Composites and Advanced Materials Testing Relative to UAS at the National Institute for Aviation Research

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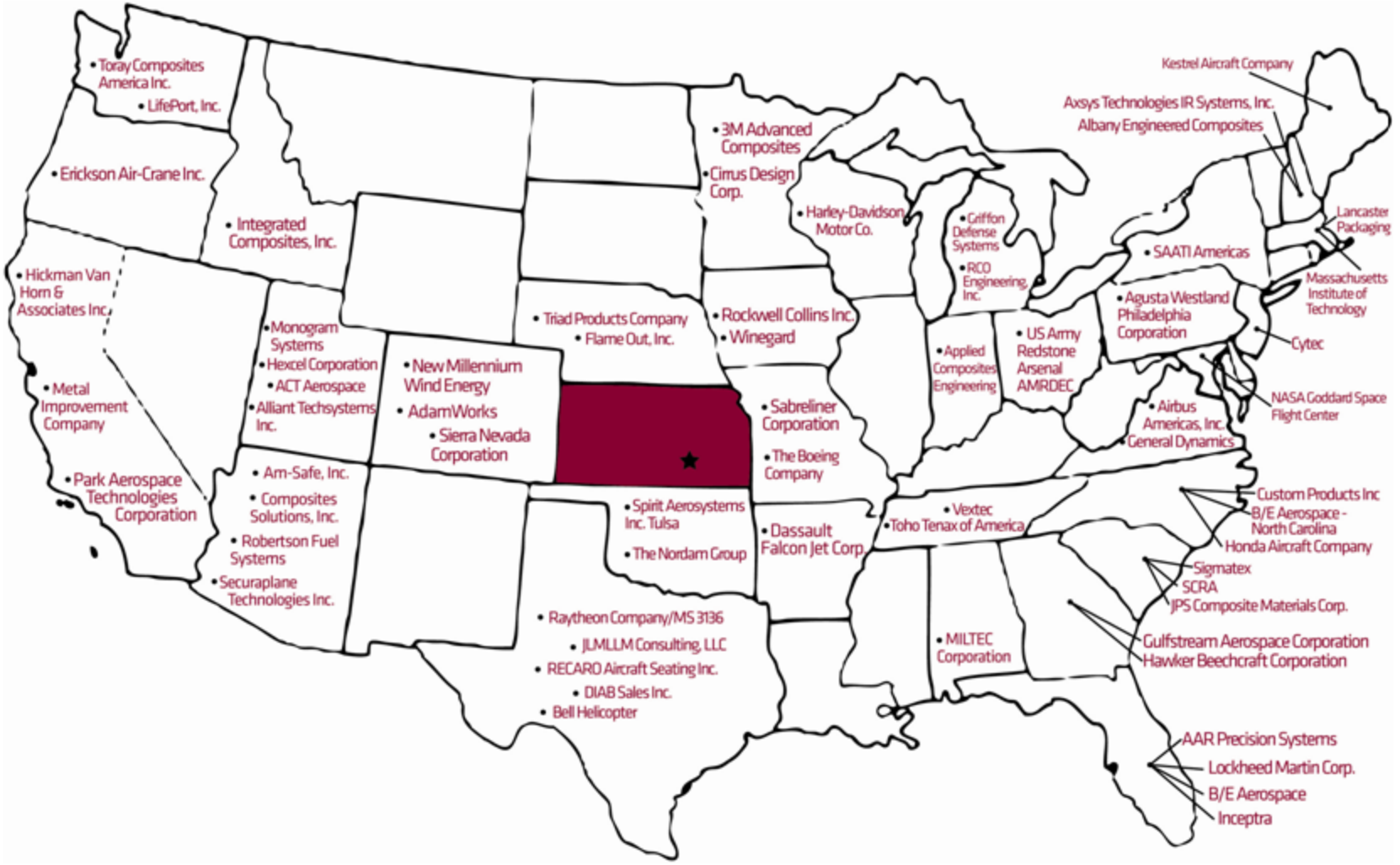
Existing Partnerships – U.S.



