

FAA Office of Environment and Energy (AEE) Research Overview

Presented to: ASCENT Advisory Committee Meeting

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Federal Aviation Administration

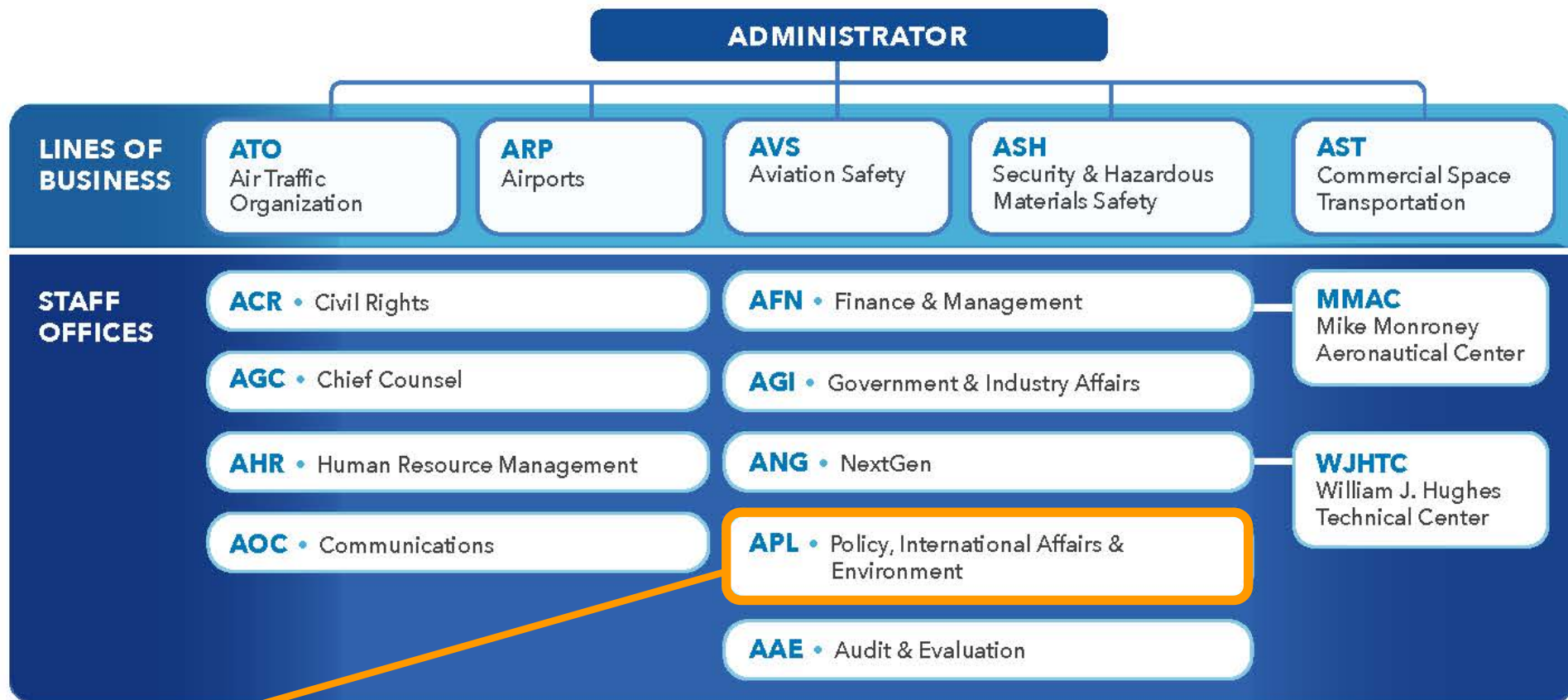
Date: October 9, 2018



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FAA Organizational Structure

