

Joint Advanced Materials and Structures Center of Excellence

Two Year Perspective

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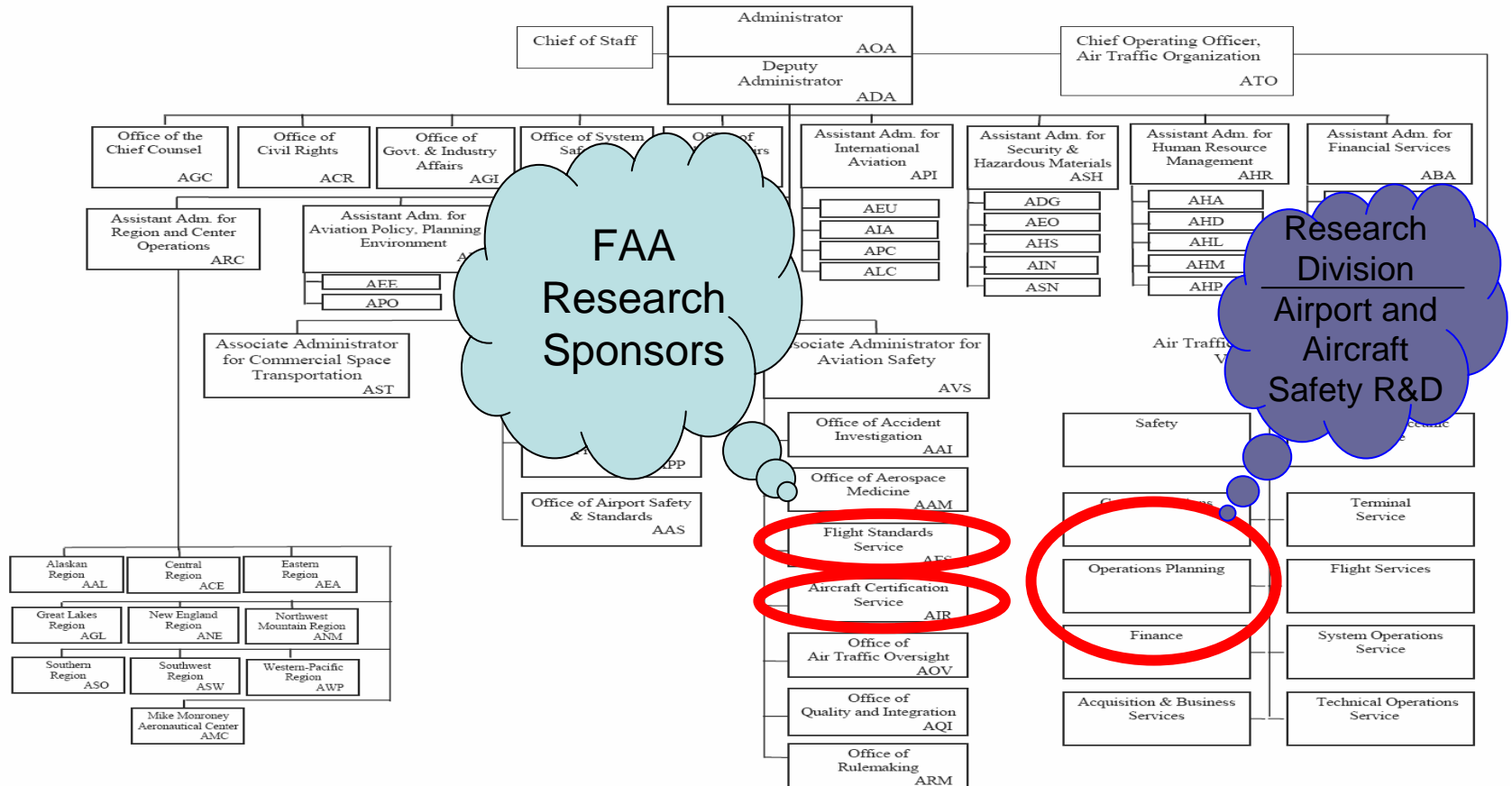
Federal Aviation
Administration



