

EDMS *Reference Manual* Supplement

-Model Changes between EDMS 4.11 and EDMS 4.12-

October 22, 2003

Study Conversion

Change	Effect
<p><u>GSE Assigned to Aircraft</u> Previously during the study conversion process from version 4.0x to 4.1x, if duplicate or similar GSE assignments to a specific aircraft were found, all entries of the assigned GSE were deleted. Version 4.12 properly leaves one copy behind for each fuel used, which consolidates the duplicate or similar GSE by summing operating times.</p> <p><u>Taxiways & Roadways</u> Previously, taxiway travel time was not updated during conversion to agree with the speed or length. Similarly, roadway roundtrip distance was not updated to agree with user-specified coordinates for dispersion analyses. Version 4.12, corrects these oversights.</p>	<p>EDMS now retains more GSE assignments when updating a study created in a previous version and allows for GSE of the same type but using different fuels to be assigned to the same aircraft.</p> <p>After converting older studies, users have more consistent taxiway times and roadway roundtrip distances automatically assigned.</p>

Study Setup

Change	Effect
<p><u>Roadway Roundtrip Distance</u> Previously, when switching study type from emissions only to emissions & dispersion, the roadway length would not reflect any previously entered coordinates. Version 4.12, updates roadway roundtrip distances to agree with the coordinates.</p>	<p>After switching between study types, users have more consistent roadway roundtrip distances automatically assigned.</p>

New Study

Change	Effect
<p><u>New Study Name</u> Previously, if a new study name contains a period, the study (.edm) file name is truncated at the period while the name of the directory is not. Version 4.12 does not truncate the file name, keeping the file name and directory name consistent.</p>	<p>Users have greater flexibility in naming their study files. This change does not impact any study results.</p>

Aircraft Operations

Change	Effect
<p><u>In-Study List Keyboard Navigation</u> Previously, pressing keys (other than the arrow or other navigation keys) caused a change in the aircraft selection in the in-study list, but left the rest of the dialog out of sync with the selection. Erroneous error messages could also result from this. Version 4.12, corrects this by allowing all meaningful keys to properly navigate the in-study aircraft.</p>	<p>Users are given more flexibility in the aircraft operations interface and a reduction in erroneous error messages.</p>
<p><u>Operations Tab</u> Previously, when an aircraft from the in-study list is first selected, both the Yearly and the Peak Hour edit boxes become incorrectly enabled. Version 4.12 allows only one of these boxes to be enabled at any time.</p>	<p>The expected aircraft LTO units are no longer ambiguous.</p>
<p><u>GSE Fuel Assignments</u> Previously, GSE of the same type that used different fuels could not be assigned to the same aircraft. Version 4.12, allows this by listing all GSE types and fuel combinations in the checklist for assignment. The fuel column is no longer editable.</p>	<p>Users can assign GSE of the same type that use different fuels to the same aircraft.</p>
<p><u>Default GSE Assignments</u> The impact on emissions from the revised default GSE assignments in version 4.1 were analyzed and compiled.</p>	<p>Users can refer to Attachment A for further details.</p>
<p><u>Engine Emissions</u> Previously, the emissions data displayed on the screen would not update properly after the engine was switched for the selected aircraft. Version 4.12 updates the tab's information following the completion of an engine switch.</p>	<p>Users can view the correct engine emissions data immediately after switching an aircraft's engine. This change does not impact any study results.</p>

GSE Population

Change	Effect
<p><u>NOx and SOx Dispersion</u> Previously, the NOx and SOx emission rates used to model dispersion from a GSE population at a gate where switched. Version 4.12 corrects this oversight.</p>	<p>Users can perform a more accurate NOx or SOx dispersion analysis involving a GSE population.</p>

Parking Lots

Change

Release Height

Previously, the parking lot release height input used for dispersion analyses would not be properly displayed in the parking lot dialog box. However, this had no impact on dispersion results, because only the display was affected. Version 4.12 corrects this problem.

Effect

Users can view the correct height of parking lots within the interface.

