Overview of Commercial Space Transportation

Federal Aviation Administration

February 9, 2010

Background

- The U.S. space program today has 3 sectors:
  - Civil
  - Military
  - Commercial
- The commercial sector was created in 1984 with the passage of the Commercial Space Launch Act.
- Regulatory oversight for the commercial sector was given to the Office of Commercial Space Transportation, which was originally a staff office within the Department of Transportation.
- Today, we are one of four lines of business within the FAA.

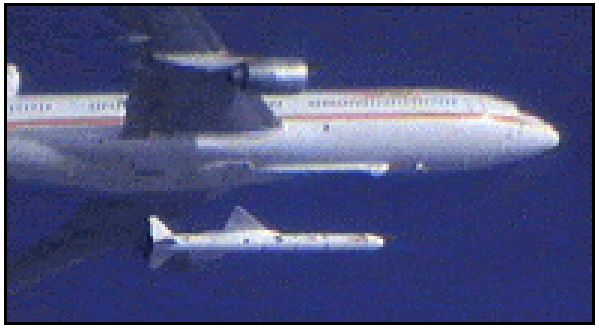
Mission

To ensure the protection of the public, property, and the national security and foreign policy interests of the United States during commercial launch and reentry activities, and to encourage, facilitate, and promote U.S. commercial space transportation.

Who Needs a Launch License?

- Commercial Space Launch Act of 1984 requires U.S. citizens to obtain a license prior to conducting the launch of a launch vehicle
- Only exception is for missions conducted by and for the government (such as launches by NASA or the U.S. Air Force)
- Over the last 20 years, there have been 200 licensed launches, without any fatalities or property damage to the uninvolved public.

Examples of Licensed Operations



Air Launch

Sea Launch

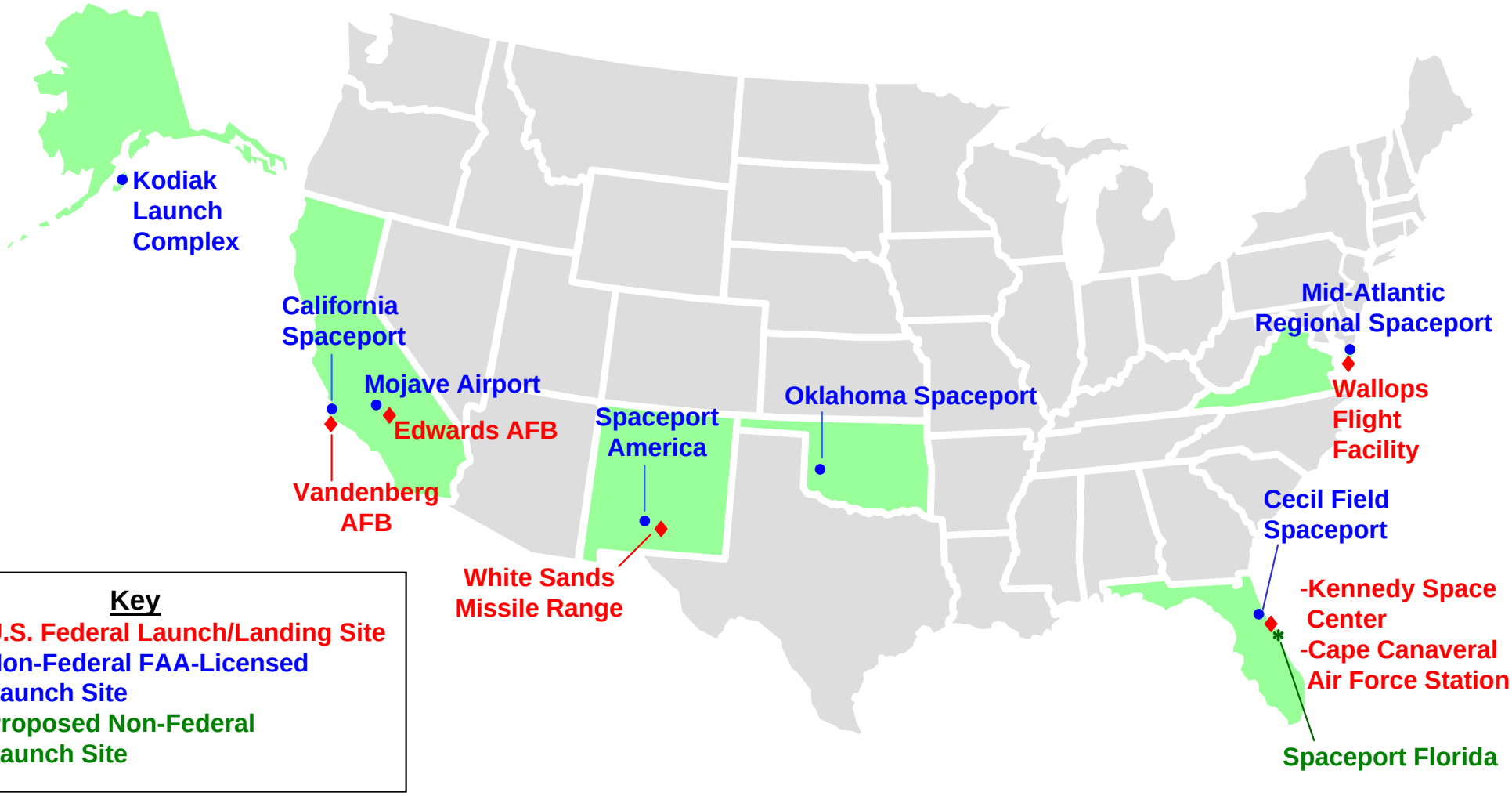
Launch Sites

Ground Launch

Reusable Launch Vehicles

Suborbital Rockets

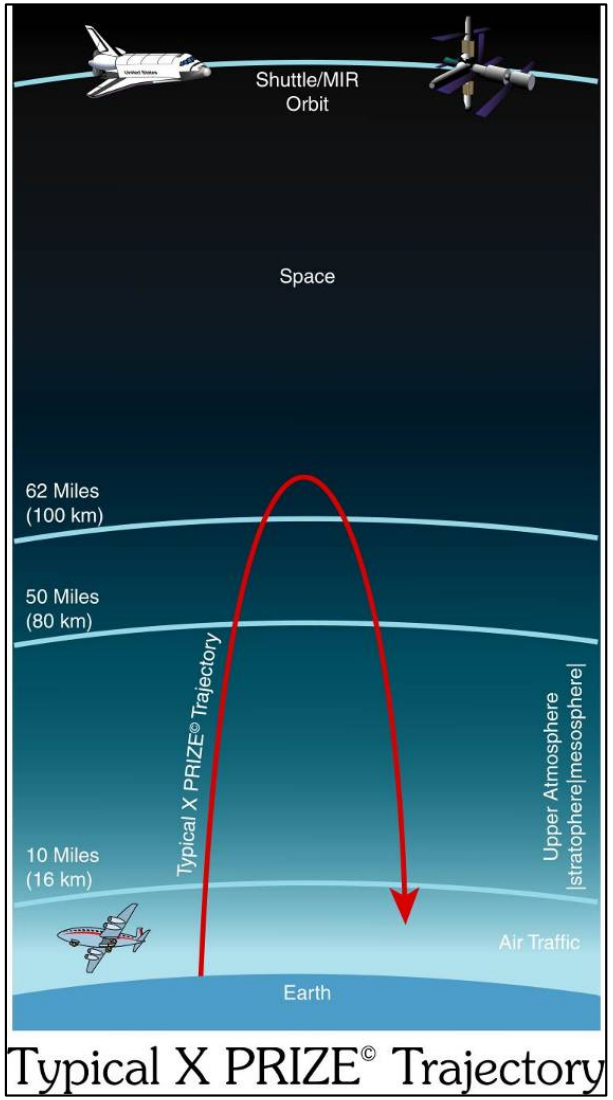
U.S. Spaceports



The Ansari X Prize

- The X Prize was a $10 Million cash prize for the first team to privately finance, build, and fly a reusable launch vehicle that is capable of safely launching three people to 100 km and conducting a repeat mission with the same vehicle within 2 weeks.

- The X Prize was founded in 1996 for the specific purpose of stimulating the creation of a new generation of launch vehicles designed to carry passengers into space.



Typical X PRIZE© Trajectory

X Prize Teams

26 Teams from 7 Different Countries

Scaled Composites/Rutan

Advent Launch Service

Armadillo Aerospace

Canadian Arrow - Canada

Starchaser - UK

DaVinci Project -Canada

SpaceShipOne and Carrier Aircraft

The Milestones of Flight Gallery

Commercial Space Launch Amendments Act of 2004

- Put Congress and the Administration on the record as supporting the development of commercial human space flight.
- Established an “informed consent” regime for carrying space flight participants.
- Created a new experimental launch permit for testing reusable suborbital launch vehicles.
- Called for the FAA to develop regulations on an accelerated schedule. (Final rules have now been issued for both human space flight and experimental permits.)

5 Licensed Launches in Last 12 Months

Winning of the Lunar Lander Challenge

Masten Space

Armadillo Aerospace

Shuttle Retirement in 2010

Commercial Resupply Services Contract Award

Commercial Crew Development

Suborbital Space Tourism

Is There a Market?

Futron recently conducted a Space Tourism Market Study, based on a poll of affluent Americans.

Some of the results:

- Space Tourism could generate more than $1B per year in revenues by 2021.
- Suborbital flights will constitute the biggest share, with the potential for 15,000 passengers and $700M in revenues per year.
- Orbital flights may include up to 60 passengers and $300M in revenues per year.

