Core Material Qualification Guidance for Aircraft Design and Certification

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Project Overview

Overall Goals

- Develop a framework for the qualification of **core materials** including guidelines and recommendations for their characterization, testing, design and utilization within the aerospace industry.
- Second goal: To transition the test data and guidelines generated in this program into shared databases, such as **CMH-17.**

CMH-17 COMPOSITE MATERIALS HANDBOOK

Research Outputs

- **Trial test results** that provide valuable lessons learned regarding test methods best suited for core materials
- **Qualification framework for core materials**
  - **Material and process specifications**
  - **Test matrix and subsequent test plan including required physical and mechanical test methods. Mechanical test plan inclusive of relevant environments for these materials and applications.**
- Lessons learned, guidelines, and data made available to **CMH-17**

Establishment of Industry Steering Committee

Framework Development (Trial Testing)

- Industry Survey
- Material Selection
- Material Acquisition and Fabrication
- Testing, Data Reduction and Data Analysis
- Steering Committee Review

Qualification Program

WE ARE HERE

- Test Plan & Specification Development
- Material Acquisition & Panel Fabrication
- Testing & Data Reduction
- Data Review (Statistical Analysis)
- Reports and Specifications Published

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Industry Survey

- **Goal of Survey:** ***Generate industry driven input on the development of a qualification framework for core materials***
- **48 responses from 23 organizations** (50% OEMS, 24% Tier 1 suppliers, others – consultants, government, academia)
  - Question 5 – Core materials primarily used by respondents:
    - **98% Honeycomb**
    - 80% Foam
    - 20% Corrugated
  - Question 6 – Core materials and parts/applications currently in use:
    - Materials: **Nomex honeycomb core** mentioned in nearly every response but other materials mentioned (fiberglass, closed cell foams)
    - Parts/applications: Secondary structures – control surfaces, access panels, fairings, spoilers
  - Questions 7 – Materials for future aircraft structures (5-10 years):
    - **91% Honeycomb**
    - 72% Foam
    - 20% Corrugated

Question	Answer Type
Q1: Company Name	Text box
Q2: What is your company's role in the aviation industry?	Radio buttons with pre-selected options + "other" option and comments box
Q3: Are you familiar with CMH-17 (previously known as MIL-17)?	Yes/No
Q4: Are you familiar with the NCAMP qualification and equivalency program through Wichita State University – NIAR?	Yes/No
Q5: Please identify the core material forms that you are currently utilizing in aircraft structures. Check all that apply.	**Select from following general options (multiple selections allowed):** ***Honeycomb, Cross-Banded, Corrugate, Waffle-Type, Foam, Natural (balsa wood and others), Other (please specify)***
Q6: Please specify the core materials and parts/applications currently in use- Multiple materials/parts can be listed	**Text box**
Q7: Please identify the core material forms that are proposed for future aircraft structures (5-10 years). Check all that apply.	**Select from following general options (multiple selections allowed):** ***Honeycomb, Cross-Banded, Corrugated, Waffle-Type, Foams, Natural (balsa wood and others), Other (please specify)***
Q8: Please specify the core material and parts/applications proposed for future aircraft- Multiple materials can be listed	Text box
Q9: Are there other core materials that you believe are likely to produce structural components in aircraft within the next 5-10 years?	List core type List materials (facesheet/core) List parts/application
Q10: Please rate the following statements for implementing new core materials from Strongly Disagree to Strongly Agree.	*Cost, Availability, Producibility, Lack of trained personnel , Lack of design and certification guidelines, Lack of available qualification data, Joint design, Flaw detection by NDI, Reparability*
Q11: Are you interested in serving on a peer advisory committee to provide technical expertise on the development of the methodology?	Yes/No If Yes, users directed page to enter contact information
Q12: Is your company interested in contributing materials and/or resources to the development of data for incorporation of results into CMH-17 and other sources for the general public?	Yes/No If Yes, users directed page to enter contact information

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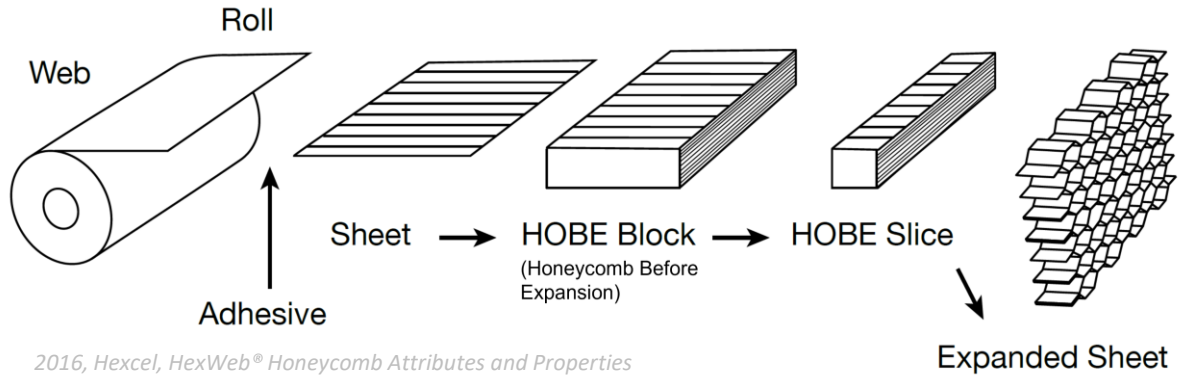
Overview of Core Material Selected

