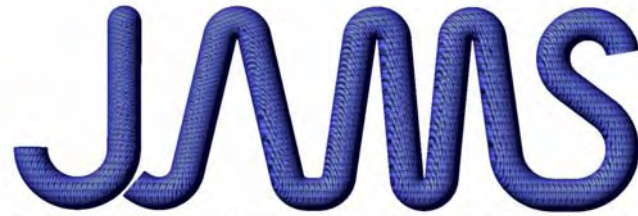


JOINT ADVANCED MATERIALS & STRUCTURES CENTER OF EXCELLENCE





JOINT ADVANCED MATERIALS & STRUCTURES CENTER OF EXCELLENCE

Joint Advanced Materials and Structures (JAMS) Center of Excellence

Second Annual Technical Meeting
June 20-22, 2006

Curtis Davies
Program Manager

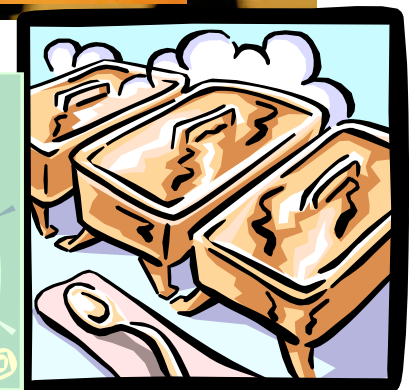


- Logistics
- JAMS Center of Excellence
- FAA Research
- Agenda and Final Thought

- **Logistics**
- JAMS Center of Excellence
- FAA Research
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- Local restaurant guide available, see Ellen
- Restrooms are just outside of the doors in the back of the room in the alcove
- Parking
 - Visitors must stop at any campus gatehouse and pay the current fee of \$10 per day.
 - Lower cost parking is available in several east campus lots along Montlake Boulevard NE.

- Various refreshment items will be available at breaks
- No Food in the Hall
- Lunch will be served on Wednesday
- Lunch sponsor is



 **ABAQUS**

BBQ Dinner on the Waterfront



- Wednesday, June 21
- University of Washington Waterfront Activities Center (WAC).
- The WAC is within easy walking distance of campus, including Kane Hall.
- Parking is available for \$4 (an after 4 p.m. evening rate) in lot E-12 (stadium entrance on Montlake), adjacent to the WAC.
- Activities at the WAC include canoe and rowboat rentals. Rate for the general public is \$7.50 per hour. Summer hours are 10 a.m. to 9 p.m., so bring your shorts!
- Casual Dress
- Sponsored by Toray