FAA Organization and R&D

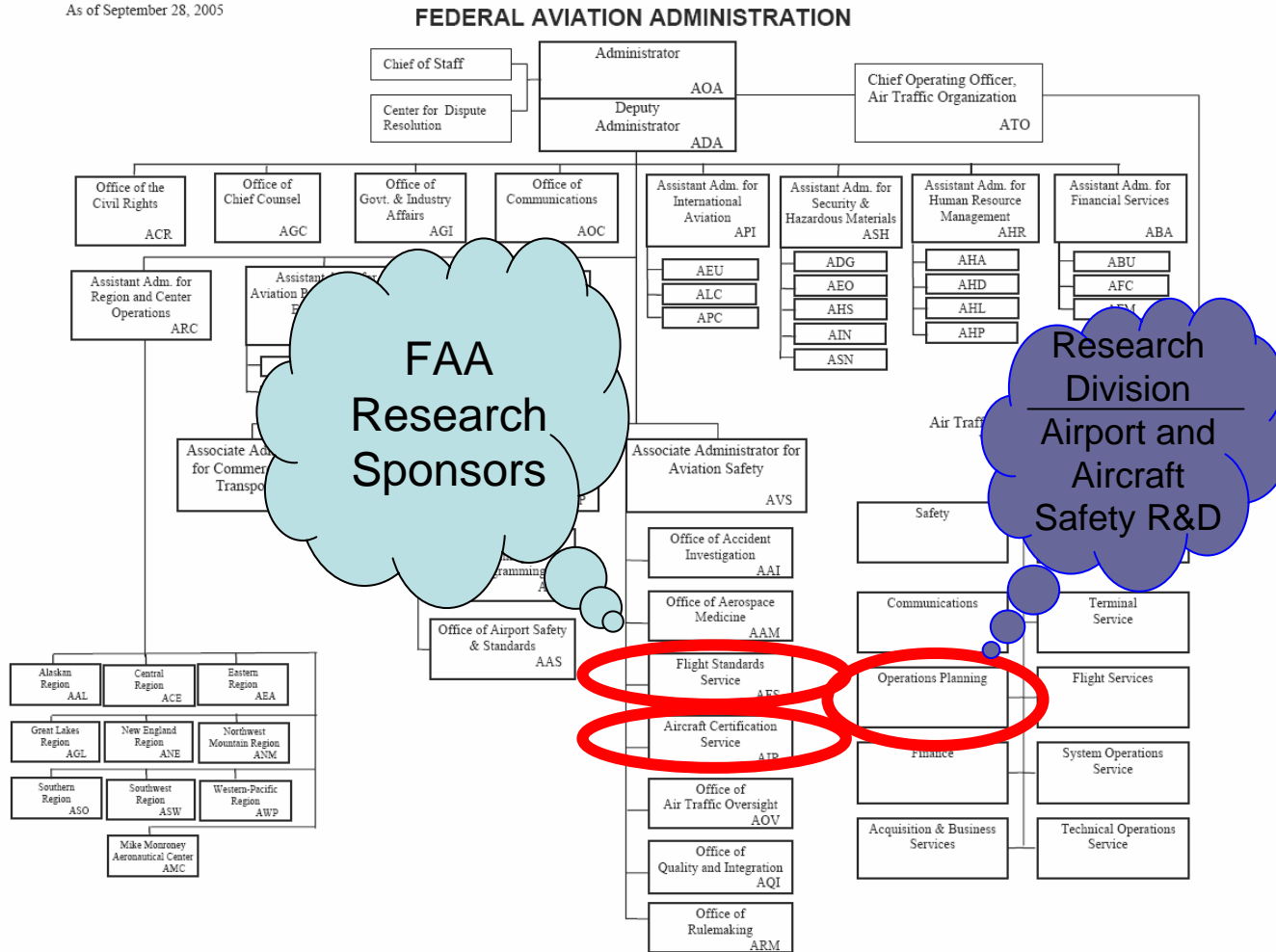
As of January 11, 2005

FEDERAL AVIATION ADMINISTRATION



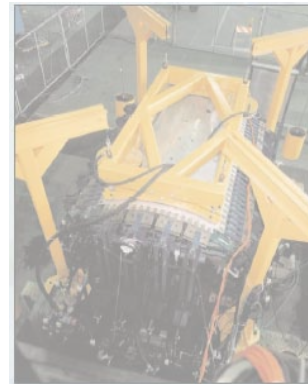
FAA Organization and R&D

As of September 28, 2005



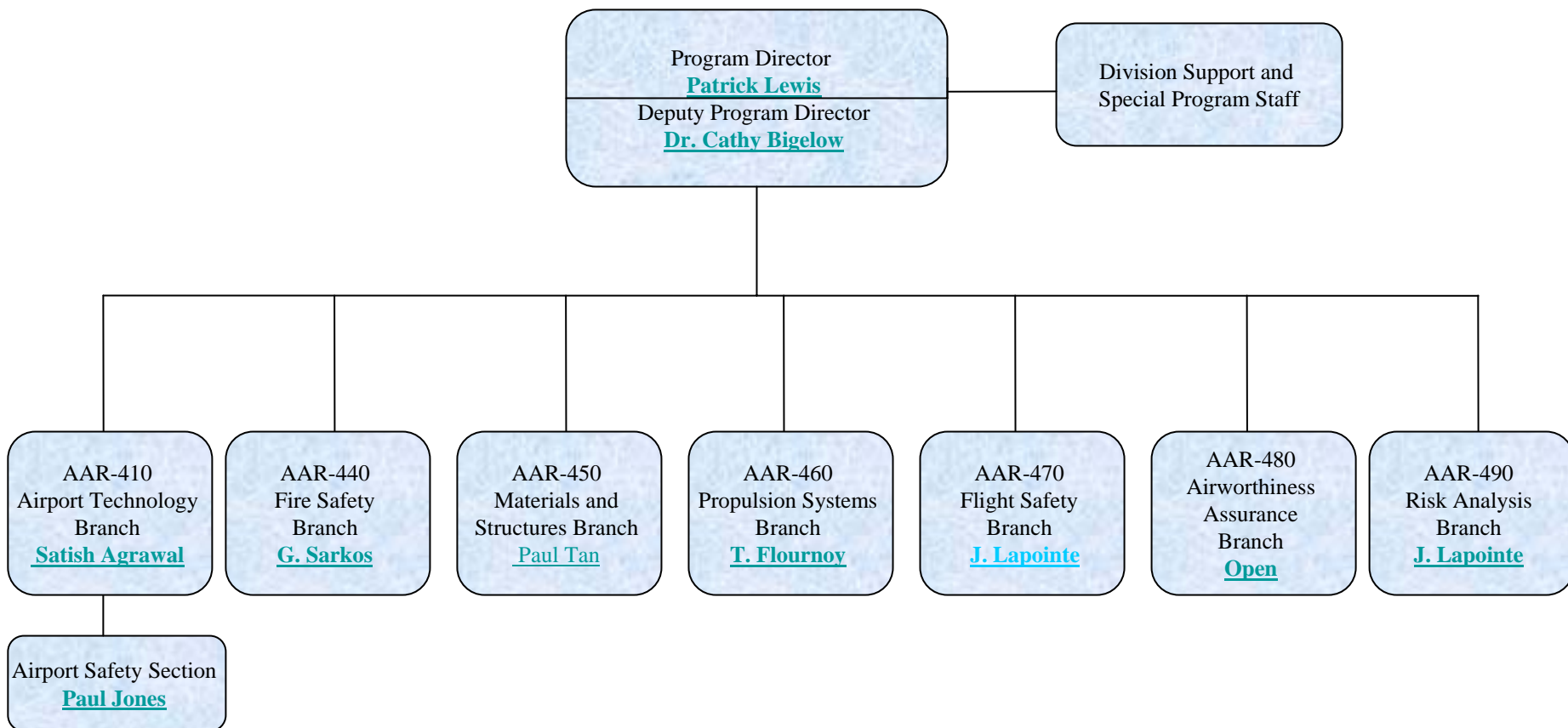
FAA William J. Hughes Technical Center

- The FAA William J. Hughes Technical Center is the nation's premier aviation research and development, and test and evaluation facility
- The Technical Center serves as the national scientific test base for the FAA.
- Technical Center programs include:
 - Testing and evaluation in air traffic control
 - Communications
 - Navigation
 - Airports & aircraft safety
 - Security.
- They also include long-range development of innovative aviation systems and concepts, development of new air traffic control equipment and software, and modification of existing systems and procedures
- Located 10 miles northwest of Atlantic City, and covering over 5,000 acres, the Technical Center consists of state-of-the-art laboratories, test facilities, support facilities, the Atlantic City International Airport (ACY), and a non-commercial aircraft hangar.



