

## Active Increments

### Portfolio Overview

The environmental vision for the FAA's strategic plan is to develop and operate a system that reduces aviation's environmental and energy impacts to a level that does not constrain growth and is a model of sustainability. Aircraft noise, air quality, climate, and energy are the most significant potential environmental constraints to increasing aviation capacity, efficiency, and flexibility. Limiting and reducing future aviation environmental impacts to levels that protect public health and welfare as well as ensuring energy availability and sustainability are the guiding principles of aviation environmental protection. The FAA is pursuing the following environmental goals:

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 national resources.

Air Quality: Achieve an absolute reduction of significant air quality health and welfare impacts attributable to aviation.

Climate: Limit the impact of aircraft carbon dioxide (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).

Energy: Improve National Airspace System (NAS) energy efficiency and develop and deploy alternative jet fuels for commercial aviation.

To achieve these goals, the FAA's environmental and energy research strategy is based on characterization of the problem and assessment of associated risks; development of technological and policy based solutions; and management of system-wide performance while working closely with stakeholders community. The FAA Office of Environment and Energy is pursuing 5-pillar approach to meet environmental goals (1) Improve scientific knowledge and enhance integrated environmental modeling capability; (2) accelerate maturation of new aircraft technologies; (3) advance alternative jet fuels; (4) explore air traffic management modernization and operational improvements; and (5) develop policies, environmental standards, and market based measures. The Operational Improvements, enabling activities and increments reflect this strategy.

Activities in this portfolio will be conducted in such a way that they do not impact the safety of the NAS. In the Bravo timeframe this portfolio will build on progress from the enabling activities in the Alpha timeframe, which includes Phase 2 maturation of environmentally friendly technologies, fuels, and continued focus on environmental and energy- favorable concepts and operations.

Note: The dates and timelines included in the NAS Segment Implementation Plan (NSIP) are for planning purposes only. All capability schedules are tentative until their supporting programs are officially baselined.

# Environment and Energy

## Portfolio Content Summary Statistics

		Increment Status				
Segment	Total by Segment	Planned	Concept Exploration & Maturation	Development	Initial Operational Availability	Completed
*Alpha (2010 - 2015)	22	0	0	0	0	22
*Bravo (2016 - 2020)	8	0	0	0	0	8
Charlie (2021 - 2025)	5	0	5	0	0	0
Delta (2026 - 2030)	0	0	0	0	0	0
Echo (2031 - 2035)	0	0	0	0	0	0
Foxtrot (2036 - 2040)	0	0	0	0	0	0
TOTAL	35	0	5	0	0	30
Segment	% by Segment	% by Segment/Increment Status				
*Alpha (2010 - 2015)	63 %	0 %	0 %	0 %	0 %	100 %
*Bravo (2016 - 2020)	23 %	0 %	0 %	0 %	0 %	100 %
Charlie (2021 - 2025)	14 %	0 %	100 %	0 %	0 %	0 %
Delta (2026 - 2030)	0 %	0 %	0 %	0 %	0 %	0 %
Echo (2031 - 2035)	0 %	0 %	0 %	0 %	0 %	0 %
Foxtrot (2036 - 2040)	0 %	0 %	0 %	0 %	0 %	0 %
TOTAL	100%	0 %	14 %	0 %	0 %	86 %

\* Please see Appendix A and B for information about Alpha and Bravo Increments, respectively.

# Environment and Energy

## Operational Improvements/Current Operations & Increments

## Benefits

OI: [701104] Integrated Environmental Modeling - Phase III (2021 - 2025)

[701104-01] Aviation Environmental Tools Suite - Phase III (2021 - 2025)



OI: [702104] NextGen Environmental Engine and Aircraft Technologies - Phase III (2021 - 2026)

[702104-01] Explore and Demonstrate New Technologies Under CLEEN - Phase III (2021 - 2026)



OI: [703104] Sustainable Alternative Jet Fuels - Phase III (2021 - 2026)

[703104-01] Support Qualification and Deployment of Drop-In Alternative Jet Fuels (2021 - 2026)



OI: [704104] Environmental Policies, Standards and Measures - Phase III (2021 - 2025)

[704104-01] Environmental Performance and Targets - Phase III (2021 - 2025)



[704104-02] Analysis to Support International Environmental Standard-Setting - Phase III (2021 - 2025)



External Commitment

Primary Benefit

Secondary Benefit

Operationally Available

Complete

Access & Equity

Capacity

Flexibility

Efficiency

Environment

Predictability

Safety

Charlie

Delta

Echo

Foxtrot

# Environment and Energy

2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
OI: [701104] Integrated Environmental Modeling - Phase III (2021 - 2025)																			
[c] [701104-01] Aviation Environmental Tools Suite - Phase III (2021 - 2025)																			
OI: [702104] NextGen Environmental Engine and Aircraft Technologies - Phase III (2021 - 2026)																			
[c] [702104-01] Explore and Demonstrate New Technologies Under CLEEN - Phase III (2021 - 2026)																			
OI: [703104] Sustainable Alternative Jet Fuels - Phase III (2021 - 2026)																			
[c] [703104-01] Support Qualification and Deployment of Drop-In Alternative Jet Fuels (2021 - 2026)																			
OI: [704104] Environmental Policies, Standards and Measures - Phase III (2021 - 2025)																			
[c] [704104-01] Environmental Performance and Targets - Phase III (2021 - 2025)																			
[c] [704104-02] Analysis to Support International Environmental Standard-Setting - Phase III (2021 - 2025)																			

Planned

OI

Concept Exploration & Maturation

CODevelopmentInitial Operation AvailableComplete



# Environment and Energy

## OI: [701104] Integrated Environmental Modeling - Phase III (2021 - 2025)

Continue to update the integrated aviation environmental analysis tool suite for the latest scientific knowledge and use this capability to further evaluate both the environmental impacts of aviation as well as the performance of potential mitigation options.

### OI Benefit

Environment (S): Improve identification of potential solutions to improve environmental performance.

### Increments

Charlie  
(2021 - 2025)

1

**C** [701104-01] Aviation Environmental Tools Suite - Phase III (2021 - 2025) (Concept Exploration & Maturation)

# Environment and Energy

## Increments/Enabling Activities

**C** [701104-01] Aviation Environmental Tools Suite - Phase III (2021 - 2025)

### Increment Overview

Develop, evaluate, and implement additional Phase III enhancements to the aviation environmental suite of tools that range from aircraft level to NAS-wide modeling and analyses to inform development of mitigation solutions and policy options that will further improve scientific knowledge, refine metrics, and reduce uncertainties of aircraft source-level noise and emissions of air pollutants and greenhouse gases, their atmospheric evolution, and impacts on human health and welfare and climate change.

### Increment Status

Concept Exploration & Maturation

### Success Criteria

- 2025 : Use of advanced scientific understanding of aviation noise and emissions and their impacts, to enhance capability of environmental assessment models to assess environmental performance and benefits of mitigation options.
- 2025 : Complete America's Phenix/MDS Coating Technologies flight test demonstration of fan blade erosion resistant coating (TRL 7)

### Implementation Approach

Release enhanced versions of AEDT and develop additional analytical capabilities to support decision-making, environmental performance assessments, and cost-benefit analyses.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Integrated advancement in scientific knowledge and environmental analytical tools capability will provide solid foundation for environmental mitigation (technological and policy based) decision-making and assessment studies.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## OI: [702104] NextGen Environmental Engine and Aircraft Technologies - Phase III (2021 - 2026)

Develop and mature aircraft and engine technologies to reduce noise, emissions, and fuel burn from commercial subsonic jet aircraft through the FAA's Continuous Lower Energy, Emissions, and Noise (CLEEN) program. Demonstrate these technologies at sufficient readiness levels to achieve goals of the CLEEN Phase III program.

### OI Benefit

Environment (P): Reduce emissions, fuel burn, and noise.

### Increments

Charlie  
(2021 - 2025)

1

**C** [702104-01] Explore and Demonstrate New Technologies Under CLEEN - Phase III (2021 - 2026) (Concept Exploration & Maturation)

# Environment and Energy

## Increments/Enabling Activities

**C** [702104-01] Explore and Demonstrate New Technologies Under CLEEN - Phase III (2021 - 2026)

### Increment Overview

This enabling activity will mature and demonstrate new environmentally beneficial aircraft technologies in CLEEN Phase III.

### Increment Status

Concept Exploration & Maturation

### Success Criteria

- ✓ 2022 : Complete GE low emissions combustor rig testing (TRL 3)
- 2023 : Complete GE wind tunnel testing of open fan technology (TRL 5)
- 2024 : Complete Boeing Quiet Landing Gear and Quiet High Lift flight test demonstration (TRL 7)
- 2024 : Complete Safran Nacelles Acoustic Air Inlet Lip Skin wind tunnel testing (TRL 5)
- 2025 : Complete Boeing Intelligent Operations and Next Generation Inlet flight test demonstration (TRL 7)
- 2025 : Complete America's Phenix/MDS Coating Technologies flight test demonstration of fan blade erosion resistant coating (TRL 7)
- 2026 : Complete Pratt & Whitney Ultra Quiet Reduced Loss Fan Stage and TALON X+ Combustor engine test demonstration (TRL 6)
- 2026 : Complete Collins Aerospace large cell exhaust acoustic technology engine test demonstration (TRL 6)
- 2026 : Complete Honeywell Highly Efficient Fan Module, Efficient Green High Pressure Core, and Compact High Work High Lift Low Pressure Turbine engine test demonstration (TRL 6)

### Implementation Approach

The focus of the CLEEN Program is to mature previously conceived noise, emissions and fuel burn reduction technologies from Technology Readiness Levels (TRLs) of 3-5 to TRLs of 6-7 to enable industry to enter product development and expedite introduction of these technologies into current and future civil, aircraft and engines.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): The aim of CLEEN Phase III is to mature and demonstrate new technologies that would reduce fuel consumption, noise and emissions, with potential entry into service beyond 2030.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## OI: [703104] Sustainable Alternative Jet Fuels - Phase III (2021 - 2026)

Utilize improved ASTM International approval process to expand the number of "drop-in" alternative fuels and increase the sustainable alternative fuel options that are available for commercial use. It will include multiple increments delivered over time.

### OI Benefit

Environment (P): Reduced emissions.

### Increments

Charlie  
(2021 - 2025)

1

C

[703104-01] Support Qualification and Deployment of Drop-In Alternative Jet Fuels (2021 - 2026)

(Concept Exploration & Maturation)

# Environment and Energy

## Increments/Enabling Activities

**C** [703104-01] Support Qualification and Deployment of Drop-In Alternative Jet Fuels (2021 - 2026)

### Increment Overview

This enabling activity will result in environmental qualification and ASTM International approval of additional advanced alternative fuel blends for their commercial deployment. It will also provide analytical evaluations of the barriers facing alternative fuel deployment and the opportunities their use provide.

### Increment Status

Concept Exploration & Maturation

### Success Criteria

- 2025 : Identify barriers to the implementation of alternative jet fuels and means to overcome the barriers. Complete analysis to support the evaluation of environmental performance and economic benefits of alternative jet fuels.
- 2025 : Completed testing and analysis to support qualification and certification by ASTM International of additional alternative jet fuels and adoption by industry.

### Implementation Approach

ASTM International approval is required before alternative jet fuels can be used by commercial aviation. Approval is a vital step to alternative jet fuel deployment. This enabler provides the technical data to support ASTM International approval.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Alternative jet fuels offer benefits through reduction in aircraft combustion emissions and fuel lifecycle greenhouse gas emissions that contribute to global climate change and impact surface air quality.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## OI: [704104] Environmental Policies, Standards and Measures - Phase III (2021 - 2025)

The development and implementation of appropriate policies, programs, and mechanisms to mitigate the environmental impacts of aviation will continue. Environmental issues that persist will be addressed through the development of mitigation strategies through the Environment and Energy Strategy.

### OI Benefit

Environment (S): Improve identification and execution of policies to improve environmental performance.

### Increments

Charlie  
(2021 - 2025)

2

- C

[704104-01] Environmental Performance and Targets - Phase III (2021 - 2025)

(Concept Exploration & Maturation)
- C

[704104-02] Analysis to Support International Environmental Standard-Setting - Phase III (2021 - 2025)

(Concept Exploration & Maturation)

# Environment and Energy

## Increments/Enabling Activities

**C** [704104-01] Environmental Performance and Targets - Phase III (2021 - 2025)

### Increment Overview

This enabling activity will evaluate additional enhancements to NAS environmental performance relating to noise, emissions, and energy developed during Phase III. Mitigation solutions will be evaluated to understand the potential for aircraft technology, alternative fuels, operations concepts, and policy options to help meet future environmental targets. Results related to energy and climate change will be published on a periodic basis in revisions to the U.S. Aviation Greenhouse Gas Emissions Reduction Plan.