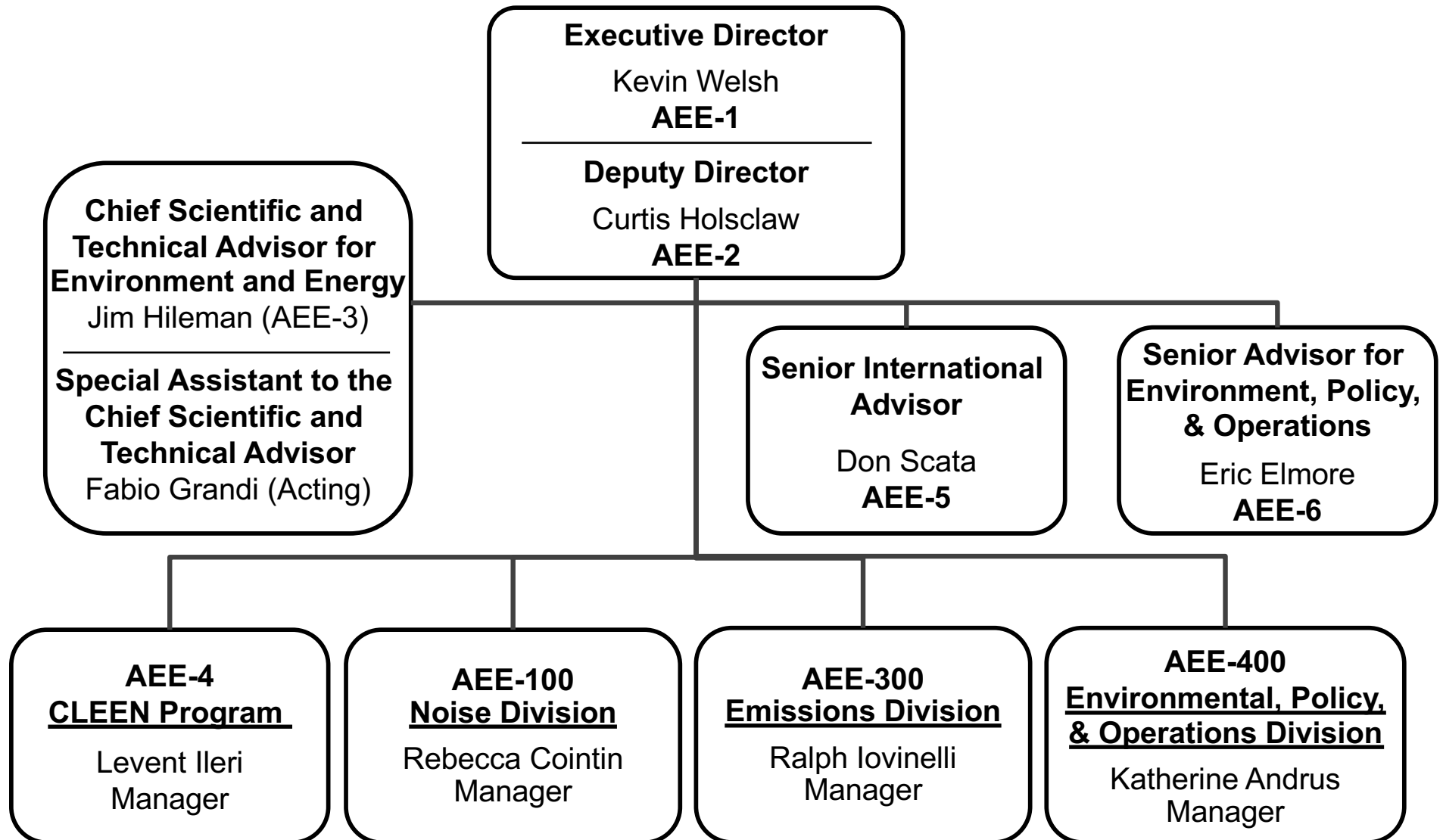


Office of Environment and Energy (AEE)



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AEE Mission and Vision

Mission:

To understand, manage, and reduce the environmental impacts of global aviation through research, technological innovation, policy, and outreach to benefit the public

Vision:

Remove environmental constraints on aviation growth by achieving quiet, clean, and efficient air transportation



Economic Benefits of Aviation



5.1% of U.S. GDP



10.6 Million

U.S. jobs



\$1.6 Trillion

in U.S. economic
activity annually



\$59.9 Billion

of U.S. Trade Balance
(exports-imports)

SOURCE: FAA Air Traffic Organization

Aviation equipment (aircraft, spacecraft, and related equipment) is largest export sector in U.S. economy accounting for over 8% of total exports.