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National Institute for Aviation Research

NIAR ranks high among U.S. universities in aero R&D funding

Aeronautical R&D Expenditures FY11

According to the National Science Foundation's National Center for Science and Engineering Statistics

1. Utah State University*	$61 million
2. Georgia Institute of Technology	$56 million
3. Wichita State University	$42 million
4. University of Colorado – Boulder	$41 million
5. University of Alabama – Huntsville	$22 million
6. Massachusetts Institute of Technology	$22 million
7. Texas A&M – College Station	$20 million
8. University of Maryland – College Park	$19 million
9. Pennsylvania State University	
10. University of Michigan – Ann	

** The Johns Hopkins University is listed as #1 with $99 million, but this includes Applied Physics expenditures.*

Industry-Financed Aeronautical R&D Expenditures

Source: National Science Foundation Higher Education Research and Development survey 2011

1. Wichita State University	$23 million
2. Georgia Institute of Technology	$6 million
3. Johns Hopkins University	$4 million
4. Massachusetts Institute of Technology	$4 million
5. University at Albany, SUNY	$4 million

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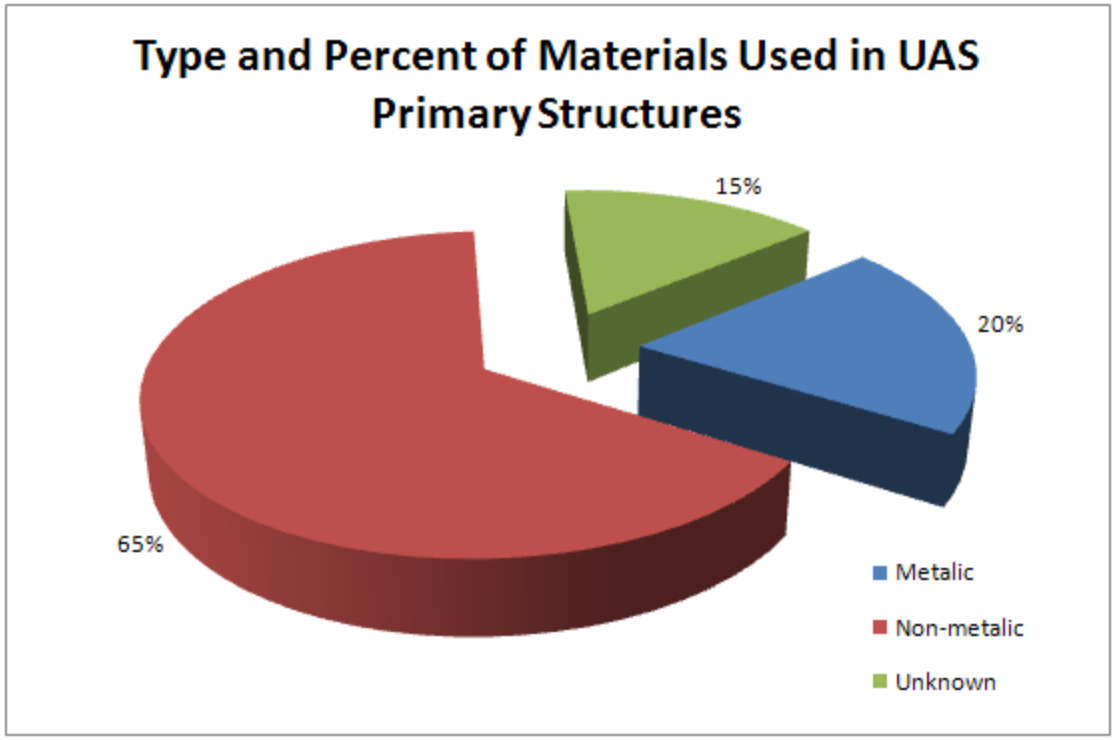
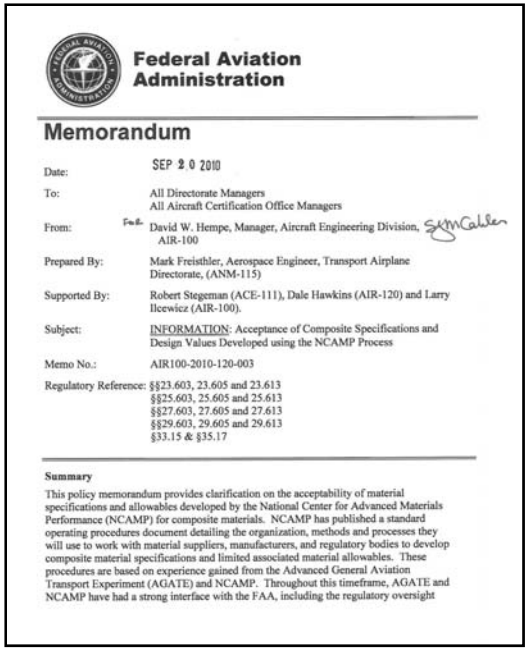
Composites and Advanced Materials Relative to UAS