### Increment Status

Concept Exploration & Maturation

### Success Criteria

2025 : Refined quantitative evaluation of progress towards attaining the NextGen environmental goals for noise, emissions and energy with an outlook to 2050 Environmental mitigation solutions are identified. Results relating to energy and emissions affecting climate change are published as a part of revisions to the U.S. Aviation Greenhouse Gas Emissions Reduction Plan.

### Implementation Approach

Outcomes will provide the benefit of developing technological and policy-based solutions and adaptations needed towards to address the shortfalls in environmental performance.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Findings of regular analysis under this incremental operational improvement will assess the progress being made towards meeting the FAA environmental goals and identify the potential shortfalls.

### System Interactions

No system interactions applicable.

To be determined



# Environment and Energy

## Increments/Enabling Activities

**C** [704104-02] Analysis to Support International Environmental Standard-Setting - Phase III (2021 - 2025)

### Increment Overview

This enabling activity provides the scientific and technical basis to support the development and implementation of International Civil Aviation Organization (ICAO) environmental standards (for noise and emissions) and policy measures for commercial aviation during Phase III.

### Increment Status

Concept Exploration & Maturation

### Success Criteria

2025 : Supported the development and implementation of International Civil Aviation Organization (ICAO) environmental standards for noise and emissions, and policy measures.

### Implementation Approach

ICAO/CAEP approved environmental standards and policy measures will be implemented as per internationally agreeable effective date.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Reduce or limit aircraft emissions and noise levels to support environmental sustainability towards meeting FAA environmental goals.

### System Interactions

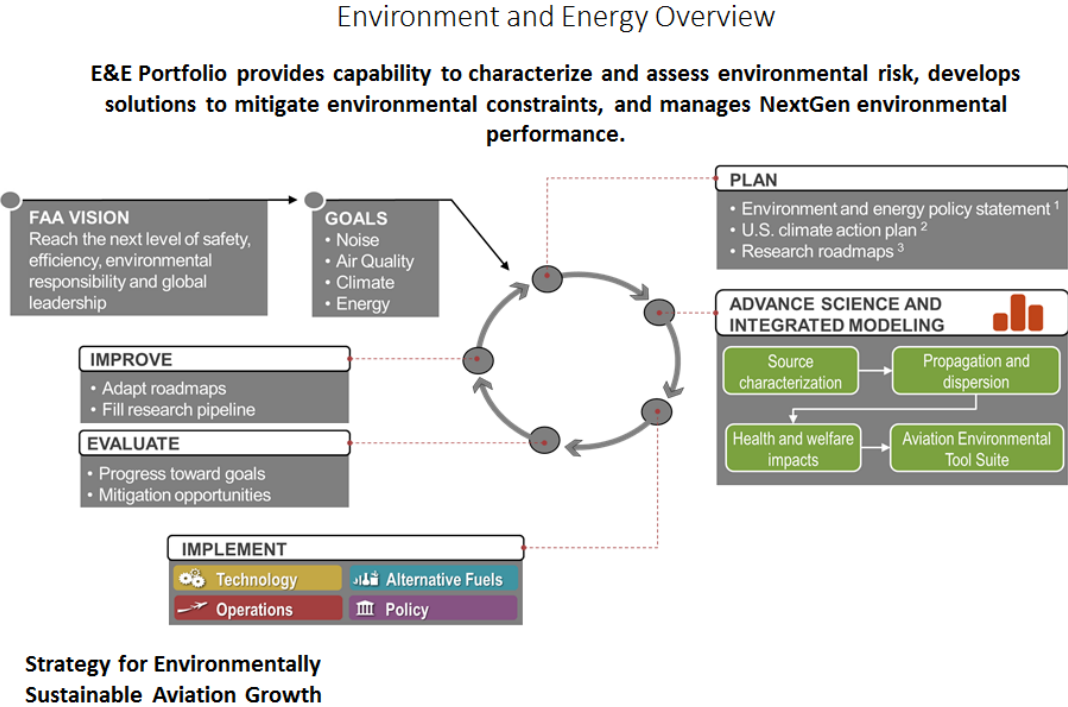
No system interactions applicable.

To be determined

# Environment and Energy

## Systems Interactions

The FAA aims to develop and operate a system that reduces aviation's environmental and energy impacts to a level that does not constrain growth and is a model of sustainability. These goals include limiting the impact of aircraft carbon dioxide (CO2) emissions on the global climate by achieving carbon- neutral growth by 2035, and net reductions of the climate impact from all aviation emissions over the longer term (by 2050). Reduce the number of people exposed to significant noise around U.S. airports. Improve National Airspace System (NAS) energy efficiency and develop and deploy alternative jet fuels for commercial aviation. Achieve an absolute reduction of significant air quality health and welfare impacts attributable to aviation



# Environment and Energy

Increment
<div><div>c</div><div>[701104-01] Aviation Environmental Tools Suite - Phase III</div></div>
<div><div>c</div><div>[702104-01] Explore and Demonstrate New Technologies Under CLEEN - Phase III</div></div>
<div><div>c</div><div>[703104-01] Support Qualification and Deployment of Drop-In Alternative Jet Fuels</div></div>
<div><div>c</div><div>[704104-01] Environmental Performance and Targets - Phase III</div></div>
<div><div>c</div><div>[704104-02] Analysis to Support International Environmental Standard-Setting - Phase III</div></div>

 Operationally Available

**P** Primary Systems

 Complete

**S** Secondary Systems

 In Service System

**T** Tertiary Systems

 Planned System

**A** Avionics Systems

c

Charlie



Stakeholders

Specific roles and responsibilities for the execution of the enabling activities in this portfolio are outlined in the RASCI (Responsible, Accountable, Supportive, Consulted, Informed) . All stakeholder organizations involved in the delivery of the capabilities/enabling activities are listed across the top. Portfolio capabilities are listed on the left side of this table, organized by OI and enabling activity. AEE works with governmental partners such as EPA, NASA, the State Department, and the White House staff to set international ICAO CAEP standards. Fundamental to this work is close coordination and collaboration with industry partners such as airframers (Boeing, Airbus, Bombardier, Embraer, Textron Industries, Gulfstream, Dassault) and engine manufacturers (Pratt & Whitney, GE Aviation, Rolls Royce, Safran, Williams), as well as with organizations such as IATA, ICSA, and ACI. AEDT is being developed by the DOT Volpe Center in conjunction with ATAC Corporation under a contract managed by AEE. AEDT version 2b was released on May 29, 2015. The latest modification of the software is AEDT 2D, released on September 30, 2017. With consultation from ANG-C7, AEE coordinated deployment, guidance, and training with AJM-1, AJM-21, AJM-22, AJM-31, AJM-33, AJV-1, AFS, and ARP. AEDT is also released for use by external stakeholders. In conducting the CLEEN II Program, AEE partners with industry in maturing technologies to reduce aircraft fuel burn, emissions and noise, as well as to advance the introduction of alternative jet fuels. AEE also partners with universities through the ASCENT Center of Excellence in assessing the potential environmental benefits of incorporating CLEEN and CLEEN II technologies into future aircraft and engines. AEE coordinates with other Federal Government agencies involved in research and development of technologies to reduce aircraft fuel burn, emissions and noise, including NASA, Department of Defense and Department of Energy. The FAA works in partnership with industry to promote the development and deployment of alternative jet fuels (AJF) through the Commercial Aviation Alternative Fuels Initiative (CAAFI). The FAA sponsors CAAFI in partnership with Airlines for America (A4A), the Aerospace Industries Association (AIA) and Airports Council International North America (ACI-NA). AEE has established strong partnerships with other Federal agencies including the Departments of Agriculture, Energy and Defense, the EPA, NASA, Department of Commerce, National Science Foundation and State Department. FAA coordinates with our counterparts in other governments and with R&D funding organizations such as the European Commission to share research activities and best practices. We have established bilateral cooperation agreements with Australia, Brazil, Germany, Indonesia and Spain which each have strong alternative jet fuel initiatives. AEE supports ICAO activities to support AFJ including participating in the ICAO CAEP Alternative Fuels Task Force.

- A

Accountable for the completion of NextGen capability. The highest level within the RASCI matrix, this office is charged by the FAA to deliver a particular capability. Typically, this designation is provided via an Acquisition Program Baseline. To foster a clear line of accountability, two different offices can never be Accountable for the same increment, and Accountability can never be delegated to another office.
- R

Responsible for the successful completion of NextGen capability or a critical component of the capability. This office is responsible to the Accountable office. The Responsible office is responsible for initiating an actual change to the NAS such as automation changes, and is often also designated as the Accountable office for that increment. However, there are examples in the NSIP where one office is Accountable for an increment while another office (or offices) is actually making a change in the NAS on behalf of the Accountable office.
- A/R

Accountable for the completion of NextGen capability as well as Responsible for its implementation.
- S

Supports the Responsible office in the implementation of NextGen capability. Typically, this support is in the form of subject matter expertise, procedural guidance, or training activities.
- C

Consulted for input during the implementation of NextGen capability. Provides input on a specific aspect in the development and implementation of a capability, such as safety analysis or approval. Input may or may not be used as determined by the Responsible and Accountable offices.
- I

Informed about the progress of implementation.

# Environment and Energy

RASCI Matrix	ANG				APO	AJT	AFS	AJI			AJM				AAE	ARP	AVS	AEE	AIR
	C	C7	5	B	001	2	001	1	2	3	22	31	32	33	001	001	001	001	001
• <b>C</b> [701104-01] Aviation Environmental Tools Suite - Phase III (2021 - 2025)		C		C														A/R	
• <b>C</b> [702104-01] Explore and Demonstrate New Technologies Under CLEEN - Phase III (2021 - 2026)		C		C													C	A/R	
• <b>C</b> [703104-01] Support Qualification and Deployment of Drop-In Alternative Jet Fuels (2021 - 2026)		C		C														A/R	
• <b>C</b> [704104-01] Environmental Performance and Targets - Phase III (2021 - 2025)		C		C														A/R	
• <b>C</b> [704104-02] Analysis to Support International Environmental Standard-Setting - Phase III (2021 - 2025)		C		C														A/R	

Appendix A

Alpha Increments

Portfolio Overview

The environmental vision for the FAA's strategic plan is to develop and operate a system that reduces aviation's environmental and energy impacts to a level that does not constrain growth and is a model of sustainability. Aircraft noise, air quality, climate, and energy are the most significant potential environmental constraints to increasing aviation capacity, efficiency, and flexibility. Limiting and reducing future aviation environmental impacts to levels that protect public health and welfare as well as ensuring energy availability and sustainability are the guiding principles of aviation environmental protection. The FAA is pursuing the following environmental goals:

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Air Quality: Achieve an absolute reduction of significant air quality health and welfare impacts attributable to aviation.

Climate: Limit the impact of aircraft carbon dioxide (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).

Energy: Improve National Airspace System (NAS) energy efficiency and develop and deploy alternative jet fuels for commercial aviation.

To achieve these goals, the FAA's environmental and energy research strategy is based on characterization of the problem and assessment of associated risks; development of technological and policy based solutions; and management of system-wide performance while working closely with stakeholders community. The FAA Office of Environment and Energy is pursuing 5-pillar approach to meet environmental goals (1) Improve scientific knowledge and enhance integrated environmental modeling capability; (2) accelerate maturation of new aircraft technologies; (3) advance alternative jet fuels; (4) explore air traffic management modernization and operational improvements; and (5) develop policies, environmental standards, and market based measures. The Operational Improvements, enabling activities and increments reflect this strategy.

Activities in this portfolio will be conducted in such a way that they do not impact the safety of the NAS. In the Bravo timeframe this portfolio will build on progress from the enabling activities in the Alpha timeframe, which includes Phase 2 maturation of environmentally friendly technologies, fuels, and continued focus on environmental and energy- favorable concepts and operations.

Note: The dates and timelines included in the NAS Segment Implementation Plan (NSIP) are for planning purposes only. All capability schedules are tentative until their supporting programs are officially baselined.

