CAPACITY
Aviation Fuel Efficiency

Federal Aviation Administration

FY 2008 Performance Target

"*Improve aviation fuel efficiency per revenue plane-mile by 6 percent, as measured by a three-year moving average, from the three-year average for calendar years 2000-2002."*

Flight Plan Objective and Performance Target

Objective 3: Address environmental issues associated with capacity enhancements.

Performance Target: Improve aviation fuel efficiency by another 1 percent over the FY 2007 level (for a total of 6 percent) through FY 2008, and 1 percent each subsequent year through FY 2012 to 10 percent, as measured by a three-year moving average of the fuel burned per revenue mile flown, from the three-year average for calendar years 2000-2002.

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
Target	- 1.00%	- 2.00%	-5.00%	-5.00%	-6.00%
Actual	- 3.46%[1]	- 5.84%	-8.23%	-10.82%	

[1] This result was revised in FY 2005, due to improvement in the model used to calculate fuel efficiency. The original result was -4.51%.

Definition of Measure

Unit of Measure: Percentage reduction in grams of fuel burned per kilometers flown.

Computation: Measuring and tracking fuel efficiency from commercial aircraft operations allows FAA to monitor improvements in aircraft/engine technology and operational procedures, as well as enhancements in the airspace transportation system. The FAA measures performance against this target using the Aviation Environmental Design Tool (AEDT)/System for assessing Aviation Global Emissions (SAGE). AEDT/SAGE is a FAA-developed computer model that estimates aircraft fuel burn and emissions for variable year emissions inventories and for operational, policy, and technology-related scenarios. For this target, AEDT/SAGE is used to generate annual fuel burn and total distance flown data for all U.S. commercial operations.

FY 2007 performance was calculated based upon full year operational data for the three calendar year period of 2004, 2005, and 2006, dividing average fuel burn by average total distance to determine the three year efficiency average of (69.91Tg/16.95Bk = 4.12 Tg/Bk). This efficiency average was compared against the baseline efficiency (from 2000, 2001, 2002) of 4.62 Tg/Bk. With the baseline considered to be 100%, the three-year efficiency average for each performance period is compared to determine the percentage improvement of aviation fuel efficiency.

Formula:

$$\frac{\text{Average Fuel Burn (Tg)}}{\text{Average Distance (billions of kilometers)}}$$

(Fuel Burn values in Tg where 1 Tg = 10^{12} g)

Scope of Measure: This measure focuses on all U.S. commercial operations.

Why the FAA Chooses this Measure

Although today's aircraft are up to 70% more efficient than early commercial jet aircraft, there is growing attention being given to aviation's impact on the environment. Aviation is currently viewed as a small contributor to those greenhouse gas emissions that have the potential to influence global climate. However the science involved with these emissions in the upper atmosphere is still evolving and many uncertainties still exist. Carbon dioxide (CO_2) emissions are a primary greenhouse gas and are directly related to the fuel

burned during the aircraft's operation.

Measuring and tracking fuel efficiency from aircraft operations allows FAA to monitor improvements in aircraft/engine technology and operational procedures and enhancements in the airspace transportation system. This information provides an assessment of their influence on reducing aviation's emissions contribution.

Source of the Data

The AEDT/SAGE system uses radar-based data from the Enhanced Traffic Management System (ETMS) and Official Airline Guide (OAG) schedule information to generate annual inventories of fuel burn and total distance flown data for all U.S. commercial operations.

Statistical Issues

Potential seasonal variability and variability from year to year can be expected when analyzing air traffic data and commercial operations. Use of the statistical measure of a three-year moving average based upon analysis of annual operations should address this variability.

The extent to which enhancements are incorporated to improve model accuracy, via more robust aerodynamic performance modeling algorithms and database of aircraft/engine fuel burn information, will impact the overall results and thus the performance target. This could create some statistical variability from year to year if not properly taken into account. In cases where such enhancements have the potential to create a significant shift in baseline, annual inventories may need to be re-processed and/or adjusted to ensure consistency and accuracy of results.

The extent to which aircraft fleet improvements cannot be sufficiently modeled because of a lack of manufacturer proprietary data may also influence the performance target results. In this case, attempts will be made to characterize such aircraft with the best publicly available information, recognizing that newer aircraft types in the fleet will likely exist in significantly lesser numbers, thus minimizing the influence upon the results.

Completeness

Data used to measure performance against the target is assessed for quality control purposes. Input data for the AEDT/SAGE model are validated before proceeding with model runs. Radar data from the ETMS are assessed to remove any anomalies, check for completeness, and pre-processed for input to the AEDT/SAGE model. ETMS data are verified against the OAG information in order to avoid any duplication of flights in the annual inventory.

In some cases ETMS data lack appropriate fields to conduct quality control and in these cases the data is removed. Data from the AEDT/SAGE model is verified by comparing output from previous years and analyzing trends to ensure that they are consistent with expectations. In other cases monthly inventories may be analyzed to validate the results. Model output is subsequently post-processed through excel worksheets to perform the calculations for the performance target. Formulae and calculations are checked in order to ensure accuracy.

Full documentation of this target is determined when the annual inventories have been accomplished and the post-processing calculations have been completed, resulting in a percentage reduction in fuel efficiency relative to the baseline. The standard for this documentation is set by the FAA Office of Environment and Energy, which is separate from the organization (DOT Volpe National Transportation Systems Center) responsible for input and output associated with the AEDT/SAGE model runs and annual inventories.

Reliability

The measuring procedure used for this performance target is highly reliable. That is to say that the processing of data through the AEDT/SAGE model including the performance of algorithms is not subject to random factors that could influence the results. However, this performance target is potentially influenced by factors outside the control of the FAA. For example a major sustained disruption or enhancement in air traffic and/or a significant shift in commercial operations amongst airlines, including changes in fleet composition and missions could have a profound impact upon the performance target.

The FY 2007 performance results illustrate how actual performance can be influenced by factors outside the control of FAA and should not be used as an indicator of future performance. Even though the number of flights increased, the FY 2007 performance above target reflects continued improvement based upon a decrease in fuel burned and an increase in distance traveled during calendar year 2006 relative to calendar

year 2005. This outcome is better than what we anticipated. Our expectation for maintaining a 5 percent improvement during FY 2007 was based upon an equitable distribution of growth in operations across the whole range of flight distances along with the general understanding that there would not be a major influx of new, more fuel efficient aircraft technology into the commercial fleet. In fact, we even anticipated some regression in fleet whereby the increased operations would have been satisfied by airlines using aircraft--some of which would be less fuel efficient--that were previously placed in storage in the aftermath of 9/11. Contrary to our expectations, the FY 2007 result is particularly influenced by a relatively significant growth in the number of flights of aircraft over shorter distances. These are the aircraft that tend to be more efficient on a fuel burned per distance basis.

We do not expect increases in fuel burn and/or decreases in distance traveled to significantly degrade the fuel efficiency of the fleet such that the FY 2008 target would not be met. However, we do expect that in the coming years aircraft/engine technology improvements and/or air traffic management enhancements may not be sufficient to offset traffic growth and congestion/delays. There is also some concern that the present metric for measuring and tracking fuel efficiency may not adequately capture system performance. Thus, we are reviewing the impact of air traffic management enhancements and changes in operational trends to assess whether a revised performance metric should be used for future targets.