Motivation

- Environmental impacts of aviation encompass several effects ranging from global climate change and stratospheric ozone reduction to local noise levels and air quality.
- IPCC estimates predict a 5% anthropogenic radiative forcing by the 2050 for a subsonic fleet.

There is a need for capabilities to assess interdependencies between aviation-related noise, emissions, and cost valuations.

FAA is developing a comprehensive suite of software tools for thorough assessment of the environmental effects of aviation:
- Aviation Environmental Portfolio Management (APMT)
- Aviation Environmental Design Tool (AEDT)
- Environment Design Space (EDS)

EDS Objectives

- Development of software tools for estimating source noise, exhaust emissions performance, and economic parameters for future and existing aircraft designs under different technological, operational, policy, and market scenarios.
- Support AEDT and APMT
- Mechanism for collecting, incorporating, and quantifying long-term technology forecasts.

Key Challenges

- Uncertainty assessment and articulation of risk
  - Module to system level uncertainty propagation
- Model fidelity and management
  - Mathematical strategies for effective representation of various elements of the complete problem
- Methods and processes for integration of expert opinion into the models for effective technology forecasting process
- Aircraft definition and appropriate system complexity for end users

Team

- FAA
- NASA
- Volpe
- GaTech
- MIT

Approach

- Develop EDS based on existing NASA tools for aircraft and engine performance, noise, and cost.
- Ensure integration with other aviation environmental analysis tools for fleet level and economic analyses.
- Engage various experts from industry, government agencies, and regulatory bodies for setting technology assumptions and forecasting scenarios.
- Demonstrate EDS capability through some sample problems relevant to decision-making exercises.
- Forecasting future aircraft through multidisciplinary optimization (MDO).

EDS in Environmental Policy Framework


Current Research

- Developing physics-based emissions model
- Collaborative assessment activities with industry
- Cruise speed – Bypass Ratio trade study for minimizing block fuel using the EDS environment for assessment purposes
- Developing an optimizer for EDS
- Developing a fidelity management system for handling various policy scenarios