Environment and Energy R&D Portfolio Overview

To: REDAC E&E Subcommittee

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Office of Environment and Energy

Date: March 19, 2019

Presentation Outline

- **E&E Portfolio – Background and Overview**
- **ASCENT COE Update**
- **Budget Profile for E&E Portfolio**
- **Summary**
- **Backup:**
  - E&E Portfolio within the new NARP

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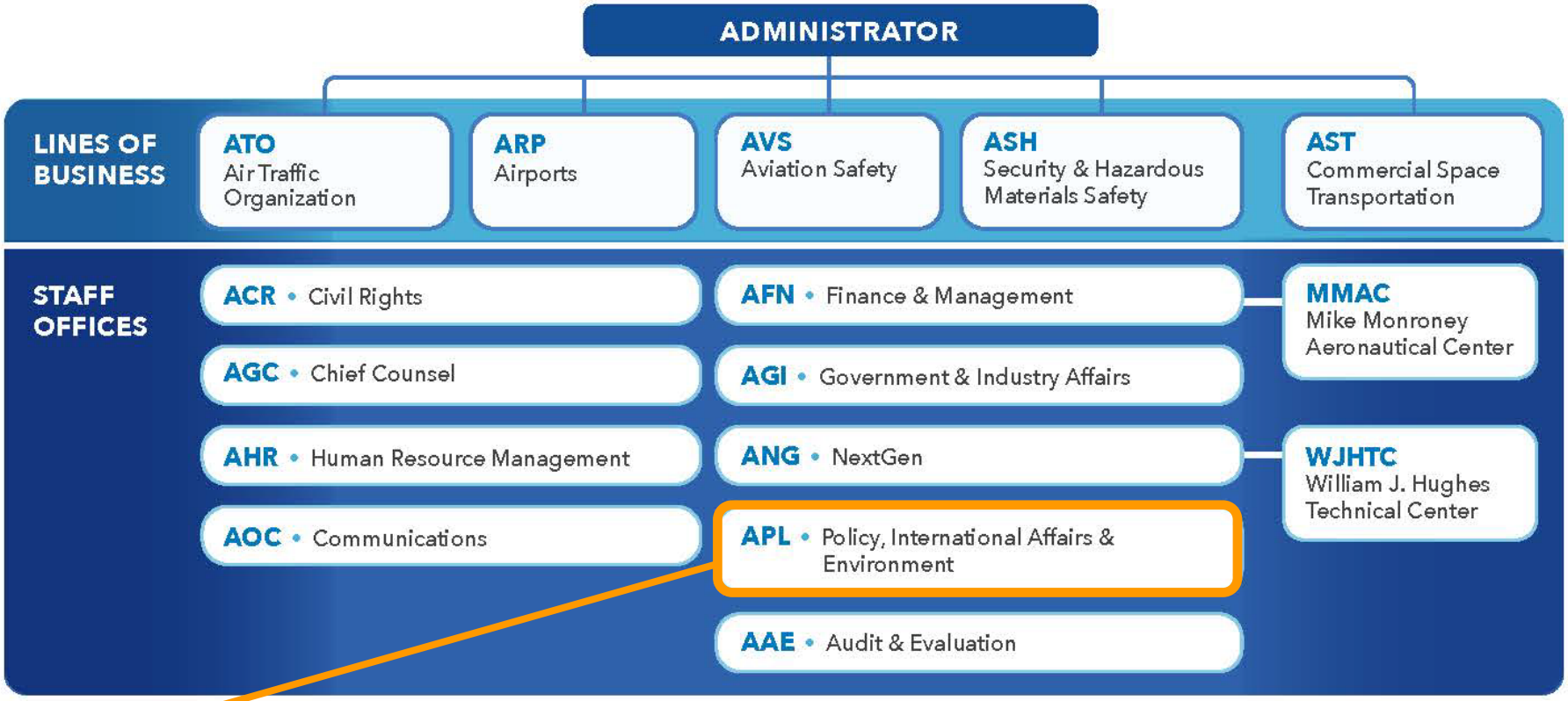
FAA Organizational Structure



Office of Environment and Energy (AEE)

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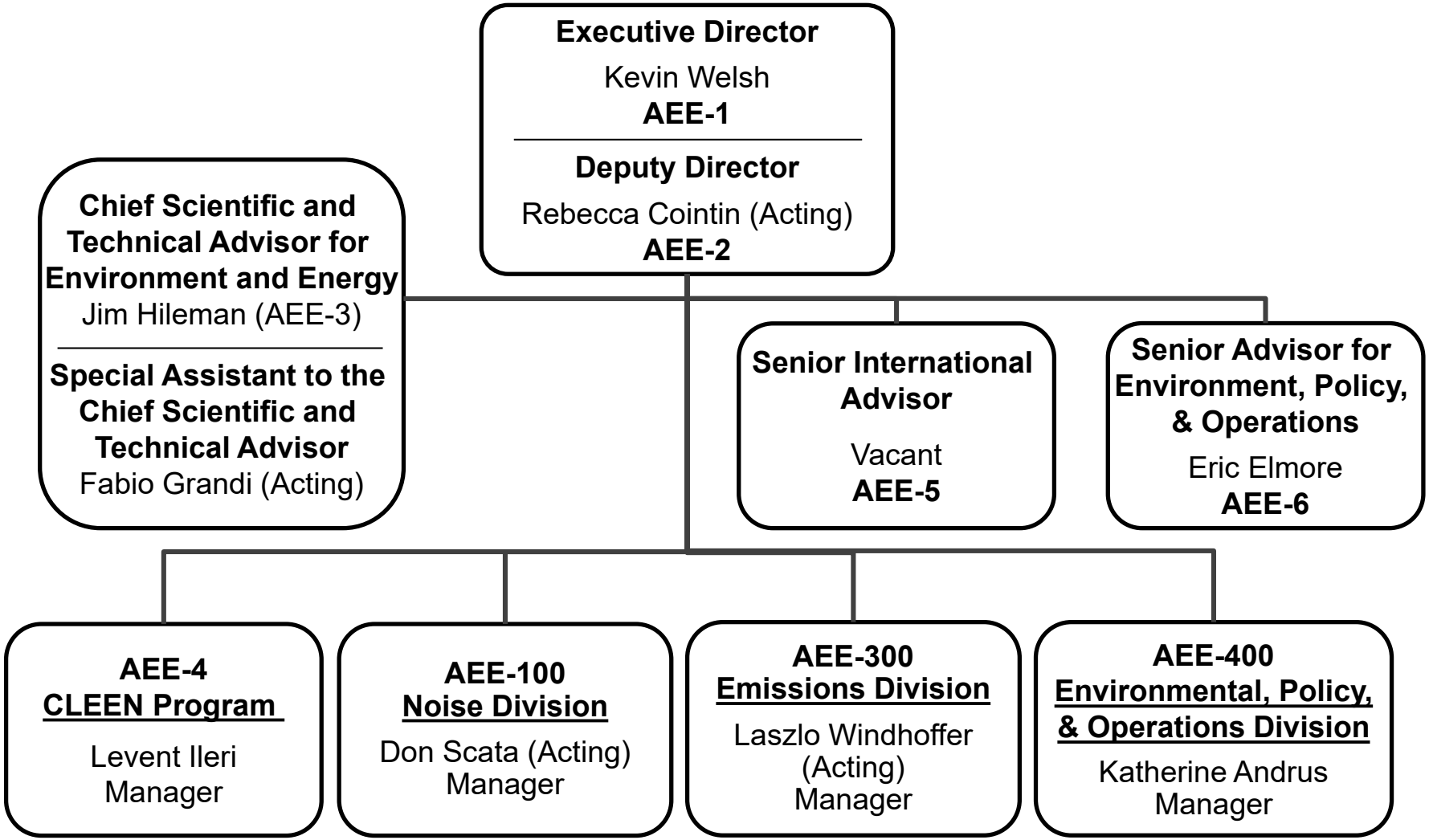