AERMOD Input File Generation

Change

Run AERMOD Automatically

In previous versions, users had to run AERMOD as an extra step after generating the input files. In version 4.12, users can check the “Automatically run AERMOD after input file generation” check box to run the input files through AERMOD automatically and immediately after they are generated.

Receptor Elevations and Hill Heights

Previously, too much white space appeared sometimes within the receptor elevations and hill height records, which caused AERMOD to give error messages and not run. Version 4.12 corrects this by eliminating any unnecessary white space.

Hourly Emission File Progress Meter

Previously, subsequent generations of hourly emission (.hre) files caused the progress meter to become partially or completely non-functional, except for the Abort button. Version 4.12 corrects the cause of this problem.

Effect

Users can generate AERMOD input files and run AERMOD in one step.

EDMS properly generates necessary receptor information so that AERMOD can successfully run a dispersion analysis. Users of previous releases of EDMS should re-generate AERMOD input files to take advantage of this change.

Users will always be shown the progress EDMS is making in the generation of the huge hourly emission files.

Airport View

Change

Roadways

Previously, graphically editing a roadway would not properly update the roadway’s length in the corresponding data table. Version 4.12 corrects this problem.

Effect

The roadway lengths in the database are synchronized with the roadway graphics. Users of previous releases of EDMS should check their roadways lengths and re-run their emissions inventories.

Reports

<u>Change</u>	<u>Effect</u>
<p><u>Printing Emissions and All Model Inputs Reports</u> When running versions 4.1 and 4.11 on the Windows NT system, EDMS would crash when attempting to print an emissions report or an all model inputs report. Version 4.12 corrects this.</p>	<p>Users of EDMS on Windows NT system can print reports without premature termination of the application.</p>
<p><u>Print Emissions Report(s)...</u> Previously, for the aircraft emissions report, the aircraft, engine and identification was printed only once for all consecutive aircraft with the same identification. Version 4.12 corrects this by printing the correct label for each aircraft its type, engine and identification.</p>	<p>The emissions of each aircraft are adequately labeled.</p>
<p>Similarly, the total emissions line for each aircraft previously included the emissions of all consecutive aircraft with the same identification. Version 4.12 corrects this by including only the emissions for a particular aircraft in each aircraft's total emissions line.</p>	<p>The total emissions from each aircraft are correctly calculated and listed for every aircraft in the study.</p>

Export Utility

<u>Change</u>	<u>Effect</u>
<p><u>Overwrite Prompt</u> Previously, if the utility was exited via the "x" in the upper right-hand corner, the user could experience a short loop of prompts asking for permission to overwrite an exiting file. In version 4.12, the user is only prompted to overwrite existing files if the "Next" key is pressed.</p>	<p>The user is prompted to overwrite only when necessary.</p>
<p><u>Comment Lines</u> Previously, the commented field header lines that appeared above the records for the user-created tables were wrong because they corresponded to other tables. Version 4.12, corrects this labeling issue.</p>	<p>The users are given the correct field labeling for user-created records in exported files.</p>

Import Utility

<u>Change</u>	<u>Effect</u>
<p><u>User-created Aircraft, GSE and APUs</u> Previously, the import utility would not always load user-created aircraft, GSE, and APUs. Version 4.12 corrects the cause of this problem.</p>	<p>The import utility now reads all user-created aircraft, GSE, and APU records properly.</p>

GSE Aircraft Assignment

Previously, GSE of the same type that used different fuels could not be assigned to the same aircraft, and therefore could not be imported either. Version 4.12, permits this.

Users can import GSE of the same type that use different fuels and are assigned to the same aircraft.

GSE Population Gate Assignments

Previously, only one gate assignment could be imported for each GSE in the population. Version 4.12, corrects this by allowing multiple gate assignments to be imported just as the interface allows.

Users can import multiple gate assignments for each GSE in a study's population.

Electric GSE

Previously, electric powered GSE could not be imported. Version 4.12 allows this.

Users can import electric GSE into either a population or for an assignment to an aircraft.

System Tables

Change

Effect

Fuel Emission Factors

Version 4.12 includes emission factors for the training fire fuel Tekflame, the new firefighter training fuel developed by Exxon. JP-5 jet fuel is included as well.

