FAA Joint Centers of Excellence for Advanced Materials (JAMS)

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Presented at SAMPE JAMS 2024

May 21, 2024

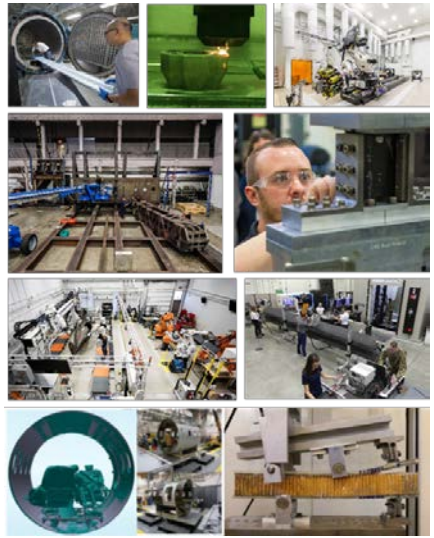
Federal Aviation Administration

FAA Joint Centers of Excellence for Advanced Materials (JAMS)

https://www.jams-coe.org

JAMS was established by the FAA as a Joint Centers of Excellence in 2004

- 8 active core member universities, ~$12M annual budget



JOINT ADVANCED MATERIALS & STRUCTURES CENTER OF EXCELLENCE

CECAM center of excellence for composites and advanced materials

National Institute for Aviation Research (NIAR) - Wichita State University (Co-Lead)
University of California San Diego
Auburn University
Mississippi State University

A Center of Excellence AMTAS Advanced Materials in Transport Aircraft Structures

University of Washington (Co-Lead)
University of Utah
Oregon State University
Washington State University

Statutory Bases for JAMS

FAA Reauthorization Act of 2024

SEC. 1005. ADVANCED MATERIALS CENTER OF EXCELLENCE ENHANCEMENTS.

(1) CONTINUED OPERATIONS.—The Administrator shall continue operation of the Advanced Materials Center of Excellence.

(2) PURPOSES.—The Center shall—

(A) focus on applied research and training on the safe use of composites and advanced materials, and related manufacturing practices, in airframe structures; and

(B) conduct research and development into aircraft structure crash worthiness and passenger safety, as well as address safe and accessible air travel of individuals with a disability, including materials required to facilitate safe wheelchair restraint systems on commercial aircraft.''

Statutory Bases for JAMS

FAA Reauthorization Act of 2024

SEC. 1005. ADVANCED MATERIALS CENTER OF EXCELLENCE ENHANCEMENTS – (Continued).

RESPONSIBILITIES.—The Center shall—

(1) promote and facilitate collaboration among member universities, academia, the Administration, the commercial aircraft industry

(2) carry out research and development activities … in relevant areas of study, which shall include—

(A) all structural materials, including—

(i) metallic and non-metallic based additive materials, ceramic materials, carbon fiber polymers, and thermoplastic composites;

(ii) the long-term material and structural behavior of such materials; and

(iii) evaluating the resiliency and long-term durability of advanced materials in high temperature conditions and in engines for applications in advanced aircraft; and

(B) structural technologies, such as additive manufacturing, to be used in applications within the commercial aircraft industry, including traditional fixed-wing aircraft, rotorcraft, and emerging aircraft types such as advanced air mobility aircraft; and

(3) conduct research activities for the purpose of improving the safety and certification of aviation structures, materials, and additively manufactured aviation products and components; and

(4) conducting research activities to advance the safe movement of all passengers, including individuals with a disability …, and individuals using personal wheelchairs in flight, that takes into account the modeling, engineering, testing, operating, and training issues significant to all passengers and relevant stakeholders.''

JAMS Funding Source

- Congress is providing directed funding for JAMS through the FAA research and development budget
- JAMS funding is primarily provided through the FAA **Advanced Materials/Structural Safety** research program and associated budget line item
- Congressional direction is outlined in an Explanatory Statement that refers to applicable House/Senate Report for that Fiscal Year
    - FY24 research budget direction is provided in Transportation-HUD Senate Report 118-70:

Advanced Materials/Structural Safety.—The Committee recommendation includes a total of $14,720,000 for advanced materials/structural safety, of which not less than $10,000,000 shall be for the COE for joint advanced materials and structures [JAMS]. The Committee recommendation includes $6,000,000 to advance the use of these new additive materials (both metallic and non-metallic based additive processes) in the commercial aviation industry and $4,000,000 to advance the use of fiber reinforced composite materials in the commercial aviation industry through the FAA joint advanced materials and structures COE.