# Environment and Energy

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TOTAL	22	0	0	0	0	22
Segment	% by Segment	% by Segment/Increment Status				
*Alpha (2010 - 2015)	100%	0 %	0 %	0 %	0 %	100 %
TOTAL	100%	0 %	0 %	0 %	0 %	100 %

# Environment and Energy

## Operational Improvements/Current Operations & Increments

## Benefits

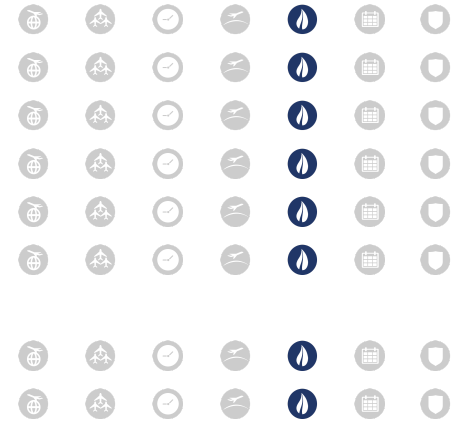
### CO: [703102] Sustainable Alternative Jet Fuels - Phase I (2011 - 2015)

- A [703102-01] Drop-In 50-50% HRJ/HEFA Blend Fuels (2011 - 2011) ✓
- A [703102-02] Drop-In >50% HRJ/HEFA Fuels (Greater than 50% Blend) (2015 - 2015) ✓
- A [703102-03] Other Advanced Aviation Alternative Fuels - Phase I (2015 - 2015) ✓



### CO: [702102] NextGen Environmental Engine and Aircraft Technologies - Phase I (2012 - 2017)

- A [702102-01] Open Rotor (2012 - 2012) ✓
- A [702102-02] TAPS II Lean Combustor (2012 - 2012) ✓
- A [702102-03] Adaptive Trailing Edges (2013 - 2013) ✓
- A [702102-04] Ceramic Matrix Composite Acoustic Nozzle (2014 - 2014) ✓
- A [702102-05] Engine Weight Reduction and High-Temperature Impeller (2015 - 2015) ✓
- A [702102-06] Flight Management System - Air Traffic Management (FMS-ATM) Integration (2015 - 2015) ✓
- A [702102-08] Ceramic Matrix Composite Turbine Blade Tracks (2017 - 2017) ✓
- A [702102-09] Dual-Wall Turbine Blade (2017 - 2017) ✓



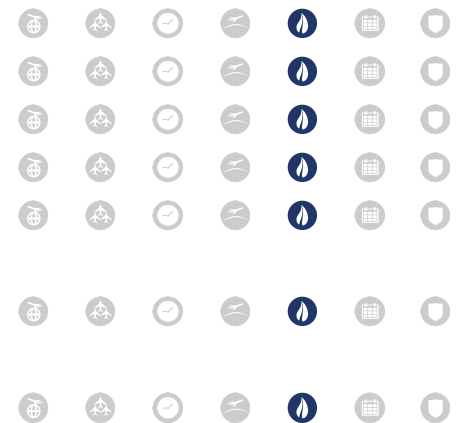
### CO: [701102] Integrated Environmental Modeling - Phase I (2010 - 2015)







- A [701102-01] Aviation Environmental Design Tool Version 2A (2012 - 2012) ✓
- A [701102-02] AEDT Version 2B (2015 - 2015) ✓
- A [701102-03] Improved Scientific Knowledge (2015 - 2015) ✓
- A [701102-04] Aviation Environmental Portfolio Management Tool (2015 - 2015) ✓










### CO: [704102] Environmental Policies, Standards and Measures - Phase I (2010 - 2015)

- A [704102-01] Environmental Policy (2012 - 2012) ✓
- A [704102-02] NEPA Strategy and Processes - Phase I (2013 - 2013) ✓
- A [704102-03] Environmental Targets (2014 - 2015) ✓
- A [704102-04] Environmental Assessment of NextGen Capabilities (2015 - 2015) ✓
- A [704102-05] Analysis to Support International Environmental Standard-Setting - Phase I (2015 - 2015) ✓
- A [704102-06] Environmental Goals and Targets Performance Tracking System (2015 - 2015) ✓
- A [704102-07] NextGen EMS Frameworks and Stakeholder Collaboration (2015 - 2015) ✓



 External Commitment  Primary Benefit  Secondary Benefit  Operational Availability  Complete  Alpha

 Access & Equity  Capacity  Flexibility  Efficiency  Environment  Predictability  Safety

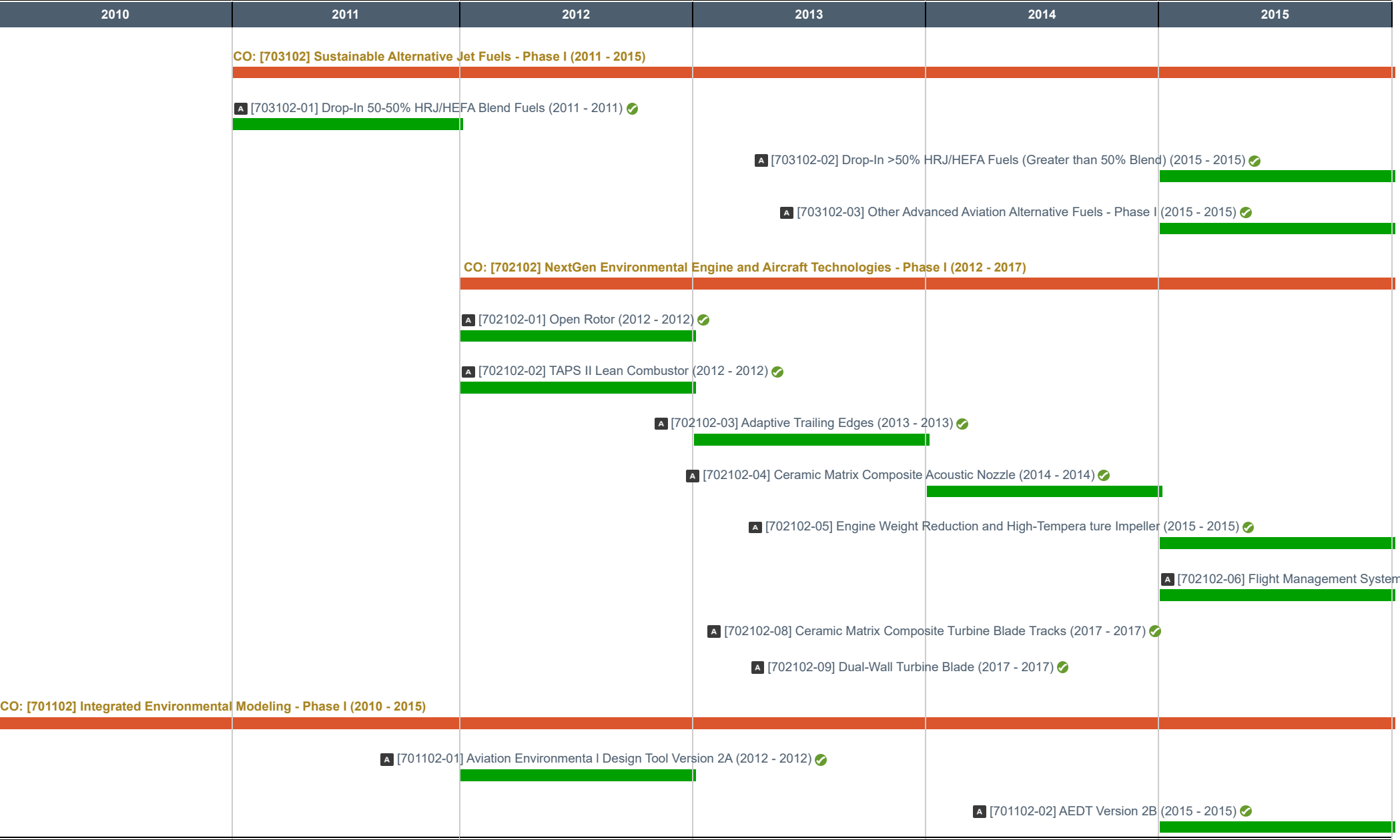


2024 Approved Baseline  
FOR INTERNAL FAA USE ONLY

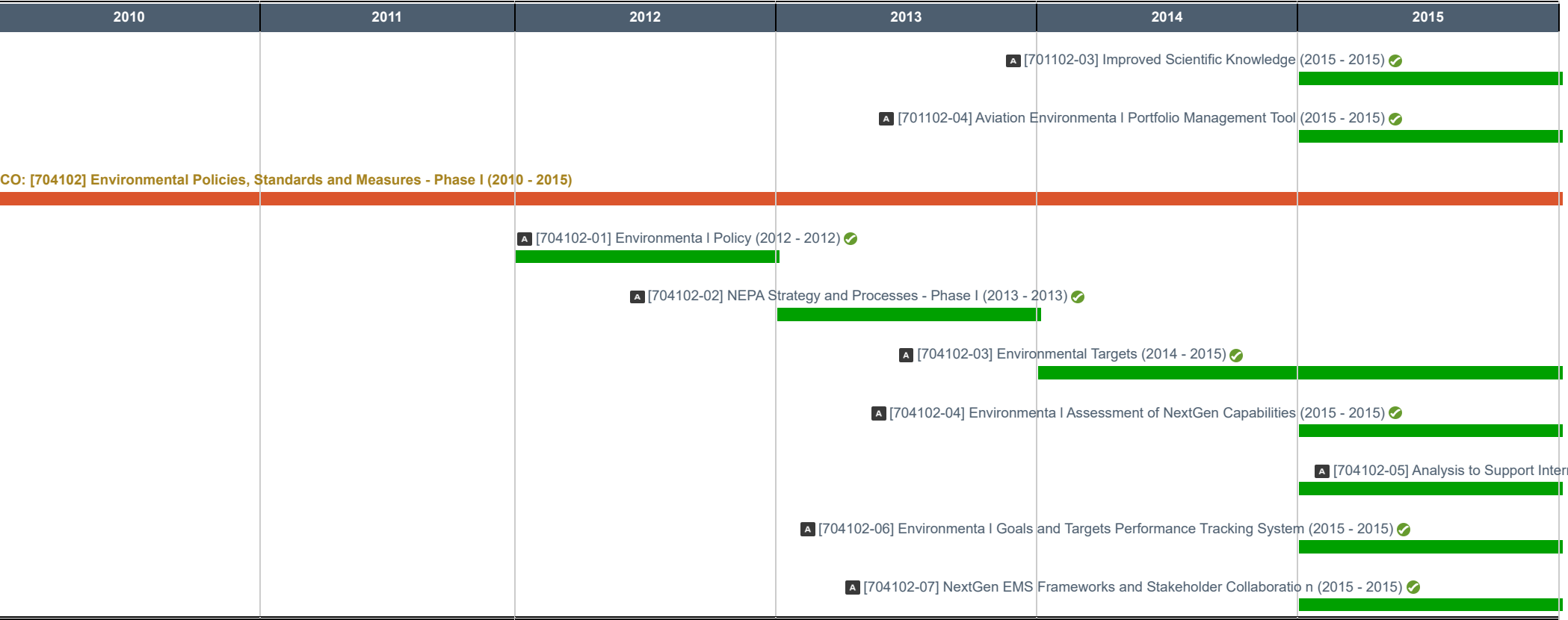




Environment and Energy



Environment and Energy



# Environment and Energy

## CO: [703102] Sustainable Alternative Jet Fuels - Phase I (2011 - 2015)

Determine the feasibility and market viability of alternative aviation fuels for commercial aviation use. Obtain ASTM International approval of Hydrotreated Renewable Jet (HRJ) blends and other advanced sustainable fuel blends from renewable resources that are compatible with existing infrastructure and fleet thus meeting requirement to be a "drop in" fuel. It will include multiple increments delivered over time.

### CO Benefit

Environment (P): Reduced emissions.

### Increments

Alpha  
(2010 - 2015)

3

- A [703102-01] Drop-In 50-50% HRJ/HEFA Blend Fuels (2011 - 2011) (Complete)
- A [703102-02] Drop-In >50% HRJ/HEFA Fuels (Greater than 50% Blend) (2015 - 2015) (Complete)
- A [703102-03] Other Advanced Aviation Alternative Fuels - Phase I (2015 - 2015) (Complete)

# Environment and Energy

## Increments/Enabling Activities

**A** [703102-01] Drop-In 50-50% HRJ/HEFA Blend Fuels (2011 - 2011)

### Increment Overview

This enabling activity resulted in ASTM International approval in 2011 of a 50-50 blend of hydroprocessed renewable jet (HRJ)/hydroprocessed esters and fatty acids (HEFA) and Jet-A fuel for use in aviation.

### Increment Status

Complete

### Success Criteria

✔ 2011 : ASTM International approval of 50-50% HRJ/HEFA blend for commercial aviation. This enabling activity has achieved its success criteria.

### Implementation Approach

Alternative jet fuels offer benefits through reduction in aircraft combustion emissions and fuel lifecycle greenhouse gas emissions that contribute to global climate change, air quality and public health.