One Example: Virgin Galactic

- British entrepreneur Richard Branson has signed an agreement to license SpaceShipOne technology
- Virgin Galactic plans to operate a fleet of 5 vehicles
- Each will carry 6 passengers and a crew of 2
- Ticket price is $200K per person per flight
- Almost 300 deposits have been received, totaling $40M

WhiteKnightTwo Carrier Aircraft

SpaceShipTwo

Spaceport America in New Mexico

Conclusions

- The next 2-3 years will be a critical time period for our nation's space program
- During this period, we are likely to see:
  - Retirement of the Space Shuttle
  - Demonstration of commercial cargo deliveries to the International Space Station
  - Start of Commercial Human Space Flight operations
- Congress, through the Commercial Space Launch Amendments Act, has challenged the FAA to "encourage, facilitate, and promote" the new activities in a way that continuously improves their safety.
- The Office of Commercial Space Transportation is committed to doing our part to enable industry's progress

Air Transportation Centers of Excellence

Government-Academic-Industry Strategic Partnerships

COE for Commercial Space Transportation

Public Meeting – Part One

Presented by: Patricia Watts, Program Director

FAA Centers of Excellence

February 9, 2010

Federal Aviation Administration

COE PROGRAM OVERVIEW

WHY:	**Legislative Authority**
WHERE:	**Geographic Distribution**
WHO:	**University Members & Affiliates**
HOW:	**Oversight Team**
HOW MUCH:	**Funding**
SO WHAT:	**Results & Outcomes**
THEN WHAT:	**Administration – FAA Program Office**
	Role of Industry and Other Affiliates
	Annual Meetings
	COE Benefits

Attachment – Established Centers

Contact Information

LEGISLATIVE AUTHORITY

Omnibus Budget Reconciliation Act of 1990
Public Law 101-508
Title IX – Aviation Safety and Capacity Expansion Act

"The Administrator may make grants to one or more colleges or universities to establish and operate several regional centers of air transportation excellence, whose locations shall be geographically equitable. The responsibilities of each regional center shall include, but not be limited to, the conduct of research concerning airspace and airport planning and design, the air transportation environment, aviation safety and security, the supply of trained air transportation personnel including pilots and mechanics, and other aviation issues pertinent to developing and maintaining a safe and efficient air transportation system.…each center may make contracts with nonprofit research organizations and other appropriate persons…."

FAA COE GEOGRAPHIC DISTRIBUTION

INTERMODAL TRANSPORTATION

(Airliner Cabin Environment Research)

Harvard University – Technical Co-Lead

Purdue University – Technical Co-Lead

Auburn University – Admin Lead

Boise State University

Kansas State University

University of California at Berkeley

University of Medicine & Dentistry of New Jersey

AIRPORT TECHNOLOGY

(Airport Pavement Research)

University of Illinois - Lead

Rensselaer Polytechnic Institute

GENERAL AVIATION

Embry Riddle Aeronautical University – Lead

University of Alaska

University of North Dakota

Wichita State University

ADVANCED MATERIALS

University of Washington/ Wichita State University/ Joint-Leads

Edmonds Comm. College

Northwestern University

Purdue University

Oregon State University

University of California at LA

University of Delaware

University of Utah

Washington State University

NOISE AND EMISSIONS MITIGATION

Massachusetts Institute of Technology - Lead

Georgia Institute of Technology

Harvard University

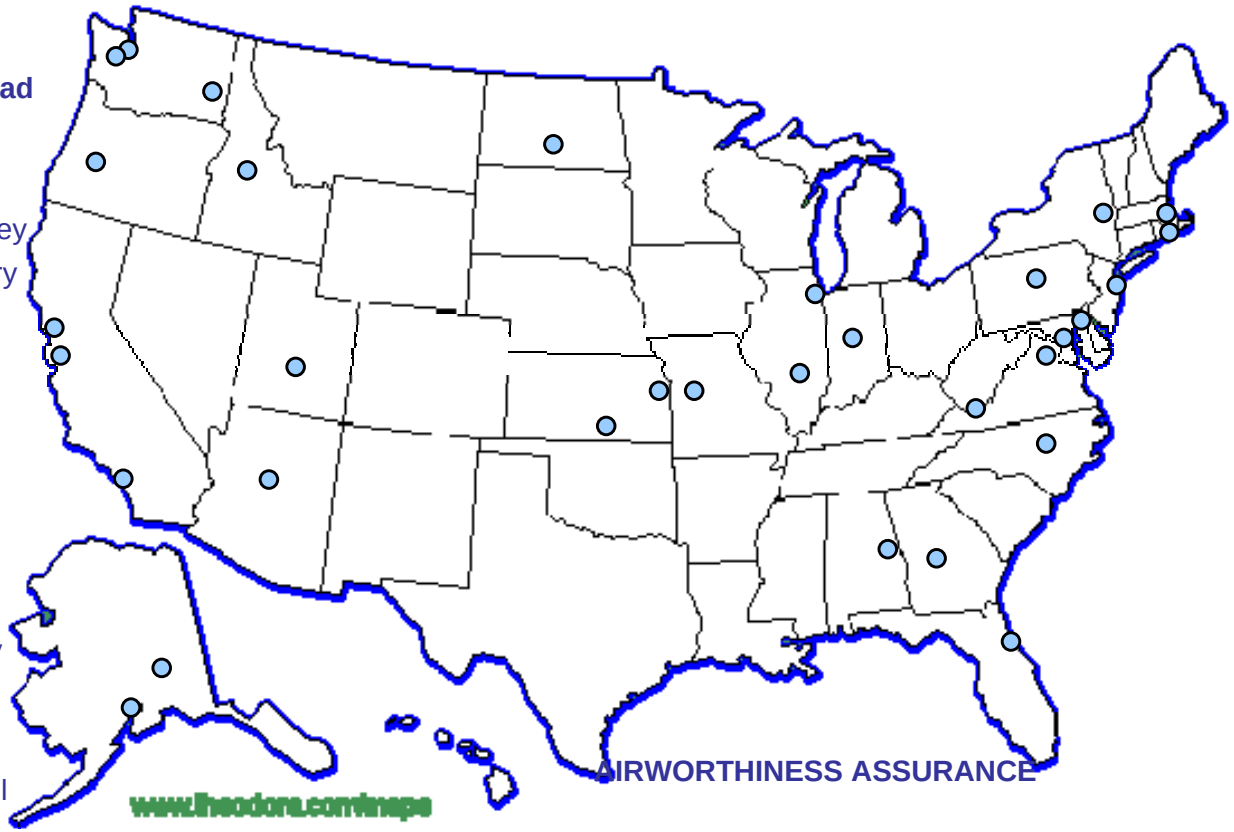
Missouri Science & Technology

Penn State University

Purdue University

Stanford University

Univ. of N Carolina - Chapel Hill



OPERATIONS RESEARCH

Co-Leads

University of California at Berkeley

Massachusetts Institute of Technology

University of Maryland

Virginia Polytechnic Institute

George Mason University

AIRWORTHINESS ASSURANCE

COMPUTATIONAL MODELING OF AIRCRAFT STRUCTURES

COE UNIVERSITY MEMBERS

Auburn University
Boise State University
Edmonds Community College
Embry-Riddle Aeronautical University
Florida A&M University
Florida International University
Georgia Institute of Technology
George Mason University

Wichita State University Composites Lab

Peter Sparacino – FAA CGAR Program Manager,
Daniel J. Halperin – ERAU COE Outstanding Student of the Year
Patricia Watts – FAA COE Program Director
Steven Hampton – ERAU CGAR Principal Investigator

Harvard University
Kansas State University
Massachusetts Institute of Technology
Northwestern University
Oregon State University
Pennsylvania State University
Purdue University
Rensselaer Polytechnic Institute
Stanford University

COE UNIVERSITY MEMBERS

Rutgers University
Tuskegee University
University of Alaska at Anchorage
University of Alaska at Fairbanks
University of California at Berkeley
University of California at Los Angeles
University of Delaware
University of Illinois at Urbana Champaign

Phillip Donovan – UIUC
DOT FAA COE Student of the Year

Allison Crockett – WSU
COE Outstanding Student of the Year

Un of Medicine & Dentistry of NJ
University of Maryland
University of Missouri at Rolla
University of North Dakota
University of North Carolina at Chapel Hill
University of Utah
University of Washington
Washington State University
Wichita State University

COE AFFILIATES / CO-SPONSORS

Advanced Transportation R&E Laboratory (ATREL)
Aero Shell
AeroClave
Aerodyne Research Inc.
Air Force Research Laboratory
Air Tran Airways
Air Transport Association of America (ATA)
Airborne Express
Airbus Industries
Aircraft Owners & Pilots Association (AOPA)
Airline Pilotss Association (APA)
Airports Council International – North America
Alaska Airmen's Association
Alaska Airways
Alaska Science and Technology
Alcoa Technical Center
AlliedSignal
Allison Engine Company
Aloha Airlines
American Airlines

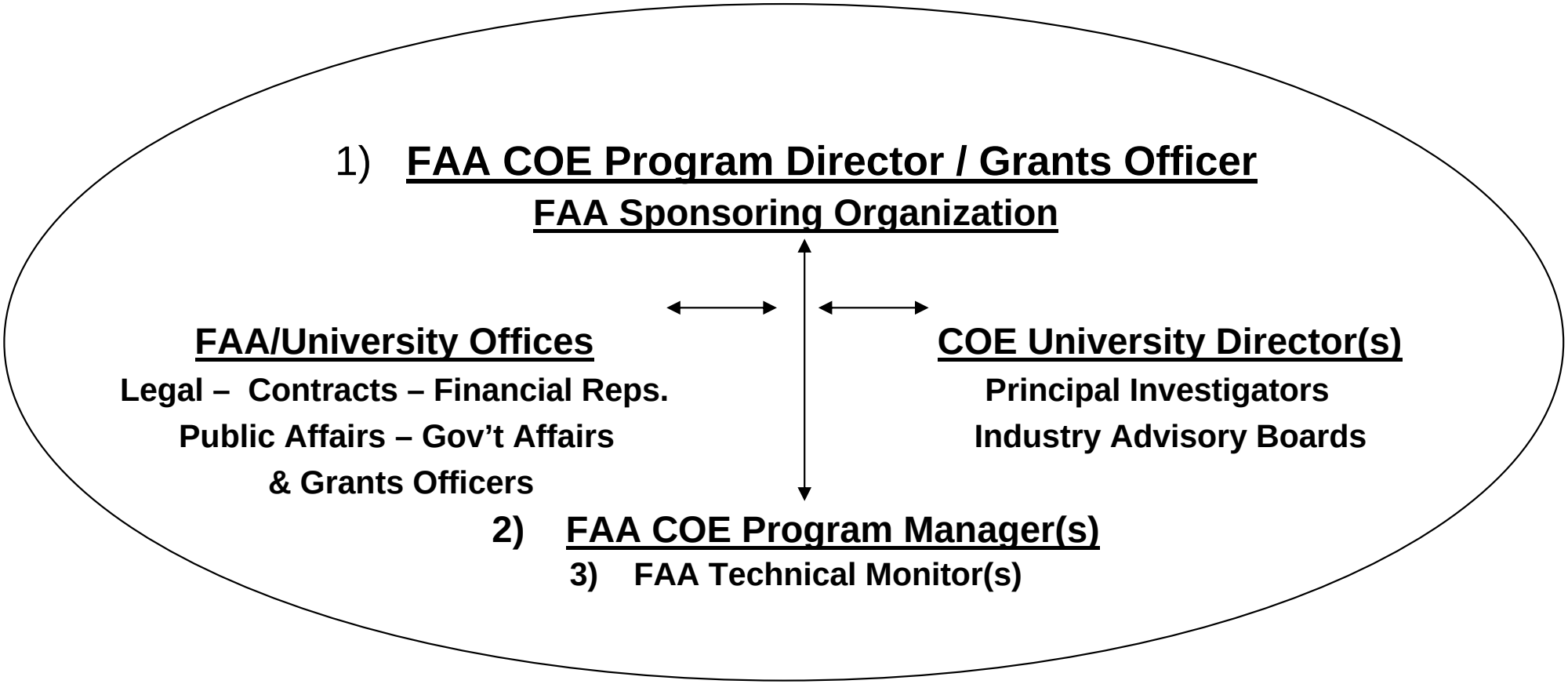
American Eagle Airlines, Inc.
American Institute of Aeronautic and Astronautics (AIAA)
ARINC Dayton
Battelle
Bell Helicopter TEXTRON
BF Goodrich R&D Center
Boeing Company
Bombardier Aerospace-Learjet
Brookhaven National Lab
California DOT
Cape Air
Cessna Aircraft
Chicago O'Hare International Airport
Cirrus Aviation
Comair, Inc.
Continental Airlines
Delta Airlines
Donaldson Company, Inc.
Draper Laboratory
Elite Air Center
Executive Jet Aviation
Experimental Aircraft Assoc (EAA)