National Center for Advanced Materials Performance (NCAMP)

- NCAMP Focus:
  - Increase efficiency of advanced material implementation into new aircraft models
  - Decrease cost of materials
  - Applicable to:
    - 23.603, 23.605, and 23.613
    - 25.603, 25.605, and 25.613
    - 27.603, 27.605, and 27.613
    - 29.603, 29.605, and 29.613
    - 33.15 and 35.17



Federal Aviation Administration

Memorandum

Date: SEP 20 2010

To: All Directorate Managers
All Aircraft Certification Office Managers

From: David W. Hempe, Manager, Aircraft Engineering Division, AIR-100

Prepared By: Mark Freisthler, Aerospace Engineer, Transport Airplane Directorate, (ANM-115)

Supported By: Robert Stegeman (ACE-111), Dale Hawkins (AIR-120) and Larry Ilcewicz (AIR-100).

Subject: INFORMATION: Acceptance of Composite Specifications and Design Values Developed using the NCAMP Process

Memo No.: AIR100-2010-120-003

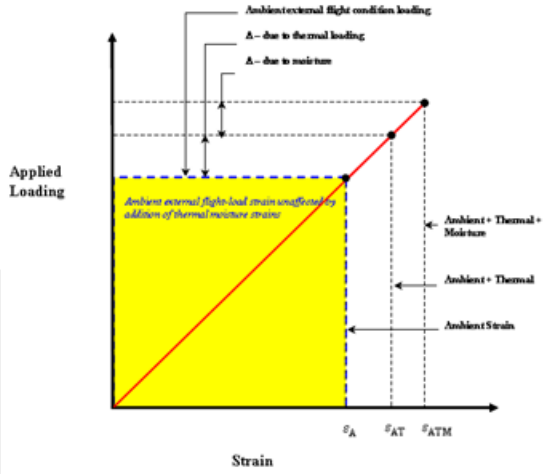
Regulatory Reference: §§23.603, 23.605 and 23.613
§§25.603, 25.605 and 25.613
§§27.603, 27.605 and 27.613
§§29.603, 29.605 and 29.613
§33.15 & §35.17