Technical Presentation Rules

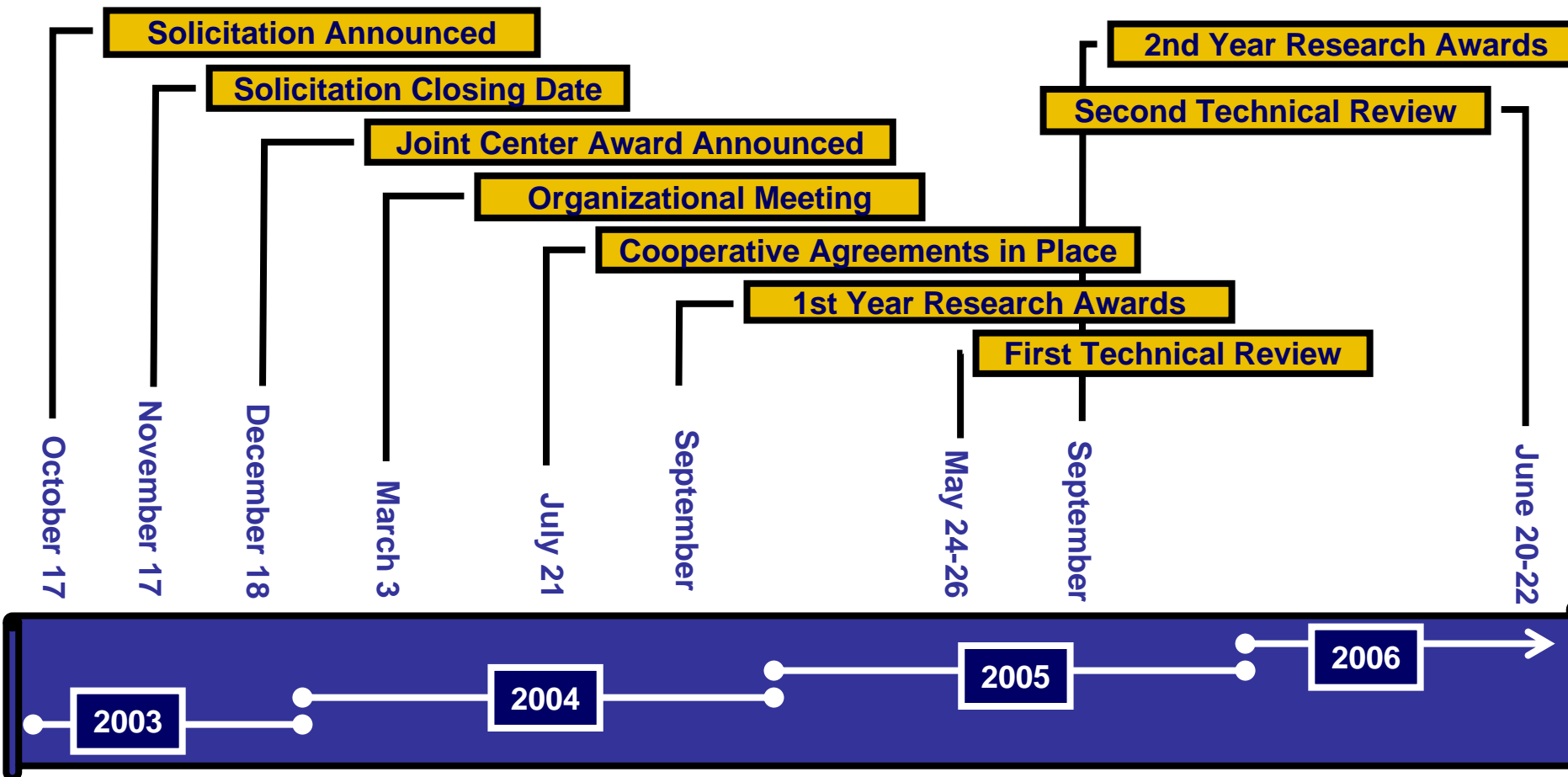
- Each project is given 40 minutes
 - 30 minute presentation period
 - 5 minutes for questions
 - 5 minutes for comment period
- We will hold to these times to be fair to all projects
- Please feel free to provide the researchers and the FAA feedback on the projects directly at breaks and after the meeting



- Logistics
- **JAMS Center of Excellence**
- FAA Research
- Agenda and Final Thought

JAMS

JOINT ADVANCED MATERIALS & STRUCTURES CENTER OF EXCELLENCE



- The joint center consists of two groups and includes ten institutions
- AMTAS (Advanced Materials for 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



NORTHWESTERN UNIVERSITY



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 will be added as needed
- Develop an advanced materials, forms and processes “knowledge base”

- 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



- The initial technology areas to be addressed by the Center include:
 - 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 Structures