SOURCE: U.S. International Trade Commission



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Environmental Protection that Allows Sustained Aviation Growth

ENVIRONMENT AND ENERGY GOALS



NOISE

Reduce the number of people exposed to significant noise around U.S. airports



AIR QUALITY

Reduce significant air quality impacts attributable to aviation



ENERGY

Achieve net fuel burn reduction by 2020 relative to a 2005 baseline and deploy sustainable aviation fuels.



Environment and Energy (E&E) Research Programs



Continuous Lower Energy, Emissions and Noise (CLEEN)

- Reduce aircraft fuel burn, emissions and noise through technology & advance alternative jet fuels
- Cost share partnership with industry



ASCENT Center of Excellence (COE)

- COE for Alternative Jet Fuel and Environment
- Cost share research with universities



Additional Efforts

- Commercial Aviation Alternative Fuels Initiative (CAAIFI)
- Contract mechanisms (e.g., SEMRS, PEARS-II)
- Volpe Transportation Center



Addressing Aircraft Noise

- **Understanding Impact of Noise**

- Improving modeling capabilities
- Examining relationship between noise and annoyance, sleep, cardiovascular health and children's learning.
- Evaluating current aircraft, helicopters, commercial supersonic aircraft, unmanned aerial systems, and commercial space vehicles.

- **Outreach**

- Enhanced community involvement (e.g., community roundtables)
- Increase public understanding

- **Mitigation**

- Noise Compatibility Planning (Part 150)
- Noise-based access restrictions (Part 161)
- Vehicle operations
- Aircraft technologies and architecture
- Noise standards



Addressing Aircraft Emissions

- **Understanding Impacts**

- Particulate Matter (PM) measurements and modeling
- Improving atmospheric impact modeling capabilities
- Evaluating current aircraft, commercial supersonic aircraft, unmanned aerial systems, and commercial space vehicles

- **Mitigation**

- Vehicle operations
- Alternative fuel sources
- Modifications to fuel composition
- Aircraft technologies and architecture
- Engine standard (CAEP PM standard)
- Policy measures (CORSIA)



The Five Pillar Approach

Science and Tools

PILLAR 1: Improved Scientific Knowledge and Integrated Modeling

- Decision-making based on solid scientific understanding
- Work with research community through the **Aviation Sustainability Center (ASCENT)**
- Understand public health and welfare impacts
- Incorporate this knowledge within the Aviation Environmental Tool Suite

Operations

PILLAR 4: Air Traffic Management Modernization and Operational Improvements

- Increase efficiency of aircraft operations through the **Next Generation Air Transportation System (NextGen)**
- Engage with industry, research community, NASA, and Department of Defense
- Develop advanced operational procedures to optimize gate-to-gate operations
- Integrate infrastructure enhancements to the National Airspace System (NAS), improving environmental performance

Technology

PILLAR 2: New Aircraft Technologies

- Offer the greatest opportunity to reduce environmental impacts
- Partner with industry, research community, NASA, and Department of Defense
- Mature new engine and airframe technologies through the **Continuous Lower Energy, Emissions and Noise (CLEEN) Program**

Policy

PILLAR 5: Policies, Environmental Standards, and Market Based Measures

- Implement domestic policies, programs, and mechanisms to support technology and operational innovation
- Develop and implement aircraft emissions and noise standards
- Work within the International Civil Aviation Organization (ICAO) to pursue a basket of measures to address emissions that affect climate, including a global market based measure as a gap filler
- Seek international partners to further our environmental and energy strategy