#### Benefits

 Access & Equity  Capacity  Flexibility  Efficiency  Environment  Predictability  Safety

Environment (P): Alternative jet fuels offer benefits through reduction in aircraft combustion emissions and fuel lifecycle greenhouse gas emissions that contribute to global climate change, air quality and public health.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**A** [703102-02] Drop-In >50% HRJ/HEFA Fuels (Greater than 50% Blend) (2015 - 2015)

### Increment Overview

This enabling activity will advance the use, acceptance, and deployment of other HRJ/HEFA blend fuels (>50%) through air quality impact assessments, lifecycle emissions analyses, engine ground tests, and flight demonstrations by 2015.

### Increment Status

Complete

### Success Criteria

✔ 2015 : Complete testing and analysis to support certification and qualification of >50% HRJ/HEFA fuels.

### Implementation Approach

Approval of alternative jet fuels allows the stakeholders community to produce, deploy and use fuels at the commercial scale.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Alternative jet fuels offer benefits through reduction in aircraft combustion emissions and fuel lifecycle greenhouse gas emissions that contribute to global climate change, air quality and public health.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**A** [703102-03] Other Advanced Aviation Alternative Fuels - Phase I (2015 - 2015)

### Increment Overview

This enabling activity will explore and qualify additional classes of sustainable aviation alternative fuel blends that use novel feedstocks and conversion processes (e.g., advanced fermentation, alcohol oligomerization, pyrolysis, etc.). Efforts include environmental and performance feasibility through air quality and lifecycle emissions analyses, fuel properties analysis, engine performance evaluation, and ground tests and flight demonstrations by 2015. These efforts will advance deployment of these sustainable alternative fuels, including environmental acceptability and ASTM International approval.

### Increment Status

Complete


### Success Criteria

✔ 2015 : Secure ASTM International approval of additional sustainable aviation alternative fuels beyond HRJ/HEFA blend

### Implementation Approach

Approval of alternative jet fuels allows the stakeholders community to produce, deploy and use fuels at the commercial scale.

#### Benefits

 Access & Equity  Capacity  Flexibility  Efficiency  Environment  Predictability  Safety

Environment (P): Alternative jet fuels offer benefits through reduction in aircraft combustion emissions and fuel lifecycle greenhouse gas emissions that contribute to global climate change, air quality and public health.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## CO: [702102] NextGen Environmental Engine and Aircraft Technologies - Phase I (2012 - 2017)

Develop and mature aircraft and engine technologies to reduce noise, emissions, and fuel burn from commercial subsonic jet aircraft. Demonstrate these technologies at sufficient readiness levels to achieve goals of the FAA's Continuous Lower Energy, Emissions, and Noise (CLEEN) program. It will include multiple time sequenced deliverables.

### CO Benefit

Environment (P): Reduce emissions, fuel burn, and noise.

### Increments

Alpha  
(2010 - 2015)

8

- A [702102-01] Open Rotor (2012 - 2012) (Complete)
- A [702102-02] TAPS II Lean Combustor (2012 - 2012) (Complete)
- A [702102-03] Adaptive Trailing Edges (2013 - 2013) (Complete)
- A [702102-04] Ceramic Matrix Composite Acoustic Nozzle (2014 - 2014) (Complete)
- A [702102-05] Engine Weight Reduction and High-Temperature Impeller (2015 - 2015) (Complete)
- A [702102-06] Flight Management System - Air Traffic Management (FMS-ATM) Integration (2015 - 2015) (Complete)
- A [702102-08] Ceramic Matrix Composite Turbine Blade Tracks (2017 - 2017) (Complete)
- A [702102-09] Dual-Wall Turbine Blade (2017 - 2017) (Complete)

# Environment and Energy

## Increments/Enabling Activities

**A** [702102-01] Open Rotor (2012 - 2012)

### Increment Overview

General Electric will mature open rotor technology to Technology Readiness Level (TRL) 5. This technology will reduce fuel burn, emissions, and noise.

### Increment Status

Complete

### Success Criteria

✔ 2012 : Successfully matured and demonstrated at TRL 5.This enabling activity has achieved its success criteria.

### Implementation Approach

Transfer of technology to industry for further maturation and commercial deployment.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): GE completed scaled Open Rotor wind tunnel tests.Results indicate aircraft fuel burn on a single aisle aircraft may be reduced 26 percent relative to a CFM International, CFM56-7B engine, and up to 15 dB cumulative noise reduction relative to FAA Stage 4 noise standards. This task has been completed.

### System Interactions

No system interactions applicable.

To be determined



# Environment and Energy

## Increments/Enabling Activities

**A** [702102-02] TAPS II Lean Combustor (2012 - 2012)

### Increment Overview

General Electric will mature Twin Annular Pre-Swirl (TAPS) II lean combustor technology to TRL 6. This technology will reduce engine combustion emissions.

### Increment Status

Complete




### Success Criteria

✔ 2012 : Successfully matured and demonstrated at TRL 6.This enabling activity has achieved its success criteria.

### Implementation Approach

Transfer of technology to industry for further maturation and commercial deployment.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): GE completed core engine tests of the TAPS II Combustor.Results show landing and take-off nitrogen oxide (NOx) emissions were reduced 60 percent compared to the International Civil Aviation Organization (ICAO) NOx standard adopted in 2004, meeting one of the CLEEN goals.This task has been completed. This combustor will be used in CFM International's LEAP turbofan engine and is expected to enter service in 2016.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**A** [702102-03] Adaptive Trailing Edges (2013 - 2013)

### Increment Overview

Boeing will mature adaptive trailing edges technology to TRL 7. This technology will reduce fuel burn, emissions, and noise.

### Increment Status

Complete


### Success Criteria


✔ 2013 : Successfully matured and demonstrated at TRL 7.This enabling activity has achieved its success criteria.


### Implementation Approach


Transfer of technology to industry for further maturation and commercial deployment.


#### Benefits


 Access & Equity


 Capacity

 Flexibility

 Efficiency

 Environment

 Predictability

 Safety

Environment (P): Boeing has developed and demonstrated Adaptive Trailing-Edge technology on the aircraft wing that could reduce aircraft fuel burn up to 2 percent and reduce noise up to 1.5db cumulative. This task has been completed.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**A** [702102-04] Ceramic Matrix Composite Acoustic Nozzle (2014 - 2014)

### Increment Overview

Boeing will mature ceramic matrix composite acoustic nozzle technology to TRL 7. This technology will reduce fuel burn, emissions, and noise.

### Increment Status

Complete


### Success Criteria

✔ 2014 : Maturation of technology through flight test demonstration (TRL 7) and its availability for further adoption by industry.

### Implementation Approach

Transfer of technology to industry for further maturation and commercial deployment.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Boeing has developed and demonstrated a Ceramic Matrix Composite (CMC) acoustic nozzle at the engine exhaust. This technology could save aircraft fuel burn up to 1 percent with potential noise reduction capability, the same or better than treated metallic nozzle. CMC nozzle is an enabler for lighter, hotter, more efficient engine and nacelle architectures. This task has been completed.

### System Interactions

No system interactions applicable.

To be determined

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# Environment and Energy

## Increments/Enabling Activities

**A** [702102-05] Engine Weight Reduction and High-Temperature Impeller (2015 - 2015)

### Increment Overview

Honeywell will mature engine weight reduction and high-temperature impeller technology to TRL 6. This technology will reduce fuel burn, emissions, and noise.

### Increment Status

Complete



### Success Criteria

✔ 2015 : Maturation of technology through ground test demonstration (TRL 6) and its availability for further adoption by industry

### Implementation Approach

Transfer of technology to industry for further maturation and commercial deployment.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Honeywell has developed and demonstrated technologies that will increase engine efficiency and reduce engine weight. The CLEEN technologies will contribute 5 percent toward an overall 15.7 percent reduction in fuel burn resulting from an engine upgrade relative to baseline engine technology. This requires demonstrating seven technologies including new coatings, higher temperature impeller, advanced seals and improved turbine cooling.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**A** [702102-06] Flight Management System - Air Traffic Management (FMS-ATM) Integration (2015 - 2015)

### Increment Overview

General Electric will mature FMS-ATM technology to TRL 6. This technology will reduce fuel burn and emissions and, potentially, noise.

### Increment Status

Complete

### Success Criteria

✓ 2015 : Maturation of technology through ground test demonstration (TRL 6) and its availability for further adoption by industry.

### Implementation Approach

Transfer of technology to industry for further maturation and commercial deployment.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): GE has developed and demonstrated Flight Management System (FMS) - Air Traffic Management (ATM) Trajectory Optimization technology to control the aircraft location in three spatial coordinates and time (4D). This approach will optimize speed, altitude, and lateral path in order to determine the most efficient trajectory to minimize fuel burn and emissions given weather and flow management constraints. This system is linked directly to each aircraft in the fleet via the communications interface (ACARS) of FMS. GE has also developed and demonstrated FMS-Engine integration technology which will reduce aircraft fuel burn through efficiencies gained by adaptive engine control, integrated vehicle health management, and integrated flight-propulsion control. Engine ground testing will be conducted in 2015. Estimated benefits of the FMS Engine Integration technologies are an approximately 1 percent reduction in fuel burn.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**A** [702102-08] Ceramic Matrix Composite Turbine Blade Tracks (2017 - 2017)

### Increment Overview

Rolls-Royce will mature ceramic matrix composite turbine blade tracks technology to TRL 6. This technology will reduce fuel burn and emissions.

### Increment Status

Complete



### Success Criteria

✔ 2014 : Maturation of technology through ground test demonstration (TRL 6) and its availability for further adoption by industry.

### Implementation Approach

Transfer of technology to industry for further maturation and commercial deployment.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Rolls-Royce has developed and demonstrated Ceramic Matrix Composite (CMC) Blade Track, technology aimed at increasing thermal efficiency in turbine section of the engine. The new blade tracks made from CMC material are projected to offer more than a 50 percent reduction in engine cooling and weight savings compared to a metallic design. Rolls Royce's Dual-Wall Turbine Airfoil and CMC Turbine Blade Track technology will together realize up to a 1 percent reduction in fuel burn for Rolls-Royce's next-generation civil products. Further benefits are attainable through incorporation of this technology in advanced engine cycles.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**A** [702102-09] Dual-Wall Turbine Blade (2017 - 2017)

### Increment Overview

Rolls-Royce will mature dual-wall turbine blade technology to TRL 6. This technology will reduce fuel burn and emissions.

### Increment Status

Complete


### Success Criteria

✔ 2015 : Maturation of technology through ground test demonstration (TRL 6) and its availability for further adoption by industry.

### Implementation Approach

Transfer of technology to industry for further maturation and commercial deployment.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Rolls-Royce has developed and demonstrated a Dual-Wall Turbine Airfoil technology aimed at increasing thermal efficiency in the turbine section of the engine. Dual-wall turbine airfoils are projected to provide 20 percent or more reduction in cooling and increased operating temperature capability. Rolls Royce's Dual-Wall Turbine Airfoil and CMC Turbine Blade Track technology benefits will together realize up to a 1 percent reduction in fuel consumption burn for Rolls-Royce's next-generation civil products. Further benefits are attainable through incorporation of this technology in advanced engine cycles.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## CO: [701102] Integrated Environmental Modeling - Phase I (2010 - 2015)

Develop an integrated aviation environmental analysis tool suite that is based on the best available scientific knowledge and use this capability to evaluate both the environmental impacts of aviation as well as the performance of potential mitigation.

### CO Benefit

Environment (S): Improve identification of potential solutions to improve environmental performance.

### Increments

Alpha  
(2010 - 2015)

4

- A [701102-01] Aviation Environmental Design Tool Version 2A (2012 - 2012) (Complete)
- A [701102-02] AEDT Version 2B (2015 - 2015) (Complete)
- A [701102-03] Improved Scientific Knowledge (2015 - 2015) (Complete)
- A [701102-04] Aviation Environmental Portfolio Management Tool (2015 - 2015) (Complete)



# Environment and Energy

## Increments/Enabling Activities

**A** [701102-01] Aviation Environmental Design Tool Version 2A (2012 - 2012)

### Increment Overview

The Aviation Environmental Design Tool (AEDT) will provide capabilities for integrated environmental analysis at regional levels for fuel burn, emissions, and noise.

The software was released on March 21, 2012, and also was released for use by external stakeholders.

### Increment Status

Complete





### Success Criteria

✔ 2012 : Public release of AEDT Version 2A.This enabling activity has achieved its success criteria.

