Environmentally and Energy Efficient Gate-to-Gate Aircraft Operations

Federal Aviation Administration

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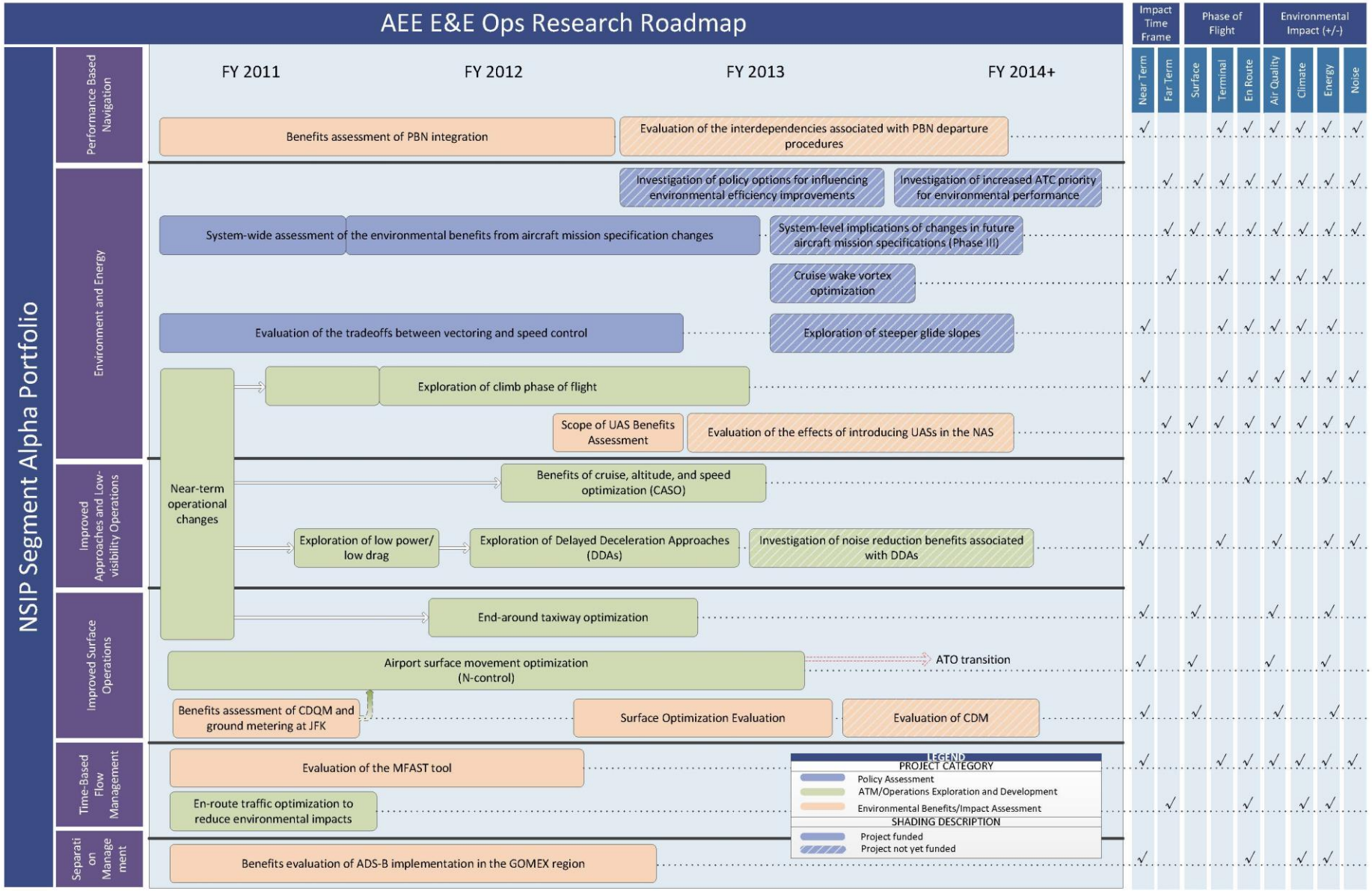
Important Drivers of Research

- **To propel fuel efficiency and reductions in environmental impacts in the near- and medium-term, Air Traffic Management (ATM) modernizations and Advanced Operational Procedures (Ops) efficiencies are required**

- **New ATM capabilities, gate to gate and surface operational procedures will allow further reduction in aviation's environmental footprint and increase energy efficiency**

