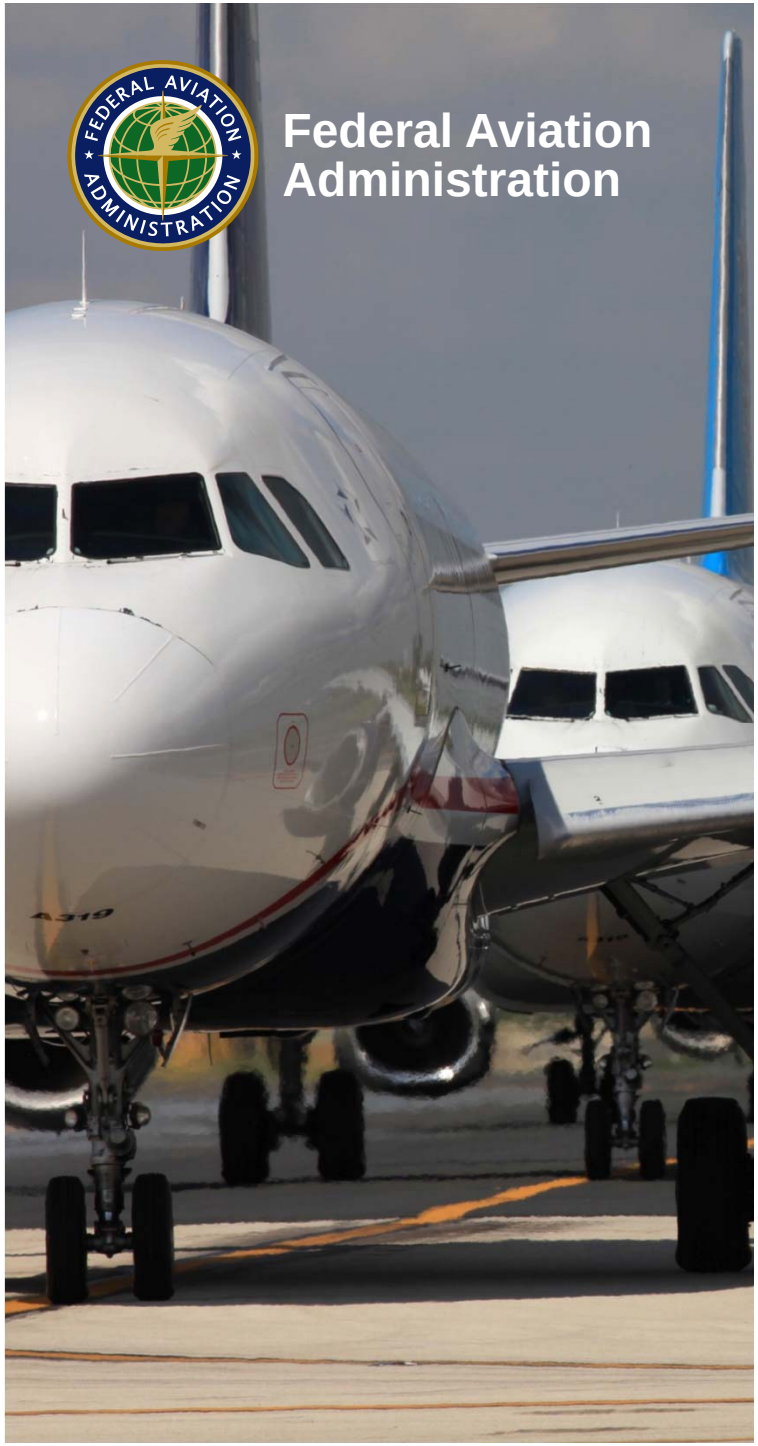
FAA Environment and Energy R&D Overview



Presented to: Public Meeting for Center of Excellence for Alternative Jet Fuels and Environment

By: Jim Hileman, Ph.D., Chief Scientific and Technical Advisor for Environment and Energy, Federal Aviation Administration

Date: November 15, 2012

Aviation, Environment and Energy

- Aviation impacts affect community noise footprints, air quality, water quality, and the global climate
- Trends show environmental impacts from aircraft noise and aviation emissions will be a critical constraint on capacity growth
- The stringency of environmental standards and efforts to mitigate environmental impacts are increasing
- Fundamental changes are ongoing in energy markets.

The <u>challenge</u> is to increase mobility with reduced environmental impacts and enhanced energy efficiency, sustainability and security.