Common JAMS CoE Initiatives

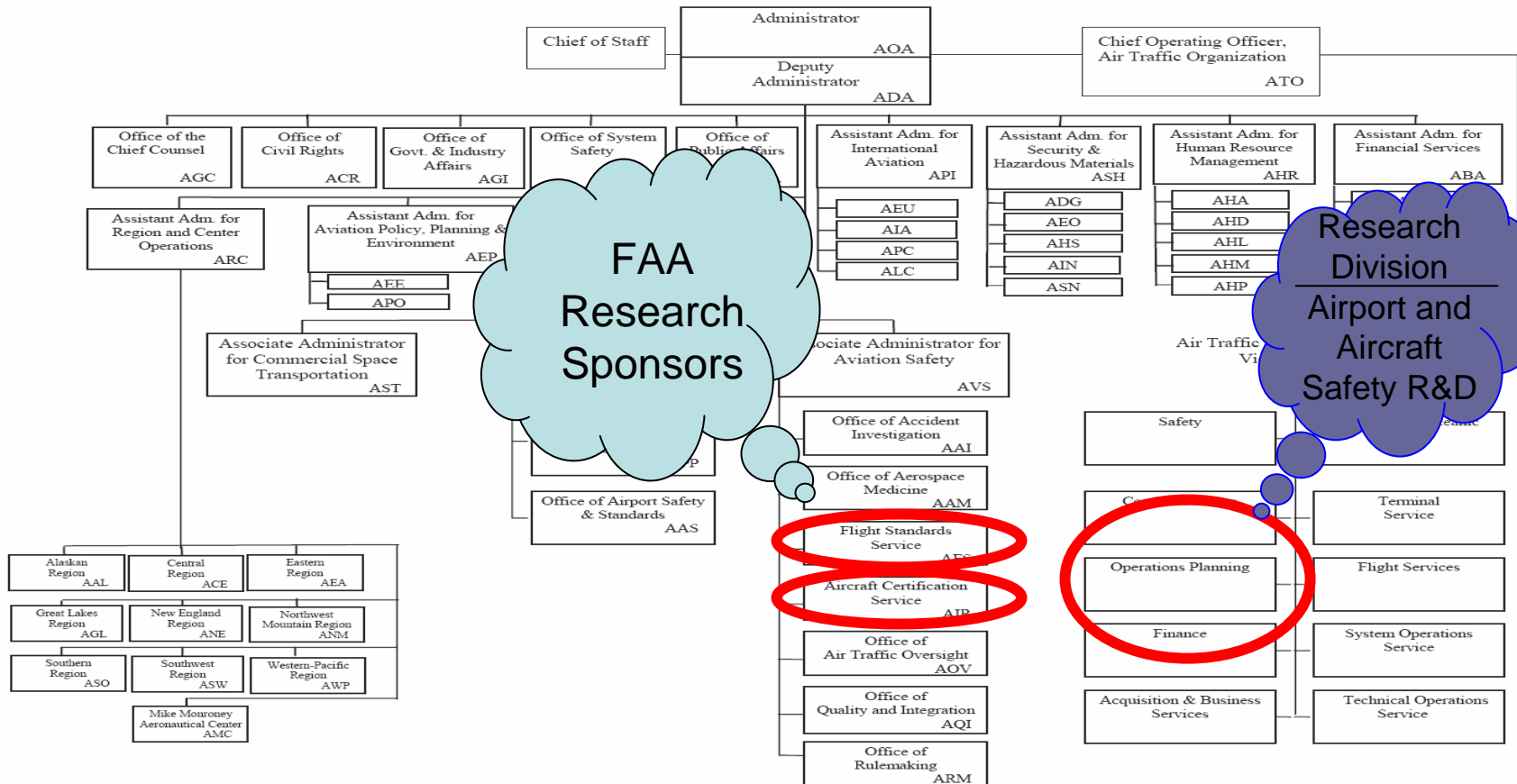
Across all technical focus areas

- **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.