Alternative Fuels

PILLAR 3: Sustainable Alternative Aviation Fuels

- Reduce environmental impacts, enhance energy security, and provide economic benefits
- Collaborate with stakeholders through the **Commercial Aviation Alternative Fuels Initiative (CAAFI)**
- Test alternative jet fuels to ensure they are safe for use through **ASCENT** and **CLEEN**
- Analyze their potential for reducing the environmental impacts of aviation



ASCENT Background

Timeline:

- In 2004, FAA established PARTNER Center of Excellence
- In 2013, FAA established Center of Excellence for Alternative Jet Fuels and Environment, a.k.a. Aviation Sustainability Center or ASCENT, that continues work of PARTNER with expanded efforts on alternative jet fuels R&D

COE fulfills requirements:

- P.L.112-95 Sec. 911 - conduct research to assist the development and qualification of jet fuel from alternative sources
- P.L.108-176 Title III Sec. 326 – conduct research to reduce community exposure to civilian aircraft noise and emissions

Budget Direction:

- FY2018 budget: FAA directed to use \$15M in RE&D funds for ASCENT
- FY2016 budget: FAA directed to use \$10.55M in RE&D funds for ASCENT



ASCENT Center of Excellence (COE)

Lead Universities:

Washington State University (WSU)*

Massachusetts Institute of Technology (MIT)

Core Universities:

Boston University (BU)

Georgia Institute of Technology (Ga Tech)

Missouri University of Science and Technology (MS&T)

Oregon State University (OSU)*

Pennsylvania State University (PSU)*

Purdue University (PU)*

Stanford University (SU)

University of Dayton (UD)

University of Hawaii (UH)*

University of Illinois at Urbana-Champaign (UIUC)*

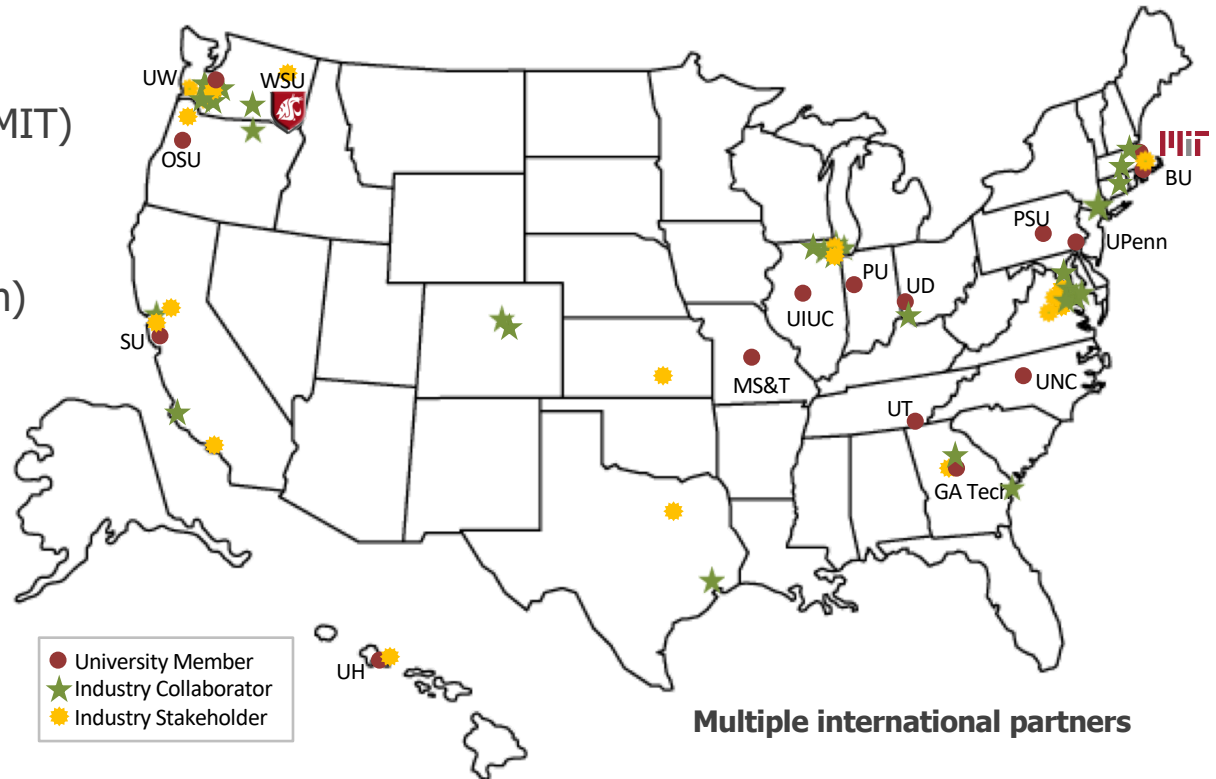
University of North Carolina at Chapel Hill (UNC)