Aviation Environmental & Energy Policy

Policy statement affirms environmental and energy policy for U.S. civil aviation. The overarching environmental performance goal for NextGen is environmental protection that allows sustained aviation growth.

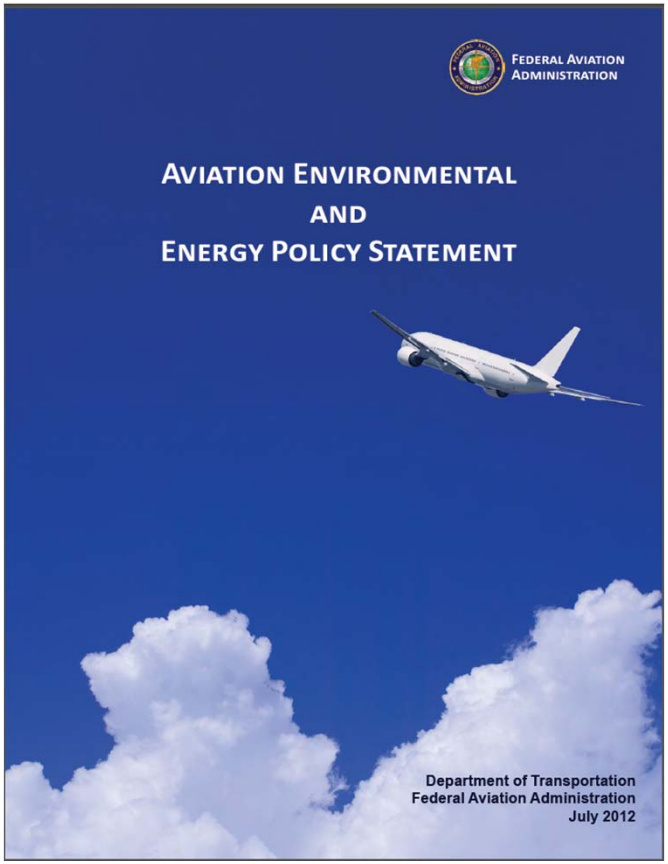
Key Aspects of Policy Statement:

E&E Policy Framework and Principles

1. Limit and reduce future aviation environmental impacts to levels that protect public health and welfare.
2. Ensure energy availability and sustainability.

Aviation E&E Goals: Noise, Air Quality, Energy, Climate and Water Quality

Aviation E&E Strategies: NextGen Five Pillar Approach



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

Environment & Energy Goals and Metrics

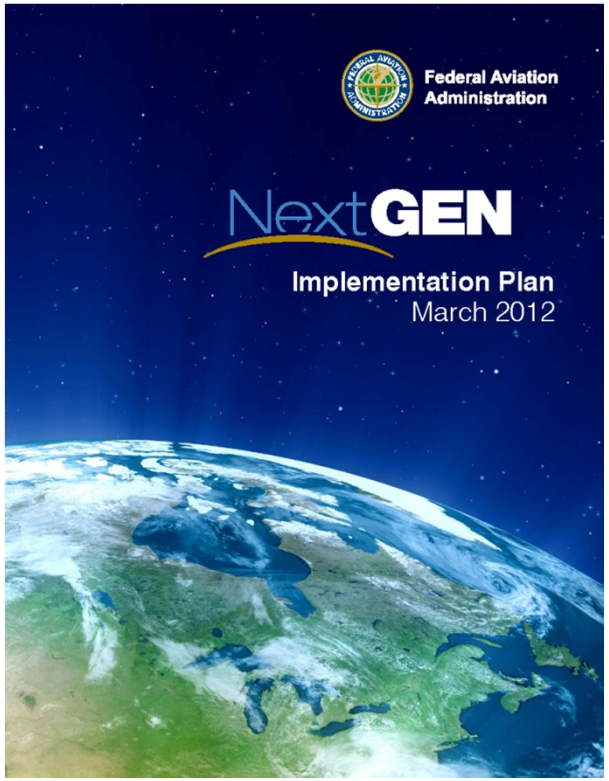
Aspect	Goal[1]	Performance Metric[2]
Noise	Reduce the number of people exposed to significant noise around U.S. airports in absolute terms, notwithstanding aviation growth, and provide additional measures to protect public health and welfare and our national resources.	The U.S. population exposed to significant aircraft noise around airports has been reduced to less than 300,000 persons by 2018.
Air Quality	Achieve an absolute reduction of significant air quality health and welfare impacts attributable to aviation, notwithstanding aviation growth.	Aviation emissions contribute 50 percent less to significant health impacts in 2018 using a 2005 baseline.
Energy	Improve National Airspace System (NAS) energy efficiency by at least two percent per year, and develop and deploy alternative jet fuels for commercial aviation.	Improve NAS energy efficiency (fuel burned per miles flown) by at least 2 percent annually. One billion gallons of renewable jet fuel is used by aviation by 2018.
Climate	Limit the impact of aircraft CO2 emissions on the global climate by achieving carbon neutral growth by 2020 compared to 2005, and net reductions of the climate impact from all aviation emissions over the longer term (by 2050).	Aviation emissions are on a trajectory for carbon neutral growth by 2018, using a 2005 baseline.