- Logistics
- JAMS Center of Excellence
- **FAA Research**
- Agenda and Final Thought

As of January 11, 2005

FEDERAL AVIATION ADMINISTRATION



Components of the Research Team

- Sponsors
 - Small Airplane Directorate
 - Marvin Nuss
 - Transport Airplane Directorate
 - Paul Hawkins
 - Rotorcraft Directorate
 - Ed Cuevas
 - Engine and Propeller Directorate
 - Jorge Fernandez
- CSTA and STS Advisors
 - Al Broz, Robert Eastin, John Howford, Terry Khaled, Steve Soltis, Dave Walen, Chip Queitzsch

- 17 TCRGs
 - Composites TCRG

Represented Group	Team Member Name	FAA Organization Number & Routing
FAA Tech. Center	Curtis Davies	AAR-450 (FAA Technical Center)
	Peter Shyprykevich	AAR-450 (FAA Technical Center)
International Directorates	John Masters	AEU-100 (Brussels Aircraft Certification Staff)
	Lester Cheng	ACE-111 (Small Airplane Directorate)
	Mark James	ACE-111 (Small Airplane Directorate)
	Charles Harrison	ASW-111 (Rotorcraft Directorate)
	Richard Yarges	ANM-115 (Transport Airplane Directorate)
	Hank Offermann	ANM-115 (Transport Airplane Directorate)
	Jay Turnberg	ANE-110 (Engine & Propeller Directorate)
	Flight Standards	Rusty Jones
ACOs,	Roger Caldwell	ANM-100D (Denver ACO)
	Mark Freisthler	ANM-120S (Seattle ACO)
	Fred Guerin	ANM-120L (Los Angeles ACO)
	John Harding	ANM-108B (Seattle CMO)
MIDOs & CMOs	Angie Kostopoulos	ACE-116C (Chicago ACO)
	David Ostrodka	ACE-118W (Wichita ACO)
	Richard Noll	ANE-150 (Boston ACO)
	David Swartz	ACE-115N (Anchorage ACO)
CS&TA	Larry Ilcewicz	ANM-115N (CS&TA, Composites)

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)
- Unmanned Aerial Systems

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 user community (Technical Community Review Group – TCRG)