Airport and Aircraft Safety Research and Development - AAR-400

Organizational Structure



Airport and Aircraft Safety Research and Development Program Areas

- **Advances Materials/Structural Safety**
- **Aging Aircraft Research**
- **Aircraft Catastrophic Failure Prevention**
- **Airport Research & Development**
- **Atmospheric Hazards**
- **Propulsion/Fuel Systems**
- **Fire Research & Safety**
- **Risk Analysis**
- **Flight Safety**
- **General Aviation/Vertical Flight (F&E)**



Airport and Aircraft Safety Research and Development Facilities

- Aircraft Components Fire Test Facility
- Air Flow Induction Test Facility
- Category I Reconfigurable Approach Lighting System Test Bed
- Chemistry and Material Sciences Laboratory
- Dynamic Vertical Drop Test Facility
- FAA Engine Nacelle Fire Simulator
- National Fire Extinguishing Agent
- Full-Scale Fire Test Facility
- Full-Scale Curved Panel Test System
- Materials Fire Test Facility
- National Pavement Test Facility
- Propulsion and Fuel Systems Test Facilities
- Runway Friction Laboratory
- Video Landing Loads Facility



What is an RPD?

- **Research Project Description**
- **A group of technology related FAA R&D Tasks**
- **RPDs are coordinated with the FAA sponsors to develop relevant tasks to address the needs of the sponsors**
- **They are guided by committees that represent the FAA user community
(Technical Community Review Group – TCRG)**

Research Project Description 504

Advanced Materials and Structures

- The Advanced Materials and Structures research project develops **criteria** to evaluate structures constructed out of **advanced materials**, thereby **reducing** the associated **risks** with use of such materials in all category aircraft.
- This knowledge will lead to **increased safety** and **shortened certification time**.
- Benefits will accrue in the form of fewer accidents, which will lead to **fewer injuries and fatalities**.

RPD 504

Technical Requirement Areas by Priority

- 1. Structural Substantiation and Damage Tolerance**
- 2. Structural Integrity of Bonded Joints**
- 3. Composite Maintenance Practices**
- 4. Environmental and Aging Effects**
- 5. Cabin Safety**
- 6. Standardization - Specifications for Material Control and Test Standards**
- 7. Fatigue & Damage Tolerance for Dynamic Applications**
- 8. Advanced Materials, Forms & Processes**
- 9. MIL-HDBK-17 (Composite Materials Handbook)**