Source:
1. Aviation Environmental and Energy Policy Statement (2012)
2. Aspirational Goals from FAA Destination 2025

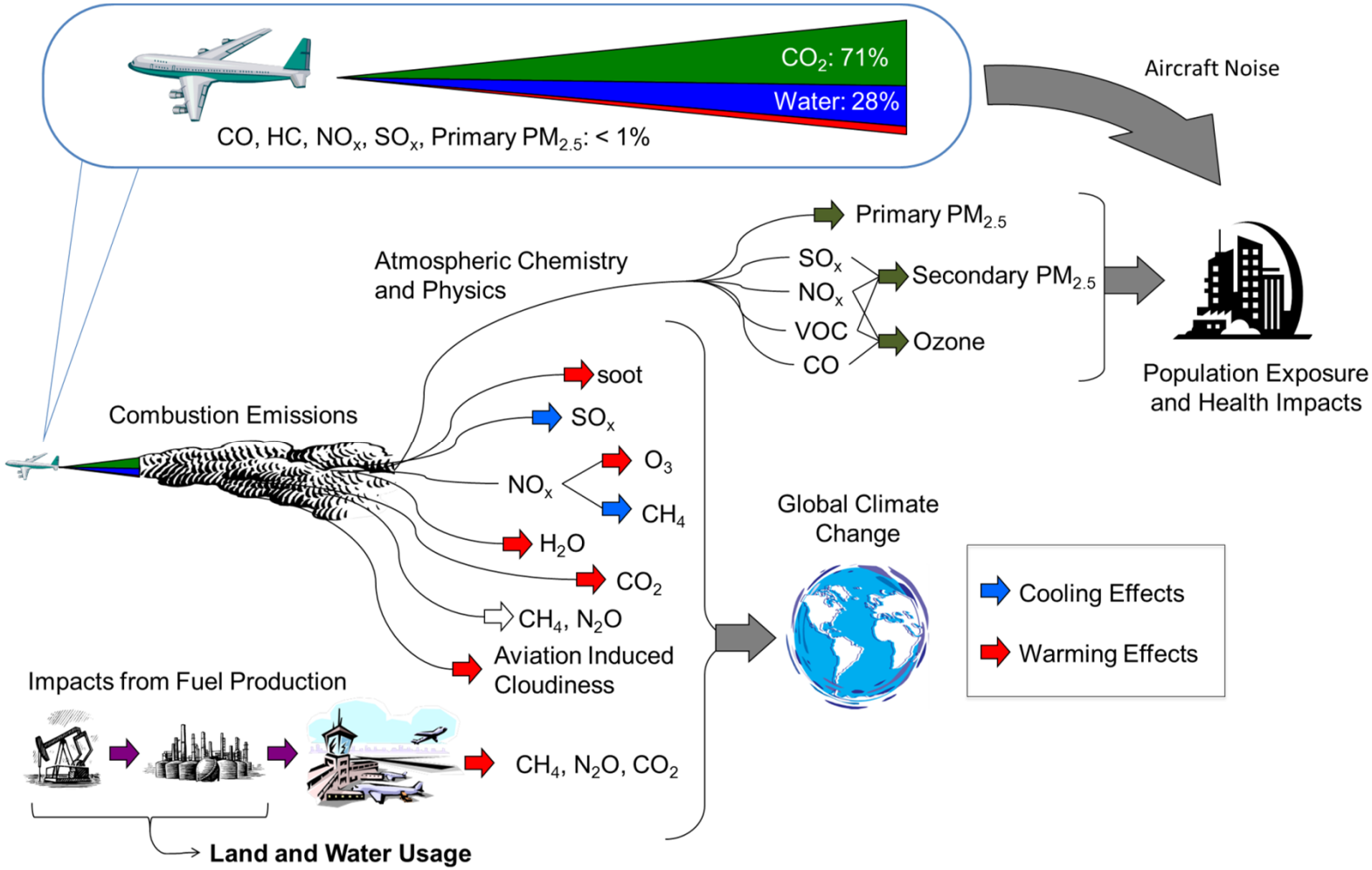
NextGen 5-Pillar Environmental Approach

To increase mobility with reduced environmental impacts and enhanced energy efficiency, sustainability, and security