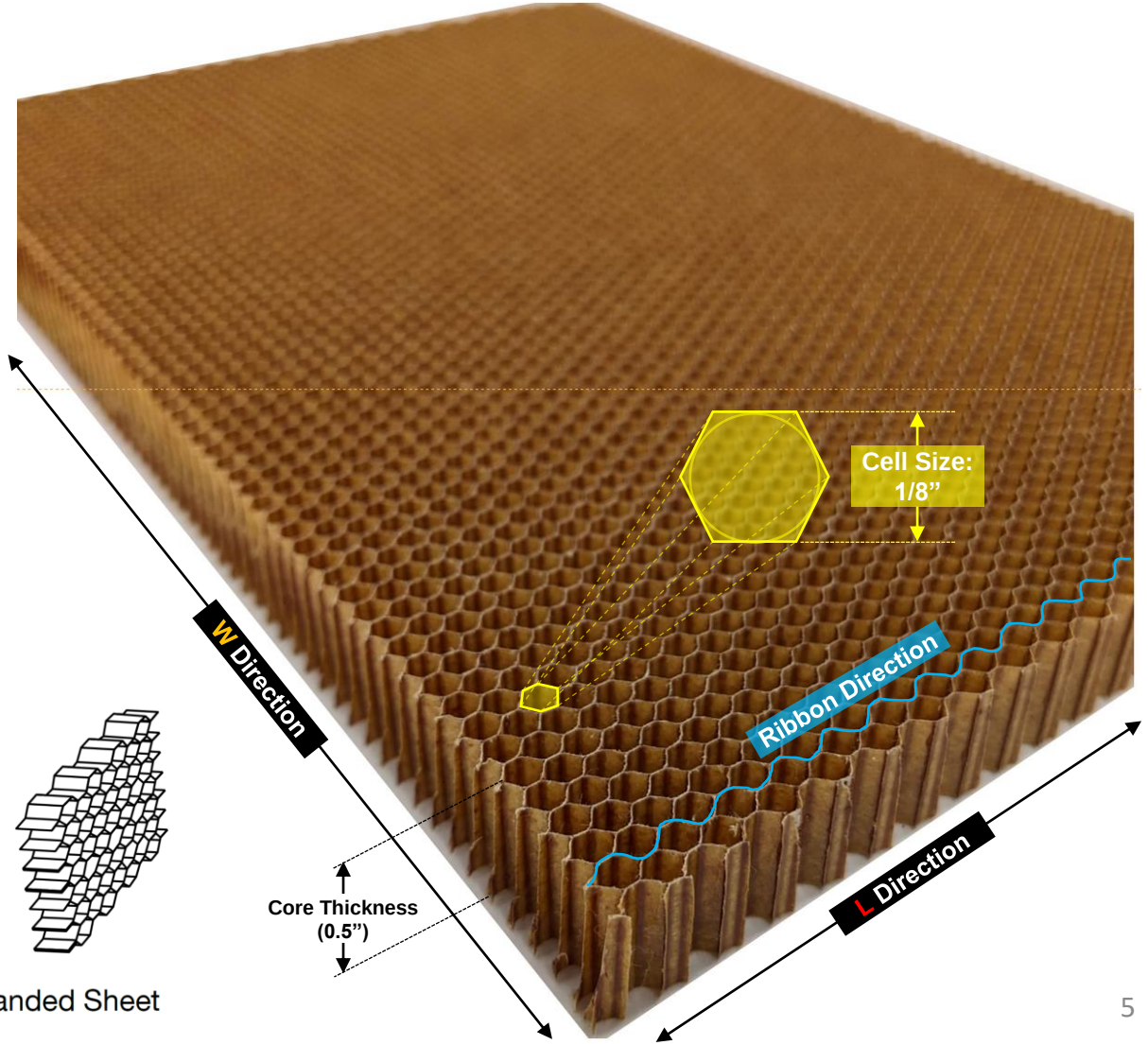
Material	Description	Selection Support
Honeycomb Core	**HexWeb® HRH-10-1/8-3.0**	**Committee feedback & Survey Commonly used in industry**
Facesheet Prepreg	HexPly® AGP193P(NT)/8552S;38%;193AW;50	NCAMP Qualified
Film Adhesive	FM 300-2M	NCAMP Qualification in Progress

HexWeb® — Hexcel Product Line

HRH-10-1/8-3.0

- **HRH**: Honeycomb Type: Aramid Fiber/Phenolic Resin Honeycomb
- **10**: Cell Size (inches)
- **1/8**: Nominal Density (lbm/ft³)
- **3.0**





Trial Test Matrix

Goal of Trial Testing: ***Evaluate selected core material using a notional test matrix (formed through the steering committee) to aid in developing the qualification test matrix.***

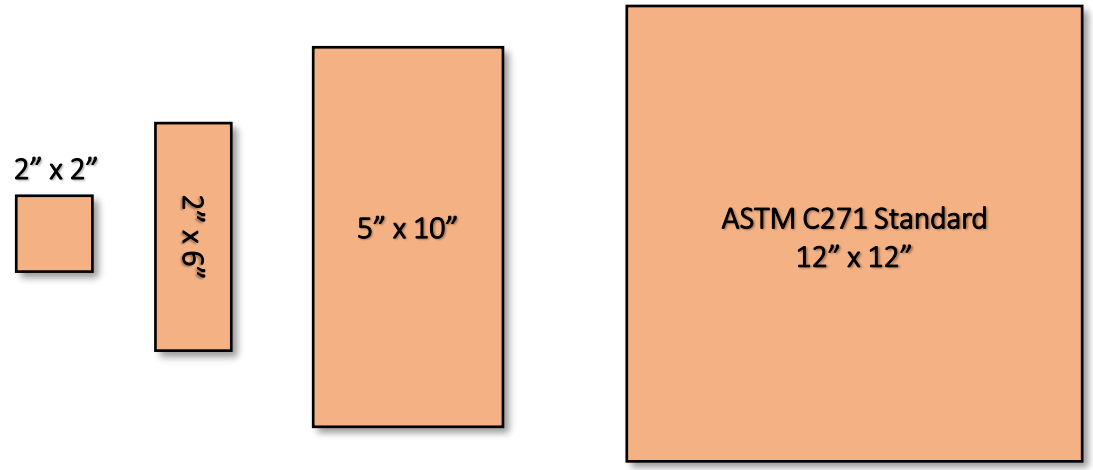
- **Core Physical Properties**
  - ASTM C271 "Standard Test Method for Density of Sandwich Core Materials"
- **Core Mechanical Test Methods**
  - ASTM C273 "Standard Test Method for Shear Properties of Sandwich Core Materials" (L & W Directions)
    - *Shear strength for honeycomb core varies with core thickness – effective strength used for design reduced by associated K factor)*
  - ASTM C365 "Standard Test Method for Flatwise Compressive Properties of Sandwich Cores" (Bare & Stabilized)
  - ASTM C363 "Standard Test Method for Node Tensile Strength of Honeycomb Core Materials"
- **Panel Test Methods (emphasis on generating core properties)**
  - ASTM C297 "Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions"
  - ASTM C364 "Standard Test Method for Edgewise Compressive Strength of Sandwich Constructions"
  - ASTM D1781 "Standard Test Method for Climbing Drum Peel for Adhesives"
  - ASTM C393 "Standard Test Method for Core Shear Properties of Sandwich Constructions by Beam Flexure"
  - ASTM D7249 "Standard Test Method for Facesheet properties of Sandwich Constructions by Long Beam Flexure"