Economic Benefits of Aviation

5.1% of U.S. GDP

10.6 Million
U.S. jobs

$1.6 Trillion
in U.S. economic activity annually

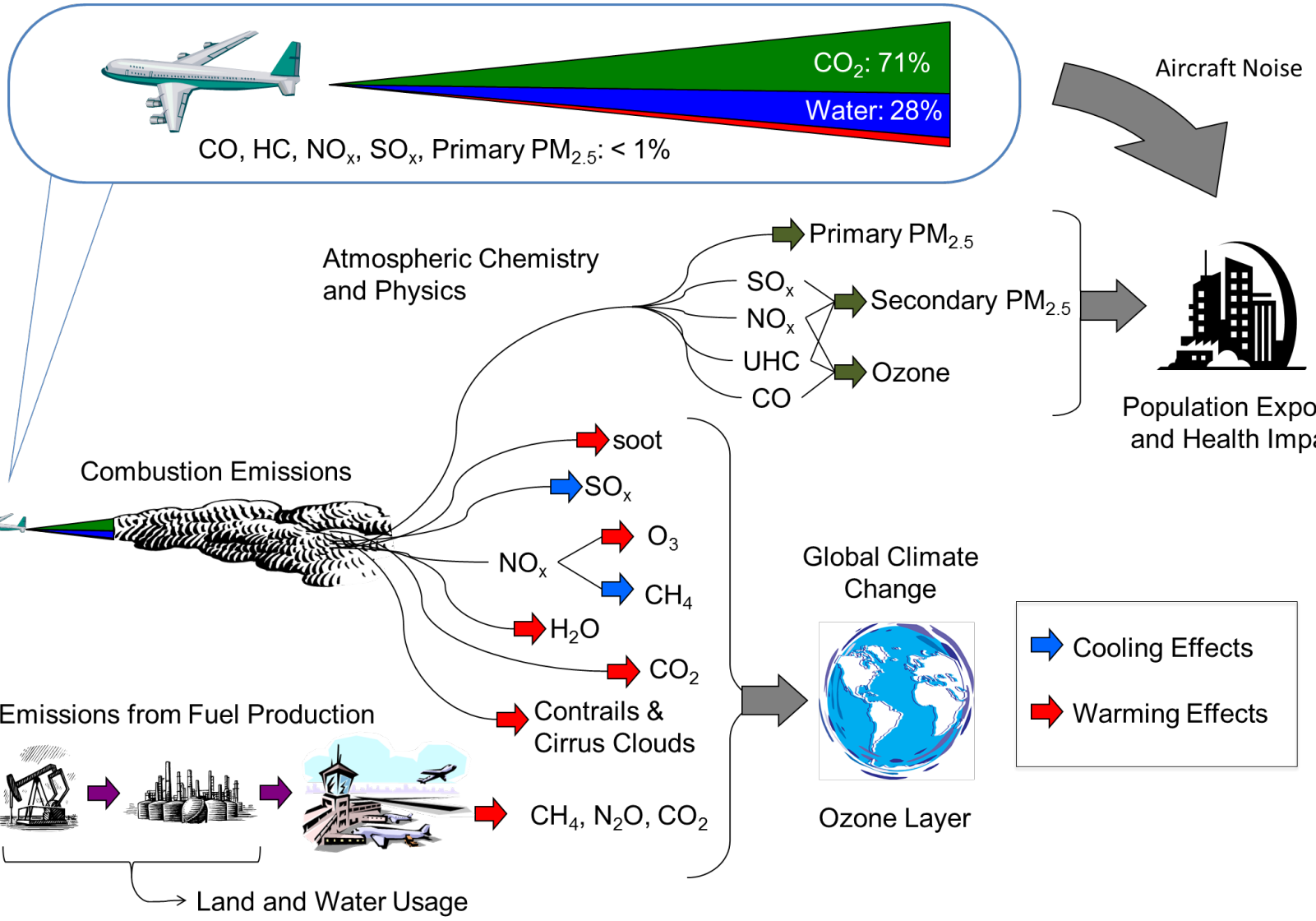
$59.9 Billion
of U.S. Trade Balance (exports-imports)