FedEx Corporation
General Aviation Mfg Assn (GAMA)
Goodrich
Gulfstream Aerospace Corporation
Harris Corporation
Honeywell
Illinois Department of Aeronautics
Indiana Department of Transportation
International Centre for Indoor Environment & Energy, Technical University of Denmark
JENTEK Sensors, Inc.
Livermore Software Technology Corp.
Lockheed Martin Aeronautics Company
Los Angeles World Airports
Lufthansa
Maryland Aviation Administration
Massachusetts Port Authority
McDonnell Douglas Aerospace
Metron Aviation, Inc.
Metropolitan Washington Airport Authority
NASA
National business Aviation Assn (NBAA)
NMS Bio-Defense

Northrop Grumman Corporation
Northwest Airlines
Northwest Composites
O'Hare Modernization Program (OMP)
O'Hare Noise Compatibility Commission
Ohio Department of Development
Ohio Department of Transportation
Pratt & Whitney
Professional Flight Attendants Association
Raytheon Aircraft Company
Regional Airport Authority of Louisville and Jefferson County
Rockwell International
Rolls Royce
SAE International
San Francisco Inter. Airport/Community Roundtable
Sandia National Laboratories
Seagull Technology

Sikorsky Aircraft
Southern Air Transport
Southern California Association of Governments
Southwest Research Institute
Spitfire Aviation Partners
SRI International
Illinois Dept. of Transportation
STERIS Corporation
Sun Microsystems
Transport Canada
United Airlines
United Parcel Service
US Airways
US DOT Volpe National Transp Systems Center
US EPA
Virginia Department of Transportation
Wyle Laboratories

FAA COE Levels of Oversight



Internal Advisors

DOT Office of Acquisition & Grants Management, M-60

UNIQUE FUNDING COMBINATIONS

- **COE Research Grants - require matching funds to establish, operate and conduct research -mandated by Congress**
- **Cost-share contracts may be awarded following competitive process – authorized by the White House Reinvention Lab**
- **Centers may receive funding from any public or private source**
- **Core Members rcv direct awards from FAA**
- **As set forth in P.L. 101-508: *Centers may contract with others as appropriate***

COE FUNDING LEVELS

YEAR	CENTER OF EXCELLENCE	AMOUNT
1992 to 1996	Computational Modeling of Aircraft Structures	$ 10 M
1995 - present	**Airport Technology (Formerly: Airport Pavement Research)**	**$ 35 M**
1996 – 2007	Operations Research*	$ 45 M
1997 – 2007	Airworthiness Assurance*	$ 135 M
2001 - present	**General Aviation***	**$ 34 M**
2003 - present	**Aircraft Noise and Emissions Mitigation***	**$ 60 M**
2004 – present	**Advanced Materials**	**$ 30 M**
2004 – present	**Research in the Intermodal Transport Environment** (Formerly: Airliner Cabin Environment)	**$ 31 M**
Level of Effort	**Grants*/Contracts/Matching Funds Interagency Agreements**	**$ 380M**

RESULTS

COE Partnerships Established	**8**
University Partners and Affiliates	**> 260**
Official Collaborations with: NASA, Transport Canada, Sandia, Iceland, DoD, Volpe, etc.	**> 12**
Projects Supported	**> 750**
Graduate Students Supported	**> 1,500**
Published Articles, Reports, Doctoral Theses	**> 2,500**
Matching Funds	**>$ 110 M**

P.L. 101-508 REQUIREMENTS AND OUTCOMES

FAA Requirements:
* geographic equity in the distribution of funds and location of Centers;
* consideration of minority and special groups

Universities Must:
* match FAA grant funds from non-federal sources;
* interpret, publish, and disseminate research results

Together we…

- strategically focus and coordinate a Nat'l research agenda with public/ private partners for 10 yrs
- avoid duplication of effort using a tested business strategy and trusted structure
- augment resources with the best and brightest throughout the U.S.
- leverage scarce govt funds
- educate and train a pool of aviation professionals for the next generation

STREAMLINED ADMINISTRATION

- **Projects are funded on an on-going basis following proposal submission and technical evaluations by sponsoring organization(s).**
- **Technical reviews are conducted quarterly during first year, semi-annually thereafter.**
- **COE management, projects, and progress are reassessed every three years; matching funds are audited. (CST during fourth year)**
- **COE members attend annual meetings hosted by industry affiliates to enhance partnership opportunities.**

ROLE OF INDUSTRY AFFILIATES

- **Serve on COE Industry Advisory Boards or Steering Committees**
- **Provide matching contributions (cash or in-kind): scientists, facilities, equipment or other in-kind contributions in accordance with OMB guidance**
  - **Labor**
  - **Materials**
  - **Lab space**
  - **Host meetings**
  - **Other**

COE BENEFITS

- **Promote** academic, government & industry scientific networks prepared to enhance the safety, security & efficiency of the national airspace system
- **Augment** government resources and leverage funds through flexible and responsive public/private partnerships
- **Expand** the U.S. math & science pipeline and facilitates aerospace recruitment opportunities
- **Provide** a formal strategy & trusted structure to coordinate a national research agenda and related education, and training
- **Advance** U.S. technology and expertise while satisfying Congressional mandate

The nation must immediately reverse the decline in and promote the growth of a scientifically and technologically trained U.S. aerospace workforce"

Final Report of the Commission on the Future of the United States Aerospace Industry

COE Annual Meetings

- **Students are provided an opportunity to highlight their work and engage in technical discussions with leaders in the field, and seek career opportunities.**
- **Senior scientists have a forum for disseminating research results, coordinating efforts, and fielding new research ideas amongst peers.**
- **Government, industry and university members are provided a venue to engage in discourse to enhance and expand partnership opportunities, generate matching funds, and review research direction and progress – across organizational lines.**

1st Annual COE Meeting

GENERAL ELECTRIC CO
OHIO STATE UNIVERSITY

Location: **GE Aircraft Engines, Cincinnati, Ohio**

Dates: **November 13 - 16, 2001**

Theme: ***Bridging the Gap* - between government, academia, and industry**

Hosts: **General Electric Aircraft Engines and Ohio State University**

Student Dinner and Poster Contest hosted and judged by GE senior management team

2nd Annual COE Meeting

AIRCRAFT MANUFACTURERS
WICHITA STATE UNIVERSITY

Location: Wichita, Kansas
Dates: October 21 - 24, 2002

Theme: *Partners Working Together for Excellence in Aviation*

Special Guests: US Transportation Secretary Norman Y. Mineta
US Congressman Todd Tiahrt

Hosts: The Boeing Company with Cessna, Raytheon, & Bombardier-Learjet and Wichita State University

Student Awards:

- **Student Dinner and Poster Contest Awards** provided and presented by local aircraft manufacturers
- **DOT COE Outstanding Student of the Year** recognized

3rd Annual COE Meeting

AVIATION INDUSTRY
ERAU

Location: Daytona Beach, Florida
Dates: November 4 - 7, 2003

Theme: *FAA COEs - The Next Five Years*

Hosts: The Boeing Company, Harris Corporation, Atlantic Southeast Airlines, Aviation Management Associates, Galaxy Scientific Corp., Sensis Corporation, Jeppesen, Embry-Riddle Aeronautical University

Keynote Speaker: Ambassador Edward Stimpson, ICAO

Student Awards:

- **Poster Contest and JPDO Futures Paper Competition** awards provided and presented by COE industry affiliates
- **DOT FAA COE Outstanding Student of the Year Award** recognized

4th Annual COE Meeting

COE INDUSTRY AFFILIATES
UNIVERSITY OF CENTRAL FLORIDA

Location: Harris Corporation, Melbourne and Orlando, Florida
Dates: March 14 - 16, 2005

Theme: *Global Leadership – Commitment to Worldwide Improvement*
Hosts: Harris Corporation, The Boeing Company, Cessna Aircraft Company, Pratt & Whitney, Lockheed-Martin, Raytheon, Tandberg Inc., General Electric, Gulfstream Aerospace Corporation, Galaxy Scientific Corporation, Engine Titanium Consortium (ETC), Aviation Management Associates, Center for Advanced Transportation Systems Simulation (CATSS), and University of Central Florida

Keynote Speaker: Ambassador Thomas Pickering, Senior Vice President, International Relations, The Boeing Company
Dinner Speaker: The Honorable John Goglia, NTSB (retired)