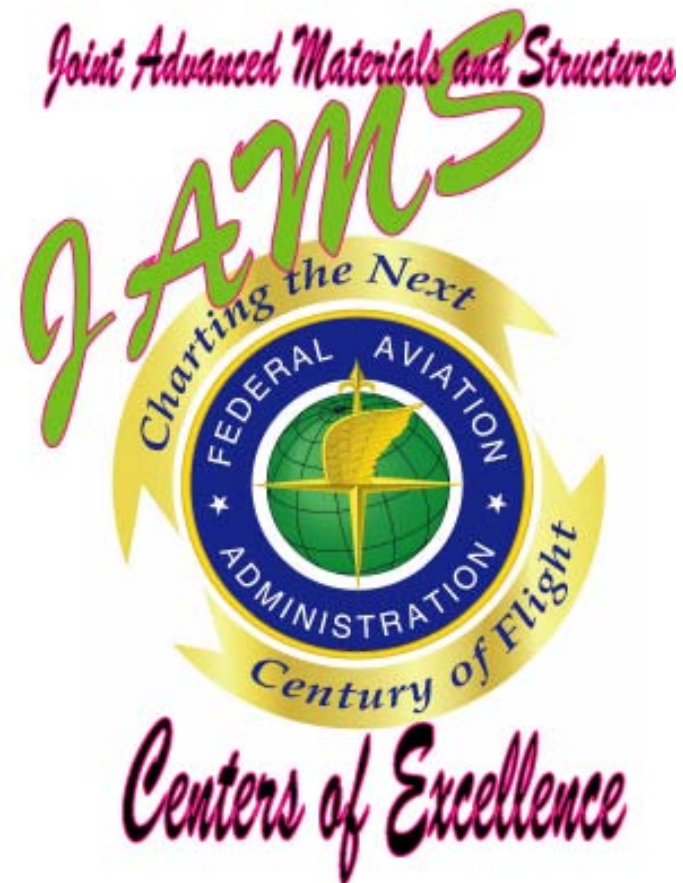


RPDs Potentially Using JAMS Expertise

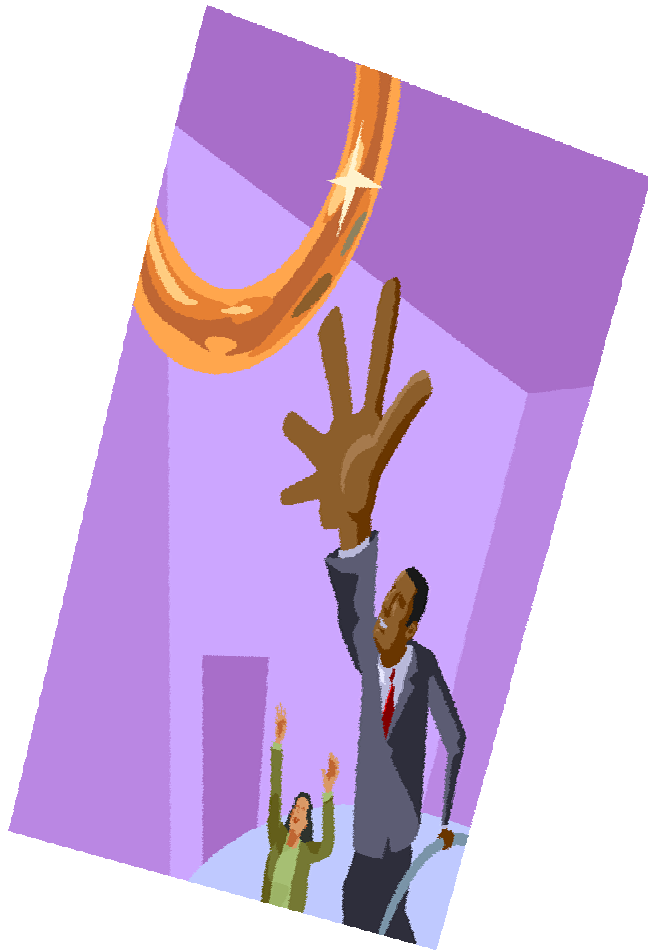
- RPD 161 Structural Integrity of Commuters
- RPD 419 Turbine Engine Research*
- RPD 460 Aircraft Maintenance
- RPD 502 Aircraft Crashworthiness
- RPD 515 Transport Airplane Structural Integrity
- RPD 516 Aircraft Catastrophic Failure Prevention
- RPD 517 Fire Resistant Cabin Materials*
- RPD 519 Rotorcraft Structural Integrity and Safety
- RPD 556 Continued Airworthiness of Aircraft Engines*
- RPD 558 Fire Safety and Cabin Safety*
- RPD 584 Inspection Systems R&D

