

# APMT/AEDT Capability Demonstration Problems

## Overview

Presented to: TRB AEDT/APMT Workshop #4

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Date: December 6-8, 2006



## Introduction

- **Several candidate policy problems identified**
  - **Four Capability Demonstrators** selected for detailed analysis in the APMT prototype phase
- **Questions to be answered include:**
  - Are the appropriate economic flows to analyze the test cases represented in the APMT prototype?
  - Are the modules internally self-consistent in their representation of the analysis scenario?
  - Are the assumptions among the various modules consistent with one another for each of the analysis scenarios?
- **Purpose is not to “answer” sample problems but to assess whether the appropriate economic and environmental behaviors and impacts are represented in a consistent way**

# Four Capability Demonstrators (AEDT and APMT)

- **Baseline (BL)**
    - With and without new aircraft technology
  - **Fuel Price Increase (FP)**
    - With and without new aircraft technology
  - **NO<sub>x</sub> Emissions Certification Stringency (NX)**
    - With and without new aircraft technology
  - **Noise Phase-Out (NB)**
    - No new aircraft technology
  - **Reduced Thrust Take-Off (RT)**
    - Operations, noise and emissions impacts
    - Sample problem defined by CAEP-SG/20063-WP/30
- } presented earlier

*\* All problems demonstrate capability to assess trade-offs among community noise, local air quality, and climate change impacts*



## New Aircraft Technology

- **New aircraft will be modeled using the Environmental Design Space (EDS)**
- **Four possible technology level assumptions**
  - Frozen technology (only products that are currently available)
  - EDS aircraft and engine trade spaces within current technology capabilities
  - EDS aircraft and engine trade spaces with future technology assumptions
  - Other stakeholder-defined aircraft
- **No technology forecast is implemented in the prototype**
  - **New EDS aircraft only reflect tradeoffs within today's technology levels**
  - These current technology trade spaces are being evaluated through a separate collaborative assessment program with P&W, GEAE and Boeing



# EDS Aircraft

- EDS vehicles defined based on the 13 ICAO/CAEP aircraft seat classes
- Only one seat class is implemented in the prototype (B777 class aircraft)
- EDS has created 8 new B777-class aircraft reflecting the tradeoffs between NO<sub>x</sub> emissions and fuel burn
- New EDS aircraft are appended to the list of currently available airframe/engine combinations for selection by the PEB for the relevant Capability Demonstrators



## BL: Problem Overview

- APMT Capability Demonstrators compare several policy scenarios to a **standard baseline**
- CD's will be run 2002--2022
  - Time period chosen to coincide with FESG demand forecasts
- Fuel prices and operating costs are assumed to remain constant in real terms for the Baseline runs
- Discount Rate set at 3% for the CD's
  - This input can later be varied to study the effects of policies under different Discount Rate assumptions
- Two Baseline runs to allow for direct Policy to Baseline comparisons
  - One with currently available aircraft only
  - One including new EDS aircraft types



# FP: Problem Overview

- **Fuel price changes used as a simplified surrogate for open emissions trading or fuel taxes**
- **100% corresponds approximately with a minimum EU rate of energy taxation (aviation sector is currently exempt), given today's fuel prices**
- **50% fuel tax**
- **15% fuel tax roughly corresponds to average price per ton of an EU CO<sub>2</sub> emissions permit (aviation sector is currently exempt)**



# FP: Cases

- **Three cases have the policy Enforcement Year five years after the Announcement year**
- **The Announcement Year is set to be the same as the Enforcement Year for one of the runs to study the effect of a lag between Announcement and Enforcement**

Case	1	2	3	4
Fuel price % increase	15%	50%	50%	100%
Announcement Year	2005	2005	2005	2005
Enforcement Year	2010	2005	2010	2010



# NX: Problem Overview

- **NO<sub>x</sub> emission stringencies modeled by constraining airframe/engine combinations available for purchase**
- **After the simulation reaches the Enforcement Year, only aircraft from the NO<sub>x</sub> compliant subset can be selected for addition to fleet**
- **Since EDS aircraft are only available for the B777 seat class, the stringency only applied to B777-class aircraft**
- **During the prototype phase, the PEB is also constrained so that airlines can only replace B777-class aircraft with other B777-class types (no purchasing of aircraft from a different class)**



# NX: Cases

- **Two NO<sub>x</sub> emissions stringency levels:**
  - CAEP/4 -20% - to leave portion of the current B777s as eligible for PEB selection
  - CAEP/4 -40% - to exclude all current B777s and exercise the EDS vehicle selection

Case	1	2
NO <sub>x</sub> emissions percent reduction with respect to CAEP/4 standards	20%	40%
Corresponding dp/Foo (gr/kN) for B777 seat class aircraft	2*OPR-6.4	2*OPR-19.8
Announcement Year	2005	2005
Enforcement Year	2010	2010



# NB: Problem Overview

- **Global phase-out of Chapter 3 minus 9 EPNdB (cumulative, e.g. 3dB at each cert. point)**
  - To provide phase-out of approximately 10% of fleet
- **Announcement year: 2005**
- **Enforcement years: 2010 and 2015**
- **Aircraft that do not comply determined offline**

Case	1	2
Announcement Year	2005	2005
Enforcement Year	2010	2015



## Summary and next steps in agenda

- **Four capability demonstration problems (CD's)**
  - Fuel Price Increase (FP)
    - With and without EDS
  - NO<sub>x</sub> Emissions Certification Stringency (NX)
    - With and without EDS
  - Noise Phase-Out (NB)
  - Reduced Thrust Take-Off (RT)
    - Presented earlier
- **Next steps in agenda**
  - Application of EDS to CD's (Kirby)
  - Discussion of economic modeling of CD's (Hancox)
  - Estimating environmental impacts of CD's (Waitz)



# ??? Questions ???

FAA Environmental Tools web site:

[http://www.faa.gov/about/office\\_org/headquarters\\_offices/aep/models/](http://www.faa.gov/about/office_org/headquarters_offices/aep/models/)