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

Environmental Impacts of Aviation



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

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

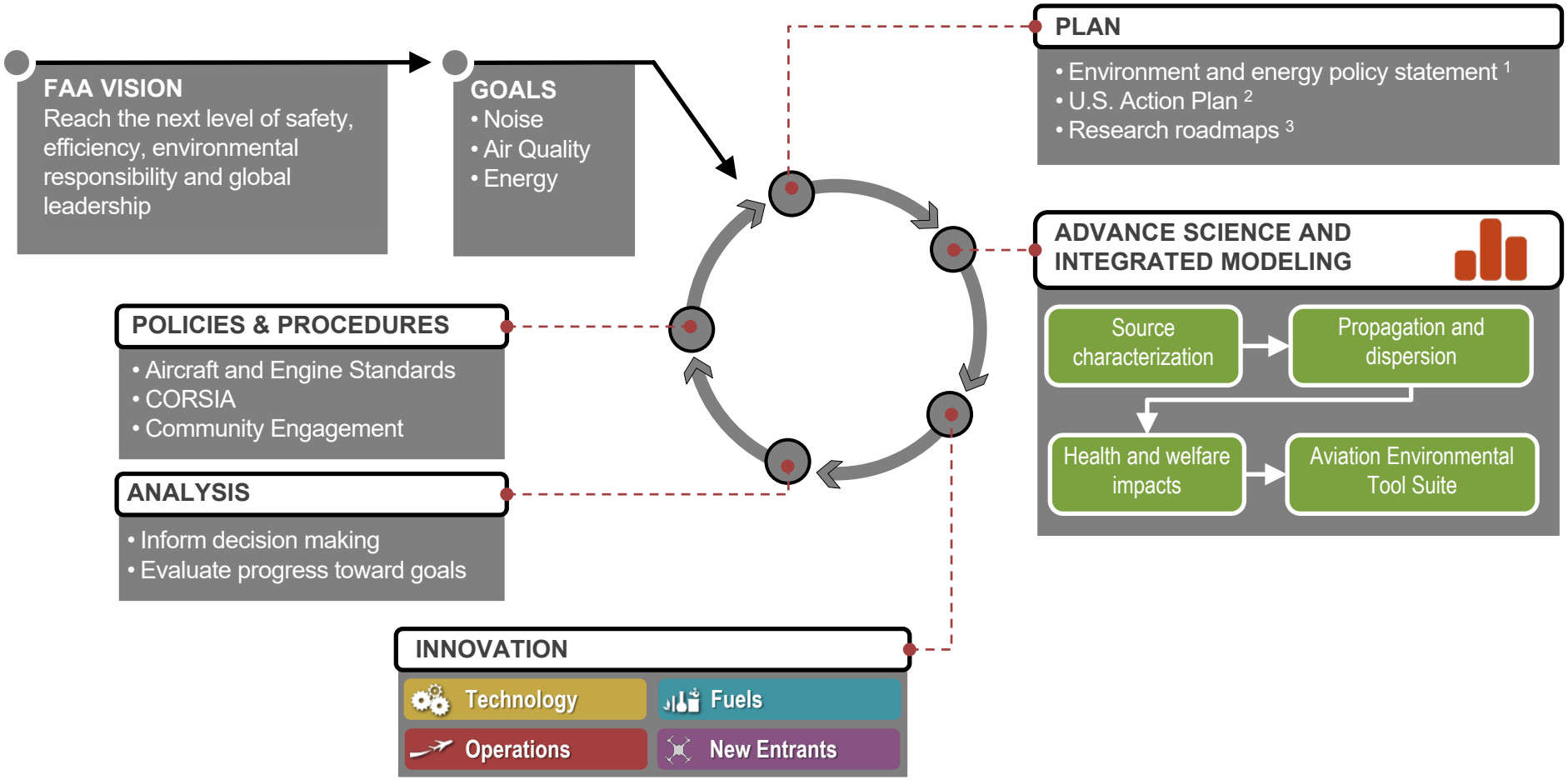
AIR QUALITY

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.

Environmental & Energy Strategy



Notes:

1. Aviation E&E Policy Statement (Federal Register 77 141, 2012): http://www.faa.gov/about/office org/headquarters offices/apl/environ_policy guidance/policy/media/FAA EE Policy Statement.pdf
2. U.S. Aviation GHG Emissions Reduction Plan: http://www.icao.int/environmental protection/Pages/ClimateChange ActionPlan.aspx
3. Environment and Energy Website: http://www.faa.gov/go/environment

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 (CAAFI)
- Contract mechanisms (e.g., SEMRS, PEARS-II)
- Volpe Transportation Center

Efforts Relating to 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

Efforts Relating to 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)

Efforts Relating to Energy

Testing

- Support Certification/Qualification testing
- Improve Certification/Qualification process

Analysis

- Environmental sustainability
- Techno-economic analysis
- Future scenarios

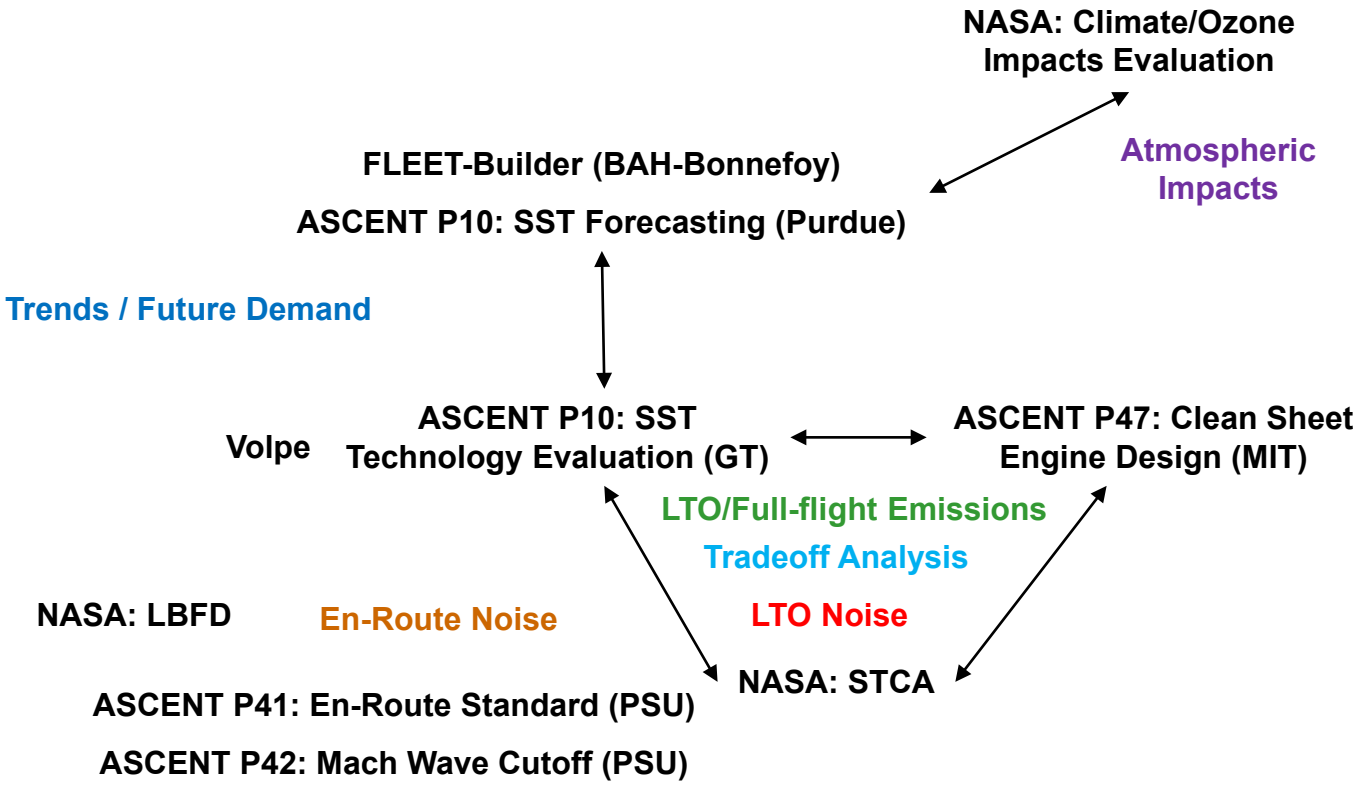
Coordination

- Interagency
- Public-Private
- State & Regional
- International

Highlights of Ongoing R&D Efforts (E&E Portfolio)