The user has the ability to model Tekflame and JP-5 fires.

Default Aircraft Engines

Version 4.12 revises the default aircraft engines based on the BACK January 2003 aviation database. Previously, December 2000 data was used.

Users will have more accurate default engines for present day baseline analyses. Please see the attachment B for greater detail.

Aircraft Performance (Flight Profile) Data

Version 4.12, revises the two flight profile data tables (approach.dbf and departrs.dbf) using the most recent and accurate data from the Integrated Noise Model. The revision includes data for a greater variety of aircraft than before, and therefore the profiles are more accurate because they can better reflect specific aircraft. The mapping of aircraft to performance data is revised in the aircombo.dbf data table.

Users have greater accuracy in aircraft performance for both emissions and dispersion modeling. A listing of aircraft with new or revised performance data is provided in Attachment C. EDMS tutorial files (referenced in Appendix B of the EDMS 4.0 Reference Manual) have been revised based on this enhancement and can be found online at <http://www.aee.faa.gov>.

Aircraft Engine Emissions

Version 4.12 includes the following 31 new aircraft engines and their respective emissions data:

- AE3007A1 (Types 1, 2 and 3)
- AE3007A1/1 (Types 1, 2 and 3)
- AE3007A1/3 (Types 1, 2 and 3)
- AE3007A1E
- AE3007A1P (Types 1, 2 and 3)
- AE3007A3 (Types 1, 2 and 3)
- AE3007C (Types 1 and 2)
- AE3007C1 (Types 1 and 2)
- CF34-8C5, -8E2, -8E5 and -8E5A1

Users can model aircraft emissions more accurately.

- CFM56-5B7/P
- GE90-110B and -115B
- PW2043
- TPE331-10, -12 and -14

Aircraft

Version 4.12 includes the following 12 new aircraft:

- B757-300
- B767-400ER
- Bombardier CRJ700
- Bombardier CRJ900 / Canadair Reg-900
- Embraer ERJ 145LR, ERJ 170 and Legacy
- Jetstream 31, 32 and 41
- KC-135B

Users can model aircraft activity more accurately.

EDMS *Reference Manual* Supplement Attachment A

- EDMS 4.1 Default GSE Assignment Revisions -

EDMS 4.1 marks the first phase of migration towards the EPA draft NONROAD model for GSE emissions. This transition includes incorporating EPA-provided fleet average emission indices (in units of grams per brake horsepower-hour) for four fuel types (gasoline, diesel, CNG, and LPG) and study years 1990 to 2020 into the EDMS system tables. Since emission indices are looked up by year, this requires users to provide a study year in EDMS. This is a new input requirement for EDMS that will increase the accuracy of GSE results.

In addition to incorporating new emission factors, EDMS 4.1 updates the default GSE assignments and their fuels used, operating times, brake horsepower (BHP) ratings, and load factors based on EPA's draft NONROAD model where data was available and supplemented by an expert review. The GSE types from NONROAD were split into subtypes for version 4.1 in order to gain a finer level of detail, which resulted in a more accurate characterization of GSE operations. Furthermore, the user is given the opportunity in EDMS 4.1 to edit load factor and brake horsepower values. The previous version of EDMS (4.0) allowed the user to only edit the fuel-type and operating time for GSE. The EDMS default GSE assignments for any version of EDMS is found in the GSE_DEF.DBF system table file.

Previously, some aircraft did not have any default GSE assignments, however all aircraft in version 4.1 have at least one default GSE assigned. There are 399 aircraft types available in the EDMS 4.0 database. Table 1 lists the 19 aircraft that have default GSE assignments in version 4.1, but did not in 4.0. Table 1 also provides the range of emissions that result from the newly added default GSE per landing and takeoff cycle (LTO). A range is given in Table 1, instead of a fixed number, since emissions rates change year to year. In general, the greater value occurs for 1990 and the lesser for 2020, due to EPA's assumptions on more efficient technologies in the future. Interpolation can be used to estimate the impact for any year between 1990 and 2020. In most of these cases, Table 1 shows the impact of including the default assignment of a fuel truck servicing small aircraft, which results in small amounts of emissions. Table 2 lists the percent change in emissions from default GSE assignments for the remaining 380 aircraft in the EDMS database.