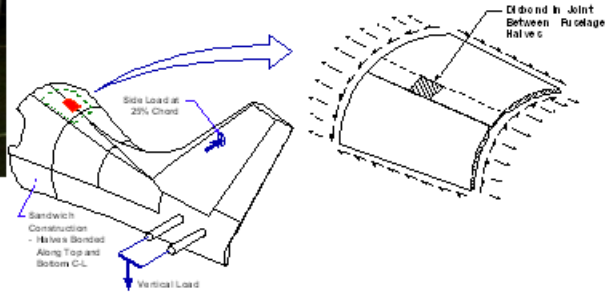
Summary

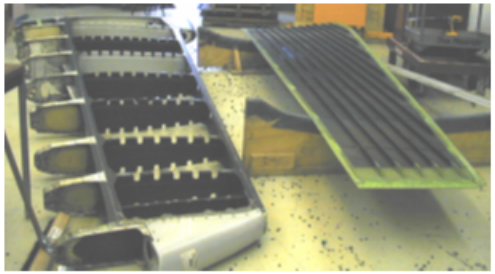
This policy memorandum provides clarification on the acceptability of material specifications and allowables developed by the National Center for Advanced Materials Performance (NCAMP) for composite materials. NCAMP has published a standard operating procedures document detailing the organization, methods and processes they will use to work with material suppliers, manufacturers, and regulatory bodies to develop composite material specifications and limited associated material allowables. These procedures are based on experience gained from the Advanced General Aviation Transport Experiment (AGATE) and NCAMP. Throughout this timeframe, AGATE and NCAMP have had a strong interface with the FAA, including the regulatory oversight

FAA Center of Excellence for Composites & Advanced Materials

CECAM
center of excellence for
composites and advanced materials







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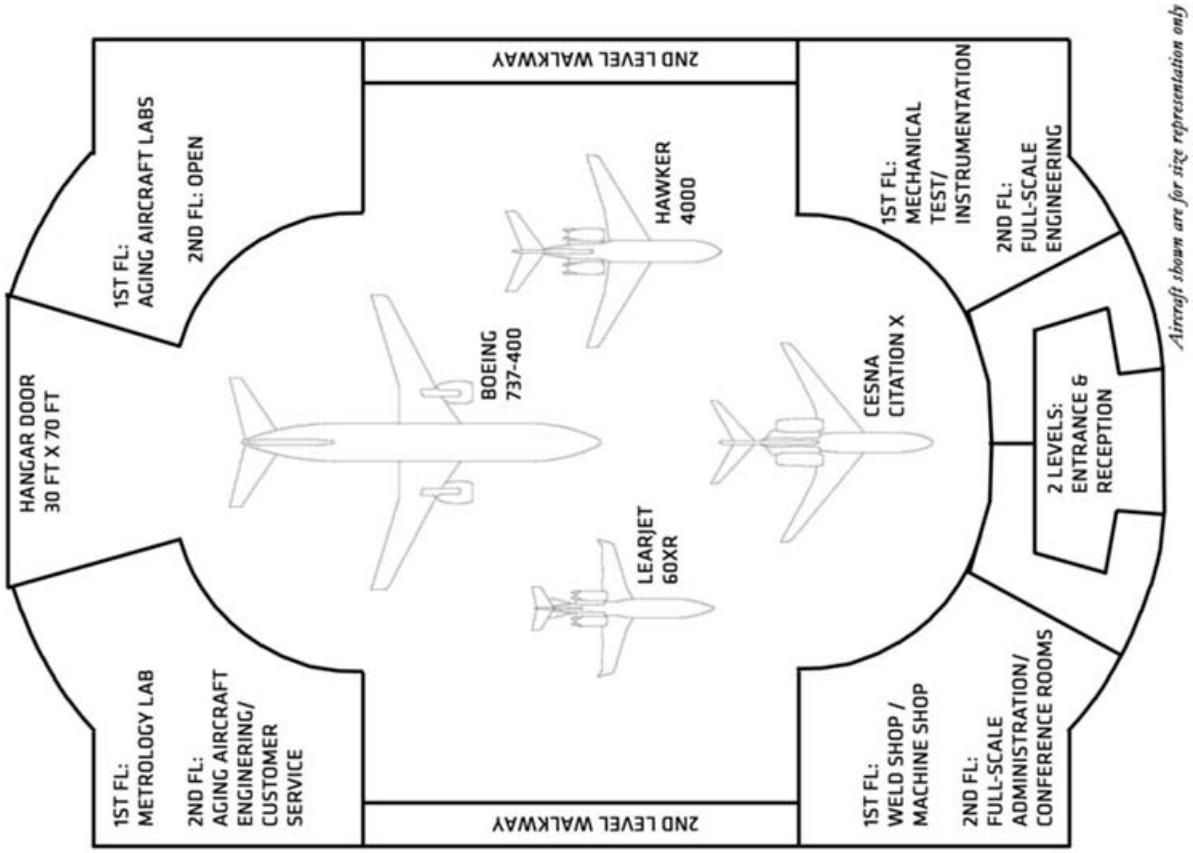
Boeing UCAS Testing