- Much effort on supersonic aircraft
- Considerable emphasis on noise:
  - Research on noise impacts continues
  - Exploring low noise operational procedures (with ATO and APP)
  - Work on helicopter noise is making good progress
  - Thinking how to approach UAS/UAM noise
- Particulate Matter efforts laid foundation for CAEP standard
- Will release AEDT3b - executing long term vision for AEDT
- Alternative jet fuels: CORSIA, CAAFI, and ASTM
- Technology maturation in CLEEN continues and we are setting stage for 3rd Phase of CLEEN
- Considering commercial space noise and emissions via ACRP

Civil Supersonic Transport R&D Efforts



Other areas of potential FAA SST R&D (not covered above)

- Technology maturation with industry (e.g., FAA CLEEN Phase III)
- Takeoff jet noise evaluation and mitigation
- Operational procedures to mitigate noise
- Emissions impacts evaluation

Outreach Materials

Continuing to maintain/update materials:

- Environment and Energy Tri-Fold

- FAA Environment and Energy Website (faa.gov/go/environment)
- Noise Website (faa.gov/go/aviationnoise)
- CLEEN Website (faa.gov/go/cleen)

- ASCENT Website (ascent.aero)
- CAAFI Website (caafi.org)

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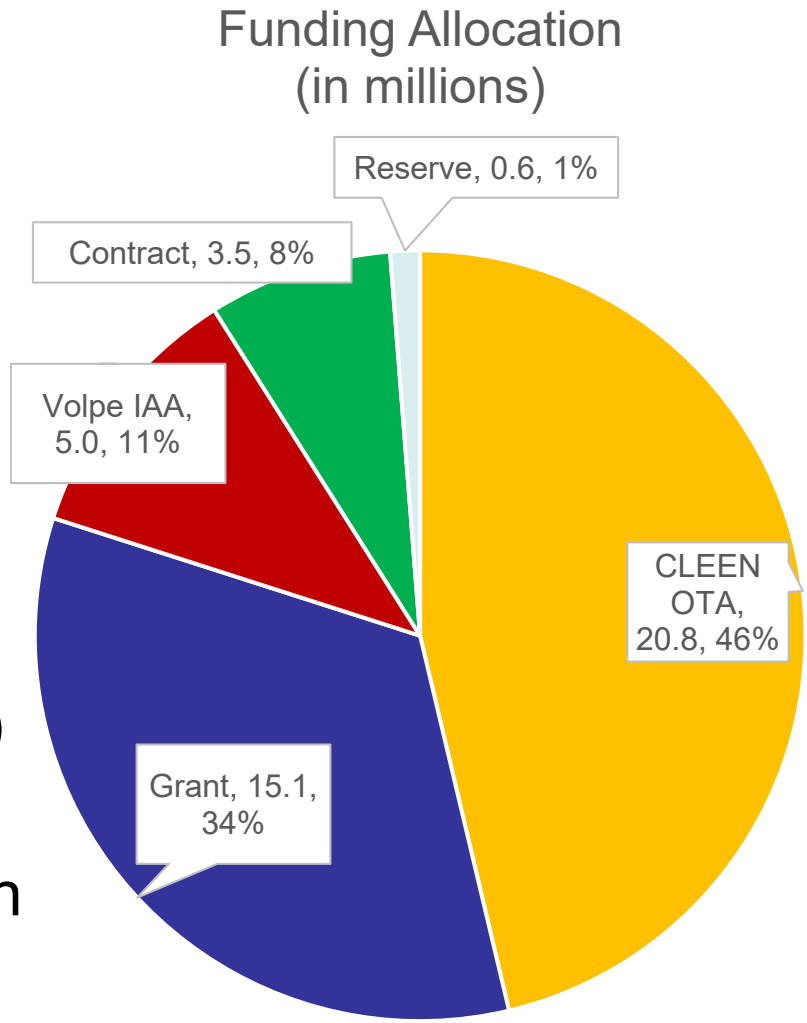
FY18 Funding Allocation – by Mechanism

- Primarily use three funding mechanisms to conduct R&D
- Contracts
  - CLEEN
  - PEARS-II
  - SEMRS
- Grants
  - ASCENT COE
- Inter Agency Agreement (IAA)
  - Volpe Center
- Have had challenges with both Grants and IAA



ASCENT Center of Excellence (COE)

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:

- FY2019 budget: FAA directed to use $15M in RE&D funds for ASCENT
- FY2018 budget: FAA directed to use $15M in RE&D funds for ASCENT
- FY2016 budget: FAA directed to use $10.6M 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)*

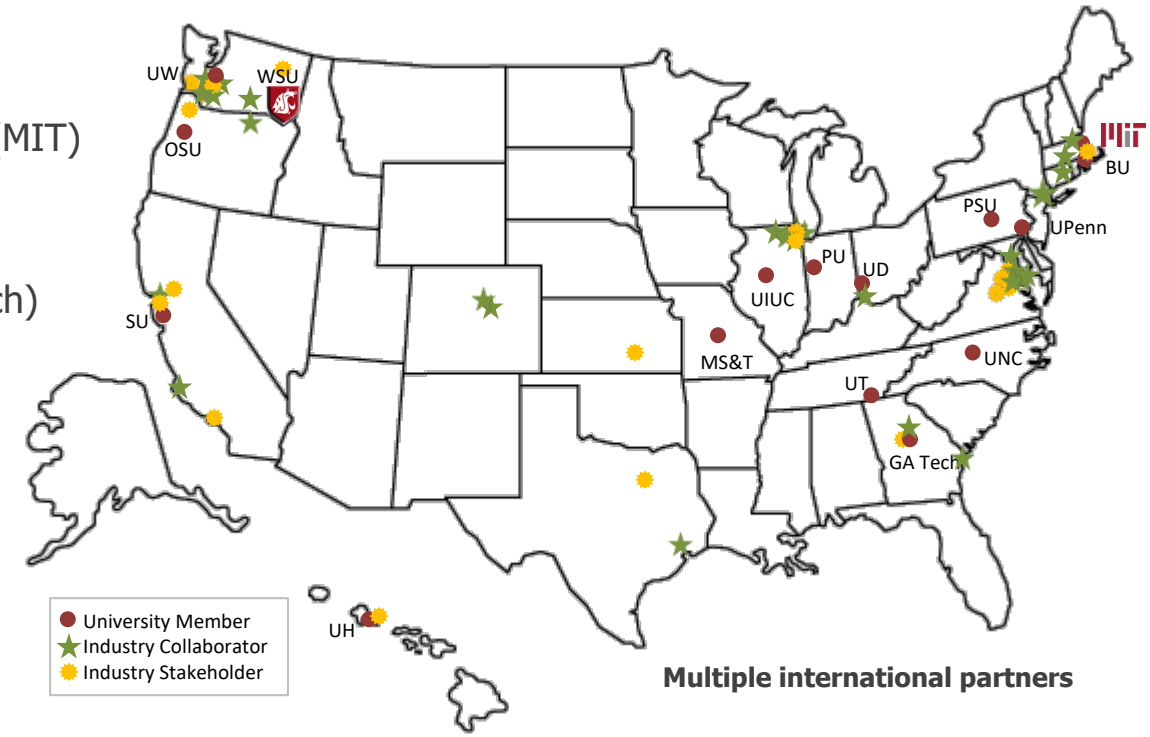
University of Illinois at Urbana-Champaign (UIUC)*