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

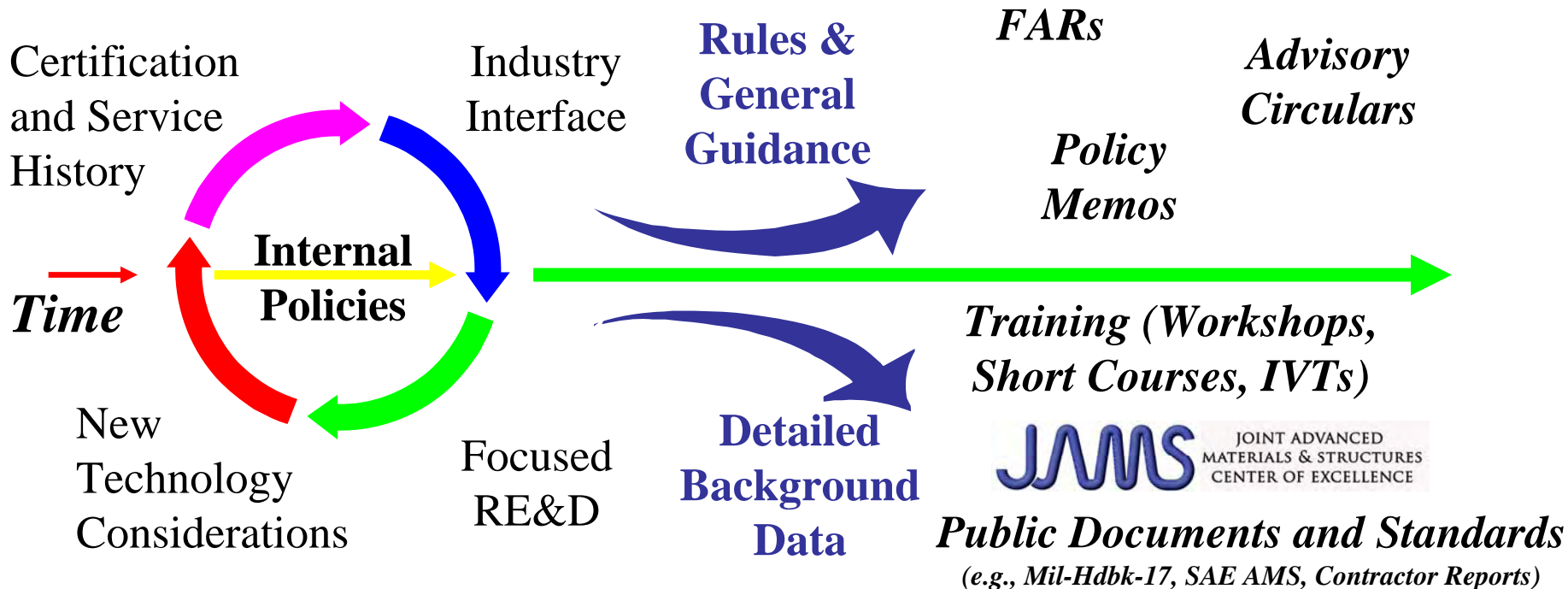
Objectives

- 1) Work with industry, other government agencies, and academia to ensure safe and efficient deployment of composite technologies used in existing and future aircraft
- 2) Update policies, advisory circulars, training, and detailed background used to support standardized composite engineering practices

** Efforts started in 1999 to address issues associated with increasing composite applications*

Evolving

Mature



Important Teammates

- NASA has been a leader for composite applications
 - Significant research support since 1970/1980s
 - AA587, A300-600 accident investigation
 - NCAMP support to material standardization
- Partnerships with industry have been essential, e.g., Mil-17, SAE P-17, CACRC, ASTM, SAMPE, AGATE, SATS, RITA, SAS/IAB/AACE