Boeing UCAS

Boeing UCAS Full-Scale Structural Testing

Aircraft Structural Test & Evaluation Center (ASTEC)



Aircraft Structural Test & Evaluation Center (ASTEC)

500,000 lb Load Frame

Full-scale Structural Testing

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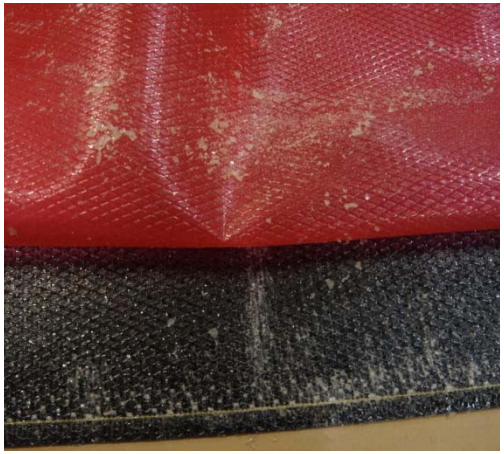
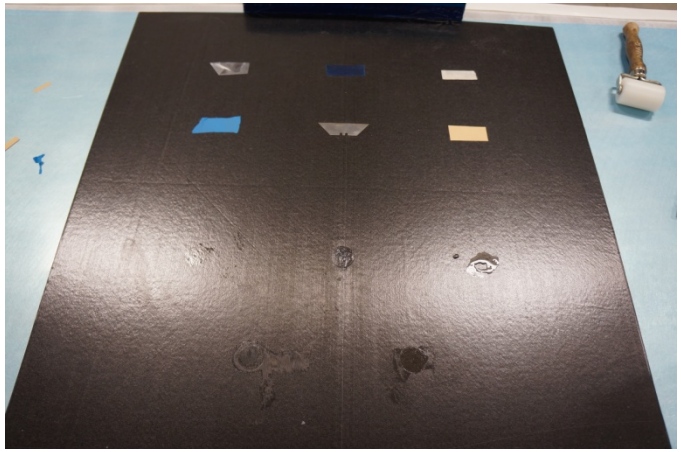
Fabrication and Material Process Controls

Dry spots observed during a visual inspection

Flake-like resin particles observed due to aging of the resin



Expendable materials imbedded between plies to determine effect on material properties