Special Awards:

- Student Poster Contest
- DOT FAA COE Outstanding Student of the Year
- Joseph A. Hartman Boise State University-Annual COE Industry Leadership Award

FAA CENTERS OF EXCELLENCE

Patricia Watts, Ph.D.
National Program Director
Air Transportation Centers of Excellence

FAA William J. Hughes Technical Center
Atlantic City International Airport, NJ 08405
Telephone (609) 485-5043
Fax: (609) 485-9430
Email: patricia.watts@faa.gov
Website: www.coe.faa.gov

Federal Aviation Administration

Overview of the Center of Excellence for Commercial Space Transportation

Ken Davidian
Program Lead for "Encourage, Facilitate & Promote"
Office of Commercial Space Transportation (AST)
February 9, 2010

COE CST Agenda

- Establishment
- Funding Guidelines
- Thematic Structure Evolution
- Program Schedule
- Team Principals

Establishment of the COE CST

To better carry out its mission, AST proposed to establish the COE CST …

- ***A formal, long-term (10 year), organizational structure.***
- ***By encouraging teaming of resources and capabilities.***
- ***To define, conduct, and disseminate research for the benefit of both government and industry.***

Federal Aviation Administration

Memorandum

Date: August 18, 2009

To: J. Randolph Babbitt, Administrator
x73111

From: Dr. George C. Nield, Associate Administrator for Commercial Space Transportation, x77793

Subject: Commercial Space Transportation Center of Excellence

I have prepared the attached memorandum, dated August 17, which provides the rationale for the FAA to establish a Commercial Space Transportation Center of Excellence in partnership with universities and their industry affiliates.

With your concurrence, we will proceed with the preliminary steps necessary to establish this Center within the next year.

Attachment

Concur: _____ Date: 8/18/09

Nonconcur: _____ Date: _____

Need to Discuss: _____ Date: _____

COE CST Funding Guidelines

- **Funding Level**
  - $1M/year
  - Term of 10 years
  - Starting with FY10 funding
- **University Matching Funds Obligation**
  - 1:1 FAA Funding:Matching Support

COE CST Thematic Structure - Original

- **4 Main Areas**
  - Space Traffic Management & Launch Operations
  - Launch Vehicle Systems, Technologies, and Operations
  - Human Space Flight
  - Space Commerce

COE CST Theme #1: Space Traffic Mgt & Ops

- **Emergency Response**
- **Ground Safety**
- **Spaceports**
- **Space Traffic Control**
  - Space Situational Awareness
  - Trajectory Analysis
  - Operational Constraints
  - MMOD Avoidance
  - Interactions w/NextGen ATC
- **Training**
  - Regulatory
  - Operations and Maintenance
- **Space Environment**
  - Space Weather
  - Terrestrial Weather

COE CST Theme #2: Launch Vehicle Systems, Technologies, and Operations

- **Safety Mgt and Eng**
- **Flight Safety Analysis**
- **Avionics**
  - GPS, Inertial, Orbital GNC
  - Docking & Berthing
- **Flight Safety Systems**
- **Material**
- **Sensors**
- **Software Safety**
- **Testing**
  - Ground Components
  - Ground Systems
  - Flight Systems
- **Vehicle Design**

COE CST Theme #2: Launch Vehicle Systems, Payloads, Technologies, and Operations

- **Safety Mgt and Eng**
- **Flight Safety Analysis**
- **Avionics**
  - GPS, Inertial, Orbital GNC
  - Docking & Berthing
- **Flight Safety Systems**
- **Material**
- **Sensors**
- **Software Safety**
- **Testing**
  - Ground Components
  - Ground Systems
  - Flight Systems
- **Vehicle Design**
  - ELVs
  - RLVs
- **Payloads**

COE CST Theme #3: Human Space Flight

- Aerospace Physiology
- ECLSS, Habitability
- Human Factors
- Personnel Training

COE CST Theme #4: Space Commerce

- **Space Commerce**
  - Business
    - Space Economics
    - Space Financing
    - Space Insurance
  - Law
  - Regulation
  - Policy

COE CST Thematic Structure - Updated

- **4 Main Areas**
  - Space Traffic Management & Launch Operations
  - Launch Vehicle Systems, Technologies, and Operations
  - Commercial Payloads
  - Space Commerce
- **3 Cross-Cutting Areas**
  - Safety
  - Testing
  - Training

COE CST Program Schedule

Date	Milestone
9 Feb ’10	**Public Meeting**
1 Mar ’10	Release of Final Solicitation
15 Apr ‘10	Proposals Due
14 May ‘10	Proposal Evaluations Complete Recommendation to the Administrator
21 May ‘10	Selection of COE CST Winners Announcement of COE CST Winners
30 July ‘10	Execution of Cooperative Agreements

CST COE Team Principals

- **Dr. Patricia Watts**
  - FAA COE, Program Manager
- **Dr. George Nield**
  - FAA AST, Associate Administrator
- **Ken Davidian**
  - FAA AST, EFP Program Lead
- **Brenda Parker**
  - FAA AST, Program Analyst

For More Information, Contact:

- **Dr. Pat Watts**
  - patricia.watts@faa.gov
- **Ken Davidian**
  - ken.davidian@faa.gov
  - 202-267-7214

Air Transportation Centers of Excellence

Government-Academic-Industry Strategic Partnerships

COE for Commercial Space Transportation

Public Meeting – Part Two

Presented by: Patricia Watts, Program Director

FAA Centers of Excellence

February 9, 2010

Federal Aviation Administration

FAA Established Centers

*** COE for Commercial Space Transportation (2010)**

*** COE for Research in the Intermodal Transport Environment**

*** Joint COE for Advanced Materials**

*** FAA/NASA/Transport Canada COE for**

Aircraft Noise & Aviation Emissions Mitigation

*** COE for General Aviation**

*** COE for Airport Technology**

COE for Airworthiness Assurance
(1997-2007)

* COE for Operations Research
(1996-2007)

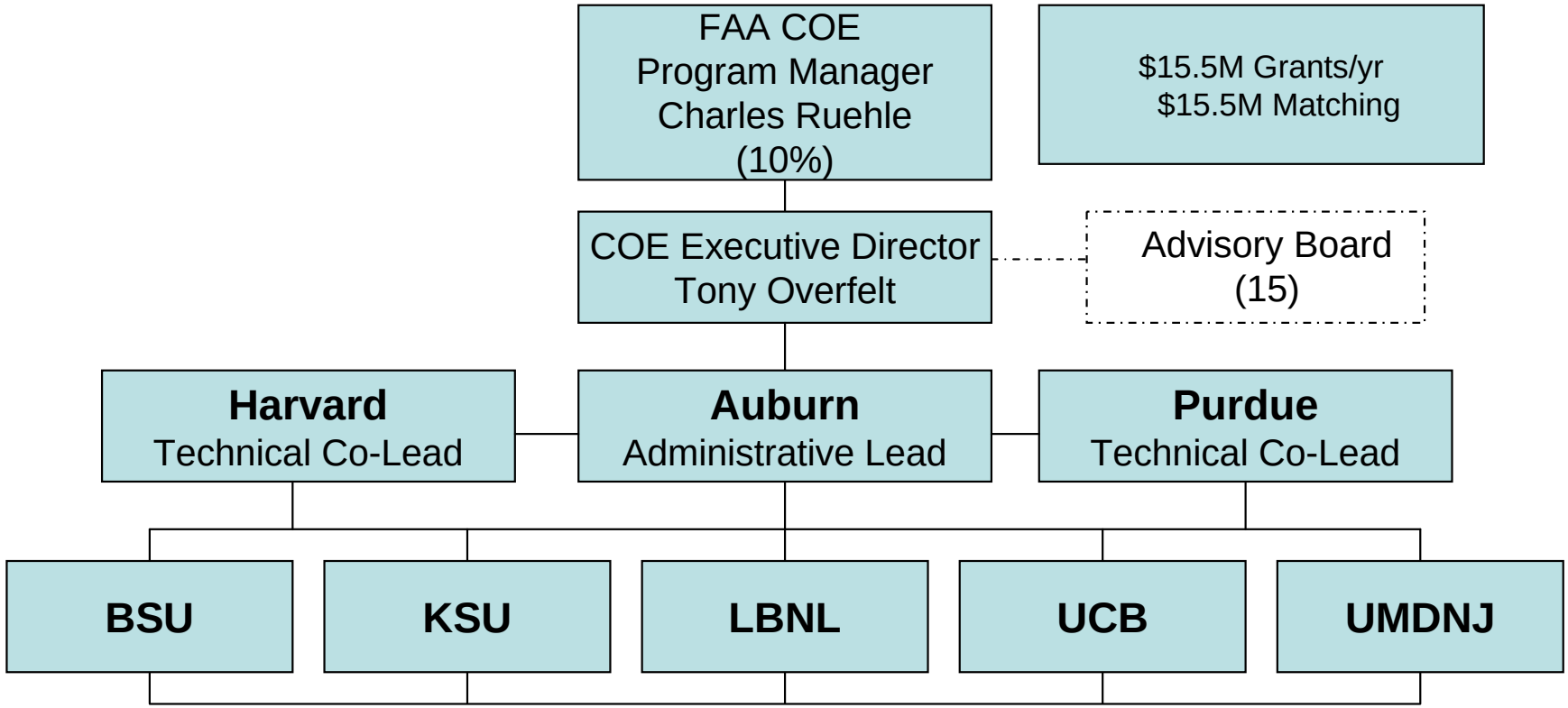
* Joint Center for Computational Modeling of Aircraft Structures

Members Designated by Congress 1992
(1993-1996)