These enhancements to the EDMS system tables significantly impact emissions for the default GSE assignments. For some aircraft, the changes appear to be quite excessive (e.g., CO for the Vickers 953 Vanguard). While not all aircraft see such dramatic increases, a majority of them do experience an increase on the order of 100% for some pollutant and study year. Such changes can be attributed to an increase in the default GSE assignments using gasoline fuel as well as the revised emission factors. The reasons for these increases are described below.

The almost 400 aircraft listed in Tables 1 and 2 all have between 1 to 14 GSE assigned to them in version 4.1. In version 4.0, there were over 2,700 default GSE-to-aircraft assignments (about 7 GSE are assigned to each aircraft on average). In version 4.1, there are over 3,000 such assignments. The net gain of 300 assignments in version 4.1 is the result of adding over 1,000 new assignments while simultaneously phasing out over 700 obsolete assignments in order to be more representative of current GSE usage. The exactly 2,000 assignments retained between

versions had their names, most of their default parameters (e.g., operating time, BHP and load factor) and emission factors revised. For example, the *Diesel Lavatory Trucks* assigned to narrow body aircraft (with defaults of 20 minutes/LTO, 172 BHP and a 20% load factor) are renamed *Lavatory Truck, Narrow Body* (with defaults of 15 minutes/LTO, 56 BHP and a 25% load factor). For some assignments, even the fuel was changed. For example, the *Diesel Belt Loaders* in 4.0 are replaced by their gasoline-powered counterparts in 4.1.

To isolate the contributing factors to the changes presented in Tables 1 and 2, Tables 3 and 4 show the changes to the emission factors and default parameters, respectively, for the 2,000 retained assignments. To illustrate the relative significance of some GSE replacements over others, both Tables 3 and 4 list the frequency distribution of each of the replacements in decreasing order.

The top 7 replacements of Table 3 all show a large increase in the emission factors for two or more pollutants. To determine the dominant cause of the change in emissions, Tables 3 and 4 should be compared. In fact, there might even be a decrease in the default parameters (operating time, BHP and load factor) for GSE that are overshadowed by a more significant increase in the emission factors. For example, the hydrocarbon (HC) emission factor for the *Gasoline Baggage Tug* in Table 3 increases 218%. From the second row of Table 4, the operating time, BHP and load factor for the “Baggage Tractor, Narrow Body” change by -12%, 7% and 0%, respectively, resulting in a change of -6% in total work output. Since -6% has little effect on +218%, the HC emission contribution from this baggage tug replacement still increases significantly.

Table 5 lists the frequencies with which obsolete GSE assignments were phased out during the transition from version 4.0 to 4.1, as well as the per LTO emission contribution from a single GSE assignment. Similarly, Table 6 lists the same for default GSE assignments added in version 4.1. Neither table demonstrates any significant net change in emissions from those GSE assignments that were phased out or added. Those GSE that are large contributors to the emissions inventory are ranked quite low. For example, the largest CO emission that was phased out is 18.700 (kg/LTO), but this occurs only for 2 gasoline baggage tugs as shown in Table 5. Likewise, the largest CO emission added to EDMS 4.1 is 25.597 (kg/LTO), which occurs for only 3 narrow body baggage tractors as shown in Table 6. Therefore, the large increases can best be explained by the revision of the emission factors and operating parameters for the GSE presented in Tables 3 and 4.