- **P1: Better Scientific Understanding and Improved Tools for Integrated Environmental Analysis**
- **P2: Mature New Aircraft Technologies**
- **P3: Develop Aviation Alternative Fuels**
- **P4: Develop and Implement Clean, Quiet and Energy Efficient Operational Procedures**
- **P5: Policies, Environmental Standards, Market Based Measures and Environmental Management System**



Environmental Impacts of Aviation



Considering environmental impacts of noise and emissions and interdependencies of potential mitigation options

Reducing Aviation's Environmental Footprint

To increase mobility with reduced environmental impacts and enhanced energy efficiency, sustainability and security, we need:

	Aircraft & Engine Design	Fuel Composition	Fuel Production	Operations
NOISE: Reduce noise footprint for each flight	X			X
AIR QUALITY: Reduce NOx, SOx, and soot emissions	X	X		X
CLIMATE: Reduce GHG emissions and their impacts	X	X	X	X
SUSTAINABILITY: Develop sustainable alternative fuels			X	

we also need to characterize interdependent environmental impacts for today and in a future with varied mitigation solutions

Overarching Research Direction

FAA Office of Environment and Energy (AEE) R&D:

- Advances scientific understanding and analytical capability to characterize and assess aviation's impact on environment
- Provides sound scientific data to inform policy making relating to aviation's energy use and environmental impacts
- Supports development of mitigation solutions that reduce environmental impacts of aviation and enhance energy efficiency, sustainability and security

Research Roadmaps and Plans

Research Roadmaps

- AEE have developed research roadmaps to guide R&D
- Cover emissions, noise, advanced operations, noise, and alternative fuels

Climate Action Plan

- USG has set an ambitious overarching goal of achieving carbon-neutral growth for U.S. commercial aviation by 2020, using 2005 emissions as a baseline.
- Plan identifies actions and progress toward GHG emissions reductions in each of the five NextGen pillars.

Pillar 1: Better Scientific Understanding & Improved Tools for Integrated Environmental Analysis

Key Aspects:

- Characterize problem
- Assess risk
- Inform development of mitigation solutions

To increase mobility with reduced environmental impacts and enhanced energy efficiency and security, we need:	Aircraft & Engine Design	Fuel Composition	Fuel Production	Operations
NOISE: Reduce noise footprint for each flight	X			X
AIR QUALITY: Reduce NOx, SOx, and soot emissions	X	X		X
CLIMATE: Reduce GHG emissions and their impacts	X	X	X	X
SUSTAINABILITY: Develop sustainable alternative fuels			X	

Main activities:

- Characterize source of noise and pollutants
- Evaluate propagation of noise as well as dispersion and transformation of pollutants
- Understand health and welfare impacts
- Develop analytical tools to model full impact pathway

Pillar 2: Mature New Aircraft Technologies

Key Aspects:

- Accelerate aircraft and engine technology development
- Technology assessment

To increase mobility with reduced environmental impacts and enhanced energy efficiency and security, we need:	Aircraft & Engine Design	Fuel Composition	Fuel Production	Operations
NOISE: Reduce noise footprint for each flight	X			X
AIR QUALITY: Reduce NOx, SOx, and soot emissions	X	X		X
CLIMATE: Reduce GHG emissions and their impacts	X	X	X	X
SUSTAINABILITY: Develop sustainable alternative fuels			X	

Main activities:

- Accelerate technology development via Continuous Lower Emissions, Energy and Noise (CLEEN) Program
- Develop and use analytical tools for effective technology assessment of suitability, environmental benefits and impact of aircraft technologies, alternative fuels and operations

Pillar 3: Develop Alternative Jet Fuels

Key Aspects:

- Fuel certification
- Environmental and economic sustainability
- Facilitate feedstock and fuel production (deployment)
- Support collaboration