### Implementation Approach

Released AEDT to FAA-internal and external (both domestic and international) stakeholders for integrated environmental analyses.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P). AEDT is used to perform regional integrated (noise, emissions and fuel burn) environmental analyses for airspace management planning, to meet environmental compliance and regulatory requirements as well as to track, report and project future system wide environmental performance, and to guide and evaluate benefit of technological and policy options.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**A** [701102-02] AEDT Version 2B (2015 - 2015)

### Increment Overview

The AEDT will provide capabilities for integrated environmental analysis at airport, regional, and global levels for fuel burn, emissions, and noise.

### Increment Status

Complete



### Success Criteria

✔ 2015 : Public release of AEDT Version 2B.

### Implementation Approach

Release of AEDT2B to FAA-internal and external (both domestic and international) stakeholders for integrated environmental analyses.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P). AEDT2B will be used to perform local airport to global scale integrated (noise, emissions and fuel burn) environmental analyses for airspace management planning, to meet environmental compliance and regulatory requirements, to track, report and project future system wide environmental performance, and to guide and evaluate benefit of technological and policy options.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**A** [701102-03] Improved Scientific Knowledge (2015 - 2015)

### Increment Overview

This enabling activity will improve knowledge of aircraft source-level noise and emissions of air pollutants and greenhouse gases, their atmospheric evolution, and impacts on human health and welfare and climate change. Improved scientific knowledge is used to inform each of the Environment and Energy enabling activities as well as support other NextGen OIs.

### Increment Status

Complete


### Success Criteria

✓ 2015 : Effective transition of scientific research on aircraft noise and emissions to evaluate environmental performance of NextGen programs.

### Implementation Approach

Advances in scientific knowledge is implemented through development of tools, analysis of scenario and solution benefits and interpretation of decision-making options.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P). Advancement in scientific knowledge will improve tools and analysis that will better inform E&E related decision-making on technological and policy solutions.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**A** [701102-04] Aviation Environmental Portfolio Management Tool (2015 - 2015)

### Increment Overview

Capabilities of the APMT will be enhanced continuously through 2015 to enable analysis of airline and aviation market responses to environmental mitigation and policy options and for analyzing U.S. environmental issues critical to NextGen under various fleet growth and evolution scenarios.

### Increment Status

Complete

### Success Criteria

✔ 2015 : Capabilities of APMT will be enhanced continuously through 2015 to enable cost-benefit analysis of environmental mitigation and policy options, and for analyzing U.S. environmental issues critical to NextGen under various fleet growth and evolution scenarios.

### Implementation Approach

Implementation of APMT is in terms of cost-benefit analysis carried out internally within FAA to support domestic and international E&E related technological and policy based decision-making.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Advancement in APMT tool will help to better perform cost-benefits and uncertainty analysis of E&E technological and policy based solution options.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## CO: [704102] Environmental Policies, Standards and Measures - Phase I (2010 - 2015)

Develop and implement appropriate policies, programs, and mechanisms to mitigate the environmental impacts of aviation. Enable the use of the NextGen Environmental Management System (EMS) framework to address, plan and mitigate environmental issues, through development of an initial EMS framework, pilot analysis, and outreach programs.

### CO Benefit

Environment (S): Improve identification and execution of policies to improve environmental performance.

### Increments

Alpha  
(2010 - 2015)

7

- A [704102-01] Environmental Policy (2012 - 2012) (Complete)
- A [704102-02] NEPA Strategy and Processes - Phase I (2013 - 2013) (Complete)
- A [704102-03] Environmental Targets (2014 - 2015) (Complete)
- A [704102-04] Environmental Assessment of NextGen Capabilities (2015 - 2015) (Complete)
- A [704102-05] Analysis to Support International Environmental Standard-Setting - Phase I (2015 - 2015) (Complete)
- A [704102-06] Environmental Goals and Targets Performance Tracking System (2015 - 2015) (Complete)
- A [704102-07] NextGen EMS Frameworks and Stakeholder Collaboration (2015 - 2015) (Complete)

# Environment and Energy

## Increments/Enabling Activities

**A** [704102-01] Environmental Policy (2012 - 2012)

### Increment Overview

This enabling activity refines and formalizes NextGen Environmental and Energy policy, including NextGen environmental goals. It also establishes EMS roles and responsibilities for FAA organizations to efficiently address critical NextGen environmental requirements, goals, and other polices to improve environmental performance.

### Increment Status

Complete


### Success Criteria

✔ 2012 : Coordinated and publicly issued NextGen Environment and Energy Policy. This enabling activity has achieved its success criteria.

### Implementation Approach

Environmental policy was released publicly and implemented in all FAA-working following FAA-wide review and approval.

#### Benefits

 Access & Equity  Capacity  Flexibility  Efficiency  Environment  Predictability  Safety

Environment (P): Environmental policy establishes environmental goals for noise, emissions, energy efficiency and alternative energy sourcesto promote environmental sustainability that will allow unconstrained aviation growth.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**A** [704102-02] NEPA Strategy and Processes - Phase I (2013 - 2013)

### Increment Overview

This enabling activity establishes effective strategic approaches for addressing the NEPA requirements of NextGen improvements. This includes applying best practices to minimize redundancy of analyses and maximizing efficiencies of time and cost. When necessary, it will outline an approach for integrating NEPA considerations into existing FAA guidance at key decision points, such as the Acquisition Management System (AMS) and Systems Engineering Manual (SEM), to ensure appropriate consideration is given early in the planning phase.

### Increment Status

Complete

### Success Criteria

✔ 2013 : Improvements in guidance, best practices, collaborating/coordinating, resource use/training, and implementation following initial NEPA review. This enabling activity has achieved its success criteria.

### Implementation Approach

AEE developed strategic approaches for addressing the NEPA requirements of NextGen improvements. AEE coordinated with ANG and other organizations to ensure integration of NEPA considerations and processes in Acquisition Management System (AMS) and NAS System Engineering Manual (SEM).

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Develop approach and address environmental regulatory requirements during early stages of NextGen planning and implementation.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**A** [704102-03] Environmental Targets (2014 - 2015)

### Increment Overview

This enabling activity will explore, test, and refine quantitative NextGen environmental targets for noise, air quality, climate, and energy.

### Increment Status

Complete








### Success Criteria

✔ 2015 : Refined quantitative evaluation of progress towards attaining the NextGen goals for noise, air quality, climate, and energy.

### Implementation Approach

Outcomes will inform technological and policy based actions and adaptations needed towards addressing the shortfalls through implementation under other operational improvements.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Finding of regular analysis under this incremental operational improvement will assess the progress being made towards meeting the FAA environmental goals and identify the potential shortfalls.

### System Interactions

No system interactions applicable.

To be determined



# Environment and Energy

## Increments/Enabling Activities

**A** [704102-04] Environmental Assessment of NextGen Capabilities (2015 - 2015)

### Increment Overview

This enabling activity will help quantify environmental benefits of NextGen operational improvements.

### Increment Status

Complete

### Success Criteria

✔ 2015 : Evaluation of environmental benefits of NextGen programs.

### Implementation Approach

Through technical and analytical support for environmental assessment to other FAA organizations in initiating and implementing NextGen initiatives.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): This enabling activity will help quantify environmental benefits of NextGen operational improvements.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**A** [704102-05] Analysis to Support International Environmental Standard-Setting - Phase I (2015 - 2015)

### Increment Overview

This enabling activity addresses analysis and benefit assessment to support the development and implementation of the U.S. Aviation Greenhouse Gas Emissions Reduction Plan and International Civil Aviation Organization (ICAO) environmental standards, such as for aircraft CO2 emissions and more stringent noise levels.

### Increment Status

Complete




### Success Criteria

✔ 2015 : Acceptance and use of analysis to inform US position on international decision-making on aircraft emissions and noise standards.

### Implementation Approach

ICAO/CAEP approved environmental standards and stringency levels will be implemented for aircraft certification as per the internationally agreeable effective date.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Reduce or limit aircraft emissions and noise levels to support environmental sustainability towards meeting FAA environmental goals.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**A** [704102-06] Environmental Goals and Targets Performance Tracking System (2015 - 2015)

### Increment Overview

A system will be established that will support the systematic identification of environmental benefits across the NAS, enabling the FAA to measure progress toward achieving NextGen environmental goals. This system may include business practices, automation capabilities, and interfaces with other automation systems.

### Increment Status

Complete

### Success Criteria

✔ 2015 : Release of NextGen EMS webportal for environmental data exchange with stakeholders to aid performance tracking of the system.

### Implementation Approach

Through development and release of webportal for communication, outreach, data and information exchange.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Performance tracking system through webportal will collect the communitywideenvironmental relevant data.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**A** [704102-07] NextGen EMS Frameworks and Stakeholder Collaboration (2015 - 2015)

### Increment Overview

Standardized approaches will be identified for aviation stakeholders (e.g., manufacturers, airports, airlines, and the FAA) to identify and address key environmental issues critical to stakeholder environmental programs or EMSs. These approaches are intended to allow aviation stakeholders to collaborate and address cross-cutting environmental challenges.

### Increment Status

Complete


### Success Criteria


✔ 2015 : Agreement with stakeholders on collaborative approaches for data exchange within NextGen EMS webportal.


### Implementation Approach


Through development and release of webportal for communication, outreach, data and information exchange


#### Benefits


 Access & Equity


 Capacity

 Flexibility

 Efficiency

 Environment

 Predictability

 Safety

Environment (P): Stakeholders outreach and collaboration will help to collect information on community-wide efforts and their contributions towards FAA aviation environmental goals.

### System Interactions

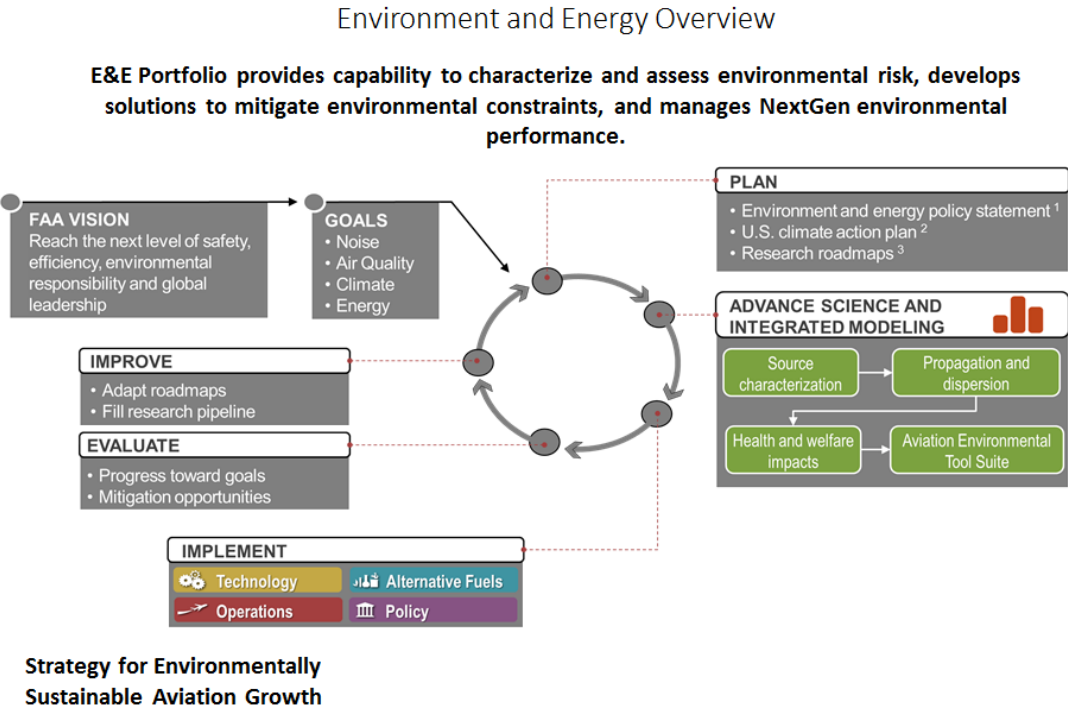
No system interactions applicable.