To determine the impact on emissions for a given study, it is important to look at the GSE changes for each aircraft. As an example, a study includes the default GSE assignments for a single LTO cycle of a Boeing 737-300 modeled for the year 1990. In version 4.0, the following 7 GSE are assigned by default to a 737-300: *Diesel Aircraft Tug Narrow*, *Diesel Belt Loader*, *Diesel Cabin Service*, *Diesel Food Truck*, *Diesel Fuel Truck*, *Diesel Lavatory Truck* and a *Gasoline Baggage Tug* (see Table 7). In version 4.1, there are 11 GSE assigned by default to this aircraft (see Table 8). The fuel truck assignment is phased-out for the Boeing 737-300 (and shaded in Table 7), hence there is a net gain of 5 new assignments. Two of the new additions are an electric *Water Service* and *Air Conditioner Narrow Body*, and therefore do not contribute any emissions. The three other new assignments are a Diesel-powered *Service Truck*, *Air Start 180 PPM* and a *Hydrant Truck Narrow Body*, which is what replaces the function of the phased-out fuel truck. The last five columns of Tables 7 and 8 clearly show the emissions increasing by

showing what each GSE contributes to the inventory (the high values of Table 8 are much greater than those in Table 7). The retained 6 assignments (all for a narrow body aircraft) have significant increases in two or more of their emission factors. Three of these 6 (lavatory truck, baggage tractor and aircraft tractor) have decreases in the total work output (-69%, -6% and -33%, respectively), but none of these decreases are significant enough to overcome increases in the emission indices such as 45% for CO, 218% for HC, 81% for NO_x, 391% for SO_x and 325% for PM. Simply put, the values of table 4 are more often than not smaller in magnitude than those of table 3. This explains the increases in emissions for the Boeing 737-300's, as shown in Table 2.

Table 9 lists the percent change in the emission rates for individual GSE. A range of percent values is shown where emissions rates change from year to year.

**Table 1: Default GSE Emission Ranges
for Aircraft Previously without Any Default GSE Assignment.**

Aircraft Names	CO Range	HC Range	NO_x Range	SO_x Range	PM₁₀ Range
337H Skymaster Aztec Cessna 150 Cessna T337 Cherokee six Commanche Navajo P-337P Skymaster Piper PA-28 Robin DR 400 Robin R 2160 Robin R 3000 Robinson R22 Rockwell Commander Socata Tampico Socata Tobago	0.002 to 0.067 lbs/LTO	0.002 to 0.017 lbs/LTO	0.004 to 0.121 lbs/LTO	0.009 to 0.013 lbs/LTO	0.014 to 0.032 lbs/LTO
A-7 CORSAIR II A-7E CORSAIR H-550A Stallion	0.6 to 2.031 lbs/LTO	0.134 to 0.666 lbs/LTO	1.852 to 7.719 lbs/LTO	0.482 to 0.484 lbs/LTO	0.201 to 0.667 lbs/LTO

Table 2: Percent Changes in Emissions from Default GSE Assigned to Aircraft.

Aircraft Name	CO Range	HC Range	NO_x Range	SO_x Range	PM₁₀ Range
400A Hustler	-100% to -99%	-96% to -79%	-82% to -10%	72% to 85%	29% to 242%
Cessna Citations (except CITATION T-47A)	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
A-10A Thunderbolt II	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
A300's (except -F models)	144% to 150%	210% to 264%	-39% to 66%	241% to 298%	83% to 339%
A300-600F	146% to 153%	216% to 291%	-26% to 97%	306% to 331%	74% to 389%
A300-F4-200	146% to 155%	218% to 307%	-25% to 127%	389% to 445%	142% to 520%
A310, A310-200 & A310-200C	153% to 159%	327% to 401%	18% to 220%	461% to 555%	296% to 851%
A310-200F	155% to 162%	335% to 439%	44% to 281%	570% to 607%	266% to 974%
A310-300	153% to 159%	327% to 401%	18% to 220%	461% to 555%	296% to 851%
A310-304	153% to 159%	325% to 390%	7% to 174%	378% to 473%	277% to 766%
A319, A320's, & A321's	87% to 90%	217% to 250%	-18% to 87%	202% to 257%	106% to 373%
A330's	153% to 160%	328% to 409%	24% to 249%	519% to 613%	311% to 920%
A340's	145% to 151%	211% to 270%	-36% to 81%	276% to 333%	90% to 370%
A-4 SKYHAWK, A-4M SKYHAWK, A-6 INTRUDER, Alpha 70, AN-72, AN-74 & AV-8B Harrier II	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%