University of North Carolina at Chapel Hill (UNC)

University of Pennsylvania (UPenn)

University of Tennessee (UT)*

University of Washington (UW)*



Multiple international partners

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

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

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

ASCENT COE Details

ASCENT Leadership

- Mike Wolcott of WSU - Director
- John Hansman of MIT - Co-Director
- Carol Sim of WSU - Assistant Director

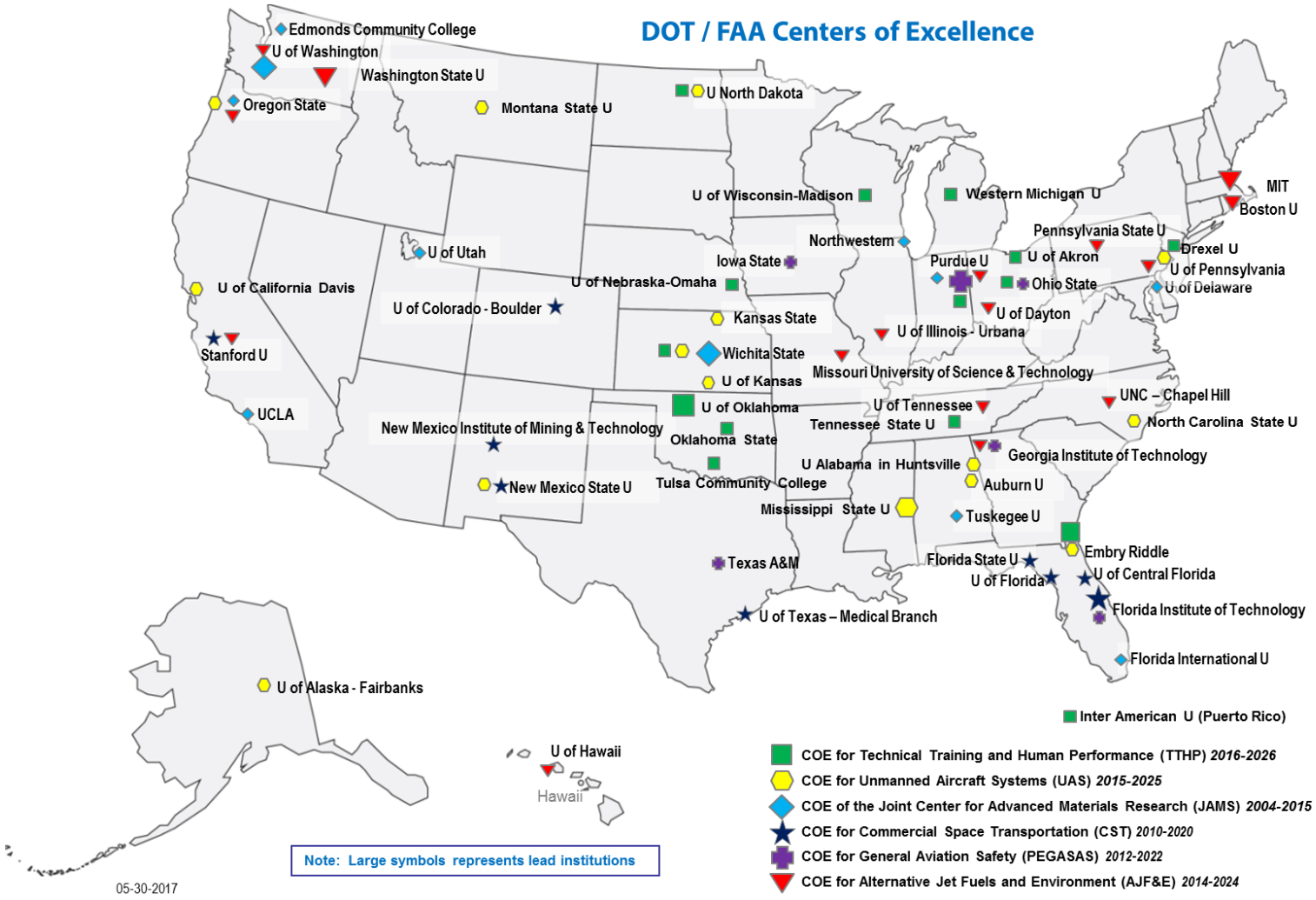
ASCENT Meetings

- Held ASCENT Symposium alongside 2018 CAAFI BGM
- April 18-19 in Atlanta at Georgia Tech