University of Pennsylvania (UPenn)

University of Tennessee (UT)*

University of Washington (UW)*

* Denotes USDA NIFA AFRI-CAP Leads and Participants & Sun Grant Schools



Advisory Committee - 58 organizations:

5 airports

4 airlines

7 NGO/advocacy

9 aviation manufacturers

11 feedstock/fuel manufacturers

22 R&D, service to aviation sector

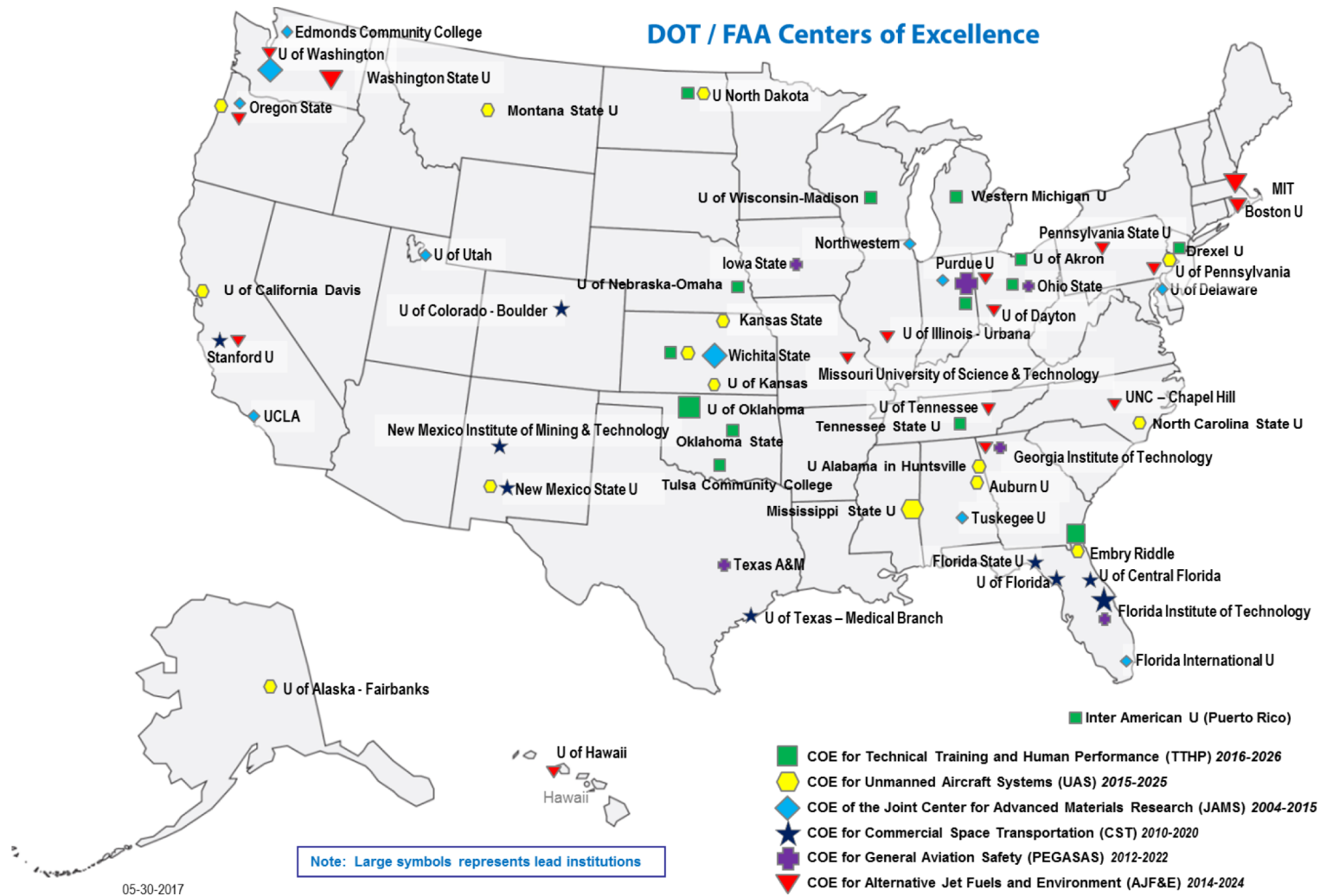
For more information:
<https://ascent.aero/>