To be determined

# Environment and Energy

## Systems Interactions

The FAA aims to develop and operate a system that reduces aviation's environmental and energy impacts to a level that does not constrain growth and is a model of sustainability. These goals include limiting the impact of aircraft carbon dioxide (CO2) emissions on the global climate by achieving carbon- neutral growth by 2035, and net reductions of the climate impact from all aviation emissions over the longer term (by 2050). Reduce the number of people exposed to significant noise around U.S. airports. Improve National Airspace System (NAS) energy efficiency and develop and deploy alternative jet fuels for commercial aviation. Achieve an absolute reduction of significant air quality health and welfare impacts attributable to aviation



# Environment and Energy

Increment
<div><div>A</div><div>[701102-01]</div><div>Aviation Environmental Design Tool Version 2A</div><div>✔</div></div>
<div><div>A</div><div>[701102-02]</div><div>AEDT Version 2B</div><div>✔</div></div>
<div><div>A</div><div>[701102-03]</div><div>Improved Scientific Knowledge</div><div>✔</div></div>
<div><div>A</div><div>[701102-04]</div><div>Aviation Environmental Portfolio Management Tool</div><div>✔</div></div>
<div><div>A</div><div>[702102-01]</div><div>Open Rotor</div><div>✔</div></div>
<div><div>A</div><div>[702102-02]</div><div>TAPS II Lean Combustor</div><div>✔</div></div>
<div><div>A</div><div>[702102-03]</div><div>Adaptive Trailing Edges</div><div>✔</div></div>
<div><div>A</div><div>[702102-04]</div><div>Ceramic Matrix Composite Acoustic Nozzle</div><div>✔</div></div>
<div><div>A</div><div>[702102-05]</div><div>Engine Weight Reduction and High-Temperature Impeller</div><div>✔</div></div>
<div><div>A</div><div>[702102-06]</div><div>Flight Management System - Air Traffic Management (FMS-ATM) Integration</div><div>✔</div></div>
<div><div>A</div><div>[702102-08]</div><div>Ceramic Matrix Composite Turbine Blade Tracks</div><div>✔</div></div>
<div><div>A</div><div>[702102-09]</div><div>Dual-Wall Turbine Blade</div><div>✔</div></div>

✔ Operationally Available

✔ Complete

● In Service System

● Planned System

P Primary Systems

S Secondary Systems

T Tertiary Systems

A Avionics Systems

A Alpha



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# Environment and Energy

Increment	
A	[703102-01] Drop-In 50-50% HRJ/HEFA Blend Fuels ✓
A	[703102-02] Drop-In >50% HRJ/HEFA Fuels (Greater than 50% Blend) ✓
A	[703102-03] Other Advanced Aviation Alternative Fuels - Phase I ✓
A	[704102-01] Environmental Policy ✓
A	[704102-02] NEPA Strategy and Processes - Phase I ✓
A	[704102-03] Environmental Targets ✓
A	[704102-04] Environmental Assessment of NextGen Capabilities ✓
A	[704102-05] Analysis to Support International Environmental Standard-Setting - Phase I ✓
A	[704102-06] Environmental Goals and Targets Performance Tracking System ✓
A	[704102-07] NextGen EMS Frameworks and Stakeholder Collaboration ✓

✓ Operationally Available

✓ Complete

● In Service System

● Planned System

P Primary Systems

S Secondary Systems

T Tertiary Systems

A Avionics Systems

A Alpha



## Stakeholders

Specific roles and responsibilities for the execution of the enabling activities in this portfolio are outlined in the RASCI (Responsible, Accountable, Supportive, Consulted, Informed) . All stakeholder organizations involved in the delivery of the capabilities/enabling activities are listed across the top. Portfolio capabilities are listed on the left side of this table, organized by OI and enabling activity. AEE works with governmental partners such as EPA, NASA, the State Department, and the White House staff to set international ICAO CAEP standards. Fundamental to this work is close coordination and collaboration with industry partners such as airframers (Boeing, Airbus, Bombardier, Embraer, Textron Industries, Gulfstream, Dassault) and engine manufacturers (Pratt & Whitney, GE Aviation, Rolls Royce, Safran, Williams), as well as with organizations such as IATA, ICSA, and ACI. AEDT is being developed by the DOT Volpe Center in conjunction with ATAC Corporation under a contract managed by AEE. AEDT version 2b was released on May 29, 2015. The latest modification of the software is AEDT 2D, released on September 30, 2017. With consultation from ANG-C7, AEE coordinated deployment, guidance, and training with AJM-1, AJM-21, AJM-22, AJM-31, AJM-33, AJV-1, AFS, and ARP. AEDT is also released for use by external stakeholders. In conducting the CLEEN II Program, AEE partners with industry in maturing technologies to reduce aircraft fuel burn, emissions and noise, as well as to advance the introduction of alternative jet fuels. AEE also partners with universities through the ASCENT Center of Excellence in assessing the potential environmental benefits of incorporating CLEEN and CLEEN II technologies into future aircraft and engines. AEE coordinates with other Federal Government agencies involved in research and development of technologies to reduce aircraft fuel burn, emissions and noise, including NASA, Department of Defense and Department of Energy. The FAA works in partnership with industry to promote the development and deployment of alternative jet fuels (AJF) through the Commercial Aviation Alternative Fuels Initiative (CAAFI). The FAA sponsors CAAFI in partnership with Airlines for America (A4A), the Aerospace Industries Association (AIA) and Airports Council International North America (ACI-NA). AEE has established strong partnerships with other Federal agencies including the Departments of Agriculture, Energy and Defense, the EPA, NASA, Department of Commerce, National Science Foundation and State Department. FAA coordinates with our counterparts in other governments and with R&D funding organizations such as the European Commission to share research activities and best practices. We have established bilateral cooperation agreements with Australia, Brazil, Germany, Indonesia and Spain which each have strong alternative jet fuel initiatives. AEE supports ICAO activities to support AFJ including participating in the ICAO CAEP Alternative Fuels Task Force.

- A** Accountable for the completion of NextGen capability. The highest level within the RASCI matrix, this office is charged by the FAA to deliver a particular capability. Typically, this designation is provided via an Acquisition Program Baseline. To foster a clear line of accountability, two different offices can never be Accountable for the same increment, and Accountability can never be delegated to another office.
- R** Responsible for the successful completion of NextGen capability or a critical component of the capability. This office is responsible to the Accountable office. The Responsible office is responsible for initiating an actual change to the NAS such as automation changes, and is often also designated as the Accountable office for that increment. However, there are examples in the NSIP where one office is Accountable for an increment while another office (or offices) is actually making a change in the NAS on behalf of the Accountable office.
- A/R** Accountable for the completion of NextGen capability as well as Responsible for its implementation.
- S** Supports the Responsible office in the implementation of NextGen capability. Typically, this support is in the form of subject matter expertise, procedural guidance, or training activities.
- C** Consulted for input during the implementation of NextGen capability. Provides input on a specific aspect in the development and implementation of a capability, such as safety analysis or approval. Input may or may not be used as determined by the Responsible and Accountable offices.
- I** Informed about the progress of implementation.





# Environment and Energy

RASCI Matrix	ANG				APO	AJT	AFS	AJI			AJM				AAE	ARP	AVS	AEE	AIR
	C	C7	5	B	001	2	001	1	2	3	22	31	32	33	001	001	001	001	001
• <b>A</b> [701102-01] Aviation Environmental Design Tool Version 2A (2012 - 2012)		C					C	S	S	S	C	C		C	A/R	C			
• <b>A</b> [701102-02] AEDT Version 2B (2015 - 2015)		C					C	S	S	S	C	C		C	A/R	C			
• <b>A</b> [701102-03] Improved Scientific Knowledge (2015 - 2015)			I					S	S	S					A/R	C			
• <b>A</b> [701102-04] Aviation Environmental Portfolio Management Tool (2015 - 2015)		C	I					S	S	S					A/R				
• <b>A</b> [702102-01] Open Rotor (2012 - 2012)		C			S			S	S	S					A/R				C
• <b>A</b> [702102-02] TAPS II Lean Combustor (2012 - 2012)		C			S			S	S	S					A/R				C
• <b>A</b> [702102-03] Adaptive Trailing Edges (2013 - 2013)		C			S			S	S	S					A/R				C
• <b>A</b> [702102-04] Ceramic Matrix Composite Acoustic Nozzle (2014 - 2014)		C			S			S	S	S					A/R				C
• <b>A</b> [702102-05] Engine Weight Reduction and High-Temperature Impeller (2015 - 2015)		C			S			S	S	S					A/R				C
• <b>A</b> [702102-06] Flight Management System - Air Traffic Management (FMS-ATM) Integration (2015 - 2015)	S	C			S	I	I	S	S	S	S				A/R				C
• <b>A</b> [702102-08] Ceramic Matrix Composite Turbine Blade Tracks (2017 - 2017)		C			S			S	S	S					A/R				C
• <b>A</b> [702102-09] Dual-Wall Turbine Blade (2017 - 2017)		C			S			S	S	S					A/R				C
• <b>A</b> [703102-01] Drop-In 50-50% HRJ/HEFA Blend Fuels (2011 - 2011)		C						S	S	S					A/R				C

 Operationally Available

 Complete

 External Commitment

**A** Alpha



# Environment and Energy

RASCI Matrix	ANG				APO	AJT	AFS	AJI			AJM				AAE	ARP	AVS	AEE	AIR
	C	C7	5	B	001	2	001	1	2	3	22	31	32	33	001	001	001	001	001
• <b>A</b> [703102-02] Drop-In >50% HRJ/HEFA Fuels (Greater than 50% Blend) (2015 - 2015)		C						S	S	S					A/R				C
• <b>A</b> [703102-03] Other Advanced Aviation Alternative Fuels - Phase I (2015 - 2015)		C						S	S	S					A/R				C
• <b>A</b> [704102-01] Environmental Policy (2012 - 2012)		C					C	S	S	S	C		C	C	A/R	C			
• <b>A</b> [704102-02] NEPA Strategy and Processes - Phase I (2013 - 2013)		C					C	S	S	S	C		C	C	A/R	C			
• <b>A</b> [704102-03] Environmental Targets (2014 - 2015)		C					C	S	S	S	C		C	C	A/R	C			
• <b>A</b> [704102-04] Environmental Assessment of NextGen Capabilities (2015 - 2015)		C	I				C	S	S	S	C		C	C	A/R	C			
• <b>A</b> [704102-05] Analysis to Support International Environmental Standard-Setting - Phase I (2015 - 2015)		C						S	S	S					A/R				
• <b>A</b> [704102-06] Environmental Goals and Targets Performance Tracking System (2015 - 2015)		C					C	S	S	S	C	C	C	C	A/R	C			C
• <b>A</b> [704102-07] NextGen EMS Frameworks and Stakeholder Collaboration (2015 - 2015)		C					S	S	S	S					A/R	S			

Appendix B

Bravo Increments

Portfolio Overview

The environmental vision for the FAA's strategic plan is to develop and operate a system that reduces aviation's environmental and energy impacts to a level that does not constrain growth and is a model of sustainability. Aircraft noise, air quality, climate, and energy are the most significant potential environmental constraints to increasing aviation capacity, efficiency, and flexibility. Limiting and reducing future aviation environmental impacts to levels that protect public health and welfare as well as ensuring energy availability and sustainability are the guiding principles of aviation environmental protection. The FAA is pursuing the following environmental goals:

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 national resources.

Air Quality: Achieve an absolute reduction of significant air quality health and welfare impacts attributable to aviation.

Climate: Limit the impact of aircraft carbon dioxide (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).

Energy: Improve National Airspace System (NAS) energy efficiency and develop and deploy alternative jet fuels for commercial aviation.

To achieve these goals, the FAA's environmental and energy research strategy is based on characterization of the problem and assessment of associated risks; development of technological and policy based solutions; and management of system-wide performance while working closely with stakeholders community. The FAA Office of Environment and Energy is pursuing 5-pillar approach to meet environmental goals (1) Improve scientific knowledge and enhance integrated environmental modeling capability; (2) accelerate maturation of new aircraft technologies; (3) advance alternative jet fuels; (4) explore air traffic management modernization and operational improvements; and (5) develop policies, environmental standards, and market based measures. The Operational Improvements, enabling activities and increments reflect this strategy.

Activities in this portfolio will be conducted in such a way that they do not impact the safety of the NAS. In the Bravo timeframe this portfolio will build on progress from the enabling activities in the Alpha timeframe, which includes Phase 2 maturation of environmentally friendly technologies, fuels, and continued focus on environmental and energy- favorable concepts and operations.

Note: The dates and timelines included in the NAS Segment Implementation Plan (NSIP) are for planning purposes only. All capability schedules are tentative until their supporting programs are officially baselined.