Aircraft Name	CO Range	HC Range	NO_x Range	SO_x Range	PM₁₀ Range
AH-1J Cobra	-97% to -90%	-90% to -48%	353% to 1787%	4282% to 4300%	458% to 1753%
ATR's	-4% to -3%	63% to 79%	-55% to -5%	51% to 70%	-13% to 105%
AVRO-RJ100	87% to 89%	215% to 242%	-29% to 46%	131% to 195%	108% to 330%
AVRO-RJ's (except RJ100)	87% to 89%	215% to 238%	-30% to 38%	111% to 168%	86% to 279%
Beech 99's	-38% to -37%	2% to 15%	-71% to -26%	26% to 40%	-32% to 70%
B-1B & B52's	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
B707's (except B707-300C & B707-E)	87% to 90%	217% to 253%	-16% to 97%	222% to 277%	111% to 398%
B707-300C	88% to 91%	220% to 267%	-9% to 126%	281% to 335%	142% to 493%
B707-E	87% to 90%	217% to 253%	-16% to 97%	222% to 277%	111% to 398%
B717-200; B720-00B; B727-100, -100RE, -200, -200RE; B737-100 through -900	87% to 90%	217% to 250%	-18% to 87%	202% to 257%	106% to 373%
B727-100C, B737-200C	87% to 91%	220% to 264%	-12% to 115%	260% to 316%	137% to 468%
B727-100F, -100RF, -200F, -200RF; B737-200F, -300F	88% to 94%	225% to 282%	5% to 156%	328% to 346%	84% to 426%
B747-100, -100B, -100SR, -200, -300, -400, -SP; B767-300ER, B777's	145% to 151%	211% to 270%	-36% to 81%	276% to 333%	90% to 370%
B747-100F, -200F, -400F; B767-300F	147% to 159%	223% to 325%	-9% to 168%	473% to 494%	107% to 513%
B747-200 (MIL)	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
B747-200C	146% to 156%	219% to 313%	-22% to 142%	425% to 480%	149% to 552%
B757-200	87% to 90%	217% to 253%	-16% to 97%	222% to 277%	111% to 398%
B757-200F	88% to 95%	225% to 285%	7% to 166%	348% to 367%	90% to 451%
B767-200 B767-200ER B767-300	145% to 152%	212% to 278%	-30% to 104%	327% to 383%	98% to 410%
BAC-111's (except BAC-111-400F)	87% to 90%	217% to 250%	-18% to 87%	202% to 257%	106% to 373%
BAC-111-400F	88% to 94%	225% to 282%	5% to 156%	328% to 346%	84% to 426%
BAE 125-700	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
Bae ATP	-4% to -1%	65% to 85%	-55% to -4%	51% to 67%	-17% to 92%
Bae Nimrod MRA4	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
BAE146's	87% to 91%	216% to 245%	-29% to 42%	118% to 171%	83% to 275%
Beechjet 400, Beechjet 400A	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
Beechjet 400T	-69.0% to -68.8%	-83.3% to -82.7%	-76% to -67%	-37% to -28%	-81% to -58%
BH-1900's	81% to 82%	253% to 259%	-2% to 22%	17% to 30%	0% to 107%
Bombardier Global Ex	-4.3% to -3.5%	62% to 70%	-63% to -40%	-20% to -3%	-39% to 32%
C-101 AVIOJET, C-12A/B/C, C-130's C-135's, C-141's, C-17A, C-1A TRADER, C-5 Galaxy, C-9's	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
C-21-A	-100% to -99%	-100% to -98%	-87% to -47%	232% to 236%	-76% to -27%
Canadair Regs	-4% to -2%	63% to 77%	-63% to -38%	-16% to 0%	-38% to 33%
Caraja NE-821	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
Caravelles	3937% to 3987%	491% to 537%	-52% to -4%	114% to 168%	11% to 130%
CITATION T-47A	-68.9% to -68.6%	-83% to -82%	-74% to -59%	-11% to -3%	-75% to -36%
CL600's (except CL601-3R)	-3% to 0%	69% to 104%	-37% to 76%	210% to 226%	34% to 237%
CL601-3R	-4% to -1%	67% to 98%	-37% to 75%	211% to 229%	38% to 249%
CN-235-200	-87% to -66%	-94% to -62%	-89% to -51%	52% to 59%	-59% to 7%
CONCORDEs	87% to 89%	215% to 239%	-29% to 41%	119% to 174%	87% to 287%
Convair liner	-91% to -53%	-92% to -53%	-93% to -61%	20% to 34%	-52% to 43%
Dash 7	-4% to -3%	64% to 80%	-55% to -1%	61% to 83%	-2% to 123%
DC10-10, -15, -30, -30ER, -40	145% to 151%	211% to 270%	-36% to 81%	276% to 333%	90% to 370%