Mechanical Test Properties					
Layup (Warp Direction)	Test Type and Direction	Property	Number of Batches x Number of Panels x Number of Test Specimens		
			Test Temperature/Moisture Condition		
			RTD	ETD1 (180F)	ETW1 (180F)
N/A	Core Shear (L) ASTM C273 (0.5" thick core) (1)	Strength and Modulus	1x1x5	1x1x5	1x1x5
N/A	Core Shear (W) ASTM C273 (0.5" thick core) (1)	Strength and Modulus	1x1x5	1x1x5	1x1x5
N/A	Bare Compression ASTM C365 (0.5" thick core)	Strength	1x1x5		
4 core 4 (2)(3)	Stabilized Compression ASTM C365 (0.5" thick core)	Strength and Modulus	1x1x5	1x1x5	1x1x5
N/A	Node Tensile Strength ASTM C363 (0.5" thick core)	Strength	1x1x5		
4 core 4 (2)(3)	Flatwise Tension ASTM C297 (0.5" thick core)	Strength	1x1x5	1x1x5	1x1x5
4 core 4 (2)(3)	Edgewise Compression ASTM C364	Strength and Modulus	1x1x5		
4 core 2 (2)(3)	Climbing Drum Peel ASTM D1781	Strength	1x1x5		
4 core 4 (2)(3)	Core Shear Stress ASTM C393	Strength and Modulus	1x1x5	1x1x5	1x1x5
4 core 4 (2)(3)	Long Beam Flex ASTM D7249	Strength and Modulus	1x1x5		
Note 1: The core thickness used for the qual and the thickness correction factor coupons can be changed to match what is available and/or required.					
Note 2: 4 core 4 corresponds to 4 plies for top facesheet bonded to core with 2 plies of film adhesive and 4 plies for the bottom facesheet bonded to the core with 2 plies of film adhesive. Facesheet layup will be [0,90,90,0] and [0,90].					
Note 3: The stacking sequence can be changed to match what is required and/or desired.					

Trial Test Results – Physical Testing

- ASTM C271 recommends the minimum specimen size to be 12-inches by 12-inches with a thickness equivalent to the core thickness
  - This will be followed for the qualification, however, data was generated for several sizes in the trial testing

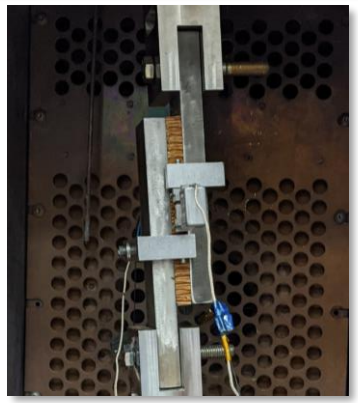
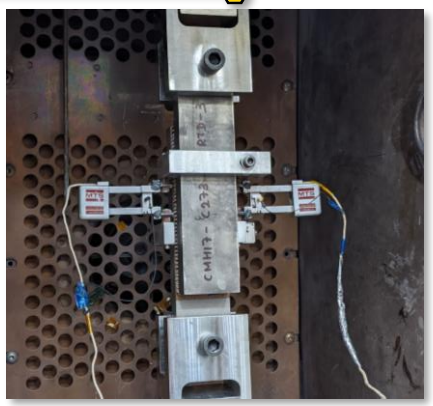
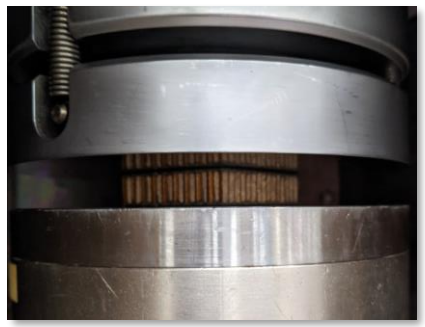
Test Method Description	ASTM	Property	Specimen Size			
			2"x2"	2"x6"	5"x10"	12"x12"
Core Density	C271	***Avg. Density (lbm/ft³)***	**3.377**	**3.263**	**3.166**	**3.296**
		St. Dev.	0.0614	0.0730	0.0677	0.0546
		CV	1.820	2.236	2.138	1.656
		No. of Specimens	10	53	16	12
			91 Specimens			

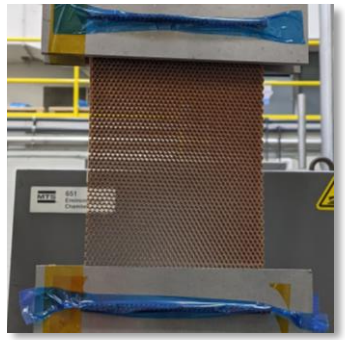


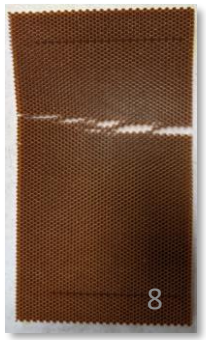
Trial Testing Results – Core Mechanical Testing

- Shear Strength in (L) ribbon direction nearly two times the (W) transverse direction as expected
- Highest C.V. witnessed with stabilized flatwise compression at ETW condition
- Node Tension Testing: Multiple **Failures at Loading Pins**