FAA Centers of Excellence

COE Organizational Structure

COE for Research in the Intermodal Transport Environment

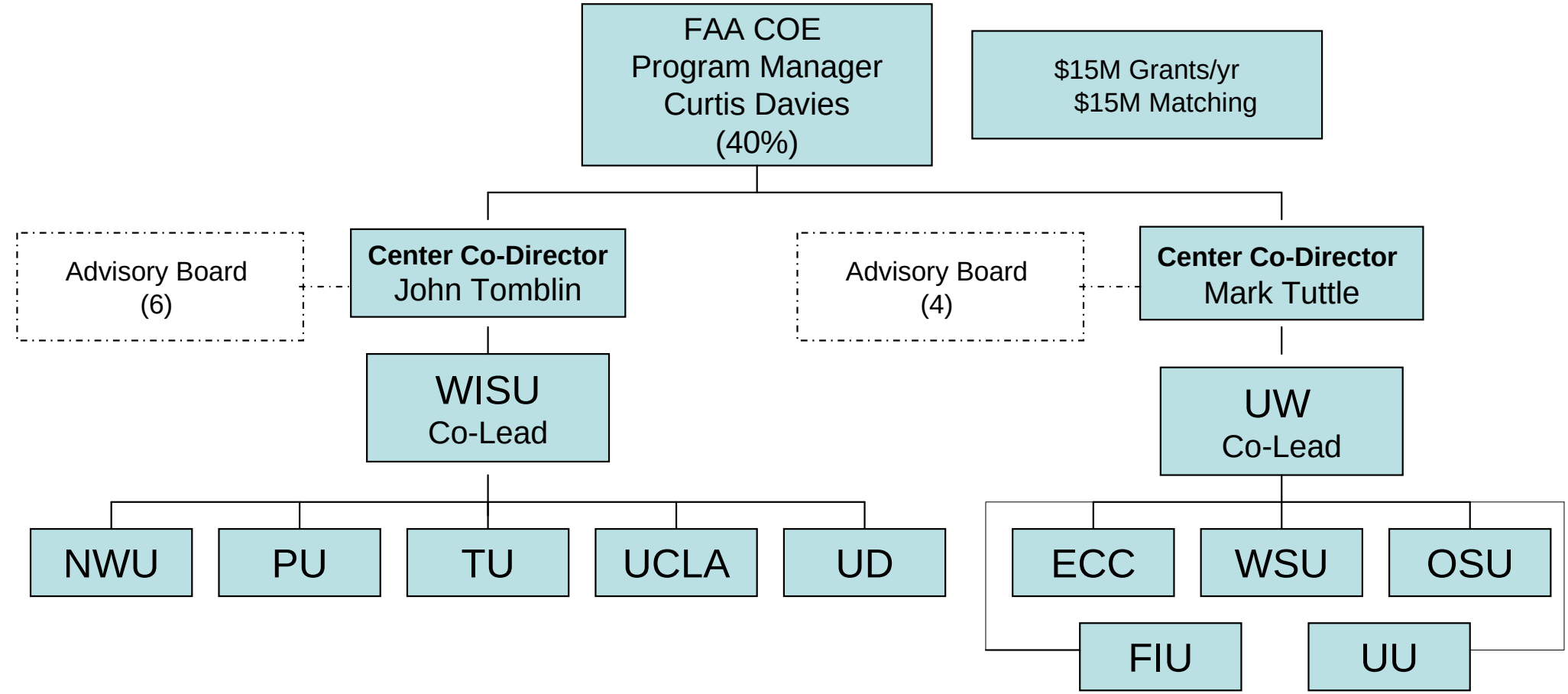


Auburn University
Harvard University
Purdue University
Boise State University
Kansas State University

FAA Technical Monitors ↔ Univ. PI
FAA Technical Monitors ↔ Univ. PI
FAA Technical Monitors ↔ Univ. PI
FAA Technical Monitors ↔ Univ. PI

Lawrence Berkeley National Lab.
University of California, Berkeley
University of Medicine and Dentistry of New Jersey

COE for Advanced Materials

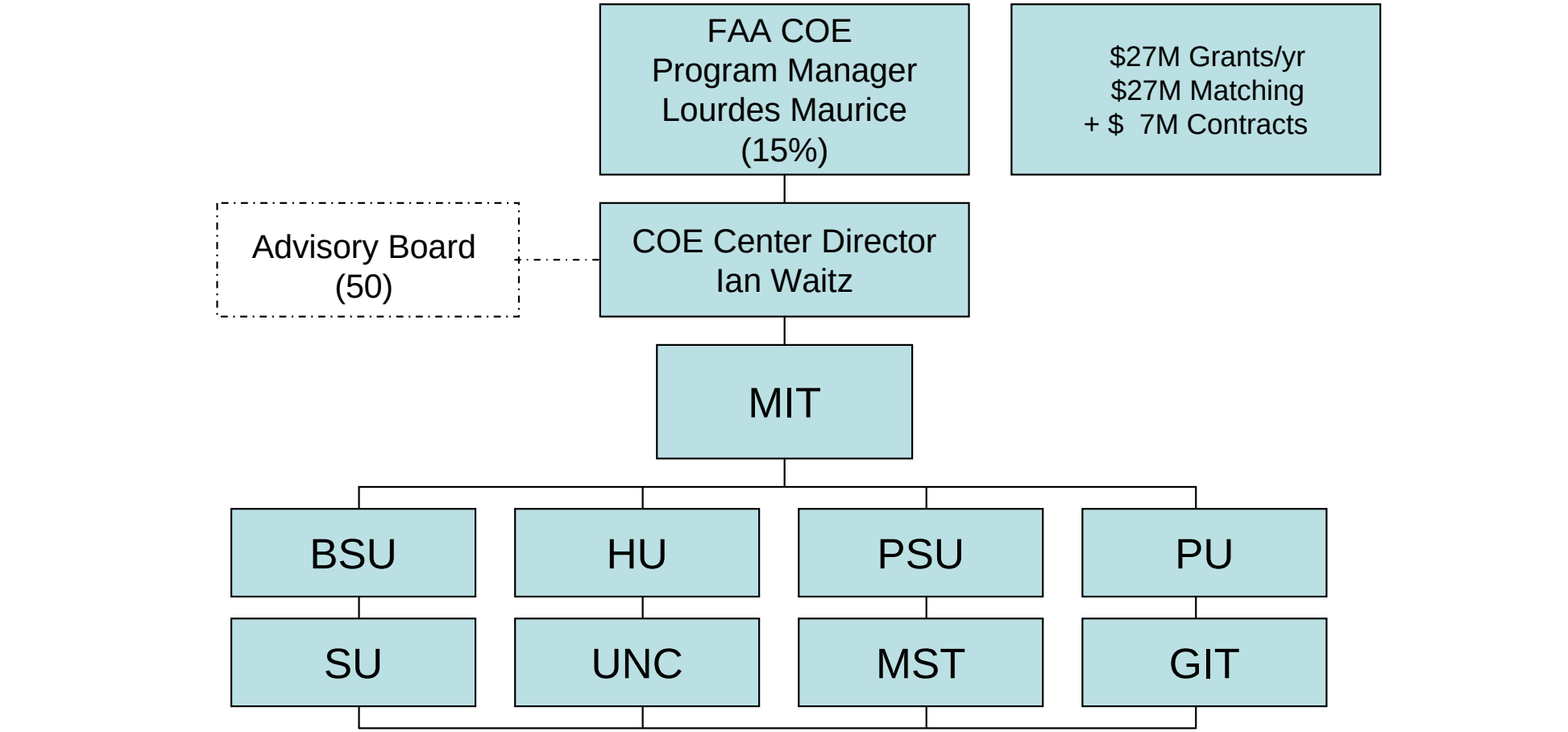


Wichita State University
Northwestern University
Purdue University
Tuskegee University
University of California, Los Angeles
University of Delaware

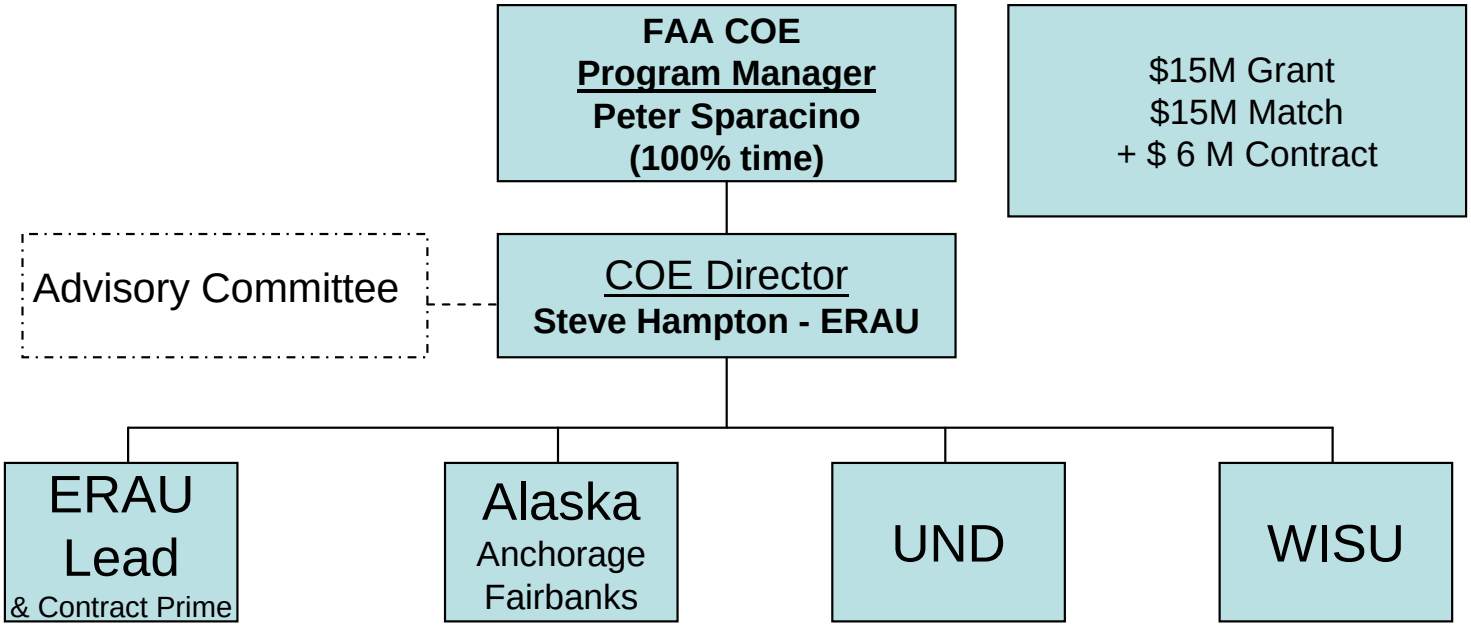
FAA Technical Monitors ↔ Univ. PI
FAA Technical Monitors ↔ Univ. PI
FAA Technical Monitors ↔ Univ. PI
FAA Technical Monitors ↔ Univ. PI