Ops Research Roadmap



Current Research Activities

- Exploring the Climb Phase of Flight
- Delayed Deceleration Approaches (DDAs)
- CASO: Cruise Altitude & Speed Optimization
- Changes to Aircraft Mission Specifications
- Surface Management Optimization (N-Control)
- Vectors vs. Speed Control
- Unmanned Aircraft Systems Scoping Study
- EAT: End-Around-Taxiway
- PBN Benefits
- ADS-B GOMEX Benefits

The COE would support AEE's research into the development of Clean, Quiet, and Energy Efficient Operational Procedures

- **AEE's Operations Research is:**
  - **Categorized into three areas**
    - **ATM/ Operations Exploration**
    - **Policy Assessment**
    - **Environmental Impact (+/-) Assessment**
  - **Explores all phases of flight**
    - **Surface**
    - **Terminal**
    - **En Route**
  - **Considers the implementation timeframe**
    - **Near-Term**
    - **Mid-Term**
    - **Far-Term**

Technical Areas of Interest (1 of 3)

- Investigate operational procedures that provide environmental and energy performance benefits during any phase of flight from surface to en-route while evaluating non-environmental system impacts (e.g., capacity, workload, etc.).
- Develop a menu of and accelerate implementation of operational procedures and strategies to reduce aircraft noise and emissions impacts, while minimizing the effects on capacity and workload.
- Conduct demonstrations and evaluations of operational procedures that could mitigate noise, emissions and/or fuel burn.

Technical Areas of Interest (2 of 3)

- Through analysis and demonstration, develop estimates of expected environmental and fuel savings benefits as well as the interdependencies amongst noise, emissions, fuel burn, and system performance.
- For demonstrations and evaluations of operational procedures, identify risks and limitations associated with all stages of project execution and develop a plan to transition matured outcomes to the NAS for implementation.
- Perform environmental regulatory and compliance analyses associated with existing and new operational procedures.

Technical Areas of Interest (3 of 3)

- Evaluate the fuel burn, noise and emissions impacts of advances in airborne and ground technologies for communication, navigation and surveillance.

- Evaluate the effectiveness, including capacity considerations, of procedures that are used to improve environmental performance.

Thank You

Climb Phase of Flight

- There has been considerable research into optimizing the descent phase of flight; this examines the less explored region; the E&E benefit opportunities during the climb phase of flight.

DDAs

- Aircraft maintain higher airspeed with clean aerodynamic configuration for as long as possible during approach. Lower drag => lower thrust => lower fuel burn/emissions;30-37% average approach fuel savings suggested across 3 a/c types (A320, B757, B777). This project will explore the E&E benefits of DDAs

CASO: Cruise Altitude & Speed Optimization

- Aircraft have an optimal fuel burn altitude and speed, ATC procedures and airline preferences often result in off-optimal operations. 2-5% cruise fuel burn reduction appears possible. This project will explore the E&E benefits of CASO

Changes to A/C Mission Specs.

- Quantify the system-level impacts of mission specification changes in future aircraft designs so that information is available to better evaluate the potential of this approach to reduce fuel burn and aviation's environmental impact – Looking at Wing Span, Design Range, and Cruise Speed changes; what are the impacts on the NAS, Industry, and Manufactures?

Vectors vs. Speed Control

- This study will assist FAA in determining whether vectoring aircraft or separating them with speed controls is better for daily operations from an environmental perspective. Environmental implications are quantified in terms of fuel burn, emissions, and noise.

UAS Scoping Study

- A qualitative assessment of the E&E benefits/impacts of UASs will be conducted to scope the E&E modeling requirements.

EAT: End-Around-Taxiway

- This project will obtain further insight into exact conditions when EATs yield environmental benefits at DFW and ATL using ASDE-X data.

N-Control

- This work will extend the Phase 1 research into surface congestion management. The initial objective is to build upon the Phase 1 work to develop refined surface traffic control schemes, implement them in a field demonstration at a suitable airport, and evaluate performance in terms of reduction in taxi time and environmental emissions.

AEDT Preprocessor

- The AEDT Input Processor is needed to convert raw data such as PDARS into a format that can be input into AEDT. This tool is necessary to evaluate the E&E benefits associated with an improved/altered Air Traffic procedure with AEDT.

PBN Benefits

- This project focused on developing a methodology to track usage and E&E benefits of select PBN procedures (OPD's & RNP with and RF-Leg approaches). Close collaboration with other offices within the FAA (ATO & ANG) contributed to method verification.

ADS-B GOMEX Benefits

- This project evaluates the E&E befits associated with the implementation of a ADS-B in the GOMEX. An analysis of helicopter operations in the Gulf of Mexico is being conducted to determine possible environmental benefits from the use of ADS-B equipment.