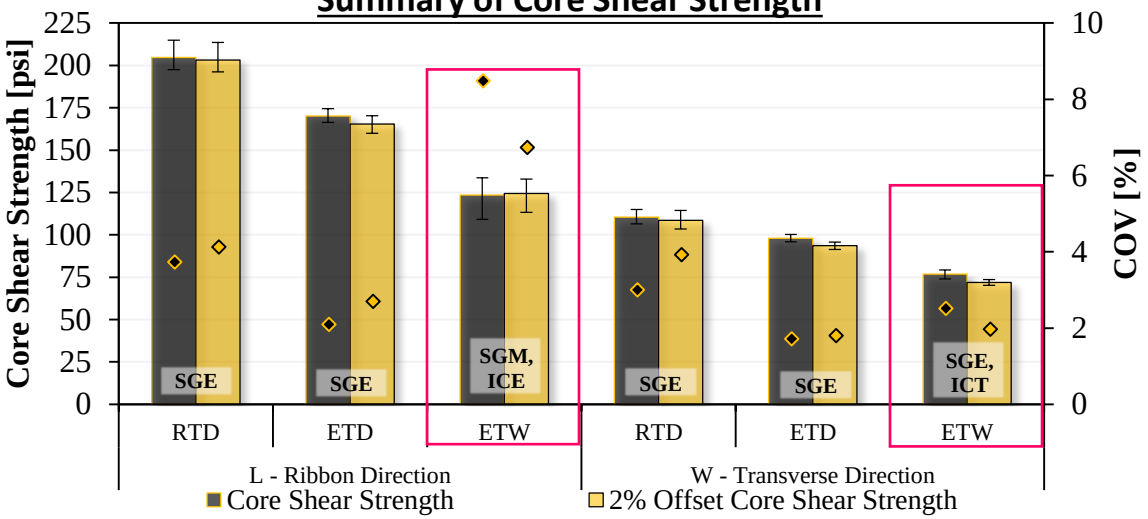
Test Method Description	ASTM	Property	RTD	ETD	ETW
Core Shear (L)	C273	***Strength (psi)***	**204.6**	**170.1**	**115.9**
		St. Dev.	7.633	3.562	3.320
		C.V. (%)	3.730	2.094	2.866
		No. of Specimens	5	5	6
		2% Offset Strength (psi)	**203.1**	**165.3**	**111.1**
		St. Dev.	8.385	4.468	3.672
		C.V. (%)	4.128	2.702	3.305
		No. of Specimens	4	5	6
		Modulus (ksi)	**6.620**	**5.969**	**4.410**
		St. Dev.	0.2372	0.1909	0.1156
		C.V. (%)	3.583	3.198	2.621
		No. of Specimens	5	5	6
Core Shear (W)	C273	***Strength (psi)***	**110.5**	**98.06**	**76.90**
		St. Dev.	3.315	1.685	1.932
		C.V. (%)	3.001	1.719	2.513
		No. of Specimens	6	5	5
		2% Offset Strength (psi)	**108.6**	**93.61**	**71.84**
		St. Dev.	4.266	1.687	1.415
		C.V. (%)	3.927	1.802	1.970
		No. of Specimens	6	5	5
		Modulus (ksi)	**3.942**	**3.479**	**3.326**
		St. Dev.	0.1132	0.0757	0.0954
		C.V. (%)	2.872	2.177	2.867
		No. of Specimens	6	5	5
Bare Flatwise Compression	C365	***Strength (psi)***	**335.5**		
		St. Dev.	5.426		
		C.V. (%)	1.617		
		No. of Specimens	5		
Stabilized Flatwise Compression	C365	***Strength (psi)***	**458.9**	**404.6**	**295.8**
		St. Dev.	4.136	5.364	32.03
		C.V. (%)	0.9014	1.326	10.83
		No. of Specimens	6	5	7
		Modulus (ksi)	**29.54**	**25.82**	**22.51**
		St. Dev.	0.6260	0.9221	1.424
		C.V. (%)	2.119	3.572	6.326
		No. of Specimens	6	5	7
Node Tensile	C363	***Strength (psi)***	**18.24**		
		St. Dev.	1.485		
		C.V. (%)	8.139		
		No. of Specimens	6		