University of Washington
Edmonds Community College
Washington State University
Oregon State University
Florida International University
University of Utah

COE for Aircraft Noise and Aviation Emissions Mitigation



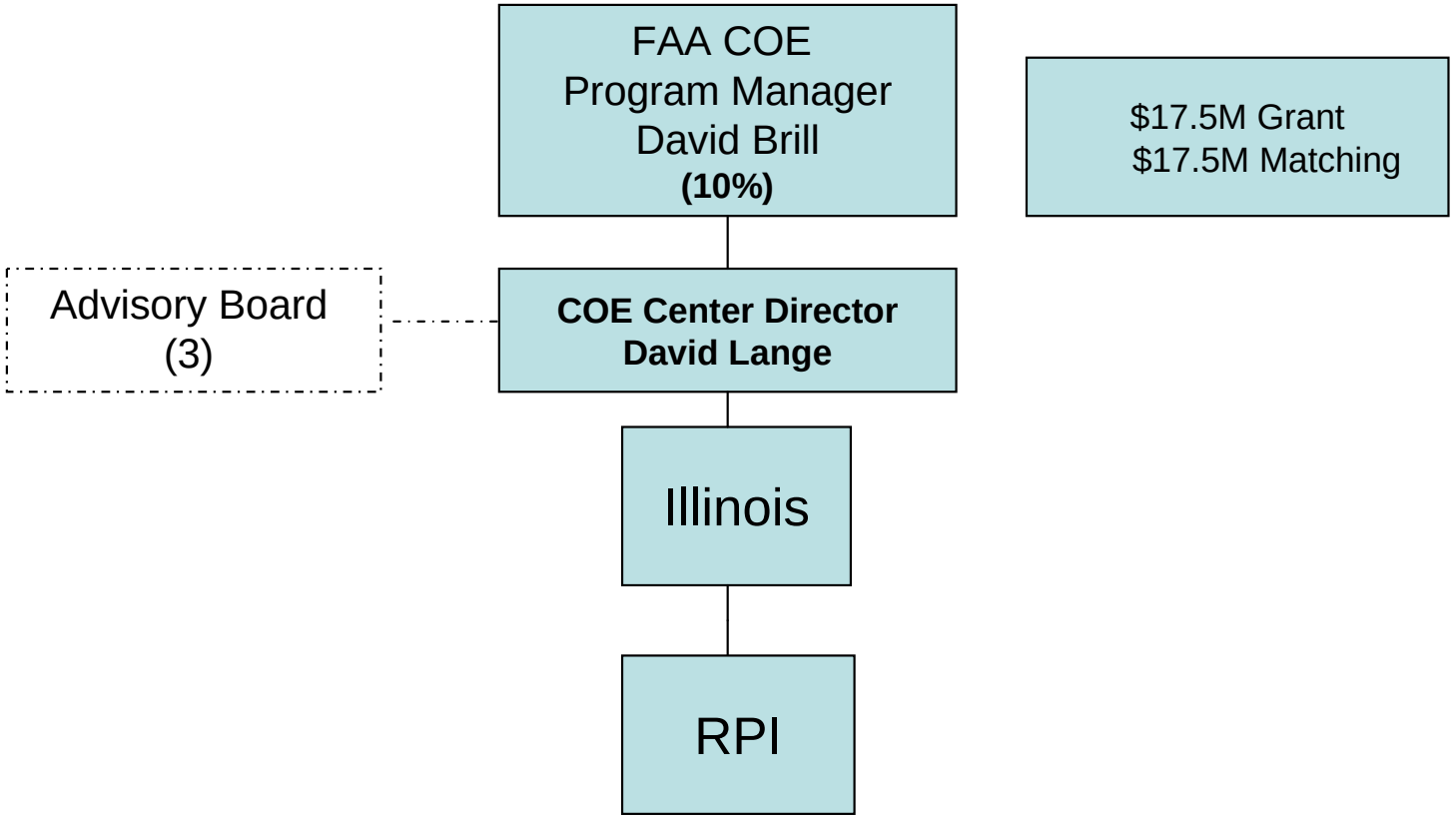
COE for General Aviation



FAA Technical Monitors ↔ Univ. PI
FAA Technical Monitors ↔ Univ. PI
FAA Technical Monitors ↔ Univ. PI
FAA Technical Monitors ↔ Univ. PI

Embry-Riddle Aeronautical University
University of Alaska at Anchorage
and Fairbanks
University of North Dakota
Wichita State University

COE for Airport Technology



COE for Commercial Space Transportation

- **To be Competitively Selected by FAA Administrator – 2010**
- **Technology Areas:**
  - **Space Traffic Management & Operations**
  - **Launch Vehicle Systems**
  - **Human Space Flight**
  - **Space Commerce**

Sponsor: FAA Headquarters - Office of Commercial Space Transportation

COE for Research in the Intermodal Transport Environment (RITE)

- **Competitively Selected by the FAA Administrator – August 2004**
- **Technology Areas:**
  - **Development of Sensors and Sensor Systems to Monitor Cabin Air Environment and Detect Potential Environment Contaminants**
  - **Investigation of the Health Effects of Potential Contaminants and Other Aspects of Contained Environments**
  - **Field and Laboratory Analysis of Potential Contaminants**
  - **Development of Databases, with Supporting Architecture, for Documentation of Contaminants and Contaminant Incidents**

Sponsor: FAA Headquarters - Office of Aerospace Medicine

Core Members: Harvard University, Purdue University, Auburn University, Boise State University, Kansas State University, University of California at Berkeley, University of Medicine and Dentistry of New Jersey;

Affiliate Members: Oklahoma State University, St. Louis University, University of Alabama at Huntsville

Technical Co-Leads: Harvard University and Purdue University

John Spengler: spengler@hsph.harvard.edu and Yan Chen: yanchen@purdue.edu

Administrative Lead: Auburn University
Tony Overfelt: overfra@auburn.edu

COE for Intermodal Transport Environment Research Affiliates

AeroClave LLC
Airline Pilots Association
Aldec
Altera Inc.
The Boeing Company
COPE International–USA
Delta Air Lines
Donaldson Company Inc.
Fluent Inc.
GE Aviation
Goodrich Sensor Systems
Hamilton Sundst./UTRC
Honeywell
Int. Cent. Indoor Environ.
InvisiMED
JYMRSA Inc.
Keddeg Company
LG Electronics
Microchip Technology Inc.
The MITRE Corporation
Pall Aeropower Corp.
EnzymSys Inc.
Samsung
Spitfire Aviation Partners
Strategix LLC
STERIS Corporation
TSI Inc.
Xilinix Inc.

Joint COE for Advanced Materials (JAMS)

- **Competitively Selected by the FAA Administrator – December 2003**
- **Technology Areas:**
  - **Safety and Certification Initiatives of Composites and Advanced Materials on Large Transport Commercial Aircraft**
  - **Safe and Reliable Use of Advanced Materials in Aircraft Workforce Training**
  - **Relationships Between Design, Manufacturing, Operations, and Maintenance**

Sponsor: FAA Airport & Aircraft Safety R&D Group

Members: University of Washington, Wichita State University, Edmonds Community College, Northwestern University, Purdue University, Oregon State University, Tuskegee University, UCLA, University of Delaware, Washington State University

University Co-Leads: Wichita State U. and the U. of Washington
John Tomblin, Ph.D., john.tomblin@wichita.edu
Mark Tuttle, Ph.D., tuttle@u.washington.edu

Joint COE for Advanced Materials Affiliates

Composites and Advanced Materials Team
Industry Affiliates
WICHITA STATE UNIVERSITY

Adam Aircraft
ASTM International
Boeing
Bombardier
Cessna, a Textron Company
CIRRUS Design
Hawker Beechcraft
Piper Aircraft
Spirit AeroSystems

Advanced Materials in Transport Aircraft Structures Team
Industry Affiliates
UNIVERSITY OF WASHINGTON

A&P Technology
Bell Helicopter
The Boeing Company
C&D Zodiac
Composite Solutions, Inc.
Cytec Engineered Materials
General Plastics Manufacturing Co.
Heatcon Composite Systems
Hexcel
Integrated Technologies, Inc.
Toray Composites (America), Inc.
Triumph Composite Systems, Inc.

FAA/NASA COE for Aircraft Noise & Aviation Emissions Mitigation (PARTNER)

- **Competitively Selected by the FAA Administrator – August 2003**
- **Single Source Contract Authority: $6M cap**
- **Technology Areas:**
  - **Socio-economic Effects of Noise and Emissions Impacts**
  - **Noise Abatement Flight Procedures**
  - **Compatible Land Use Management**
  - **Airport Operational Controls**
  - **Noise and Emissions Measurements and Health**

Sponsors: FAA Hdq - Office of Environment & Energy in partnership with NASA and Transport Canada

Members: Massachusetts Institute of Technology, Harvard University, Pennsylvania State University, Purdue University, Stanford University, University of Missouri-Rolla, Georgia Institute of Technology, University of North Carolina – Chapel Hill, York University of Canada

University Lead: Massachusetts Institute of Technology
Ian Waitz, iaw@mit.edu

COE for Aircraft Noise & Aviation Emissions Mitigation Affiliates

- Aerodyne Research, Inc.
- Aerospace Industries Association
- Airbus
- Air Line Pilots Association
- Air Transport Association of America
- Airports Council International - North America
- American Institute of Aeronautics and Astronautics
- Bay Area Air Quality Management District
- Bell Helicopter Textron, Inc.
- Boeing Commercial Airplanes Group
- Delta Air Lines, Inc.
- General Electric Aircraft Engines
- Gulfstream Aerospace Corporation
- Indiana Department of Transportation
- Lockheed Martin Aeronautics Company
- Logistics Management Institute
- Massachusetts Port Authority
- Metron Aviation, Inc.
- Metropolitan Washington Airports Authority
- National Organization to Insure a Sound-controlled Environment (N.O.I.S.E.)
- O'Hare Noise Compatibility Commission
- Palisades Citizens Association
- Pratt & Whitney
- Raisbeck Engineering
- Regional Airport Authority of Louisville and Jefferson County
- Rolls-Royce, plc
- San Francisco International Airport/Community Roundtable
- Sikorsky Aircraft Corporation
- United Parcel Service Airline
- United Technologies Pratt & Whitney
- Wyle Laboratories