* These RPDs currently have a CoE or Consortium arrangement





Goals for the Advanced Materials Center



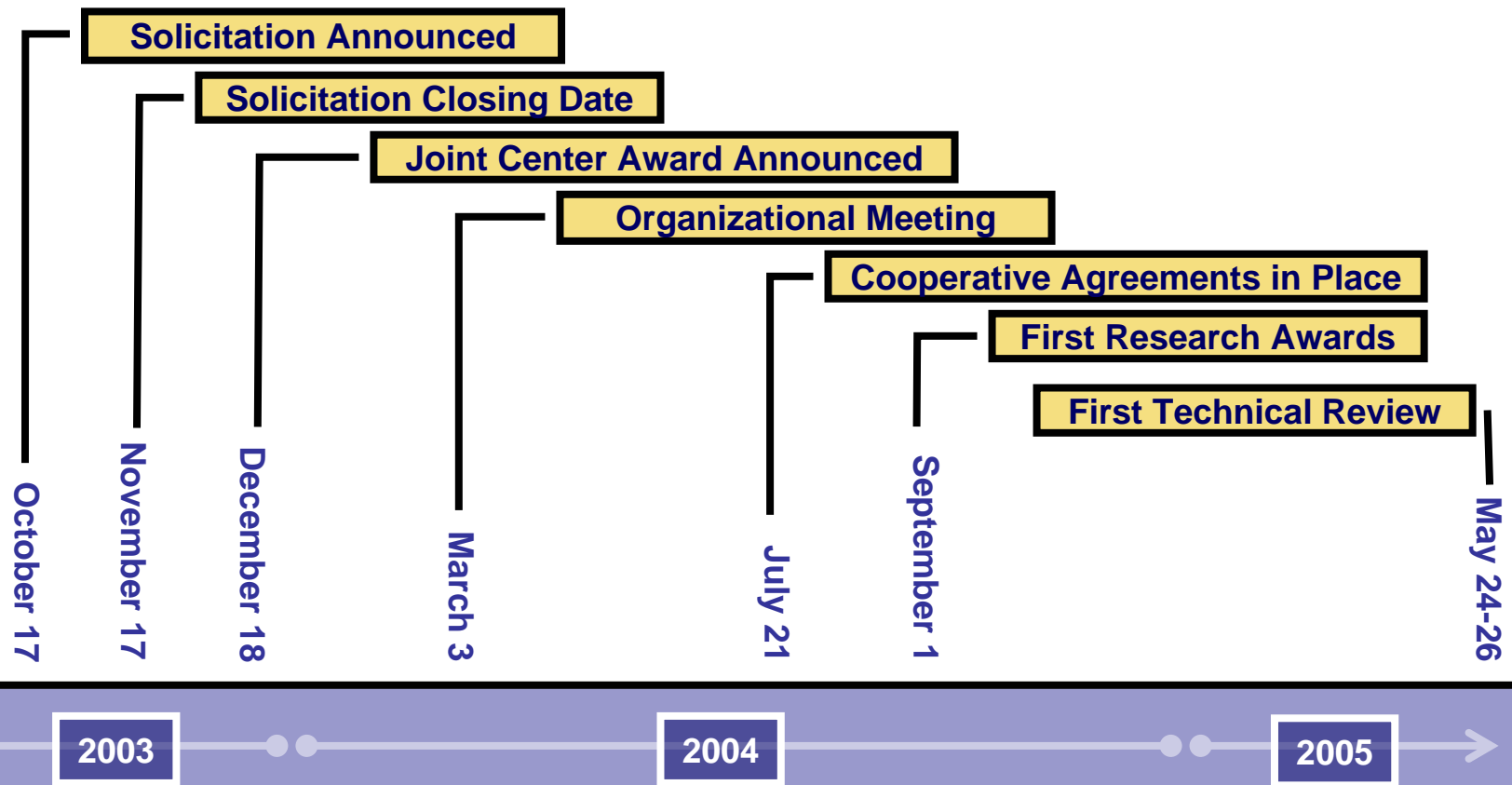
- Address the engineering and science issues associated with safety regulation and product certification of advanced materials
- Ensure equivalent or higher levels of safety relative to existing technology
- Establish engineering standards and unique skills training for advanced materials
- Nine technical areas to be studied, others beyond identified will be added as needed
- Develop an advanced materials, forms and processes “knowledge base”

FAA Objectives for Center

- **Define and prioritize activities by directly linking to applications relevant to specific regulation and certification needs.**
- **Support FAA guidance & policy development and solve safety problems by bridging experiences from the field.**
- **Interface with international organizations, which are developing engineering standards**
- **Transfer the technology beyond normal means through the training of engineers and technicians**
- **Coordinate the research efforts of academia, industry and government agencies**
- **Extend partnerships beyond research initiatives with programs that address technology transfer, continuous education and training of the engineering workforce**



Center Development Chronology



JAMS-CoE Members

- **The joint center consists of two groups and includes ten institutions**
- **AMTAS (Center of Excellence for Advanced Materials in Transport Aircraft Structures)**

- Director, Dr. Mark Tuttle
- University of Washington, Lead
- Washington State University
- Oregon State University
- Edmonds Community College



- **CECAM (Center for Composite and Advanced Materials)**

- Director, Dr. John Tomblin
- Wichita State University, Lead
- Northwestern University
- Purdue University
- Tuskegee University
- University of Delaware
- University of California at Los Angeles



CoE Technical Focus Areas

- **Structural Substantiation**
- **Damage Tolerance and Durability**
- **Bonded Joints Processing Issues**
- **Maintenance Practices**
- **Material Standardization and Shared Databases**
- **Advanced Material Forms and Processes**
- **Cabin Safety and Crashworthiness**
- **Life Management of Materials for Improved Aircraft Maintenance Practices**
- **Nanotechnology for Composite Structures**



Common JAMS CoE Initiatives

Across all technical focus areas

- **Work with industry** to study issues and validate design details, analysis procedures, materials and processes for advanced aircraft structure.
- **Work with international standards organizations** (e.g., ASTM, SAE P-17, CACRC, TTCP and MIL-HDBK-17) to establish engineering guidelines.
- **Develop coursework and conduct workshops** to train the workforce.