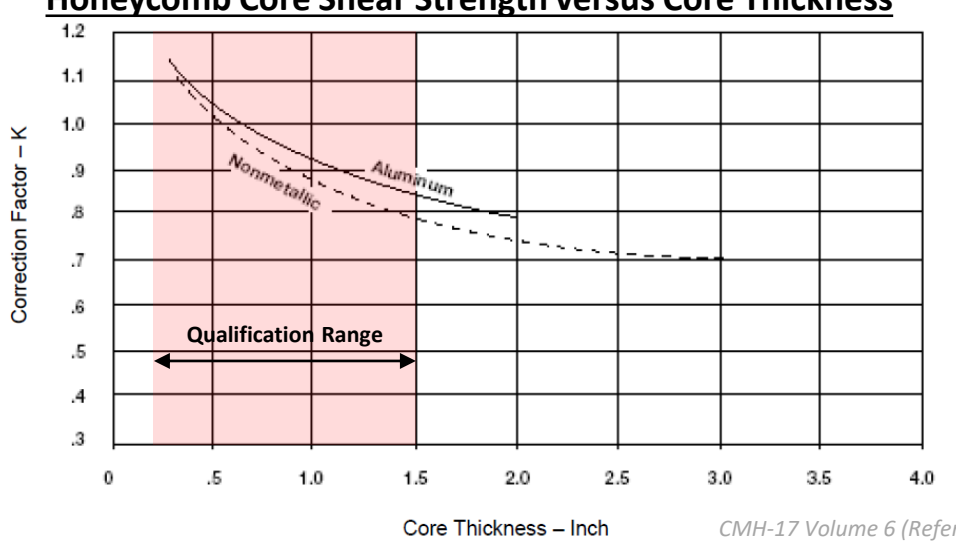






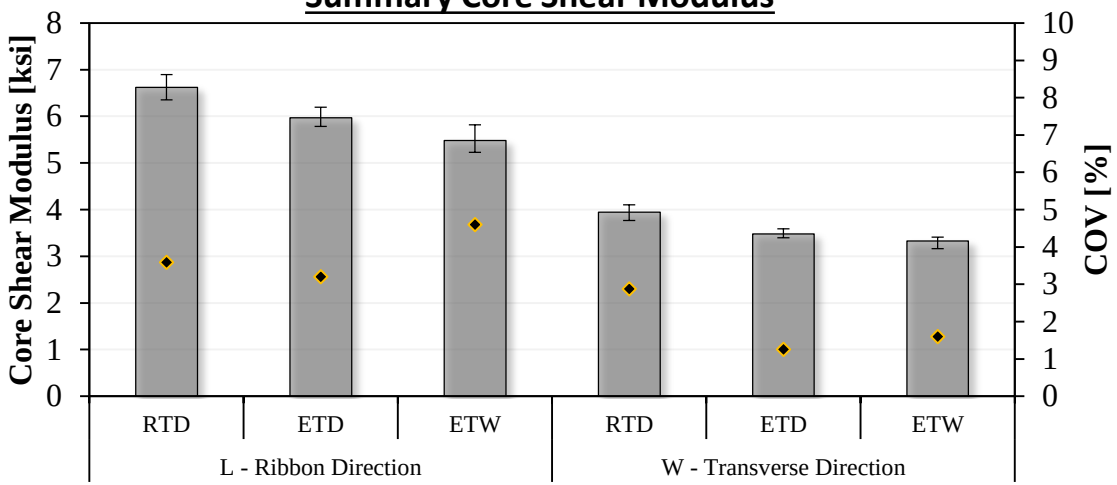


Trial Testing Results – ASTM C273 Core Shear



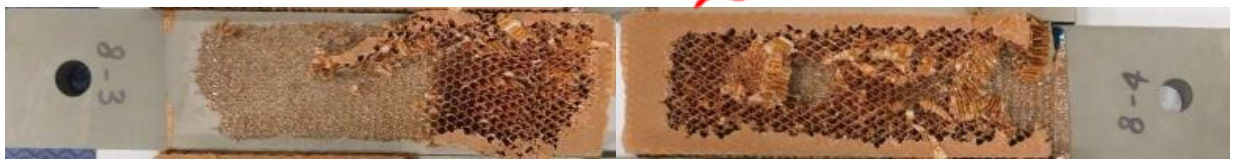


CMH-17 Volume 6 (Reference 2.3.3)



SGE ✓

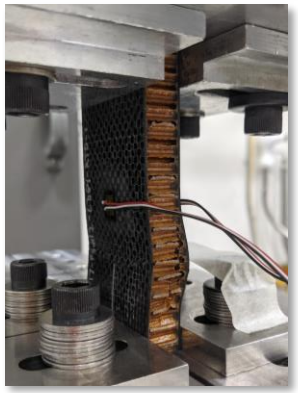
SGM / ICE ✗



Trial Testing Results – Panel Mechanical Testing

- Edgewise Compression
  - Primarily facesheet property (removed for qualification)
- Climbing Drum Peel
  - Committee interest

Test Method Description	ASTM	Property	RTD	ETD	ETW
Core Shear Stress	C393	***Ultimate Stress (psi)***	**212.7**	**197.9**	**146.2**
		St. Dev.	4.751	4.184	2.309
		C.V. (%)	2.233	2.115	1.58
		No. of Specimens	5	5	6
		Bending Stress (ksi)	**24.50**	**21.65**	**16.11**
		St. Dev.	1.216	0.6138	0.5930
		C.V. (%)	4.965	2.836	3.682
		No. of Specimens	5	5	6
Edgewise Compression	C364	***Strength (ksi)***	**63.02**		
		St. Dev.	4.152		
		C.V. (%)	6.589		
		No. of Specimens	6		
		Modulus (Msi)	**9.569**		
		St. Dev.	0.4065		
		C.V. (%)	4.248		
		No. of Specimens	6		
Climbing Drum Peel	D1781	***Avg Peel Torque (in-lb/in)***	**12.86**		
		St. Dev.	1.056		
		C.V. (%)	8.213		
		No. of Specimens	5		
Long Beam Flex	D7249	***Ultimate Stress (psi)***	**61459.7**		
		St. Dev.	3245.9		
		C.V. (%)	5.281		
		No. of Specimens	5		
		Chord Modulus (tensile) (Msi)	**10.91**		
		St. Dev.	0.4514		
		C.V. (%)	4.137		
		No. of Specimens	5		
		Chord Modulus (compressive) (Msi)	**10.07**		
		St. Dev.	0.3695		
		C.V. (%)	3.67		
		No. of Specimens	5		
		Stiffness (M lb.in2)	**0.1200**		
		St. Dev.	0.002054		
		C.V. (%)	1.711		
		No. of Specimens	5		



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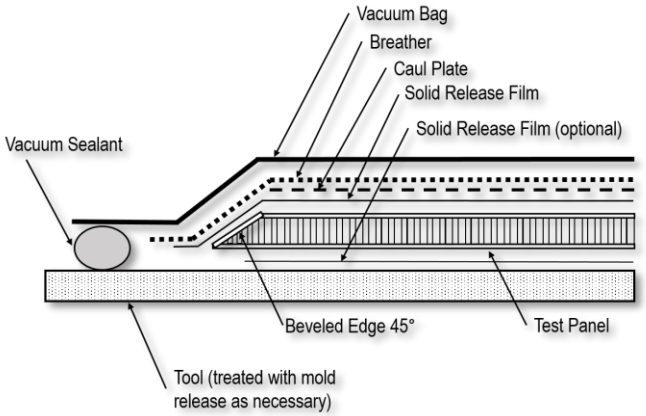
Summary of Qualification Documentation