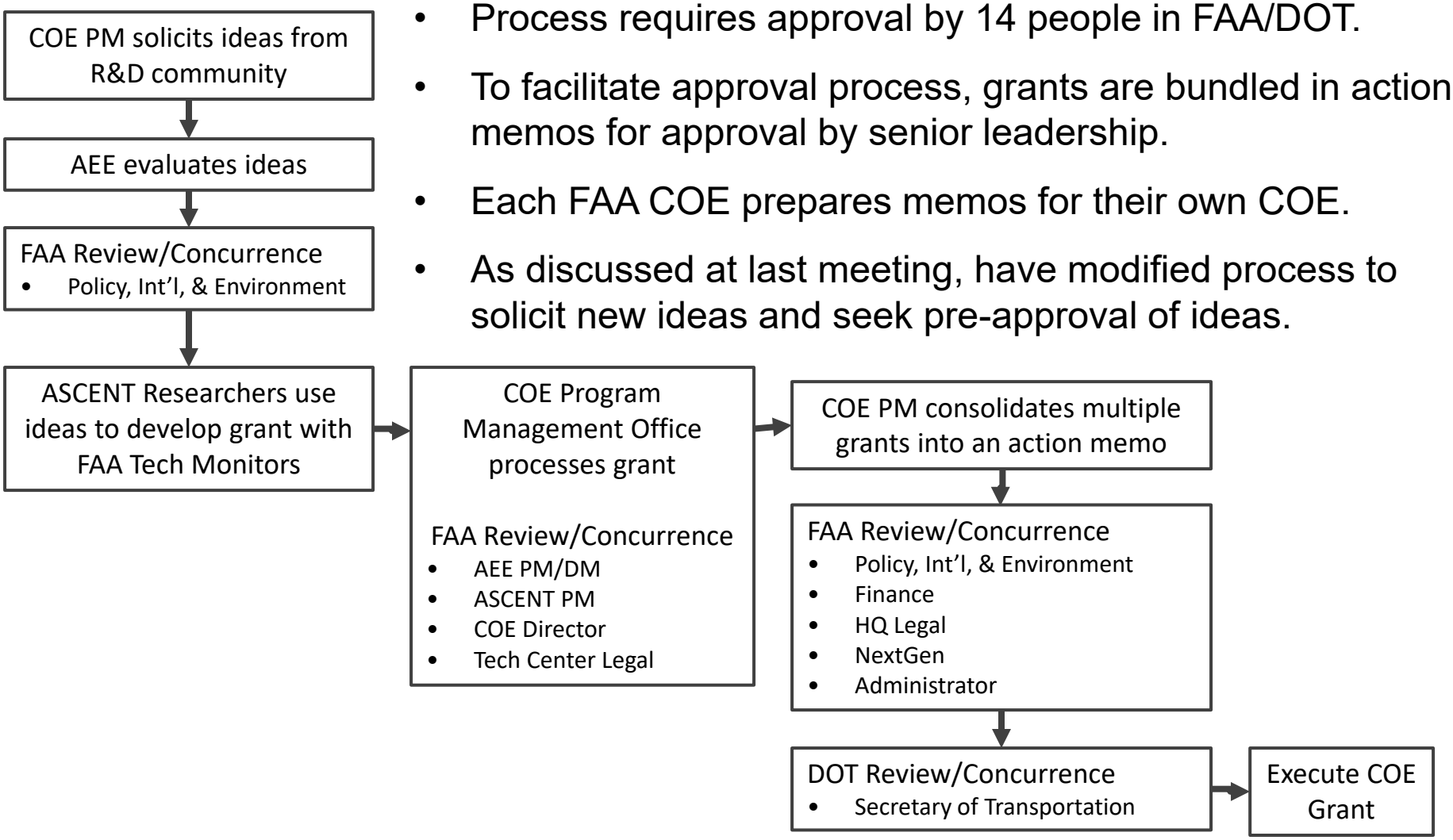
	Report 1	Report 2	Report 3
Time period	9/2013 – 9/2015	10/2015 – 9/2016	10/2016 – 9/2017
Research Projects	50	54	43
Publications, Reports, and Presentations	137	119	110
Students involved	131	112	105
Industry partners	63	70	72

DOT/FAA Centers of Excellence

(ASCENT is one of 6 active COEs within FAA)



ASCENT COE Grant Approval Process



- Process requires approval by 14 people in FAA/DOT.
- To facilitate approval process, grants are bundled in action memos for approval by senior leadership.
- Each FAA COE prepares memos for their own COE.
- As discussed at last meeting, have modified process to solicit new ideas and seek pre-approval of ideas.

ASCENT COE Grant Status

- Grants currently working through approval process (~$10M of FY18 funding):
  - 9 grants have been approved by Sec. of Transportation
  - 15 additional grants are with Office of Secretary for final approval
  - 8 additional grants are with NextGen/Finance for review
  - 1 additional grant just entering system for NextGen/Finance review

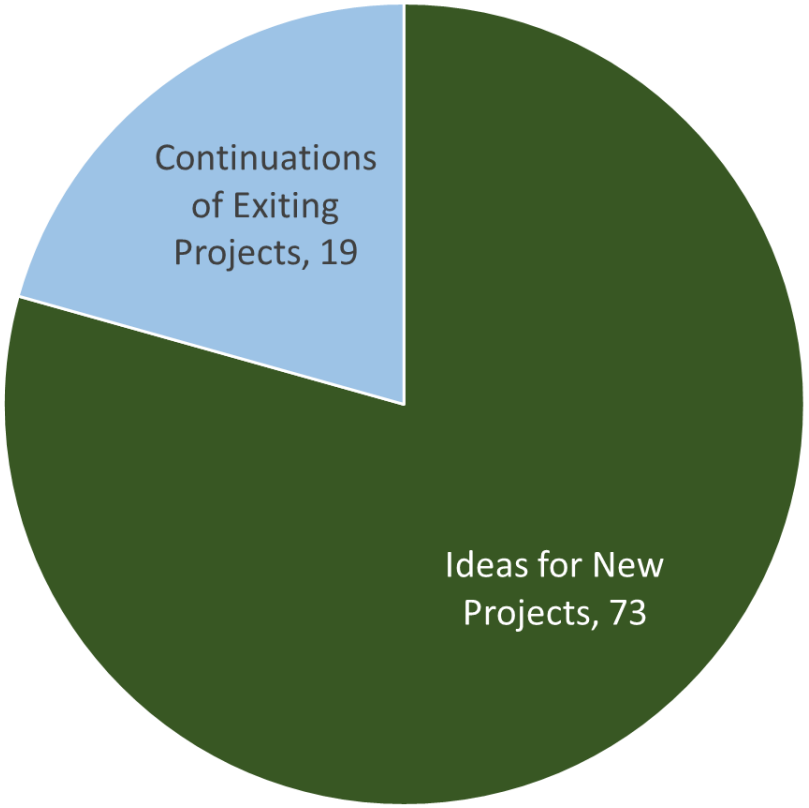
- Additional grants will enter approval process this spring/summer (~$20M in FY18/FY19 funding)
  - Considering both existing ASCENT Projects and new project ideas
  - Working with APL-1 to select projects for this funding cycle
  - Will develop full grants for projects that are selected