Activities Funded in FY04

Activity Area	Performer	Description
Damage Tolerance	Univ of WA	Control Surface Damage Tolerance Eval
	Wichita State	Full Scale DT Test
Structural Integrity of Adhesive Joints	Purdue	Damage Tolerance of Bonded Structure
	Wichita State	Bonded Structure (Adhesive Ctrl/ Element Testing)
Composite Repair Practices	NWU	Health Monitoring
	Edmonds	Adhesive training/ educational development
	Univ of WA	Reliability based Damage Tolerance
	Wash SU	Effect of Surface Treatment on Degradation of Adhesives
	Univ of WA	Improving Adhesive Bonding by Surface Characterization
	Wichita State	Chemical Assessment of Surface Condition
	Wichita State	Repair Training
Specifications for Material Control and Test Standards	Wichita State	Production controls affect on material quality
Environmental Effects	Wichita State	Aging Aircraft-Composites (Starship Teardown)
New Composite Materials & Processes	UCLA	Fibre Metal Laminates or Flammability
	Univ of DE	VARTM Variability and substantiation
	Tuskegee	Nanocomposites
	Wichita State	Friction Stir - weld
Cabin Safety	Wichita State	Crashworthiness of composites-mtrl dynamic properties



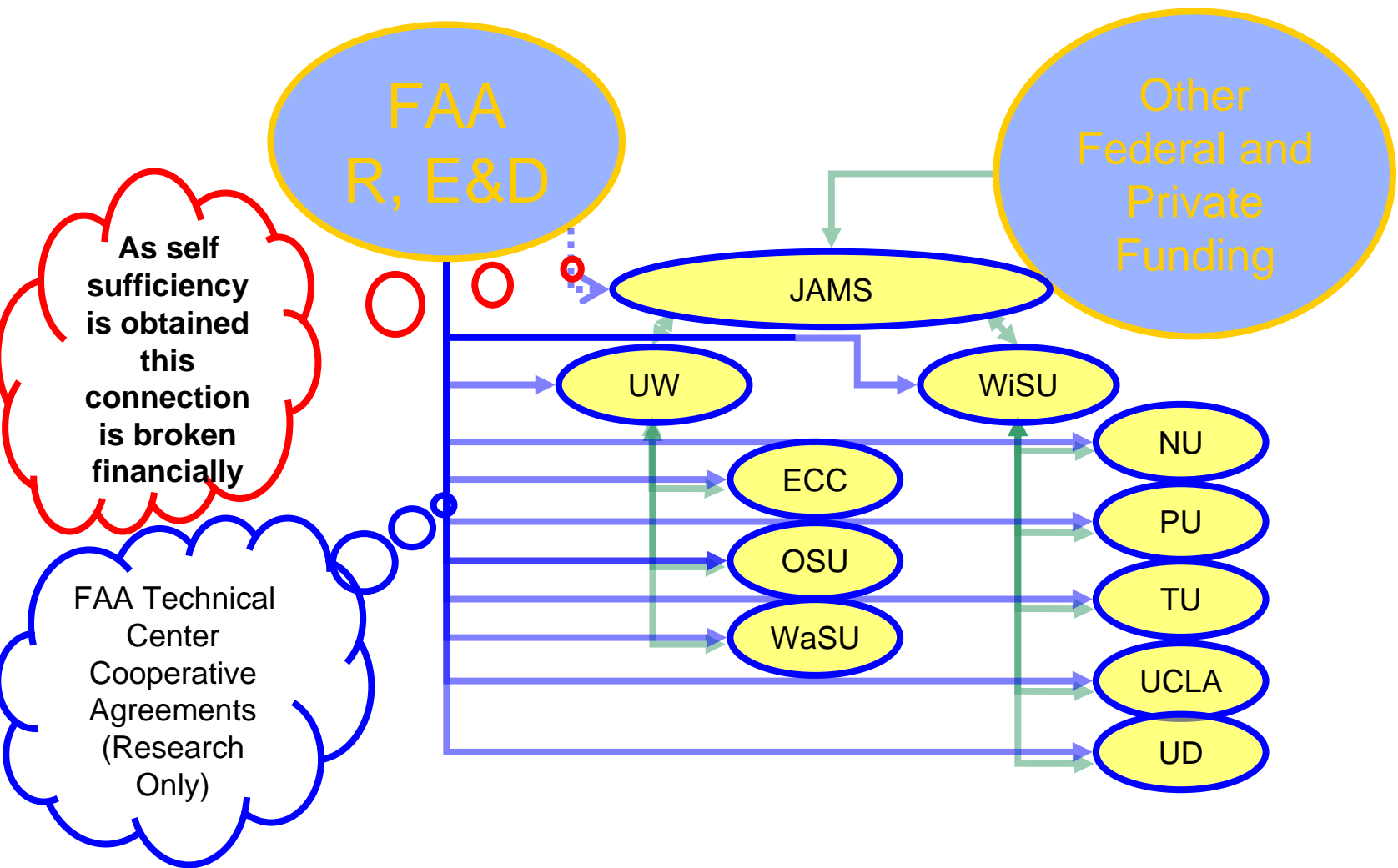
Activities Funded in FY05

Activity Area	Performer	Description
Damage Tolerance	Univ of WA	Control Surface Damage Tolerance Eval
	Wichita State	Damage Tolerance Certification Protocols
	Univ of WA	Reliability based Damage Tolerance
Structural Integrity of Adhesive Joints	Purdue	Damage Tolerance of Bonded Structure
	Wichita State	Chemical Assessment of Surface Condition
Composite Maintenance Practices	NWU	Health Monitoring
	Edmonds	Adhesive training/ educational development
	Wash SU	Effect of Surface Treatment on Degradation of Adhesives
	Univ of WA	Improving Adhesive Bonding by Surface Characterization
	Wichita State	Repair Effects on Structure
Environmental and Aging Effects	Wichita State	Aging Aircraft-Composites (Starship Teardown)
Cabin Safety	Wichita State	Certification by Analysis
	Wichita State	Crashworthiness of composites-mtrl dynamic properties