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DOT/FAA Centers of Excellence

(ASCENT is one of 6 active COEs within FAA)



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ASCENT COE - By the Numbers

- **Seeking Three New Research Projects (using FY2018 Funding)**
 - Project 9: Noise Estimation Tool for New Entrants (GT)
 - Project 44: Validation of Aircraft Noise Abatement Procedure Modeling (MIT)
 - Project 47: Clean Sheet Supersonic Engine Design and Performance (MIT)
- **Annual Tech Report**
 - Available from <https://ascent.aero/resources/>

	Report 1	Report 2	Report 3
Time period	9/2013 – 9/2015	10/2015 – 9/2016	10/2016 – 9/2017
Research Projects	50	54	43
Publications, Reports, and Presentations	137	119	110
Students involved	131	112	105
Industry partners	63	70	72



ASCENT COE - Update

Receiving increased attention on all our efforts

Need university PIs to work closely with FAA PMs to:

- Keep project websites on ascent.aero up to date
- Ensure publications/citations are getting uploaded onto National Transportation Library (as well as ascent.aero)
- Update Data Management Plans (DMP) as appropriate

Meeting Update

- Spring 2019 ASCENT Meeting – **Need to Choose Dates & Venue**
- 5 Year Symposium – have Briefings / Sessions at:
 - ACI-NA AAAE Noise Conference Oct, 2018 (Indianapolis, IN)
 - CAAFI Biennial General Meeting Dec 3-6, 2018 (Washington, DC)

Working through new grant approval process – delayed in executing funds this year (have additional slides on this)



Grant Approval Process

- Grant approval process at FAA has undergone changes
- Putting new process in place, as well as additional steps, have resulted in a delay
- Grants currently working through new process:
 - 9 grants have been approved by Office of Secretary of Transportation (OST) (\$2.6M)
 - 14 additional grants are working through system to get to OST review (\$3.3M)
 - 15 additional grants have been approved by FAA legal (\$4.9M)
 - Will develop additional grants from FY18 funding (\$4.2M)
- Normally have most (if not all) of the grant funds obligated in fiscal year funding is issued – will be executing grants for FY18 funds for several more months
- Approval delays resulting in ASCENT efforts being stopped



Additional Path for ASCENT Project Development

- Existing path for ASCENT Project Development
 - Project idea is developed by AEE
 - Idea is shared with ASCENT research community within a Notice of Funding Opportunity
 - Selected ASCENT researcher develops full proposal with AEE input
 - Seek approval of full proposal
- New, additional path for ASCENT Project Development
 - Share an open solicitation with ASCENT research community for new project ideas that would result in innovative solutions to reduce noise, fuel burn, and emissions (short project statements)
 - Compile best ideas and review with senior leadership in FAA
 - Once approval is obtained, develop full proposals



