

# APMT/AEDT/EDS Sample and Capability Demonstration Problems

## Overview

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## Introduction

- **Several candidate test cases identified**
  - **Three Sample Problems** to promote development of AEDT
  - **Four Capability Demonstrators** selected for detailed analysis in the AEDT and APMT
- **Our terminology**
  - *Sample problem*: appropriate when model is fairly mature, should be capable of addressing the question, etc. (e.g. AEDT)
  - *Capability demonstrator*: appropriate when model is still subject to significant development effort, addressing questions for first time, etc. (e.g. APMT)



# Sample problems and capability demonstrators

- **The objective IS**
  - To identify gaps in our capabilities
  - To promote improvement of modeling practices
  - To demonstrate our ability to address such questions
  - To communicate openly our methods, strengths, weaknesses



# Sample problems and capability demonstrators

- **The objective IS NOT**
  - To accurately quantify impacts, costs, benefits, etc., for specific test cases
- **Therefore, we make many assumptions for convenience and expedience**
  - For example, using a representative day x 365, 2002 datum year, only one seat class for EDS aircraft, small number of airports, etc.
  - **These assumptions should not be interpreted as model limitations**
- **Therefore, do NOT take the “numbers” as “the answer”**



# Three sample problems

## *AEDT only (for now)*

- **ICAO/CAEP/6 NO<sub>x</sub> stringency reassessment (NOX)**
- **Continuous descent approach (CDA)**
- **Assessment of reduced vertical separation minimum standards (RVSM)**



# 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
  - Expansion of sample problem defined by ICAO/CAEP-SG/20063-WP/30 to include evaluation of health and welfare impacts

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



# Desired attributes of capability demonstration problems

- Realistic and relevant to the FAA-AEE goals
- *When taken together* span most of the important economic and environmental responses
- Explicitly allow us to demonstrate assessment of trade-offs and interdependencies
- Assumptions, input data, scenarios, etc. could be readily developed (even if only notional or approximate)



## APMT Prototype responses

Response types	Response in Prototype	Capability Demonstration Problems			
		Fuel Price Increase	Certification Standards	Phase Out	Reduced Thrust
<b>Block 1: PEB / DSP</b>					
Supply side response					
Accelerated fleet renewal (forced)	Yes			X	
Accelerated fleet renewal (financial)	Yes	X			
Redistribution of aircraft operation	No			(X) <sup>1)</sup>	
Recertification of existing aircraft	Yes <sup>3)</sup>			X	
Improvement of existing aircraft	Yes <sup>3)</sup>	X			
New aircraft technology shift	Yes	X	X		
Best available technology shift	Yes <sup>4)</sup>	X <sup>2)</sup>	X		
New aircraft capacity shift	No	(X)	(X)	(X)	
<b>Demand side responses</b>					
Demand response to direct cost change	Yes	X			
Demand response to indirect cost change	Yes	X	X	X	(X)
<b>Operational responses</b>					
Changes in flight path	No	(X)			
Changes in flight speed	No	(X)			
Weight reduction (on board service levels)	No	(X)			
Load factors	Yes <sup>6)</sup>	(X)			
Utilization rates	No	(X)			
<b>Evasive responses</b>					
Destination switching	No	(X) <sup>1)</sup>			
Fuel tankering	No	(X) <sup>1) 5)</sup>			
<b>Block 2: AEDT</b>					
Noise	Yes	X	X	X	X
Emissions	Yes	X	X	X	X
<b>Block 3: BVB</b>					
Benefits of reduction climate impacts	Yes	X	X	X	X
Benefits of reduction noise impacts	Yes	X	X	X	X
Benefits of reduction local air quality impacts	Yes	X	X	X	X

# Table Explained

**X** – Potential response in the APMT Prototype

**(X)** – Potential response not modeled in the APMT Prototype

- 1) – Response is only there in the case of a regional application of the policy
- 2) – Response is only there if a policy is applied to a significant part of global air traffic
- 3) – Only if data for the possibilities for re-certification / modification are made available
- 4) – Possibilities for modeling of this response is depending on availability of inputs from the EDS
- 5) – Only in the case of a fuel taxation
- 6) – Only ‘what if’ changes to load factors can be tested.



## Lessons

- **Sample and capability demonstration problems very valuable for identifying errors and gaps in methods**
  - Data challenges
  - Modeling challenges
- **Takes >3 times through a problem to get it “right”**
- **Common problems build AEDT/APMT/EDS interconnectivity**
- **Sample and capability demonstration problems allow us to share, in an open way, our challenges and capabilities with stakeholders**



# Summary

- **Sample problems and capability demonstrations are important part of our development activities**
  - Remember they are “Samples”, “Demonstrations”, etc.
- **Provide a view of what the future will hold for AEDT and APMT**
  - **Comprehensive policy guidance** with multiple metrics for multiple market segments, regions and effects
  - **Rigorous, with explicit representation of uncertainty**
  - **A true capability for assessing interdependences**



## ??? 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/)