To increase mobility with reduced environmental impacts and enhanced energy efficiency and security, we need:	Aircraft & Engine Design	Fuel Composition	Fuel Production	Operations
NOISE: Reduce noise footprint for each flight	X			X
AIR QUALITY: Reduce NOx, SOx, and soot emissions	X	X		X
CLIMATE: Reduce GHG emissions and their impacts	X	X	X	X
SUSTAINABILITY: Develop sustainable alternative fuels			X	

Main activities:

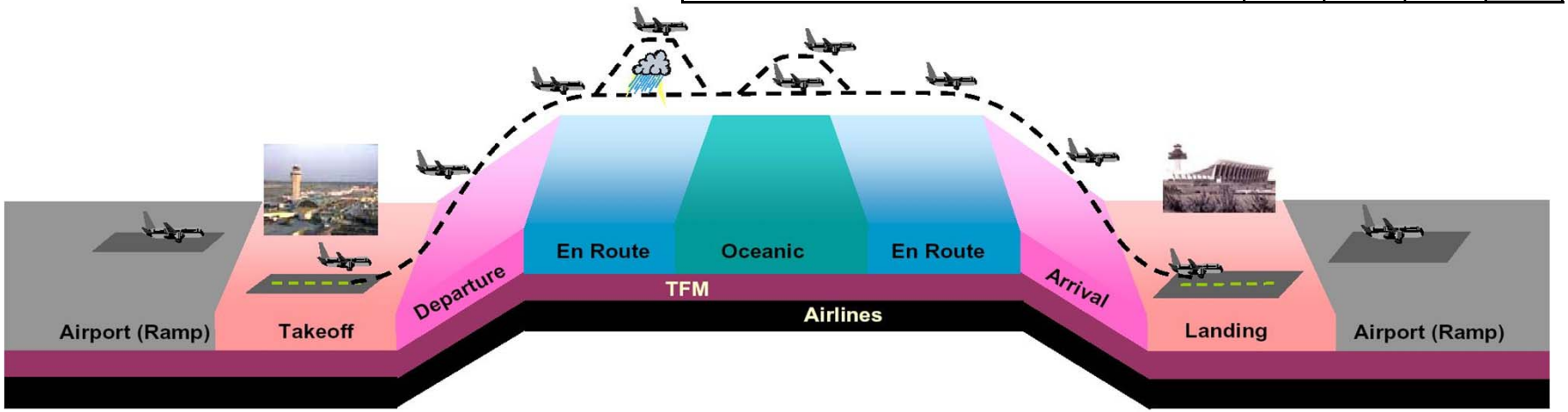
- Test fuel performance for certification / qualification and for impact on aircraft and engine systems
- Analyze environmental sustainability and economics of fuel production
- Evaluate regional feedstock supply chains and support other federal agencies in examining feedstock development and fuel production

Pillar 4: Develop and Implement Clean, Quiet and Energy Efficient Operational Procedures

Key Aspects:

- New air traffic management capabilities
- Gate-to-gate and surface operational procedures

To increase mobility with reduced environmental impacts and enhanced energy efficiency and security, we need:	Aircraft & Engine Design	Fuel Composition	Fuel Production	Operations
NOISE: Reduce noise footprint for each flight	X			X
AIR QUALITY: Reduce NOx, SOx, and soot emissions	X	X		X
CLIMATE: Reduce GHG emissions and their impacts	X	X	X	X
SUSTAINABILITY: Develop sustainable alternative fuels			X	



Pillar 5: Policy Measures and Environmental Management System

Key Aspects:

