

information, we would then be better situated to make decisions on an appropriate level of stringency and implementation timing that maximizes emission reductions from aircraft engines, taking into consideration cost.

In addition, if we address more stringent future standards in accordance with CAEP/6 action, we would have the benefits of harmonizing with international standards.⁹⁶ Due to the international nature of the aviation industry, setting NO_x standards at the appropriate level to meet U.S. air quality needs through international consensus provides the potential for greater environmental benefits. Aircraft and aircraft engines are international commodities, and they are designed and built to meet international standards. Adoption of international standards ensures emission reductions from domestic and foreign aircraft in the U.S. In addition, international consensus standards lead to air quality benefits in the U.S. and throughout the world.

B. Already Certified, Newly Manufactured Engines

Under current rules, the proposed NO_x standards would not apply to already certified, newly manufactured engines (in-production engines or engines built after the effective date of the proposed standards), and the rationale for not applying these standards to already certified low-, mid-, and high-thrust engines is discussed below. Nearly all already certified engines (94 percent of in-production engine models in the ICAO Aircraft Engine Exhaust Emissions Data Bank⁹⁷) currently meet or perform better than the standards we are

proposing to adopt today.⁹⁸ (See Figure IV.B-1 below for a comparison of the NO_x emission levels of current in-production engines to the CAEP/4 NO_x standards.)⁹⁹ At the time the CAEP/4 NO_x standards were adopted in 1998, all but 11 in-production engines and 5 newly designed engine models (these 5 engines were in the design and development process in 1998) had NO_x emission levels that would perform better than the CAEP/4 standards.¹⁰⁰

⁹⁸ 116 out of 124 (94 percent) engine models that are currently in production perform better than the CAEP/4 NO_x standards. The 8 engine models (which are mid- and high-thrust engines) that are not achieving the CAEP/4 NO_x standards are from three different Pratt and Whitney (PW) engine types or families (engines and their thrust variants with the same build standard). These engines are the following: (1) JT8D-217C E-kit and JT8D-219 E-kit; (2) PW4077D, PW4084D, and PW4090; and (3) PW4164, PW4168, and PW4168A. (See Figure IV.B-1 below that specifically shows these 8 in-production models in relation to the CAEP/4 or proposed NO_x standards.) For the year 2000, these 8 engine models were found on approximately 751 out of 20,137 (3.7 percent) aircraft owned by U.S. carriers and accounted for approximately 1,541,172 out of 11,505,063 (13.4 percent) of U.S. domestic flights.

(The above reference for the fleet fraction is BACK Aviation Solutions, http://www.backaviation.com/Information_Services/default.htm.)

The domestic flight information is based on SAGE, the System for Assessing Aviation Emissions. SAGE is an FAA model that estimates aircraft emissions through the full flight profile using non-proprietary input data, such as BACK, FAA's Enhanced Traffic Management System (ETMS), and the Official Airline Guide (OAG). The year 2000 air traffic movements database portion of SAGE was used to estimate the number of flights using the subject engines.)

⁹⁹ For Figure IV.B-1, the Allison, Rolls-Royce, and Textron Lycoming engines with rated pressure ratios less than 20 and NO_x perform better than the standards, since there are different CAEP/4 NO_x standards for these low-thrust engines (see section IV.A.3 for further discussion of NO_x standards for low thrust engines). (16 of the 124 engines, 13 percent of engine models in production, in Figure IV.B-1 and the ICAO Aircraft Engine Exhaust Emissions Data Bank are low-thrust engines—engines with thrust greater than 26.7 kN but not more than 89 kN.)

¹⁰⁰ ICAO, CAEP/4, Working Paper 4, "Economic Assessment of the EPG NO_x Stringency Proposal," March 12, 1998, Presented by the Chairman of Forecasting and Economic Analysis Support Group (FESG), Agenda Item 1: Review of proposals relating to NO_x emissions, including the amendment of Annex 16, Volume II, See Table 3.1

Based on a recent CAEP working group (specifically, the Forecasting and Economic Analysis Support Group—FESG) analysis of applying the CAEP/4 standards to already certified engines (at dates 2, 4, and 6 years after the implementation date for newly certified engines), from those 16 engine models identified in 1998 today there are only 4 already certified engine models or two engine families remaining that would not meet the CAEP/4 standards.¹⁰¹ The other engine models have either, through additional testing or modifications, been improved to meet the standards or the engines are no longer in-production.¹⁰² (There is only one remaining newly designed engine model—out of the five identified in 1998—that may be certified after 2003, and thus, it would need to meet the CAEP/4 or proposed standards for newly certified engines, which are effective beginning in 2004.)¹⁰³

of paper. A copy of this paper can be found in Docket OAR-2002-0030.

¹⁰¹ CAEP Steering Group Meeting, "FESG Economic Assessment of Applying a Production Cut-Off To the CAEP/4 NO_x Standard", Presented by the FESG Co-Rapporteurs, Paris, September 10-13, 2002 (CAEP-SG20022-WP/20, September 12, 2002). The remaining already certified engine models are the JT8D-217C, JT8D-219, PW4084D, and PW4090. A copy of this paper can be found in Docket OAR-2002-0030.

¹⁰² Only the first and second engine types of the three PW types described earlier would not meet the CAEP/4 NO_x standards if they were applied to newly manufactured or already certified engines. The PW4077D is a derated version of the PW4084D, and it is essentially considered the same engine. In addition, the PW4077D has a NO_x level that is 0.2 percent greater than the CAEP/4 standards. FESG rounded this margin to zero and considered the PW4077D to be meeting the NO_x levels of the CAEP/4 standards. The third engine type—PW4164, PW4168 and PW4168A engines—are now certified with the PW 4168 Technologically Affordable Low NO_x (Talon) II engine combustor technology, which performs significantly better than the CAEP/4 standards.

¹⁰³ The PW Canada growth engine is the one remaining newly designed engine model. The ICAO Aircraft Engine Exhaust Emissions Data Bank currently does not have emissions certification data for such an engine, and thus, we anticipate that the PW Canada growth engine would still be affected by the proposed standards. Yet, due to the CAEP/4 standards already established, we expect that PW Canada has already planned modifications for this engine or any other newly certified engines to meet today's proposed standards.

analysis of the costs and emission benefits for the further stringency options.

⁹⁶ As discussed earlier, the U.S. has an obligation to be compatible with the ICAO program if deemed appropriate.

⁹⁷ International Civil Aviation Organization (ICAO), Aircraft Engine Exhaust Emissions Data Bank, July 2002. This data bank is available at <http://www.qinetiq.com/aircraft.html>. In addition, a copy of a table including data of engine NO_x emissions from the ICAO data bank and their margin to the proposed NO_x standards can be found in Docket OAR-2002-0030.