COE for General Aviation (CGAR)

- **Competitive Selection by FAA Administrator Announced by Secretary of Transportation: 2001**
- **Single source contract authority: $20M cap**
- **GA Technology Areas:**
  - **Aging Aircraft**
  - **Crashworthiness**
  - **Propulsion**
  - **Icing**
  - **Advanced Materials**

Sponsor: FAA Airport & Aircraft Safety R&D Group

Members: Embry-Riddle Aeronautical University, University of Alaska at Fairbanks and Anchorage
University of North Dakota, Wichita State University

University Lead: Embry-Riddle Aeronautical University
Steven Hampton, hamptons@db.erau.edu

COE for General Aviation Affiliates

Industry Affiliates

- Aero Shell
- Aircraft Welding Works
- Alaska Airmen's Association
- Alaska Aviation Safety Foundation
- Aviation Management Associates
- Avidyne Corporation
- Bombardier Aerospace
- Cessna Aircraft Corporation
- Cirrus Aviation
- Eclipse Aviation
- Elite Air Shares
- Frasca International
- Goodrich Corporation
- HandySoft Corporation
- Hartzell Propeller, Inc.
- Jeppesen
- Lancair
- Lockheed Martin
- Raytheon Aircraft Company
- Sun Microsystems
- SMA
- The Alaska Science & Technology
- The Boeing Company
- Vector Training Systems

Advisory Group Members

- Aircraft Owners and Pilots Association (AOPA)
- Experimental Aircraft Association (EAA)
- General Aviation Manufacturers Association (GAMA)
- National Business Aviation Association (NBAA)
- State Aviation Directors – Florida, Arizona, Alaska, Kansas, and North Dakota

COE for Airworthiness Assurance (AACE)

- **Competitively Selected by FAA Administrator:**
  September 11, 1997 and operational through September 11, 2007
- **Single source contract authority: $100M cap**
- **Technology Areas:**
  - **Maintenance, Inspection, and Repair**
  - **Crashworthiness**
  - **Propulsion and Fuel Systems Safety Technologies**
  - **Advanced Materials**

Sponsor: FAA Airport & Aircraft Safety R&D Group

Members: Phase II – Equal University Partners (following list)

COE for Airworthiness Assurance
Phase II - University Members

Arizona State University
Baylor University
Carnegie Mellon University
Embry-Riddle Aeronautical University
Florida International University
George Washington University
Iowa State University
Johns Hopkins University
Lehigh University
Mississippi State University
New Jersey Institute of Technology
North Carolina A&T State University
Northwestern University
Ohio State University
Ohio University
Pennsylvania State University
Purdue University
Rutgers University
Tuskegee University
University of Arizona
University of California at Berkeley
University of California at Los Angeles
University of California at Santa Barbara
University of Dayton
University of Maryland
University of Missouri at Columbia
University of North Dakota
University of Utah
University of Washington
Wayne State University
Wichita State University

COE for Airworthiness Assurance
Phase II – Industry Affiliates

ABX Air, Inc.
AirTran Airways
Alaska Airlines
Aloha Airlines
American Airlines
American Eagle
Atlantic Coast Airways
Boeing
Bombardier Aerospace-Learjet
Cape Air
Cessna
Continental
Delta
Federal Express
General Electric
Honeywell
JetBlue Airways
Lufthansa
Nantucket Airlines
Northwest
Pratt & Whitney
Raytheon
United Airlines
US Airways

COE for Operations Research (NEXTOR)

- **Competitive Selection Announced by FAA Administrator: 1996**
- **Contract authority: $10M - Phase I; $50M - Phase II**
- **Technology Areas**:
  - **Air Traffic Management and Control**
  - **Human Factors**
  - **System Performance and Assessment Measures**
  - **Safety Data Analysis**
  - **Communications, Data Collection and Distribution**
  - **Aviation Economics**

Sponsor: FAA Hdq - Technology Development & Operations Research

Members: University of California at Berkeley, Massachusetts Institute of Technology, Virginia Polytechnic Institute, University of Maryland, George Mason University

University Contact: University of California at Berkeley
Mark Hansen: mhansen@ce.berkeley.edu

COE for Operations Research Partners and Affiliates

University Partners

Air Force Institute of Technology

Rensselaer

San Jose State University

University of Michigan

University of Minnesota

University of Rochester

University of Southern California

University of Texas at Austin

Industrial Affiliates

The Boeing Company

California Department of Transportation

Draper Laboratory

Federal Express

Honeywell

Leigh Fisher Associates

Logistics Management Institute

Maryland Aviation Administration

Los Angeles World Airports

Massachusetts Port Authority

Metron Aviation, Inc.

Northrop Grumman

Sabre

San Francisco International Airport

Seagull Technology

Southern California Association of Governments

Virginia Department of Transportation

COE for Airport Technology (CEAT)

- **Competitively Selected by the FAA Administrator: 1995**
- Originally established as the Center of Excellence for Airport Pavement Technology R&D
  - **Currently operating under a 5-year cooperative agreement and funded through matching grants, 2005 – 2010**
  - **Request to re-compete during 2010**
- **Technology Areas:**
  - **High Performance Concrete**
  - **Non-destructive Evaluation of Pavements**
  - **Stabilized Base Material**
  - **Structural Behavior and Modeling**
  - **Airport Pavement Design Concepts/Procedures**
  - **Wildlife Research**

Sponsor: FAA Airport & Aircraft Safety R&D Group

Members: University of Illinois, Rensselaer Polytechnic Institute

Public Partners: O'Hare Modernization Program and City of Chicago

University Lead: University of Illinois at Urbana-Champaign
(Located at the former Chanute Air Force Base, Rantoul, ILL)
David A. Lange, dlange@uiuc.edu

COE for Airport Technology University Members

CENTER PARTNERS

University of Illinois at Urbana Champaign

Rensselaer Polytechnic Institute

PUBLIC PARTNERS

O'Hare Modernization Program

City of Chicago

Joint Center for Computational Modeling of Aircraft Structures

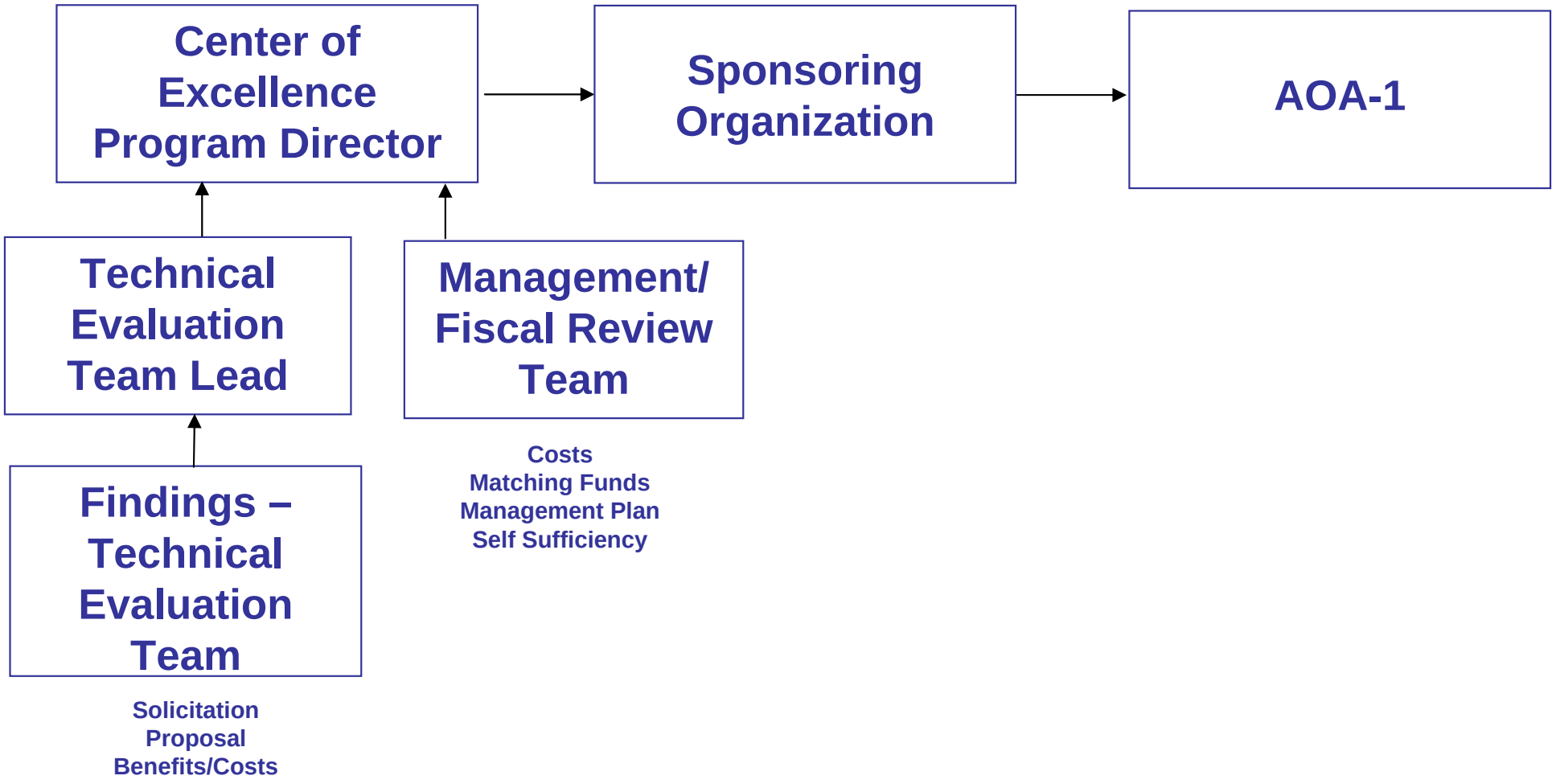
- **Members Designated by Congress: Operational 1993 through 1996**

- **Technology areas funded through matching grants:**
  - **Widespread Fatigue-Damage**
  - **Residual-Life and Residual-Strength Estimations**
  - **Mechanical and Composite-Patch Repairs**
  - **Life-Enhancement Methodologies**
  - **Discrete Source Damage**

Rutgers University and Georgia Institute of Technology

Evaluation Process

Center of Excellence Evaluation and Selection Process



Previously Asked Questions

COE Team Membership

Q. Can a team member, drop out of the team during the research period?

A. Yes, e.g., a team member will complete all of its research or responsibilities.

Q. Are other Federal entities allowed to be part of the overall proposal?

A. Yes. However, should they provide funding to the COE, these funds must also be matched.

Q. Can a university or other organizations be added to the team, after the winning team has been selected (i.e. during the research period).