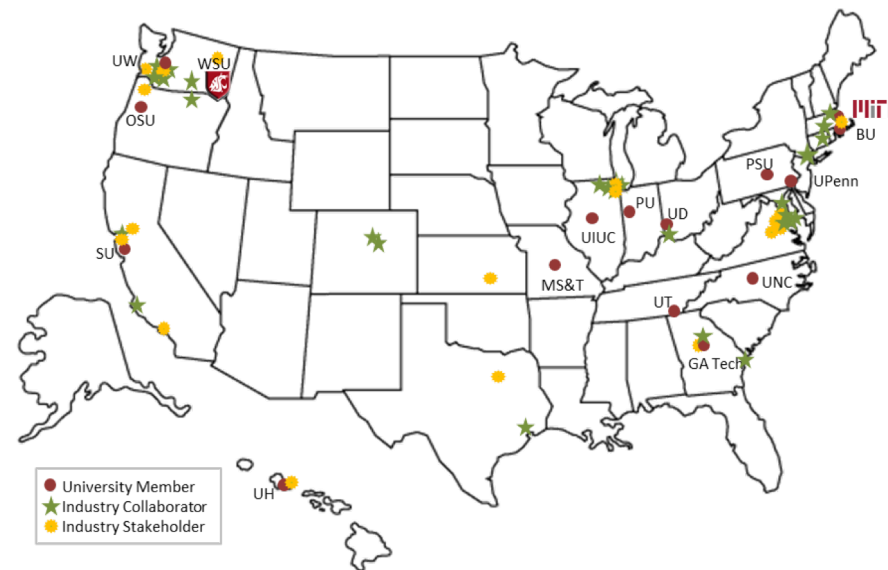
ASCENT COE Update – Funding Summary

University	Funding
Georgia Institute of Technology	\$ 6,950,000
Massachusetts Institute of Technology	\$ 6,900,000
Missouri Univ. of Science and Technology	\$ 5,300,000
University of Dayton	\$ 4,200,000
Washington State University	\$ 3,911,000
Pennsylvania State Univ. (Penn State)	\$ 3,820,000
Purdue University	\$ 3,014,000
Stanford University	\$ 2,100,000
Boston University	\$ 1,700,000
University of Illinois	\$ 1,500,000
University of North Carolina	\$ 1,300,000
University of Pennsylvania	\$ 900,000
University of Tennessee	\$ 600,000
Oregon State University	\$ 300,000
University of Hawaii	\$ 300,000
University of Washington	\$ 100,000
Total	\$ 42,900,000