ASCENT COE Project Idea Generation

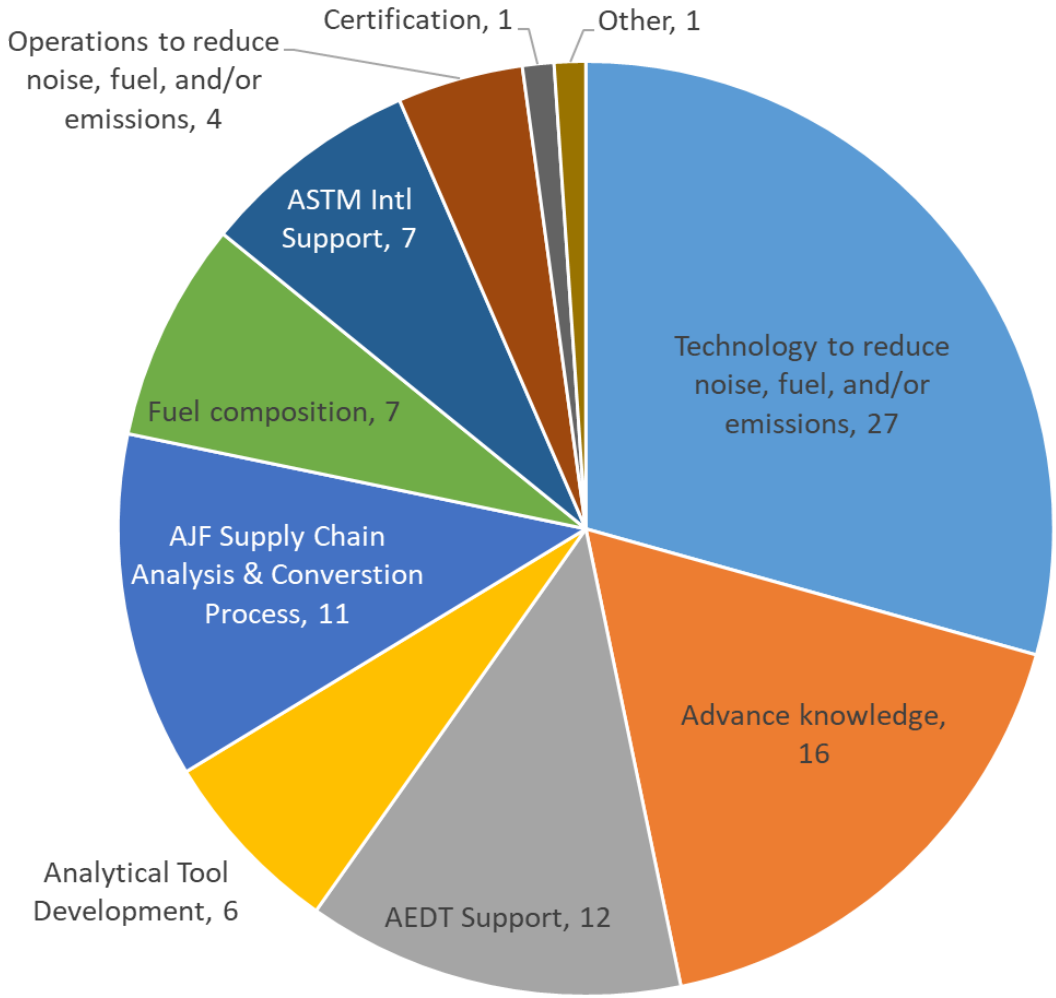
- Emailed ASCENT and CLEEN R&D Communities seeking new project ideas for innovative solutions to reduce noise, fuel burn, and emissions:
  - Aircraft and engine technologies
  - Both fixed wing and rotorcraft air vehicles at all scales and vehicle speeds
  - Changes in aircraft architecture (e.g., to enable shielding of fan forward engine noise)
  - Vehicle flight management systems and other software systems that are used in air vehicle operations
  - Alternative jet fuels
  - Changes in fuel composition of conventional jet fuels
  - Vehicle flight operations
  - Methods to improve modeling of noise and emissions for air vehicles that could lead to reduction in noise, fuel burn, and emissions
- If idea was not submitted by ASCENT university, it would be submitted to all ASCENT schools through a Notice of Funding Opportunity
- AEE reviewed existing research portfolio to identify potential project extensions

ASCENT COE Projects Ideas

New Ideas / Continuations



Project Types



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Environment & Energy Portfolio - FY19

Core RE&D (A13.a) Environment & Energy

- Improve scientific understanding of noise and emissions constraints
- Incorporate scientific knowledge into an integrated analytical tool suite
  - Robust support to the continued development of AEDT
  - Continued support to the development of a fleet forecast tool, FLEET-Builder
  - Starting new effort to develop screening tools to complement AEDT
- Analyze mitigation options for reducing environmental impacts including policy measures and environmental standards
  - ICAO CAEP standards (e.g., LTO noise standard for supersonic aircraft)
  - Low noise operational procedure concepts for aircraft and helicopters
  - Analysis of technology and innovative ideas to reduce noise, fuel burn, and emissions

Environment & Energy Portfolio - FY19

NextGen RE&D (A13.b) Environmental Research

- Accelerate maturation of airframe and engine technologies
  - Technology maturation in partnership with industry via the CLEEN Program – complete CLEEN Phase II with additional options
  - Demonstrate and assess benefits of new aircraft technologies via ASCENT COE
- Advance alternative jet fuels and consider changes in fuel composition
  - Advance ASTM Intl approvals via fuel testing and process improvements
  - Conduct supply chain analyses and support fuel evaluations within CORSIA
  - Coordinate activities of the aviation industry via CAAFI

Airport Technology Research (ATR)

ATR Overview:

- Three Research Programs Areas (RPA): Airport Safety, Pavement and Airport Environment
- All three RPAs presented to Airports Subcommittee

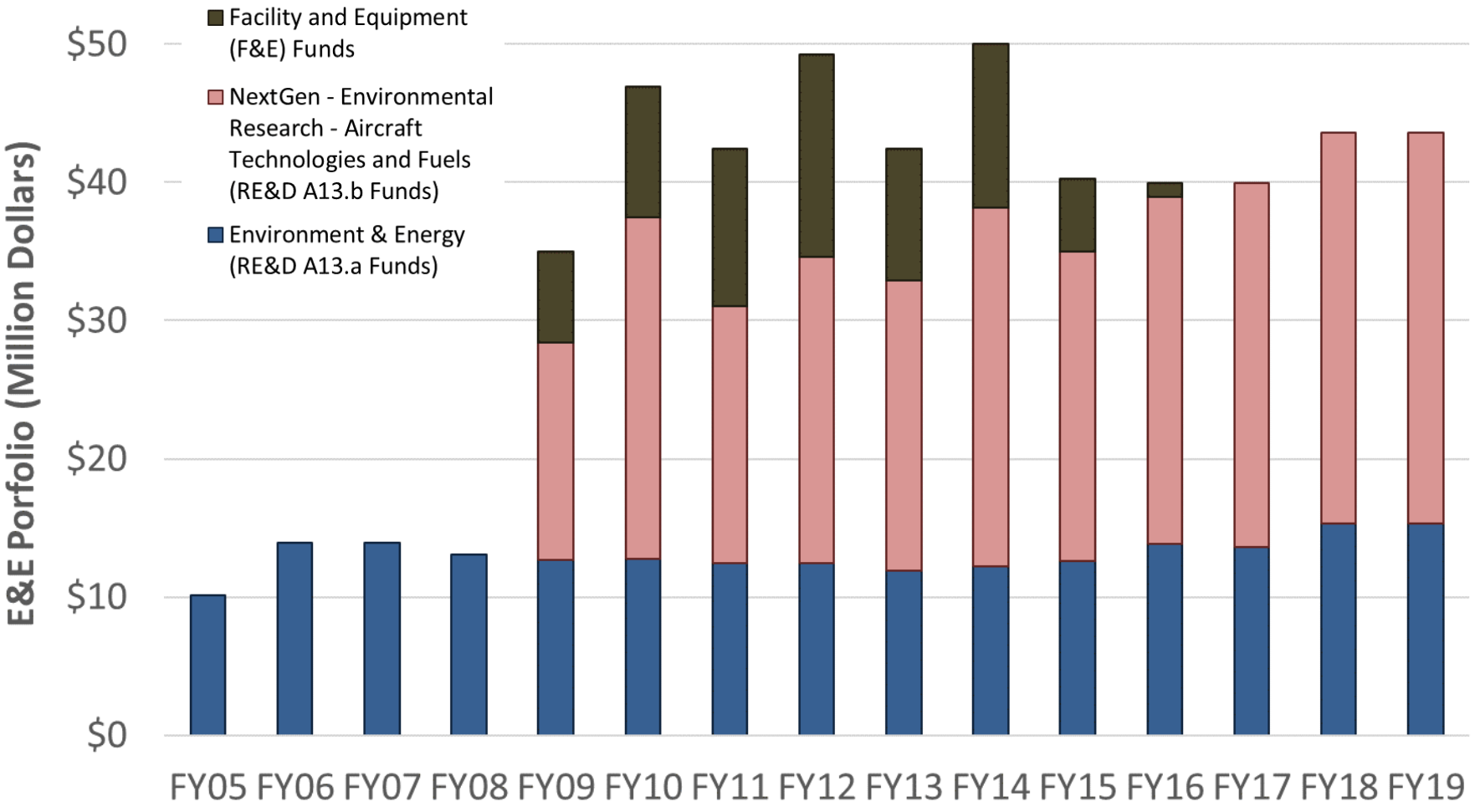
Environmental Efforts within ATR:

