loads	r	SW
4.6 LOCAL STRENGTH ANALYSIS METHODS	r	SW
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4.6.2 Core shear	r	SW
4.6.3 Flatwise tension and compression	r	SW
4.6.4 Flexural core crushing	r	SW
4.6.5 Intracell buckling (dimpling)	r	SW
4.6.5.1 Sandwich having cellular (honeycomb) core	r	SW
4.6.5.2 Sandwich having corrugated core	r	SW
4.6.5.3 Shear intracell buckling	r	SW
4.6.5.4 Combined compression and shear intracell buckling	r	SW
4.6.6 Face sheet wrinkling	r	SW
4.6.6.1 Wrinkling of sandwich face sheets under edgewise load	r	SW
4.6.6.2 Sandwich with core supporting face sheets continuously	r	SW
4.6.6.3 Sandwich with honeycomb core	r	SW
4.6.6.4 Shear face sheet wrinkling	r	SW
4.6.6.5 Face sheet wrinkling - combined loads	r	SW
4.6.6.6 Face sheet wrinkling - curved panels	r	SW
4.6.7 Core shear crimping	r	SW
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4.7.2.1.1 Use of design charts	r	SW
4.7.2.1.2 Determining core shear stress	r	SW
4.7.2.1.3 Checking procedures	r	SW
4.7.2.2 Determining face sheet thickness, core thickness, and core shear modulus for simply supported flat circular panels under uniform load	r	SW
4.7.2.2.1 Use of design charts	r	SW
4.7.2.2.2 Determining core shear stress	r	SW
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4.8 CURVED SANDWICH PANEL INTERNAL LOADS AND STRESSES	r	SW

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4.9.2.2.1 Determination of minimum values of d	r	SW
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4.9.2.3 Checking procedure for determining buckling stress, Fcr	r	SW
4.9.3 Design of flat rectangular sandwich panels under edgewise shear load	r	SW
4.9.3.1 Determining face sheet thickness	r	SW
4.9.3.2 Determining core thickness and core shear modulus	r	SW
4.9.3.2.1 Determination of minimum values of d	r	SW
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4.9.4.1.2 Determination of actual values of d and t	r	SW
4.9.4.1.3 Checking procedure for sandwich strips of trapezoidal and rectangular cross section	r	SW
4.9.4.2 Determining face sheet thickness, core thickness and core shear modulus for sandwich strips of triangular cross section	r	SW
4.9.4.2.1 Determination of minimum values of t	r	SW
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4.11.2.2 Final design	r	SW
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4.11.2.1 Determining facesheet thickness, core thickness, and one core shear modulus to sandwich cylinders under external radial pressure	r	SW
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4.11.3.1 Determining face sheet thickness for sandwich cylinders under torsion	r	SW
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5.2.3 Adhesives	✓	SW
5.2.4 Surfacing and sealing	✓	SW
5.3 PROCESSES	✓	SW
5.3.1 Core	✓	SW
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5.3.1.2 Drying	✓	SW
5.3.1.3 Forming	✓	SW
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5.3.1.7 Core stabilization for machining	✓	SW

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5.3.3.3 Filleting	✓	SW
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6.2 MATERIAL PROCUREMENT QUALITY ASSURANCE PROCEDURES	✓	SW
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6.3 PART FABRICATION VERIFICATION	✓	SW
6.3.1 Process verification	✓	SW
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6.3.3 Destructive tests	✓	SW
6.4 STATISTICAL PROCESS CONTROL	✓	SW
6.5 MANAGING CHANGE IN MATERIALS AND PROCESSES	✓	SW

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7.2 DESIGN FOR SUPPORTABILITY	✓	SW
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7.2.7 Repairability	✓	SW
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7.3.2 Damage assessment	✓	SW
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7.3.4 Repair of composite structures	✓	SW
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7.3.4.4 Repair procedures	✓	SW
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7.3.4.6 Repair validation	✓	SW
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8.3 NASA SPACECRAFT LESSONS		SW
8.4 LEONARDO HELICOPTER TAIL BOOM FAILURE		SW
8.5 HAWKER JET FUSELAGE DEVELOPMENT		SW
8.6 SANDWICH COMPOSITE WING DEMONSTRATOR		SW
8.7 AIRBUS SANDWICH DISBOND STUDY		SW
8.8 HELICOPTER TAIL BOOM ANALYSIS DEMONSTRATOR		SW
8.9 SANDWICH NDE METHODS DEVELOPED		SW

COMPOSITE MATERIALS HANDBOOK 17

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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.

OBTAINING CMH-17

VOLUMES 1 and 3 REVISION G (2012), 2 REVISION H (2018), 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. SAE (http://store.sae.org/cmh-17/) offers a hardcopy version of the five volumes of the handbook (Volumes 1 and 3 – G, 2-H, 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 –

http://cmh17.org/RESOURCES/StatisticsSoftware.aspx

Update: 10/30/2018

COMPOSITE MATERIALS HANDBOOK 17

IMPORTANT DATES

IMPORTANT DATES

COMPOSITE MATERIALS HANDBOOK PMC COORDINATION
March 2021 through October 2021 DUE DATES

March 2021	**PMC Coordination Meeting** **March 3 – 31, 2021 - Virtual**
April	April 23 - Minutes, 1st Cycle Yellow Pages and Presentations due to Secretariat (PMC) – *send to info@cmh17.org*
May	May 17 – Proceedings and 1st Yellow Page cycle complete and posted on website
June	June 21, 2021 – 1st Yellow Page ballot comments due to Secretariat (PMC)
July	2nd Yellow Pages Ballot posted – *tentative*
August	
September	2nd Yellow Page Cycle ballot and comments due to Secretariat - *tentative*
October	October 25-28, 2021 PMC Coordination Meeting, Wichita State University- *tentative*

COMPOSITE MATERIALS HANDBOOK 17

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