Note: totals as of October 2019

Funding levels provided to
ASCENT universities since
September 2013

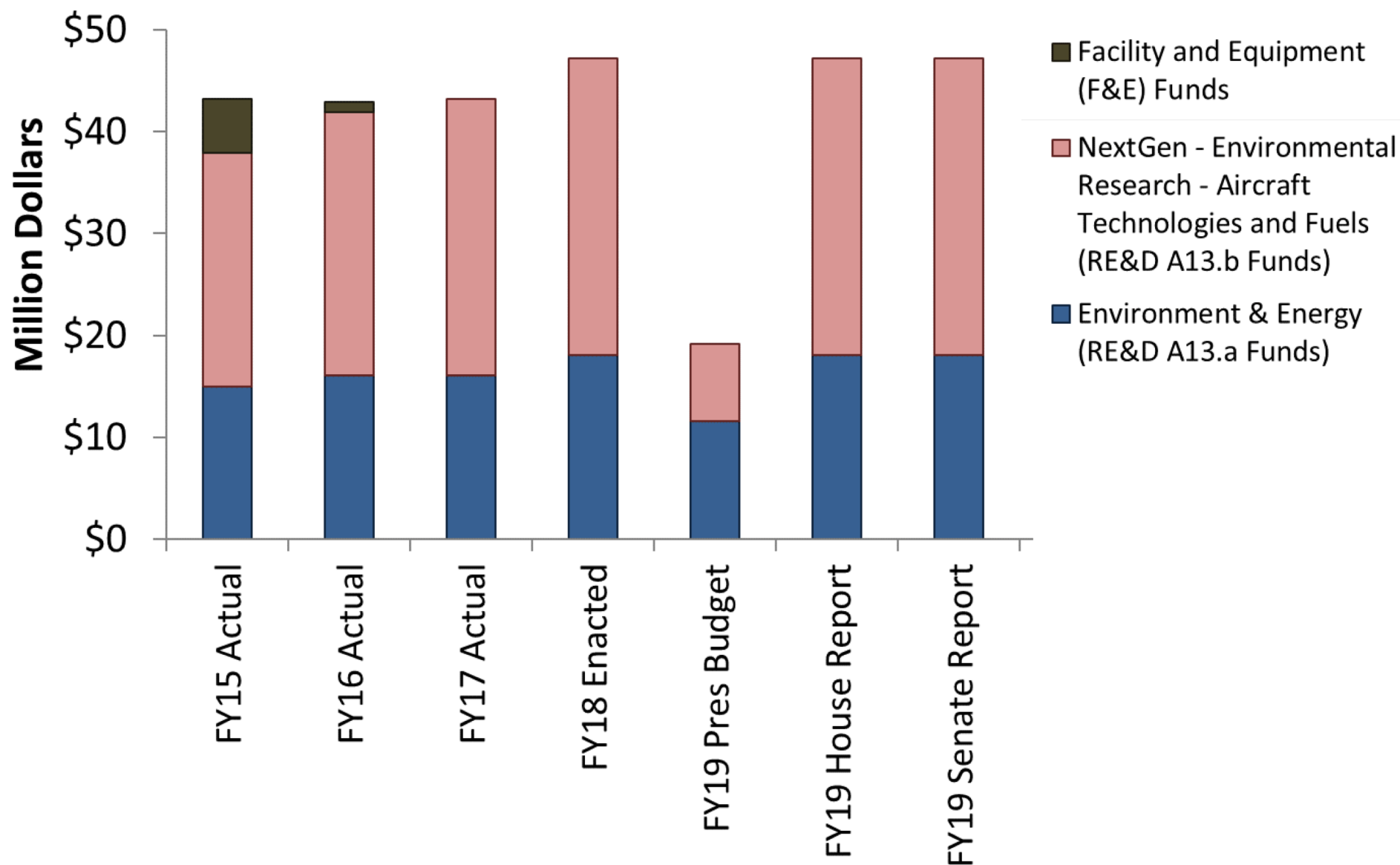
(does not include cost share generated by universities)



Geographical Distribution of ASCENT



FY15-19 Funding Profile for E&E Portfolio



Not shown on graph:

- Airport Technology Research has ~\$1.5M/year for noise/environment projects
- Airports Cooperative Research Program (ACRP) provides ~\$5M/year for environment projects



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Recent Successes from E&E Program

capabilities and solutions that are helping today

- Noise impacts work is starting to deliver results. Community noise survey nearing completion. Published report on pilot phase of aircraft noise sleep impacts study. Starting work on national sleep study.
- Provided critical analytical support to development of Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).
- Alternative fuels scenarios adopted by ICAO CAEP for future trends assessment and research efforts instrumental for alternative fuel inclusion within CORSIA.
- Measurement technique and data providing foundation for ICAO CAEP PM standard.
- Integrated tool suite and analyses provided the scientific data used to support the decision making for the ICAO CAEP CO₂ standard.
- CLEEN aircraft and engine technologies appearing in next generation of aircraft with FMS technologies retrofitted into today's fleet - reduces noise, emissions and fuel use for many years to come.
- Certification of five alternative jet fuel pathways – certification enabled multiple airlines to buy and use biofuels in LAX and elsewhere.
- Aviation Environmental Design Tool (AEDT) being used extensively.
- Analytical framework was used to develop operational procedure concepts for Boston Logan that could provide noise reduction. Work is continuing to develop additional concepts and evaluate potential for broader use.





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