- Airport noise research started in FY12
- Expanded to cover broader environmental research in FY16

Collaborative effort among Tech Center, Office of Airports, and Office of Environment and Energy

Have dedicated briefing on ATR today

Long Term Enacted Funding Profile
E&E Portfolio (Contract Funding)



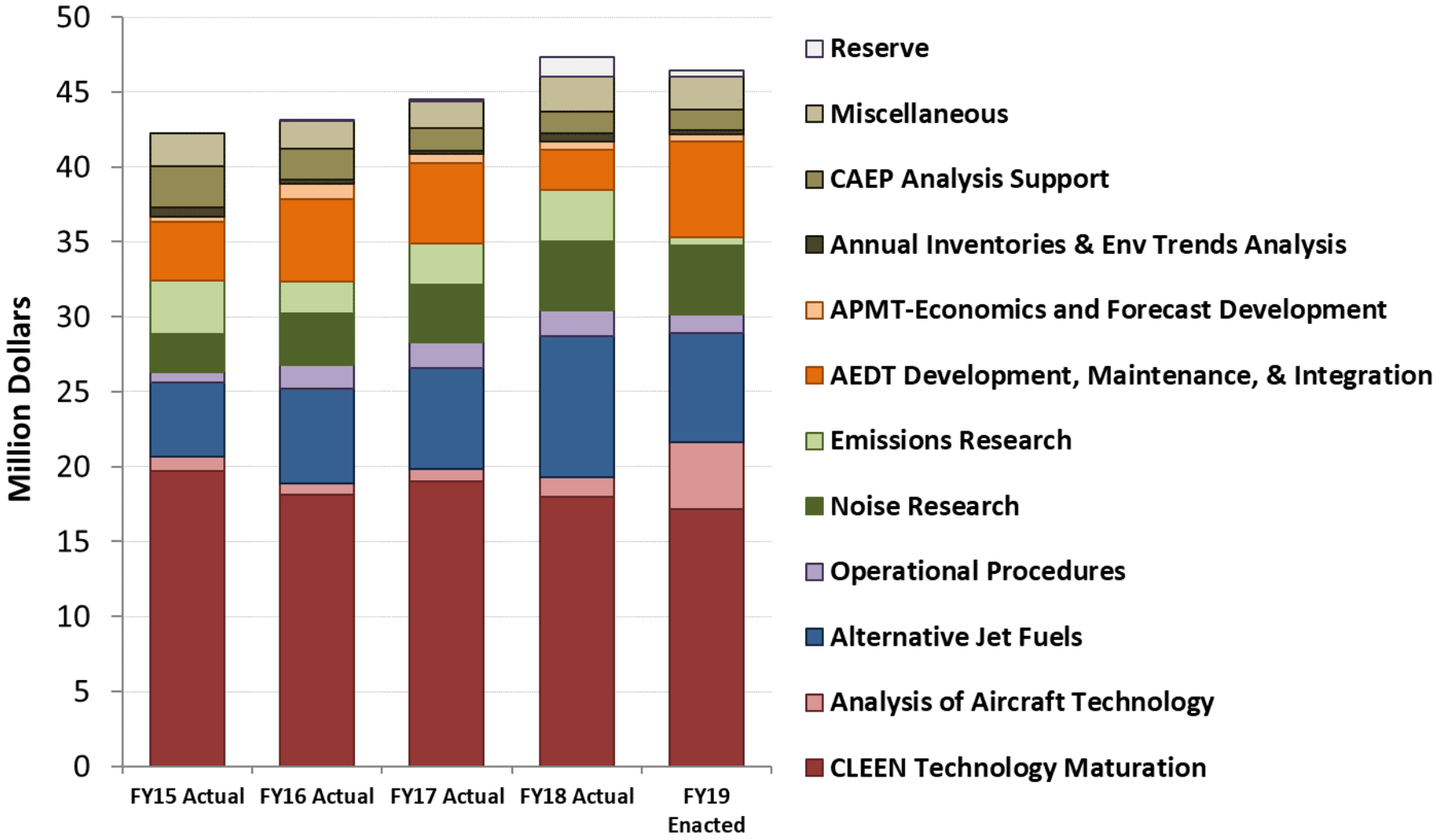
Not shown on graph:

Airport Technology Research has ~$1.5M/year for noise/environment projects

Airports Cooperative Research Program (ACRP) provides ~$5M/year for environment projects

Environment and Energy Funding

Includes: RE&D, F&E, ATR, Operations, and non-FAA funds (e.g., other US Government and Transport Canada)



FAA Portion of the Remaining Agenda

Subject	Presenters
ATR Environmental Research - Update	M. Hovan & L. Vitagliano
Noise Research	D. Scata
Research to Lower Noise through Operational Procedures	J. DiPardo
Emissions Research	D. Jacob
Alternative Jet Fuels Research	N. Brown
Aircraft Technology Resarch (CLEEN)	L. Ileri
Analysis & Tool Development	F. Grandi
AEDT Update	M. Majeed & J. DiPardo

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Recent Successes

capabilities and solutions that are helping today

- Aviation Environmental Design Tool (AEDT) being upgraded to better capture actual operations and is being used extensively.
- Measurement technique and data provided foundation for ICAO CAEP PM standard.
- Noise impacts work is starting to deliver results. Community noise survey under review. Starting work on national sleep study.
- 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.
- 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.
- Analytical tools provided foundation for ICAO CAEP Independent Expert review of aircraft technologies for the purpose of setting goals for noise, fuel burn, and NOx emissions.
- Certification of five alternative jet fuel pathways – certification enabled multiple airlines to buy and use biofuels in LAX and elsewhere.
- 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.