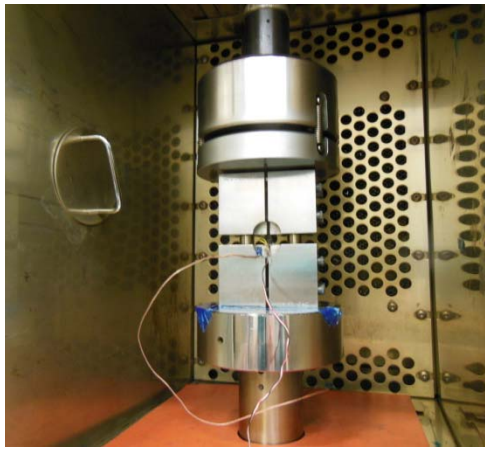
Material Properties and Allowables

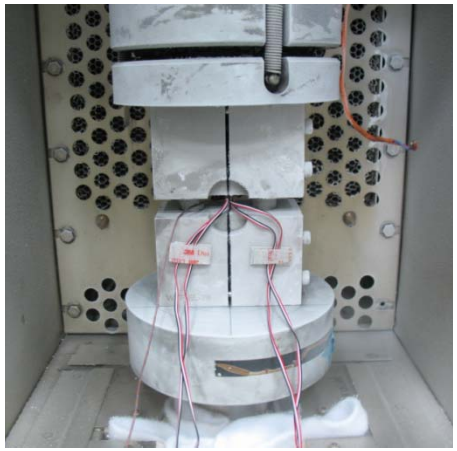
Mechanical Test Lab

Open-Hole Tension Test – ASTM D5766

In-Plane Shear Test – ASTM D5379

Combined Loading Compression Test – ASTM D6641





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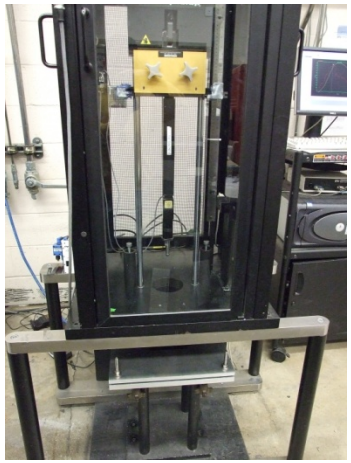
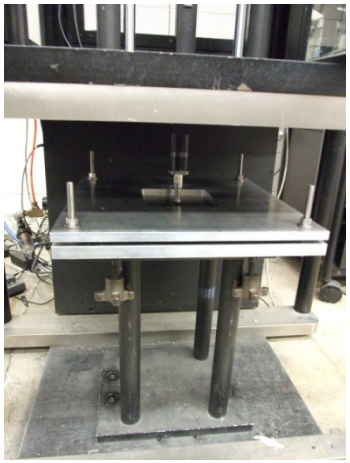
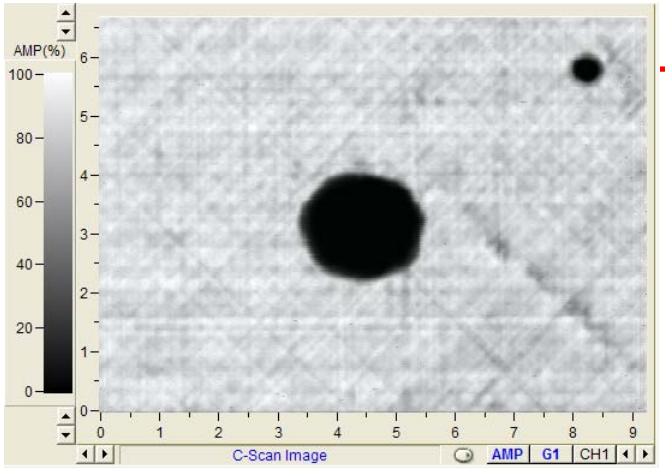
Durability and Damage Tolerance of Airframe Structures