- NCAMP Test Plan
  - Batch Definition
    - Paper is tracked via distinguishable lots
    - Resin Dip Date is tracked via a “unique” resin batch with at least 3-4 weeks between the dates.
- NCAMP Material Specification
  - Material Spec Limits
    - Core Mechanical & Physical Properties
- NCAMP Process Specification



Batch Definition

Core Batch	A	B	C
Paper Lot	Paper Lot 1	Paper Lot 2	Paper Lot 3
Resin Dip Date	MM/DD/YYYY	MM/DD/YYYY	MM/DD/YYYY

Material Specification Required Mechanical Properties

Property	Test Method	Number of Replicates
Bare Compression Strength	ASTM C365	3 per batch
Plate Shear Strength (L)	ASTM C273	3 per batch
Plate Shear Strength (W)	ASTM C273	3 per batch

Material Specification Required Physical Properties

Property	Test Method	Number of Replicates
Core Density	ASTM C271	3 per batch
Flame Resistance (1)	DOT/FAA/AR-00/12 Chapter 1	3 per batch

Note 1: Flammability will only be tested as part of the qualification program and will be removed as long as the material passes FAA requirements. The data will be left in the reports to show the material does pass this requirement and provide information for potential users.

Qualification Test Matrix

Mechanical Test Matrix

Layup (Warp Direction)	Test Type and Direction	Core Thickness	Property	Number of Batches x Number of Sheets x Number of Test Specimens			
				Test Temperature/Moisture Condition			
				CTD	RTD	ETD1	ETW1
N/A	Core Shear (L) ASTM C273	0.5"	Strength and Modulus	3x2x3	3x2x3	3x2x3	1x2x3
N/A	Core Shear (W) ASTM C273	0.5"	Strength and Modulus	3x2x3	3x2x3	3x2x3	1x2x3
N/A	Core Shear (L) ASTM C273	0.25" 0.375" 0.75" 1.0" 1.5"	Strength and Modulus (thickness correction factor)	1x2x4	1x2x4	1x2x4	1x2x4
N/A	Core Shear (W) ASTM C273	0.25" 0.375" 0.75" 1.0" 1.5"	Strength and Modulus (thickness correction factor)	1x2x4	1x2x4	1x2x4	1x2x4
N/A	Bare Flatwise Core Compression ASTM C365	0.5"	Strength	3x2x3	3x2x3	3x2x3	1x2x3
4 core 4 (1)	Stabilized Flatwise Core Compression ASTM C365	0.5"	Strength and Modulus	3x2x3	3x2x3	3x2x3	1x2x3
4 core 4 (1)	Flatwise Tension ASTM C297	0.5"	Strength	3x2x3	3x2x3	3x2x3	1x2x3
4 core 2 (1)	Climbing Drum Peel ASTM D1781	0.5"	Strength	3x2x3	3x2x3	3x2x3	1x2x3
4 core 4 (1)	Core Shear Stress ASTM C393	0.5"	Strength and Modulus	3x2x3	3x2x3	3x2x3	1x2x3
4 core 4 (1)	Long Beam Flex ASTM D7249	0.5"	Strength and Modulus	3x2x3	3x2x3	3x2x3	1x2x3

Note 1: "4 core 4" corresponds to 4 plies for top facesheet bonded to core with 2 plies of film adhesive and 4 plies for the bottom facesheet bonded to the core with 2 plies of film adhesive. Facesheet layup will be [0,90,90,0] for 4 ply facesheets and [0,90] for 2 ply facesheets.

Physical Test Matrix

Property	Condition/Method	Min Replicates per Test Type
Core Thickness	ASTM C366	All data from mechanical test specimens
Core Density	ASTM C271	Density to be taken from each sheet of core material used with 10 replicates per sheet.

Fluid Sensitivity Test Matrix (ASTM C365 Bare)

Extended Contact:	Exposure	Test Condition	Code
ASTM D1655 Jet A Fuel (other jet fuel may be used but its type must be reported)	90 days min. @ 70°F±10°F	70°F	FS12RT
	90 days min. @ 70°F±10°F	180°F	FS12ET
MIL-PRF-5606 Hydraulic Oil	90 days min. @ 70°F±10°F	70°F	FS13RT
	90 days min. @ 70°F±10°F	180°F	FS13ET
MIL-PRF-83282 Hydraulic Oil	90 days min. @ 70°F±10°F	70°F	FS14RT
	90 days min. @ 70°F±10°F	180°F	FS14ET
MIL-PRF-7808 Engine Oil	90 days min. @ 70°F±10°F	70°F	FS15RT
	90 days min. @ 70°F±10°F	180°F	FS15ET
MIL-PRF-23699, Class STD Engine Oil	90 days min. @ 70°F±10°F	70°F	FS16RT
	90 days min. @ 70°F±10°F	180°F	FS16ET
Sea Water (ASTM D1141 or equiv.)	90 days min. @ 70°F±10°F	70°F	FS17RT
	90 days min. @ 70°F±10°F	180°F	FS17ET
Skydrol LD-4 (SAE AS1241, Type IV, Class 1)	90 days min. @ 70°F±10°F	70°F	FS18RT
	90 days min. @ 70°F±10°F	180°F	FS18ET
50% Water with 50% Skydrol LD-4 (SAE AS1241, Type IV, Class 1)	90 days min. @ 70°F±10°F	70°F	FS19RT
	90 days min. @ 70°F±10°F	180°F	FS19ET
Short Duration Contact:			
MEK washing fluid. ASTM D740	90 minutes min. @ 70°F±10°F	70°F	FS21RT
	90 minutes min. @ 70°F±10°F	180°F	FS21ET
Polypropylene Glycol Deicer (Type I) SAE AMS 1424	90 minutes min. @ 70°F±10°F	70°F	FS22RT
	90 minutes min. @ 70°F±10°F	180°F	FS22ET
Isopropyl Alcohol Deicing Agent (TT-I-735)	48±4 hours @70°F±10°F	70°F	FS23RT
	48±4 hours @70°F±10°F	180°F	FS23ET
Control Tests:			
Distilled Water	90 days min. at 70°F±10°F	70°F	FS31RT
	90 days min. at 70°F±10°F	180°F	FS31ET
Dry	Dry per section 6.1	70°F	FS32RT
	Dry per section 6.1	180°F	FS32ET
85% Relative Humidity	Per section 6.1	70°F	FS33RT
	Per section 6.1	180°F	FS33ET