A. Yes, e.g., the team may need a specific expertise.

Q. Are FAA offices/organizations, e.g. FAA's Civil Aerospace Medical Institute (CAMI) allowed to participate as team members? If yes, can FAA offices/organizations receive grant money?

A. The FAA office/organization can participate through AST, but it would not receive funds through the COE.

Q. We are looking into what potential role JSC and local universities might play in this effort. Is there any way I can get more background on it? What's the vision? Role of COE? Expected outcomes? Impediments?

A. We hope JSC will join us for what will surely be a mutually beneficial effort over time. Also, additional information is posted on Grants.gov/FAA/Centers of Excellence/CFDA # 20.109/Commercial Space Transportation. Please see our COE website for additional information about our program. For more information about FAA Centers, see www.coe.faa.gov

Q. Will proposers be required to attend the public meeting?

A. Proposers are not required to attend the Public Meeting, but it is highly recommended. Teams form very often during this gathering and the information presented is generally critical to preparing a sound proposal.

Q. Is there a requirement that the principal investigator (PI) have a PhD?

A. No.

Q. Is there a requirement that the PI have no current or pending Federal support from any Federal agency?

A. No. If you have experience with Grants.gov, you know that the application forms for funding are standardized. COE Proposals are shipped to the FAA COE Program Office in hard copy.

COE CST Solicitation

*Q. Why does the Draft Solicitation for the COE CST use the term "air transportation services?" Does this mean just "air," "space," or "air and space?" ***

A. The language is quoted from Public Law 101-508 and we assume a meaning to include both air and space as appropriate within the scope of FAA responsibilities.
**References to "air transportation" in Draft Solicitation

- Page 4: "The extent to which the needs of the State in which the applicant is located are representative of the needs of the region for improved air transportation services and facilities."
- Page 4: "The ability of the applicant to provide leadership in making national and regional contributions to the solution of both long-range and immediate air transportation problems."
- Page 4: "The extent to which the applicant has an established air transportation program."
- Page 6: "3.1 CRITERION 1: THE EXTENT TO WHICH THE NEEDS OF THE STATE IN WHICH THE APPLICANT IS LOCATED ARE REPRESENTATIVE OF THE NEEDS OF THE REGION FOR IMPROVED AIR TRANSPORTATION SERVICES AND FACILITIES."
- Page 6: "The applicant must demonstrate: Relevant partnerships with members of the aviation industry."
- Page 6: "3.3 CRITERION 3: THE ABILITY OF THE APPLICANT TO PROVIDE LEADERSHIP IN MAKING NATIONAL AND REGIONAL CONTRIBUTIONS TO THE SOLUTI ON OF LONG-RANGE AND IMMEDIATE AIR TRANSPORTATION PROBLEMS."
- Page 7: "3.4 CRITERION 4: THE EXTENT TO WHICH THE APPLICANT HAS AN ESTABLISHED AIR TRANSPORTATION PROGRAM."

Q. Can you give an estimated date of when the actual RFP will be released and the deadline to submit the proposal?

A. We allow for public comment and input during and after the public meeting. The final solicitation will be issued approximately 4 weeks after the public meeting. The deadline to submit will be announced at that time, but generally the solicitation is open for approximately 4-6 weeks. A tentative schedule is provided at the Public Meeting.

Funding Questions

Q. What are the current requirements for cost-sharing? If a for-profit industrial organization participates in the COE, is that organization required to provide cash payments to the academic partner or are "in-kind" contributions acceptable?

A. In-kind is fine. PIs are encouraged to discuss specific contributions with their Grants Officers while planning. Dr. Watts will provide information on OMB Guidance for Matching Funds at the Public Meeting.

Q. Are there restrictions on the matching funds? Do they have to be non-Federal matching funds or can we use other gov't funds, as matching?

A. Matching must be from a non-Federal source, in-kind or cash contributions.

Q. Interested parties have heard that at least one aeronautical college is trying to use the Congressional earmark or authorization process to circumvent your competitive solicitation. Can this be addressed publicly? Would serious outside bidders be wasting their time?

A. The FAA Administrator has made a decision to initiate a COE competitive process as a separate action from any politically supported activities. The FAA will conduct the competition as mandated in the enabling legislation. There may more information available about such Congressional language by February 9th. If more information is available, the FAA will address the issue during the open discussion session at the Public Meeting.

Q. I have been working with the engineering staff at an Airport in NV to explore a lighting efficiency retrofit for the C Gates. It looks as though they missed the deadlines for relevant Department Of Energy Federal grant applications. Would their project qualify for these monies? Or, are you aware of any stimulus funding sources for which they should apply? The project targets are: High performance lighting controls, Digitally addressed, Software controlled, lighting, Automated daylight harvesting, Enhanced commissioning, Building as a teaching tool, Demand response/ load shedding capabilities, Advanced reporting, Buy American components, Self-installation and optimization (with manufacturer-provided training)

A. I am not aware of efforts in this field other than the establishment of our FAA COE - Commercial Space Transportation. You can view our web site noted below for complete information about our Program. This COE, however, is not the recipient of Recovery funds at this point.

FAA Centers of Excellence
Matching Contribution

Patricia Watts, Ph.D.
FAA COE Program Director
Phone: 609-485-5043
FAX: 609-485-9430

Date:_____

Center of Excellence for _____
Project Title:_____

Please refer to OMB Circular A-110 Section.23 Cost Sharing or Matching for allowable support.

Name: _____

Title:_____

Contributing Organization: _____

Address:_____

Telephone:_____ Email:_____

In-kind support: *(see following guidance)*

Describe Contribution:_____

_____

_____

_____

_____

_____

_____

_____

Period of Contribution: _____

Total In-Kind Contribution: $ _____

Signature:_____ Date: _____

University PI:_____ E-mail:_____

FAA Tech Monitor:_____

Please include this completed form when submitting matching contribution reports and return to

Patricia Watts, Grants Officer
FAA Centers of Excellence Program Director
William J. Hughes Technical Center
Atlantic City International Airport, NJ 08405

MATCHING GUIDANCE -
OMB Circular A-110 Section .23 Cost Sharing or Matching

(a) All contributions, including cash and third party in-kind, shall be accepted as part of the recipient's cost sharing or matching when such contributions meet all of the following criteria.

(1) Are verifiable from the recipient's records.

(2) Are not included as contributions for any other federally-assisted project or program.

(3) Are necessary and reasonable for proper and efficient accomplishment of project or program objectives.

(4) Are allowable under the applicable cost principles.

(5) Are not paid by the Federal Government under another award, except where authorized by Federal statute to be used for cost sharing or matching.

(6) Are provided for in the approved budget when required by the Federal awarding agency.

(7) Conform to other provisions of this Circular, as applicable.

(b) Unrecovered indirect costs may be included as part of cost sharing or matching only with the prior approval of the Federal awarding agency.

(c) Values for recipient contributions of services and property shall be established in accordance with the applicable cost principles. If a Federal awarding agency authorizes recipients to donate buildings or land for construction/facilities acquisition projects or long-term use, the value of the donated property for cost sharing or matching shall be the lesser of (1) or (2).

(1) The certified value of the remaining life of the property recorded in the recipient's accounting records at the time of donation.

(2) The current fair market value. However, when there is sufficient justification, the Federal awarding agency may approve the use of the current fair market value of the donated property, even if it exceeds the certified value at the time of donation to the project.

(d) Volunteer services furnished by professional and technical personnel, consultants, and other skilled and unskilled labor may be counted as cost sharing or matching if the service is an integral and necessary part of an approved project or program. Rates for volunteer services shall be consistent with those paid for similar work in the recipient's organization. In those instances in which the required skills are not found in the recipient organization, rates shall be consistent with those paid for similar work in the labor market in which the recipient competes for the kind of services involved. In either case, paid fringe benefits that are reasonable, allowable, and allocable may be included in the valuation.

(e) When an employer other than the recipient furnishes the services of an employee, these services shall be valued at the employee's regular rate of pay (plus an amount of fringe benefits that are reasonable, allowable, and allocable, but exclusive of overhead costs), provided these services are in the same skill for which the employee is normally paid.

(f) Donated supplies may include such items as expendable equipment, office supplies, laboratory supplies or workshop and classroom supplies. Value assessed to donated supplies included in the cost sharing or matching share shall be reasonable and shall not exceed the fair market value of the property at the time of the donation.

(g) The method used for determining cost sharing or matching for donated equipment, buildings and land for which title passes to the recipient may differ according to the purpose of the award, if (1) or (2) apply.

(1) If the purpose of the award is to assist the recipient in the acquisition of equipment, buildings or land, the total value of the donated property may be claimed as cost sharing or matching.

(2) If the purpose of the award is to support activities that require the use of equipment, buildings or land, normally only depreciation or use charges for equipment and buildings may be made. However, the full value of equipment or other capital assets and fair rental charges for land may be allowed, provided that the Federal awarding agency has approved the charges.

(h) The value of donated property shall be determined in accordance with the usual accounting policies of the recipient, with the following qualifications.

(1) The value of donated land and buildings shall not exceed its fair market value at the time of donation to the recipient as established by an independent appraiser (e.g., certified real property appraiser or General Services Administration representative) and certified by a responsible official of the recipient.

(2) The value of donated equipment shall not exceed the fair market value of equipment of the same age and condition at the time of donation.

(3) The value of donated space shall not exceed the fair rental value of comparable space as established by an independent appraisal of comparable space and facilities in a privately-owned building in the same locality.

(4) The value of loaned equipment shall not exceed its fair rental value.

(5) The following requirements pertain to the recipient's supporting records for in-kind contributions from third parties.

(i) Volunteer services shall be documented and, to the extent feasible, supported by the same methods used by the recipient for its own employees.

(ii) The basis for determining the valuation for personal service, material, equipment, buildings and land shall be documented.