Impact Event

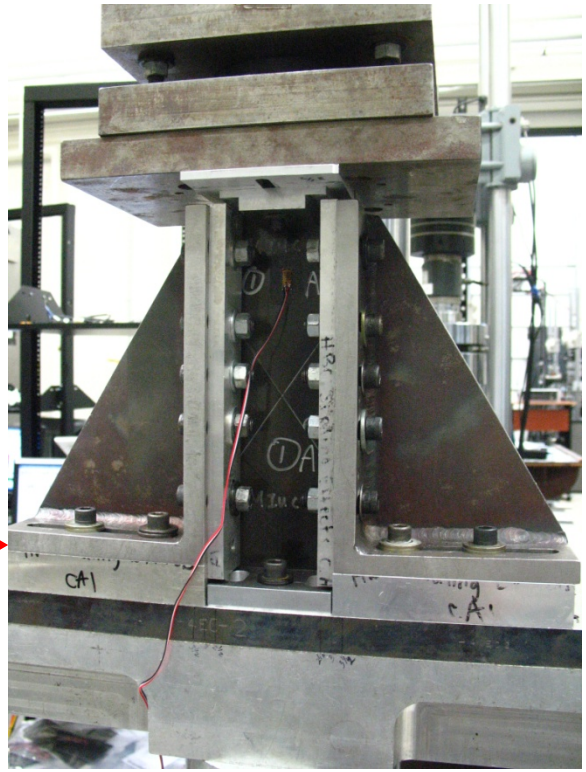




Non-Destructive Inspection



Residual Compression Strength (After Impact)



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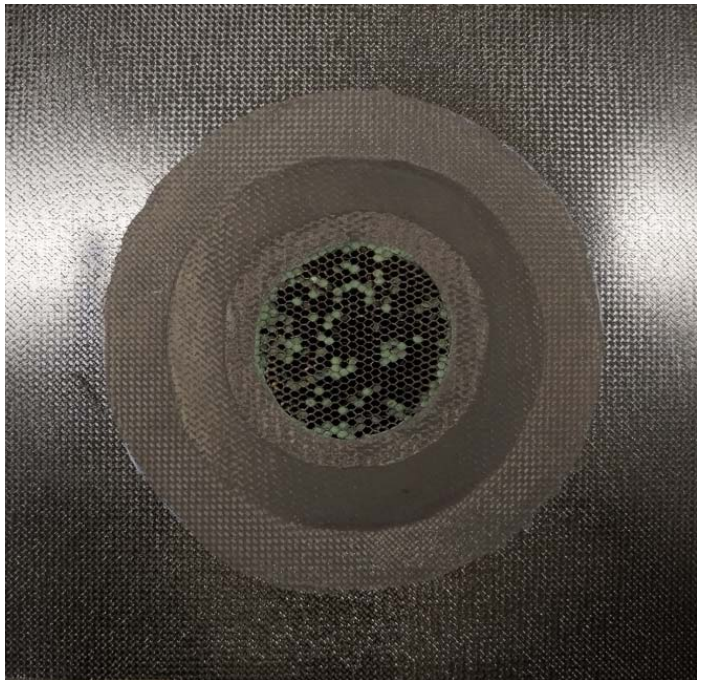
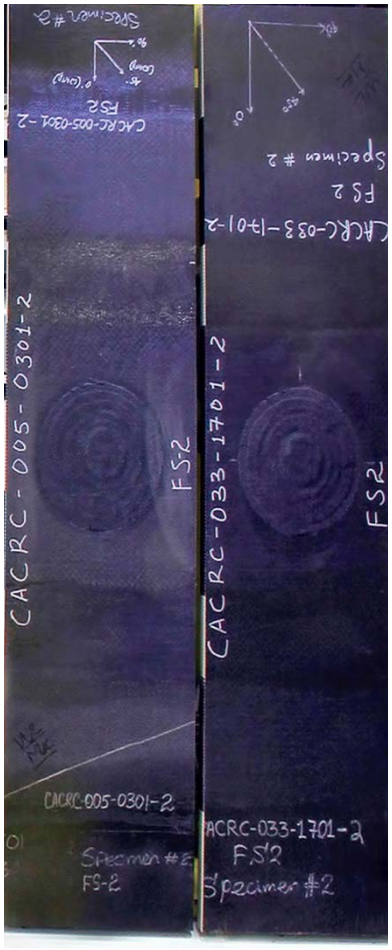
Repair of Airframe Structures

Preparation of bonded repair section



Repaired Panels



Residual Strength Test

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