# Environment and Energy

## Portfolio Content Summary Statistics

		Increment Status				
Segment	Total by Segment	Planned	Concept Exploration & Maturation	Development	Initial Operational Availability	Completed
*Bravo (2016 - 2020)	8	0	0	0	0	8
TOTAL	8	0	0	0	0	8
Segment	% by Segment	% by Segment/Increment Status				
*Bravo (2016 - 2020)	100%	0 %	0 %	0 %	0 %	100 %
TOTAL	100%	0 %	0 %	0 %	0 %	100 %

# Environment and Energy

## Operational Improvements/Current Operations & Increments

## Benefits

### CO: [702102] NextGen Environmental Engine and Aircraft Technologies - Phase I (2012 - 2017)

**B** [702102-07] Ultra High-Bypass Ratio Geared Turbo Fan (2015 - 2017) ✓



### OI: [701103] Integrated Environmental Modeling - Phase II (2016 - 2020)

**B** [701103-01] Aviation Environmental Tools Suite (2016 - 2020) ✓



### CO: [702103] NextGen Environmental Engine and Aircraft Technologies - Phase II (2016 - 2022)

**B** [702103-03] Explore and Demonstrate New Technologies Under CLEEN - Phase II (2016 - 2022) ✓



### OI: [703103] Sustainable Alternative Jet Fuels - Phase II (2016 - 2020)

**B** [703103-01] Other Advanced Drop-In Aviation Alternative Jet Fuels - Phase II (2016 - 2020) ✓



**B** [703103-02] Generic Methodology for Alternative Jet Fuel Approval (2016 - 2020) ✓



### CO: [704103] Environmental Policies, Standards and Measures - Phase II (2016 - 2020)

**B** [704103-01] Environmental Performance and Targets - Phase II (2016 - 2020) ✓



**B** [704103-03] EMS Data Management (2016 - 2020) ✓



**B** [704103-04] Analysis to Support International Environmental Standard-Setting - Phase II (2016 - 2020) ✓



# Environment and Energy

2016	2017	2018	2019	2020
CO: [702102] NextGen Environmental Engine and Aircraft Technologies - Phase I (2012 - 2017)				
B [702102-07] Ultra High-Bypass Ratio Geared Turbo Fan (2015 - 2017) ✓				
OI: [701103] Integrated Environmental Modeling - Phase II (2016 - 2020)				
B [701103-01] Aviation Environmental Tools Suite (2016 - 2020) ✓				
CO: [702103] NextGen Environmental Engine and Aircraft Technologies - Phase II (2016 - 2022)				
B [702103-03] Explore and Demonstrate New Technologies Under CLEEN - Phase II (2016 - 2022) ✓				
OI: [703103] Sustainable Alternative Jet Fuels - Phase II (2016 - 2020)				
B [703103-01] Other Advanced Drop-In Aviation Alternative Jet Fuels - Phase II (2016 - 2020) ✓				
B [703103-02] Generic Methodology for Alternative Jet Fuel Approval (2016 - 2020) ✓				

Planned

OI

Concept Exploration & Maturation

CO

Development

COE/CBTE

Initial Operation Available

Bravo

Complete

External Commitment

# Environment and Energy

2016	2017	2018	2019	2020
CO: [704103] Environmental Policies, Standards and Measures - Phase II (2016 - 2020)				
B [704103-01] Environmental Performance and Targets - Phase II (2016 - 2020) ✓				
B [704103-03] EMS Data Management (2016 - 2020) ✓				
B [704103-04] Analysis to Support International Environmental Standard-Setting - Phase II (2016 - 2020) ✓				

Planned

OI

Concept Exploration & Maturation

CO

Development

COE/CBTE

Initial Operation Available ✓

Bravo

Complete ✓

External Commitment



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# Environment and Energy

## CO: [702102] NextGen Environmental Engine and Aircraft Technologies - Phase I (2012 - 2017)

Develop and mature aircraft and engine technologies to reduce noise, emissions, and fuel burn from commercial subsonic jet aircraft. Demonstrate these technologies at sufficient readiness levels to achieve goals of the FAA's Continuous Lower Energy, Emissions, and Noise (CLEEN) program. It will include multiple time sequenced deliverables.

### CO Benefit

Environment (P): Reduce emissions, fuel burn, and noise.

### Increments

Bravo  
(2016 - 2020)

1

**B** [702102-07] Ultra High-Bypass Ratio Geared Turbo Fan (2015 - 2017)  (Complete)



# Environment and Energy

## Increments/Enabling Activities

**B** [702102-07] Ultra High-Bypass Ratio Geared Turbo Fan (2015 - 2017)

### Increment Overview

Pratt & Whitney will mature ultra high-bypass ratio geared turbo fan technology to TRL 6. This technology will reduce fuel burn, emissions, and noise.

### Increment Status

Complete


### Success Criteria

✔ 2017 : Maturation of technology through ground test demonstration (TRL 6) and its availability for further adoption by industry.

### Implementation Approach

Transfer of technology to industry for further maturation and commercial deployment.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Pratt & Whitney is developing and demonstrating an ultra-high bypass ratio geared turbofan (GTF) engine and associated advanced technologies. Geared turbofan engine technologies will contribute to reduced aircraft noise and fuel consumption because of increased engine efficiency. This engine is projected to reduce single aisle aircraft fuel consumption by 20 percent relative to a CFM International, CFM56-7 engine and 25 dB noise reduction relative to the Stage 4 noise standards.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## OI: [701103] Integrated Environmental Modeling - Phase II (2016 - 2020)

Enhance the integrated aviation environmental analysis tool suite to reflect new scientific information and use this capability to evaluate both the environmental impacts of aviation as well as the performance of potential mitigation options.

### OI Benefit

Environment (S): Improve identification of potential solutions to improve environmental performance.

### Increments

Bravo  
(2016 - 2020)

1

**B** [701103-01] Aviation Environmental Tools Suite (2016 - 2020)  (Complete)

# Environment and Energy

## Increments/Enabling Activities

**B** [701103-01] Aviation Environmental Tools Suite (2016 - 2020)

### Increment Overview

Develop, evaluate, and implement enhancements in an aviation environmental suite of tools for aircraft level to NAS-wide modeling and analyses to inform development of mitigation solutions and policy options that will further improve scientific knowledge, refine metrics, and reduce uncertainties of aircraft source-level noise and emissions of air pollutants and greenhouse gases, their atmospheric evolution, and impacts on human health and welfare and climate change.

### Increment Status

Complete

### Success Criteria

- 2016 : Release Aviation Environmental Design Tool (AEDT) Version 2c
- 2018 : Release Aviation Environmental Design Tool (AEDT) Version 3 with improved noise, emissions, and fuel burn estimation methodologies
- 2020 : Use of advanced scientific understanding of aviation noise and emissions and their impacts, to enhance capability of environmental assessment models to assess environmental performance and benefits of mitigation options.

### Implementation Approach

Release enhanced versions of AEDT and develop additional analytical capabilities to support decision-making, environmental performance assessments, and cost-benefit analyses.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Integrated advancement in scientific knowledge and environmental analytical tools capability will provide solid foundation for environmental mitigation (technological and policy based) decision-making and assessment studies.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## CO: [702103] NextGen Environmental Engine and Aircraft Technologies - Phase II (2016 - 2022)

Support certification and commercialization of aircraft technologies for enhanced environmental and energy efficiency improvements demonstrated during Phase I. Demonstrate additional technologies meeting CLEEN goals, including wing laminar flow, advanced aircraft noise reduction, and a lower drag vertical tail. It will include multiple increments delivered over time.

### CO Benefit

Environment (P): Reduce emissions, fuel burn, and noise.

### Increments

Bravo  
(2016 - 2020)

1

## B [702103-03] Explore and Demonstrate New Technologies Under CLEEN - Phase II (2016 - 2022) ✓ (Complete)

# Environment and Energy

## Increments/Enabling Activities

**B** [702103-03] Explore and Demonstrate New Technologies Under CLEEN - Phase II (2016 - 2022)

### Increment Overview

This enabling activity will explore and demonstrate new technologies in CLEEN Phase II.

### Increment Status

Complete

### Success Criteria

- ✓ 2018 : Double-Bubble Aircraft Fuselage (TRL 5)
- ✓ 2018 : Compact Nacelle (TRL 6)
- ✓ 2019 : Structurally Efficient Wing (TRL 6)
- ✓ 2019 : Flight Management System/Engine Integration (TRL 6)
- ✓ 2020 : Leading Edge Protective Coating (TRL 7)
- ✓ 2020 : Turbine Aero-Efficiency Technologies (TRL 6)
- ✓ 2020 : TAPS III Combustor (TRL 6)
- ✓ 2020 : Advanced Turbine Blade Outer Air Seal Systems (TRL 6)
- ✓ 2020 : Compact Combustor (TRL 6)
- ✓ 2020 : Advanced Rich Quench Lean (RQL) Low NOx Combustor (TRL 6)
- ✓ 2020 : More Electric Systems and Technologies for Aircraft in the Next Generation (MESTANG) (TRL 6)
- ✓ 2021 : Flight test of compact nacelle aft duct acoustics technology (TRL 7)
- ✓ 2022 : Engine test of compact high pressure compressor and advanced acoustics fan technologies (TRL 6)

### Implementation Approach

The focus of the CLEEN Program is to mature previously conceived noise, emissions and fuel burn reduction technologies from Technology Readiness Levels (TRLs) of 3-5 to TRLs of 6-7 to enable industry to enter product development and expedite introduction of these technologies into current and future civil, aircraft and engines.

#### Benefits

- Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Environment (P): The aim of CLEEN II is to mature and demonstrate new technologies that would reduce fuel consumption, noise and emissions, with potential entry into service by 2026.

### System Interactions

Flight Management System (A)

- External Commitment Primary Benefit Secondary Benefit Operationally Available Complete Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety Bravo



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# Environment and Energy

## OI: [703103] Sustainable Alternative Jet Fuels - Phase II (2016 - 2020)

Obtain ASTM International approval of additional advanced “drop-in” sustainable alternative fuels. These advanced "drop-in" fuels should reduce fuel production cost, reduce environmental impacts, improve energy security, and enable carbon neutral growth by 2020. It will include multiple increments delivered over time.

### OI Benefit

Environment (P): Reduced emissions.

### Increments

Bravo  
(2016 - 2020)

2

**B** [703103-01] Other Advanced Drop-In Aviation Alternative Jet Fuels - Phase II (2016 - 2020)  (Complete)

**B** [703103-02] Generic Methodology for Alternative Jet Fuel Approval (2016 - 2020)  (Complete)

# Environment and Energy

## Increments/Enabling Activities

**B** [703103-01] Other Advanced Drop-In Aviation Alternative Jet Fuels - Phase II (2016 - 2020)

### Increment Overview

This enabling activity will result in ASTM International approval of additional advanced alternative fuel blends for use by the commercial fleet. Fuel types may include renewable jet fuel from fermentation, pyrolysis, catalysis, and other processes. ASTM International approval is required before alternative jet fuels can be used by commercial aviation. Approval is a vital step to alternative jet fuel deployment.

### Increment Status

Complete


### Success Criteria

- ✓ 2018 : ASTM International added ethanol as an approved feedstock in ASTM D7566 Annex A5.
- ✓ 2020 : Complete testing and analysis to support qualification and certification by ASTM International of additional alternative jet fuels and adoption by industry.

### Implementation Approach

ASTM International approval is required before alternative jet fuels can be used by commercial aviation. Approval is a vital step to alternative jet fuel deployment. This enabler provides the technical data to support ASTM International approval.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Alternative jet fuels offer benefits through reduction in aircraft combustion emissions and fuel lifecycle greenhouse gas emissions that contribute to global climate change and impact surface air quality.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**B** [703103-02] Generic Methodology for Alternative Jet Fuel Approval (2016 - 2020)

### Increment Overview

This enabling activity will develop a generic bulk chemical composition based methodology that ASTM International could use to aid the approval process of alternative jet fuels.

### Increment Status

Complete

### Success Criteria

✔ 2020 : Developed generic testing and modelling capabilities for screening of potential alternative jet fuels candidates in support of ASTM International approval.

### Implementation Approach

Transfer of the methodology to industry and/or ASTM International to aid the approval of new alternative jet fuels for use by commercial aviation.

#### Benefits

 Access & Equity  Capacity  Flexibility  Efficiency  Environment  Predictability  Safety

Environment (P): Alternative jet fuels offer benefits through reduction in aircraft combustion emissions and fuel lifecycle greenhouse gas emissions that contribute to global climate change and impact surface air quality.

### System Interactions

No system interactions applicable.

To be determined



# Environment and Energy

## CO: [704103] Environmental Policies, Standards and Measures - Phase II (2016 - 2020)

Continue to develop and implement appropriate policies, programs, and mechanisms to mitigate the environmental impacts of aviation. The Environment and Energy Strategy will be used to address, plan and mitigate environmental issues.

### CO Benefit

Environment (S): Improve identification and execution of policies to improve environmental performance.