Qualification Test Matrix

Mechanical Test Matrix

Layup (Warp Direction)	Test Type and Direction	Core Thickness	Property	Number of Batches x Number of Sheets x Number of Test Specimens			
				Test Temperature/Moisture Condition			
				CTD	RTD	ETD1	ETW1
N/A	Core Shear (L) ASTM C273	0.5"	Strength and Modulus	3x2x3	3x2x3	3x2x3	1x2x3
N/A	Core Shear (W) ASTM C273	0.5"	Strength and Modulus	3x2x3	3x2x3	3x2x3	1x2x3
N/A	Core Shear (L) ASTM C273	0.25" 0.375" 0.75" 1.0" 1.5"	Strength and Modulus (thickness correction factor)	1x2x4	1x2x4	1x2x4	1x2x4
N/A	Core Shear (W) ASTM C273	0.25" 0.375" 0.75" 1.0" 1.5"	Strength and Modulus (thickness correction factor)	1x2x4	1x2x4	1x2x4	1x2x4
N/A	Bare Flatwise Core Compression ASTM C365	0.5"	Strength	3x2x3	3x2x3	3x2x3	1x2x3
4 core 4 (1)	Stabilized Flatwise Core Compression ASTM C365	0.5"	Strength and Modulus	3x2x3	3x2x3	3x2x3	1x2x3
4 core 4 (1)	Flatwise Tension ASTM C297	0.5"	Strength	3x2x3	3x2x3	3x2x3	1x2x3
4 core 2 (1)	Climbing Drum Peel ASTM D1781	0.5"	Strength	3x2x3	3x2x3	3x2x3	1x2x3
4 core 4 (1)	Core Shear Stress ASTM C393	0.5"	Strength and Modulus	3x2x3	3x2x3	3x2x3	1x2x3
4 core 4 (1)	Long Beam Flex ASTM D7249	0.5"	Strength and Modulus	3x2x3	3x2x3	3x2x3	1x2x3

Thickness Correction Factor Range

Single Batch for Wet Properties

Note 1: "4 core 4" corresponds to 4 plies for top facesheet bonded to core with 2 plies of film adhesive and 4 plies for the bottom facesheet bonded to the core with 2 plies of film adhesive. Facesheet layup will be [0,90,90,0] for 4 ply facesheets and [0,90] for 2 ply facesheets.

Physical Test Matrix

Property	Condition/Method	Min Replicates per Test Type
Core Thickness	ASTM C366	All data from mechanical test specimens
Core Density	ASTM C271	Density to be taken from each sheet of core material used with 10 replicates per sheet.

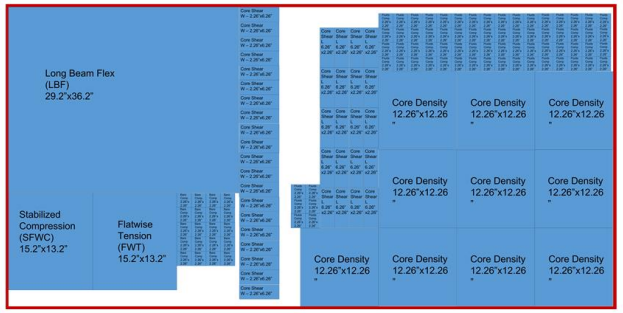
Fluid Sensitivity Test Matrix (ASTM C365 Bare)

Extended Contact:	Exposure	Test Condition	Code
ASTM D1655 Jet A Fuel (other jet fuel may be used but its type must be reported)	90 days min. @ 70°F±10°F	70°F	FS12RT
	90 days min. @ 70°F±10°F	180°F	FS12ET
MIL-PRF-5606 Hydraulic Oil	90 days min. @ 70°F±10°F	70°F	FS13RT
	90 days min. @ 70°F±10°F	180°F	FS13ET
MIL-PRF-83282 Hydraulic Oil	90 days min. @ 70°F±10°F	70°F	FS14RT
	90 days min. @ 70°F±10°F	180°F	FS14ET
MIL-PRF-7808 Engine Oil	90 days min. @ 70°F±10°F	70°F	FS15RT
	90 days min. @ 70°F±10°F	180°F	FS15ET
MIL-PRF-23699, Class STD Engine Oil	90 days min. @ 70°F±10°F	70°F	FS16RT
	90 days min. @ 70°F±10°F	180°F	FS16ET
Sea Water (ASTM D1141 or equiv.)	90 days min. @ 70°F±10°F	70°F	FS17RT
	90 days min. @ 70°F±10°F	180°F	FS17ET
Skydrol LD-4 (SAE AS1241, Type IV, Class 1)	90 days min. @ 70°F±10°F	70°F	FS18RT
	90 days min. @ 70°F±10°F	180°F	FS18ET
50% Water with 50% Skydrol LD-4 (SAE AS1241, Type IV, Class 1)	90 days min. @ 70°F±10°F	70°F	FS19RT
	90 days min. @ 70°F±10°F	180°F	FS19ET
Short Duration Contact:			
MEK washing fluid. ASTM D740	90 minutes min. @ 70°F±10°F	70°F	FS21RT
	90 minutes min. @ 70°F±10°F	180°F	FS21ET
Polypropylene Glycol Deicer (Type I) SAE AMS 1424	90 minutes min. @ 70°F±10°F	70°F	FS22RT
	90 minutes min. @ 70°F±10°F	180°F	FS22ET
Isopropyl Alcohol Deicing Agent (TT-I-735)	48±4 hours @70°F±10°F	70°F	FS23RT
	48±4 hours @70°F±10°F	180°F	FS23ET
Control Tests:			
Distilled Water	90 days min. at 70°F±10°F	70°F	FS31RT
	90 days min. at 70°F±10°F	180°F	FS31ET
Dry	Dry per section 6.1	70°F	FS32RT
	Dry per section 6.1	180°F	FS32ET
85% Relative Humidity	Per section 6.1	70°F	FS33RT
	Per section 6.1	180°F	FS33ET