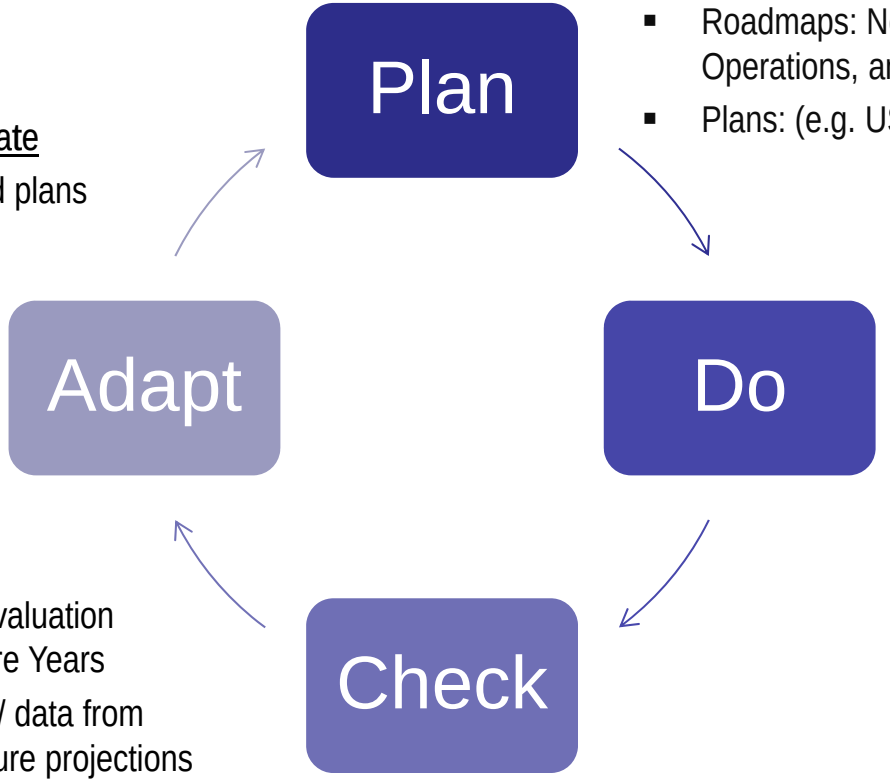
- Domestic policy (e.g., NextGen Deployment)
- International policy (e.g., ICAO CAEP)

To increase mobility with reduced environmental impacts and enhanced energy efficiency and security, we need:	Aircraft & Engine Design	Fuel Composition	Fuel Production	Operations
NOISE: Reduce noise footprint for each flight	X			X
AIR QUALITY: Reduce NOx, SOx, and soot emissions	X	X		X
CLIMATE: Reduce GHG emissions and their impacts	X	X	X	X
SUSTAINABILITY: Develop sustainable alternative fuels			X	

Main activities:

- Perform research to aid development of domestic and international policies for aviation environmental impacts emissions
- Analyze environmental impacts, economic trade-offs and cost-benefit assessments of policy options and mitigation strategies
- Support Environmental Management System (EMS) to improve environmental performance of national aviation system

EMS Framework for AEE R&D



Roadmap and Plan Development

- Roadmaps: Noise, Emissions, Advanced Operations, and Alternative Fuels
- Plans: (e.g. US Climate Action Plan)

NextGen 5 Pillar Approach

P1: Advance Scientific Understanding and Develop Improved Tools for Integrated Environmental Analysis

P2: Mature New Aircraft Technologies

P3: Develop Aviation Alternative Fuels

P4: Develop and Implement Clean, Quiet and Energy Efficient Operational Procedures

P5: Policies, Environmental Standards, Market Based Measures and Environmental Management System

Goals Evaluation

- Goals and Metrics Evaluation for Current and Future Years
- Compile information / data from stakeholders and future projections
- Use Tool Suite to evaluate current and future years
- Compare results against E&E Goals
- Identify gaps and potential solutions

Roadmap and Plan Update

- Modify roadmaps and plans to resolve gaps with identified solutions

FAA Office of Energy and Environment Research & The Center of Excellence for Alt Jet Fuels and Environment

- Overarching direction: utilize a goals-focused research program to inform solution development to overcome aviation E&E challenges.

- Overall AEE R&D Plan:
  - Use research roadmaps to guide efforts
  - Further scientific understanding
  - Develop analytical tools
  - Mature solutions that could help us meet goals
  - Conduct analyses to track progress toward our goals

- AJF&E COE will be integral component to our overall plan

Technical Areas - Morning

Presenter	Technical Areas – Alt Jet Fuels*	Pillar
R. Cointin	Aircraft Noise and Impacts	1
R. Iovinelli	Aviation Emissions and Impacts	1
M. Gupta	Aviation Modeling and Analysis	1
R. Jefferies	Aircraft Technology Assessment	2
J. Marks	Environmentally and Energy Efficient Gate-to-Gate Aircraft Operations	4

*** All technical areas include Pillar 5**

Technical Areas - Afternoon

Presenter	Technical Areas – Environment*	Pillar
N. Brown	Feedstock Development, Processing and Conversion Research	3
N. Brown	Regional Supply and Refining Infrastructure	3
J. Hileman	Environmental Benefits Analysis	3
M. Rumizen	Aircraft Component Deterioration and Wear Assessment	3
M. Rumizen	Fuel Performance Testing	3

*** All technical areas include Pillar 5**