### Increments

Bravo  
(2016 - 2020)

3

- B** [704103-01] Environmental Performance and Targets - Phase II (2016 - 2020) (Complete)
- B** [704103-03] EMS Data Management (2016 - 2020) (Complete)
- B** [704103-04] Analysis to Support International Environmental Standard-Setting - Phase II (2016 - 2020) (Complete)

# Environment and Energy

## Increments/Enabling Activities

**B** [704103-01] Environmental Performance and Targets - Phase II (2016 - 2020)

### Increment Overview

This enabling activity will evaluate NAS environmental performance relating to noise, emissions, and energy. Mitigation solutions will be evaluated to understand the potential for aircraft technology, alternative fuels, operations concepts, and policy options to help meet future environmental targets. Results related to energy and climate change will be published on a periodic basis in revisions to the U.S. Aviation Greenhouse Gas Emissions Reduction Plan.

### Increment Status

Complete



### Success Criteria

✔ 2018 : Refined quantitative evaluation of progress towards attaining the NextGen environmental goals for noise, emissions, and energy with an outlook to 2050. Environmental mitigation solutions are identified.

### Implementation Approach

Outcomes will provide the benefit of developing technological and policy-based solutions and adaptations needed towards to address the shortfalls in environmental performance.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Findings of regular analysis under this incremental operational improvement will assess the progress being made towards meeting the FAA environmental goals and identify the potential shortfalls.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**B** [704103-03] EMS Data Management (2016 - 2020)

### Increment Overview

This enabling activity will address cross-cutting environmental challenges to facilitate NextGen EMS implementation for select capabilities with environmental and energy aspects by establishing, where appropriate, approaches, programs, and processes for working closely with stakeholders (e.g. manufacturers, airlines, airports) to develop approaches to enhance environmental benefits or reduce negative impacts, develop effective efficient approaches to address NEPA requirements, and to track environmental performance resulting from the implementation of capabilities.

### Increment Status

Complete


### Success Criteria

✔ 2016 : Provided the Environment and Energy Strategy

### Implementation Approach

Implementation through environmental data exchange and communication.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Expansion and involvement of stakeholders for cooperative efforts and data exchanges for NAS-wide aviation environmental sustainability towards meeting FAA environmental goals.

### System Interactions

No system interactions applicable.

To be determined

# Environment and Energy

## Increments/Enabling Activities

**B** [704103-04] Analysis to Support International Environmental Standard-Setting - Phase II (2016 - 2020)

### Increment Overview

This enabling activity provides the scientific and technical basis to support the development and implementation of International Civil Aviation Organization (ICAO) environmental standards, such as particulate matter emissions, and policy measures for commercial aviation.

### Increment Status

Complete

### Success Criteria

- ✓ 2016 : Supported the development and implementation of International Civil Aviation Organization (ICAO) environmental standard for CO2 emissions.
- ✓ 2019 : Supported the development and implementation of International Civil Aviation Organization (ICAO) global market based measure for international CO2 emissions.
- ✓ 2019 : Supported the development and implementation of International Civil Aviation Organization (ICAO) environmental standard for particulate matter emissions.

### Implementation Approach

ICAO/CAEP approved environmental standards and policy measures will be implemented as per internationally agreeable effective date.

#### Benefits

-  Access & Equity
-  Capacity
-  Flexibility
-  Efficiency
-  Environment
-  Predictability
-  Safety

Environment (P): Reduce or limit aircraft emissions and noise levels to support environmental sustainability towards meeting FAA environmental goals.

### System Interactions

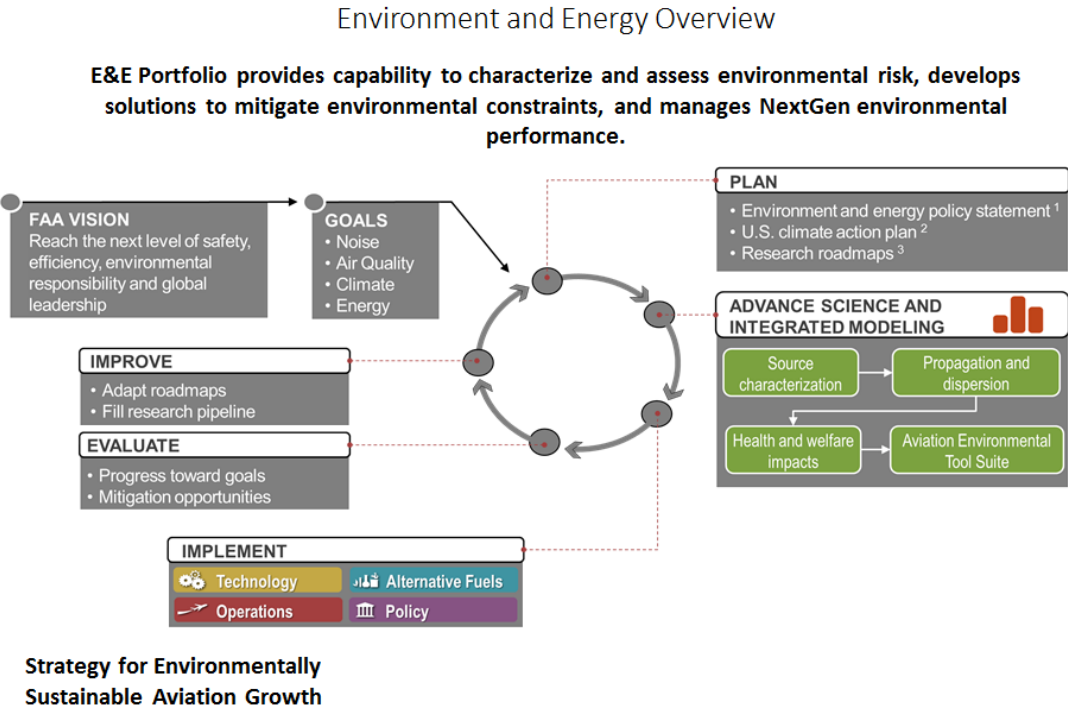
No system interactions applicable.

To be determined

# Environment and Energy

## Systems Interactions

The FAA aims to develop and operate a system that reduces aviation's environmental and energy impacts to a level that does not constrain growth and is a model of sustainability. These goals include limiting the impact of aircraft carbon dioxide (CO2) emissions on the global climate by achieving carbon- neutral growth by 2035, and net reductions of the climate impact from all aviation emissions over the longer term (by 2050). Reduce the number of people exposed to significant noise around U.S. airports. Improve National Airspace System (NAS) energy efficiency and develop and deploy alternative jet fuels for commercial aviation. Achieve an absolute reduction of significant air quality health and welfare impacts attributable to aviation



# Environment and Energy

Increment	FMS
<div><div>B</div><div>[701103-01] Aviation Environmental Tools Suite</div><div>✔</div></div>	
<div><div>B</div><div>[702102-07] Ultra High-Bypass Ratio Geared Turbo Fan</div><div>✔</div></div>	
<div><div>B</div><div>[702103-03] Explore and Demonstrate New Technologies Under CLEEN - Phase II</div><div>✔</div></div>	A
<div><div>B</div><div>[703103-01] Other Advanced Drop-In Aviation Alternative Jet Fuels - Phase II</div><div>✔</div></div>	
<div><div>B</div><div>[703103-02] Generic Methodology for Alternative Jet Fuel Approval</div><div>✔</div></div>	
<div><div>B</div><div>[704103-01] Environmental Performance and Targets - Phase II</div><div>✔</div></div>	
<div><div>B</div><div>[704103-03] EMS Data Management</div><div>✔</div></div>	
<div><div>B</div><div>[704103-04] Analysis to Support International Environmental Standard-Setting - Phase II</div><div>✔</div></div>	

✔ Operationally Available

P Primary Systems

✔ Complete

S Secondary Systems

● In Service System

T Tertiary Systems

● Planned System

A Avionics Systems

B

 Bravo



## Stakeholders

Specific roles and responsibilities for the execution of the enabling activities in this portfolio are outlined in the RASCI (Responsible, Accountable, Supportive, Consulted, Informed) . All stakeholder organizations involved in the delivery of the capabilities/enabling activities are listed across the top. Portfolio capabilities are listed on the left side of this table, organized by OI and enabling activity. AEE works with governmental partners such as EPA, NASA, the State Department, and the White House staff to set international ICAO CAEP standards. Fundamental to this work is close coordination and collaboration with industry partners such as airframers (Boeing, Airbus, Bombardier, Embraer, Textron Industries, Gulfstream, Dassault) and engine manufacturers (Pratt & Whitney, GE Aviation, Rolls Royce, Safran, Williams), as well as with organizations such as IATA, ICSA, and ACI. AEDT is being developed by the DOT Volpe Center in conjunction with ATAC Corporation under a contract managed by AEE. AEDT version 2b was released on May 29, 2015. The latest modification of the software is AEDT 2D, released on September 30, 2017. With consultation from ANG-C7, AEE coordinated deployment, guidance, and training with AJM-1, AJM-21, AJM-22, AJM-31, AJM-33, AJV-1, AFS, and ARP. AEDT is also released for use by external stakeholders. In conducting the CLEEN II Program, AEE partners with industry in maturing technologies to reduce aircraft fuel burn, emissions and noise, as well as to advance the introduction of alternative jet fuels. AEE also partners with universities through the ASCENT Center of Excellence in assessing the potential environmental benefits of incorporating CLEEN and CLEEN II technologies into future aircraft and engines. AEE coordinates with other Federal Government agencies involved in research and development of technologies to reduce aircraft fuel burn, emissions and noise, including NASA, Department of Defense and Department of Energy. The FAA works in partnership with industry to promote the development and deployment of alternative jet fuels (AJF) through the Commercial Aviation Alternative Fuels Initiative (CAAFI). The FAA sponsors CAAFI in partnership with Airlines for America (A4A), the Aerospace Industries Association (AIA) and Airports Council International North America (ACI-NA). AEE has established strong partnerships with other Federal agencies including the Departments of Agriculture, Energy and Defense, the EPA, NASA, Department of Commerce, National Science Foundation and State Department. FAA coordinates with our counterparts in other governments and with R&D funding organizations such as the European Commission to share research activities and best practices. We have established bilateral cooperation agreements with Australia, Brazil, Germany, Indonesia and Spain which each have strong alternative jet fuel initiatives. AEE supports ICAO activities to support AFJ including participating in the ICAO CAEP Alternative Fuels Task Force.

- A

Accountable for the completion of NextGen capability. The highest level within the RASCI matrix, this office is charged by the FAA to deliver a particular capability. Typically, this designation is provided via an Acquisition Program Baseline. To foster a clear line of accountability, two different offices can never be Accountable for the same increment, and Accountability can never be delegated to another office.
- R

Responsible for the successful completion of NextGen capability or a critical component of the capability. This office is responsible to the Accountable office. The Responsible office is responsible for initiating an actual change to the NAS such as automation changes, and is often also designated as the Accountable office for that increment. However, there are examples in the NSIP where one office is Accountable for an increment while another office (or offices) is actually making a change in the NAS on behalf of the Accountable office.
- A/R

Accountable for the completion of NextGen capability as well as Responsible for its implementation.
- S

Supports the Responsible office in the implementation of NextGen capability. Typically, this support is in the form of subject matter expertise, procedural guidance, or training activities.
- C

Consulted for input during the implementation of NextGen capability. Provides input on a specific aspect in the development and implementation of a capability, such as safety analysis or approval. Input may or may not be used as determined by the Responsible and Accountable offices.
- I

Informed about the progress of implementation.

# Environment and Energy

RASCI Matrix	ANG				APO	AJT	AFS	AJI			AJM				AAE	ARP	AVS	AEE	AIR
	C	C7	5	B	001	2	001	1	2	3	22	31	32	33	001	001	001	001	001
• <b>B</b> [701103-01] Aviation Environmental Tools Suite (2016 - 2020)		C			C			S	S	S	C	C		C	A/R	C			C
• <b>B</b> [702102-07] Ultra High-Bypass Ratio Geared Turbo Fan (2015 - 2017)		C						S	S	S					A/R				C
• <b>B</b> [702103-03] Explore and Demonstrate New Technologies Under CLEEN - Phase II (2016 - 2022)	C	C			S	I	I								A/R		C		C
• <b>B</b> [703103-01] Other Advanced Drop-In Aviation Alternative Jet Fuels - Phase II (2016 - 2020)		C						S	S	S					A/R				C
• <b>B</b> [703103-02] Generic Methodology for Alternative Jet Fuel Approval (2016 - 2020)		C						S	S	S					A/R				C
• <b>B</b> [704103-01] Environmental Performance and Targets - Phase II (2016 - 2020)		C						S	S	S					A/R				C
• <b>B</b> [704103-03] EMS Data Management (2016 - 2020)		C						S	S	S					A/R				C
• <b>B</b> [704103-04] Analysis to Support International Environmental Standard-Setting - Phase II (2016 - 2020)		C						S	S	S					A/R				C