$10M directed to JAMS in FY24

FY23 Advanced Materials Research Objectives

1. **Develop guidelines for characterizing new material forms and assessing manufacturing maturity**
   1. Develop new material database protocols
   2. Evaluate equivalence for changes to materials and processes relative to an existing database
   3. Evaluate key process parameters and key characteristics for selected new materials and processes, as well as effectiveness of manufacturing control and inspection methods including in-situ monitoring and NDI
2. **Evaluate long-term material and structural behavior and associated maintenance activities**
   1. Evaluate aging effects on selected material or structural detail
   2. Evaluate fatigue and damage tolerance behavior of bonded joints
   3. Evaluate fatigue behavior of metallic AM materials
3. **Evaluate and characterize dynamic behavior of advanced structures to drive new test and certification standards and guidelines**
   1. Evaluate analytical methods for evaluating composite seat performance
   2. Evaluate analytical methods for modeling bird strike of composite structure
   3. Investigate dynamic behavior of composites and other advanced materials/processes
4. **Develop efficient methods for characterizing composite and additive manufacturing details and elements to tie to best practice design and certification principles**
   1. Develop one or more standards and supporting data evaluation protocols for characterizing/testing mid-level composite building block configurations
   2. Develop one or more standards and supporting data evaluation protocols for characterizing/testing mid-level additive manufacturing building block configurations
   3. Evaluate non-structural behaviors of advanced materials and processes

JAMS Research Output

- Technical reports published by the FAA Technical Center
  - Publicly-accessible repositories consistent with the DOT's Public Access such as Repository & Open Science Access Portal at the National Transportation Library
- Industry standards such as those published by SAE and ASTM
- Data and best practices in MMPDS and the Composite Materials Handbook (CMH-17)
- FAA Policy and Guidance
- Training Materials

rosap Repository & Open Science Access Portal

FAA Technical Library @NTL

Research Goals

- AVS-Sponsored Research Development Process is in revision
  - Looking forward, research will be guided by FAA Strategic Thrusts, service events, and industry input
- FAA Strategic Thrusts identify industry-level research needs
  - Establish research goals and gain support from industry
  - Guide FAA investments in internal and external research
  - Inform and leverage research plans of NASA, other government agencies, industry, and academia
- Strategic thrusts are developed in several areas; JAMS is most directly related to:

  Structure, Materials and Manufacturing Normalize the safety requirements and compliance for new materials and manufacturing techniques.

Structures, Materials, and Manufacturing Strategic Thrust

- Purpose:
  - Improve certification readiness and methods
  - Understand the safety risks associated with introduction of new materials, manufacturing methods, and structures, and develop ways to mitigate them
  - Develop and evaluate certification protocols and manufacturing and maintenance practices for advanced materials and structures to support their safe implementation
- Program Goals:
  - Understand and document fundamental behaviors of emerging materials and structures,
  - Establish methods of compliance to regulations,
  - Document background information on lessons learned and best practices in achieving form, fit, and function for a lifetime of structural applications
  - Advise and maintain an educated workforce

Future Research Activities

Major Activities	Objective	Expected Outputs
1. Understand aging behaviors of new material forms and associated maintenance practices	Investigate in-service aging behaviors of advanced metallic and non-metallic materials and structures	An understanding of the aging behaviors, including fatigue, that occur in advanced materials and structures in different operating environments
2. Develop guidelines for characterization and control of new material forms and assess manufacturing maturity	Identify unique aspects of material characterization and process control for new materials and manufacturing processes being introduced in aviation products	• An understanding of the maturity, key characteristics, and key process parameters of new materials and processes • Public specifications and material databases
3. Understand large-scale structural behavior of new composite materials	Understand the difference in properties and behaviors of new composite materials, such as those with discontinuous fiber reinforcement or thermoplastic resin systems, when scaled from standard-size coupons to real aircraft structure	An understanding of the behavior of new composite material forms at structural scale, because many advantageous behaviors, such as load redistribution, may not be apparent until larger sizes
4. Improve certification efficiency for advanced materials and structures	Develop certification standards for the new advanced materials, structural configurations, and applications being introduced into aviation products	Test and analytical methods for new materials, structures, and applications
5. Evaluate modern manufacturing inspection methods	Evaluate advanced manufacturing inspection methods, such as in-situ monitoring and machine learning, being proposed by manufacturers	An understanding of the capabilities and limitations of advanced manufacturing inspection methods

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