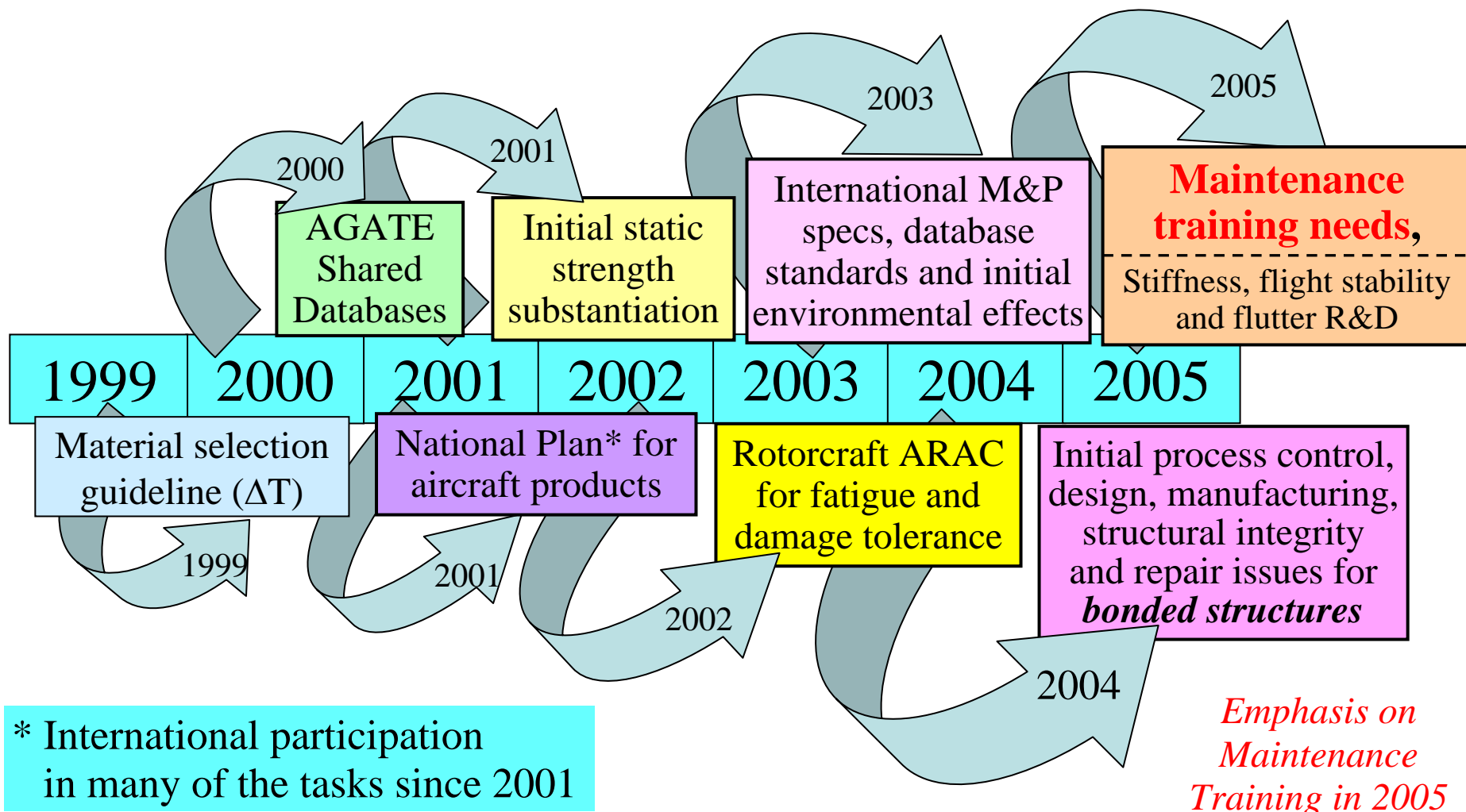


Training
Databases
Standardization
Engineering guidelines

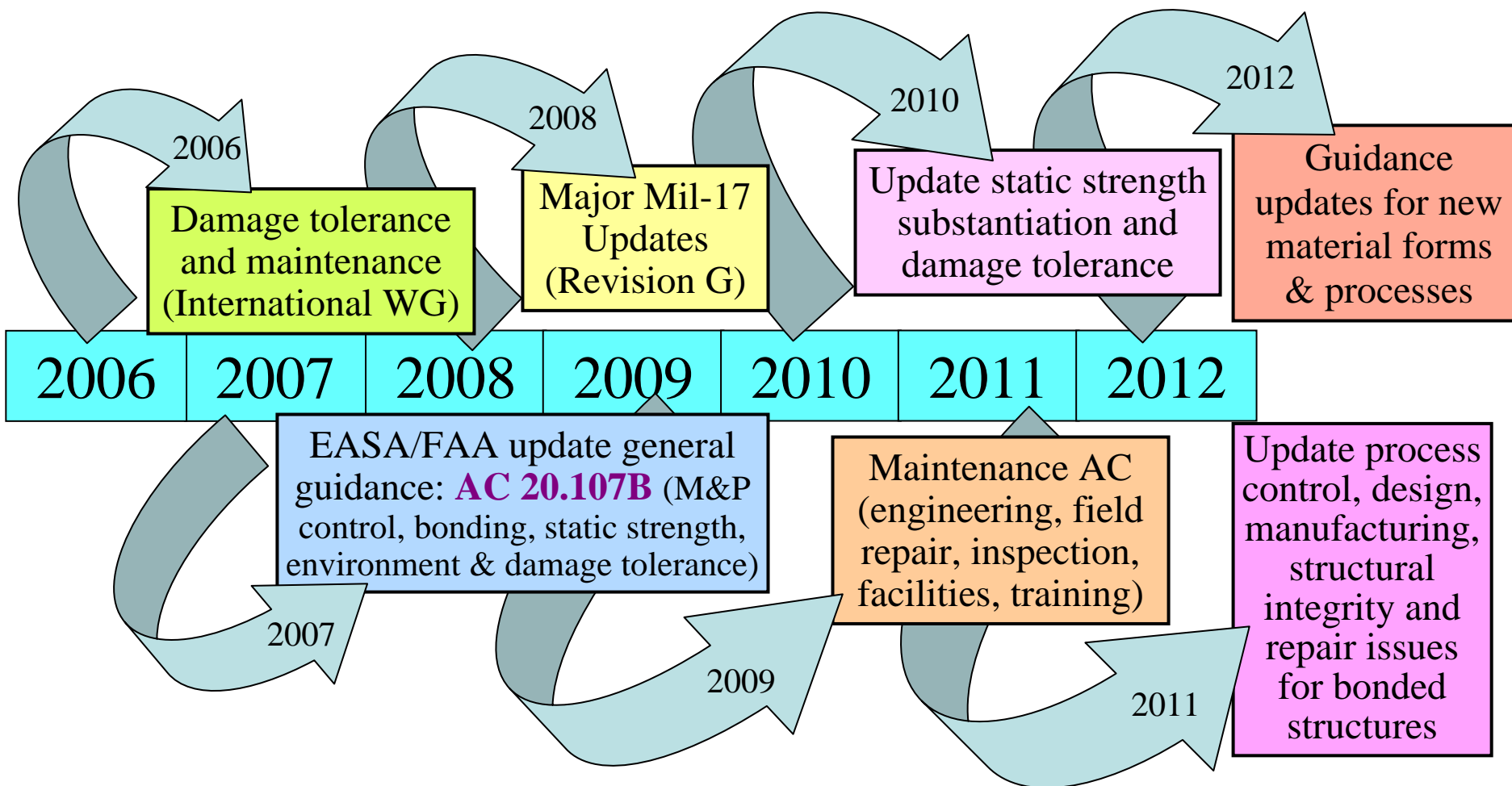


- DOD and DARPA research
- EASA and other foreign research/standardization

Milestones for Composite Safety and Certification Policy, Guidance & Training



Milestones for Composite Safety and Certification Policy, Guidance & Training



FAA Policy and Regulations Supported by Research

- AC
 - Acceptance Guidance on Material Procurement and Process Specifications for Polymer Matrix Composite Systems; AC 23-20
- Policy Memorandum
 - Static Strength Substantiation of Composite Aircraft Structure; PS-ACE100-2001-006
 - Substantiation of Secondary Composite Structures (SCS); PS-ACE100-2004-10030
 - Composite Certification Roadmap
 - Bonded Joints and Structures – Technical Issues and Certification Considerations: PS-ACE100-2005 10038

Research Project Description

504

- 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**.

Environmental and Aging Effects

- Environmental effects
- Reliability assessment
- Aged Structure Destructive Evaluation

Standardization

- Shared Databases
- Test Methods
- Material and Process Control

Structural Substantiation and Damage Tolerance

- Advances in analysis & test building blocks
- Critical defects
- Fatigue & damage considerations
- Life assessments (tests & analysis)
- Manufacturing defects

Advanced Materials, Forms and Processes

- Braiding
- Stitching
- Liquid Resin Molding

FAA R&D is currently active in all these areas

MIL-HDBK-17

Crashworthiness and Cabin Safety*

Fatigue & Damage Tolerance for Dynamic Rotorcraft Applications

Structural Integrity of Bonded Joints

- Processing Issues
- Analysis Methods

Composite Maintenance Practices

- Bonded structure & repair issues
- Accelerated testing
- Impact damage effects
- Quantitative NDE/service POD
- Equivalent levels of safety

*New focus area for FY07

Other RPDs with Potential for JAMS Activities

- 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
- RPD 678 Unmanned Aerial Systems

* These RPDs currently have a CoE or Consortium arrangement available

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- Logistics
- JAMS Center of Excellence
- FAA Research
- **Agenda and Final Thought**