Specifications for Material Control and Test Standards	Wichita State	Production controls affect on material quality
Advanced Materials & Processes	UCLA	Fibre Metal Laminates or Flammability
	Univ of DE	VARTM Variability and substantiation
	Wichita State	Friction Stir - weld

Coe Activities

Activity Area	Performer	Description
Damage Tolerance	Univ of WA	Control Surface Damage Tolerance Eval
	Wichita State	Damage Tolerance Certification Protocol
	Wichita State	Full Scale DT Test
	Technical Cente	FASTER Support for Composite Panel Testing
	Technical Cente	FASTER Modification for Composite Panel Testing
	Structural Integrity of Adhesive Joints	Purdue
	Wichita State	Bonded Structure (Adhesive Ctrl/ Element Testing)
Composite Repair Practices	NWU	Health Monitoring
	Edmonds	Adhesive training/ educational development
	FIU	Chemical Test for Accept of Bond Surface Prep
	Univ of WA	Reliability based Damage Tolerance
	Wash SU	Effect of Surface Treatment on Degradation of Adhesives
	Univ of WA	Improving Adhesive Bonding by Surface Characterization
	Wichita State	Chemical Assessment of Surface Condition
	Wichita State	Repair Training
Specifications for Material Control and Test Standards	Univ of Utah	Adhesive Practices
	Wichita State	Production controls affect on material quality
Environmental Effects	Wichita State	Aging Aircraft-Composites (Starship Teardown)
New Composite Materials & Processes	UCLA	Fibre Metal Laminates or Flammability
	Univ of DE	VARTM Variability and substantiation
	Tuskegee	Nanocomposites
	Wichita State	Friction Stir - weld
Flammability and Crashworthiness	Wichita State	Flammability of Composites
	Wichita State	Crashworthiness of composites-mtrl dynamic properties

Business Process for JAMS



Final Thoughts

- **Two years into the center activities many good things resulting from the research are evident**
- **Research has benefited from the addition of funds through earmarks that have allow longer term research which has then become important to the FAA sponsors**
- **An FAA independent financial model for administration of the center is the most important challenge in the next year**