Fluid Sensitivity Using Bare ASTM C365

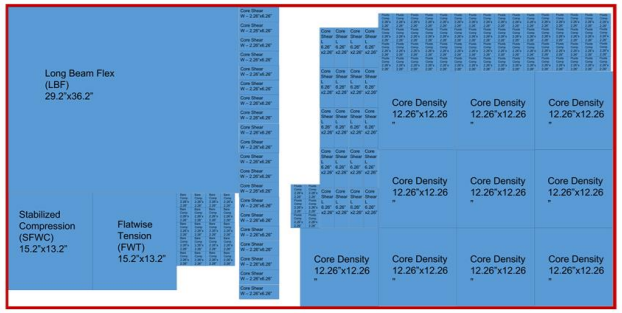
Status of Qualification Testing

Material Received			
Material	**Description**	**Quantity (Sheets / Roll Length)**	**Batch No.**
Honeycomb Core HexWeb® HRH-10-1/8-3.0	Batch A 0.5"	7	NA34151
	Batch B 0.5"	6	NA34469
	Batch C 0.5"	6	NA34523
	Batch A 0.25"	1	NA34151
	Batch A 0.375"	1	NA34151
	Batch A 0.75"	1	NA34151
	Batch A 1.0"	1	NA34151
	Batch A 1.5"	1	NA34151
Facesheet Prepreg	HexPly® AGP193P(NT)/8552 S;38%;193AW;50	225.8 yds	92M0081054
Film Adhesive	FM 300-2M	167.05 yds	-



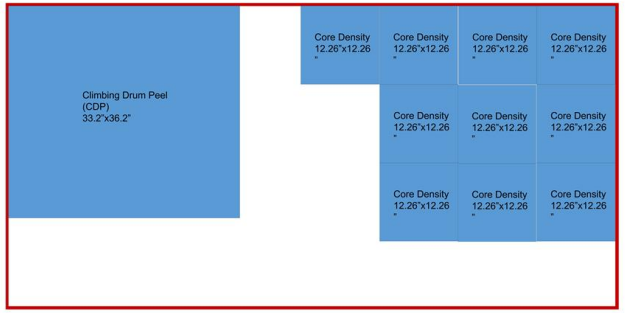
Batch A Sheet 1 0.5”

0.5” border around all panel edges (red)
0.13” added on all sides of all specimens
All measurements 0°(W)x90°(L)



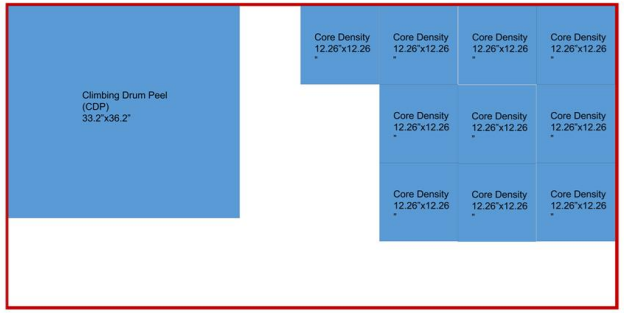
Batch A Sheet 2 0.5”

0.5” border around all panel edges (red)
0.13” added on all sides of all specimens
All measurements 0°(W)x90°(L)



Batch A Sheet 3 0.5”

0.5” border around all panel edges (red)
0.13” added on all sides of all specimens
All measurements 0°(W)x90°(L)



Batch A Sheet 4 0.5”

0.5” border around all panel edges (red)
0.13” added on all sides of all specimens
All measurements 0°(W)x90°(L)

Batch A Sheet 5 0.5”

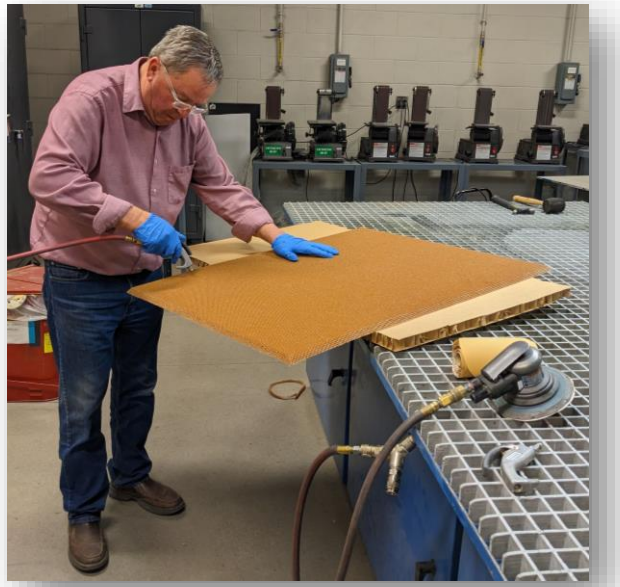
0.5” border around all panel edges (red)
0.13” added on all sides of all specimens
All measurements 0°(W)x90°(L)

Batch A Sheet 6 0.5”

0.5” border around all panel edges (red)
0.13” added on all sides of all specimens
All measurements 0°(W)x90°(L)

Program Status & Summary

- All 3 batches of core have been delivered to NIAR.
- All core has been cut for sandwich panels to be fabricated.
- Bare core test specimens have be cut in preparation for conformity



Program Status & Next Steps

- **Honeycomb Core Qualification Program**
  - Specimen and Panel preparation
  - Panel Fabrication
  - Specimen ETW Saturation
  - Qualification Testing
  - Data Review
- **Benefit to Aviation**
  - Publicly available honeycomb core data along with framework for qualifying core materials.
  - Guidelines generated in this program will be transitioned into shared databases, such as CMH-17

Questions/Comments: Contact Rachael – Rachael.Andrulonis@idp.wichita.edu
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