- **Tuesday, June 20, 2006 PM**
 - 12:15 Registration
 - 1:00 Welcome and Opening Remarks
(Curtis Davies, FAA and Mark Tuttle, AMTAS Director, University of Washington)
 - 1:10 Welcome
(Dan Schwartz, Acting Associate Dean for New Initiatives, University of Washington College of Engineering)
 - 1:15 Introduction to FAA Research (Curtis Davies, FAA)
 - 1:45 Industry Presentation: Jim Brown, Toray Composites (America), Inc.
 - 2:00 Industry Presentation: Cytec Engineered Materials
 - 2:15 Industry Presentation: Jason Scharf, C&D Zodiac
 - 2:30 "Composite Education in the UK" (Andrew Walker, University of Manchester)
 - **2:45 Break**
 - 3:00 Course Development: Maintenance of Composite Aircraft Structures(Larry Ilcewicz, FAA)
 - 3:40 Crashworthiness Certification by Analysis: Numerical Model Preparation and Analysis Guidelines (Gerardo Olivares, Wichita State University)
 - 4:20 Damage Tolerance and Durability of Adhesively Bonded Composite Structures (Hyonny Kim, Purdue University)
 - 5:00 Adjourn

- **Wednesday, June 21, 2006 AM**
 - 8:00 VARTM Variability and Substantiation (Dirk Heider, University of Delaware)
 - 8:40 Development of Reliability-Based Damage Tolerant Structural Design Methodology (Kuen Y. Lin, University of Washington)
 - 9:20 Structure Health Monitoring for Life Management of Aircraft (Sridhar Krishnaswamy, Northwestern University)
 - **10:00 Break**
 - 10:20 Full-Scale Damage Tolerance of Sandwich Structures (Suresh (Raju) Keshavanarayana, Wichita State University)
 - 11:00 Damage Tolerance and Durability of Fiber Metal Laminates for Aircraft Structures (J.M. Yang, UCLA)
 - **11:40 Lunch – Sponsored by ABAQUS, Inc.**

- **Wednesday, June 21, 2005 PM**

- 12:45 Combined Global/Local Variability and Uncertainty in Integrated Aeroservoelasticity of Composite Aircraft (Eli Livne, University of Washington)
- 1:25 Quantifying Methods for the Evaluation of the Fitness of Fiber Reinforced Composite Surfaces for Subsequent Adhesive Bonding (Bill Stevenson, Wichita State University)
- 2:05 Improving Adhesive Bonding of Composites through Surface Characterization (Brian Flinn, University of Washington)
 - **2:45 Break**
- 3:00 Effect of Surface Treatment on the Degradation of Composite Adhesives (Prasanthi Pothakamuri, Washington State University)
- 3:40 Identification and Validation of Analytical Chemistry Methods for Detecting Composite Surface Contamination and Moisture (Xiangyang Zhou, Florida International University)
- 4:20 Effect of Repair Procedures Applied to Composite Airframe Structures (Lamia Salah, Wichita State University)
 - **5:00 Adjourn**
 - **6:00 Barbeque and Water Activities**

- **Thursday, May 26, 2005 AM**

- 8:00 Production Control Effect on Composite Material Quality and Stability (Yeow Ng, Wichita State University)
- 8:40 Aging of Composite Aircraft Structures (Lamia Salah, Wichita State University)
- 9:20 Crashworthiness of Composites (Suresh (Raju) Keshavanarayana, Wichita State University)
 - **10:00 Break**
- 10:15 Evaluation of Friction Stir Weld Process and Properties for Aerospace Application (Christian Widener, Wichita State University)
 - ***Aviation Industry Perspective on the Presented Research***
- 10:55 Industry Feedback: Andy Thomas, Bell Helicopter Textron
- 11:20 Industry Feedback: George Miller, Spirit AeroSystems
- 11:45 Industry Feedback: Jim Krone, Cessna Aircraft Company
- 12:05 Industry Feedback: John Quinlivan, The Boeing Company
- 12:30 Wrap up
 - **12:45 Conclusion of Technical Meeting**

- This meeting is a peer review forum
- Please do not hesitate to ask questions on things you do not understand
- Commentary is also welcomed
- We will limit each individual to one question at a time and when time allows we will allow individuals additional questions