Aircraft Name	CO Range	HC Range	NO_x Range	SO_x Range	PM₁₀ Range
DC10-10C, -30C	146% to 156%	219% to 313%	-22% to 142%	425% to 480%	149% to 552%
DC10-10F, -30CF Series, -30F	84% to 95%	149% to 246%	-23% to 142%	427% to 448%	96% to 486%
DC8, -51, -52, -53, -55, -60, -61, -62, -63, -70, -71, -72	87% to 89%	216% to 242%	-26% to 51%	139% to 195%	93% to 312%
DC8-50F, -51F, -52F, -53F, -54F, -55F, -62F, -63F, -71F, -73F	88% to 96%	227% to 296%	9% to 192%	408% to 446%	150% to 613%
DC8-55C, -62C, -63C, -72C, -73C	153% to 158%	324% to 387%	12% to 191%	403% to 497%	265% to 756%
DC8-61F	-100% to -99%	-99% to -95%	-96% to -81%	-61.46%	-90% to -54%
DC9-10, -20, -30, -40, -50, -80	87% to 90%	217% to 250%	-18% to 87%	202% to 257%	106% to 373%
DC9-10C, -30C	87% to 91%	220% to 264%	-12% to 115%	260% to 316%	137% to 468%
DC9-10F, -15F, -30F, -40F	88% to 94%	225% to 282%	5% to 156%	328% to 346%	84% to 426%
DHC-6's	-4% to -3%	64% to 79%	-55% to -3%	56% to 76%	-7% to 110%
DHC-7; DHC-8-100, -200, -300, -400	-4% to -3%	64% to 80%	-55% to -1%	61% to 83%	-2% to 123%
DIAMOND 300	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
DO 328	-4% to -3%	62% to 72%	-63% to -34%	-5% to 17%	-23% to 63%
E-2 HAWKEYE, EA-6B PROWLER, EC-135's	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
EMB-110's, -120	-4% to -3%	63% to 79%	-55% to -5%	51% to 70%	-13% to 105%
Embraer ERJ 145	-4% to -3%	62% to 71%	-63% to -38%	-15% to 4%	-34% to 45%
Equator P-550 Turbo	-6.0% to -5.6%	93% to 97%	-39% to -24%	-24% to -19%	-42% to 24%
F/A-18 HORNET, F-117 Night Hawk, F-14A Tomcat, F-15's, F-16, F-4's, F-5F TIGER II	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
F-27 SERIES	-4% to -3%	62% to 72%	-63% to -34%	-5% to 17%	-23% to 63%
F-28's	87% to 89%	214% to 233%	-31% to 26%	84% to 133%	62% to 205%
Falcons	-100% to -99%	-96% to -79%	-82% to -10%	72% to 85%	29% to 242%
FH-227	-4% to -3%	64% to 80%	-55% to -1%	61% to 83%	-2% to 123%
Fokker 100	87% to 90%	217% to 250%	-18% to 87%	202% to 257%	106% to 373%
Fokker 50	-4% to -3%	62% to 72%	-63% to -34%	-5% to 17%	-23% to 63%
Fokker 50 HI Perf	-4% to -3%	62% to 73%	-62% to -30%	2% to 24%	-21% to 72%
Fokker 60 Utility	-100% to -99%	-99% to -91%	-97% to -75%	-47% to -33%	-55% to 14%
Fokker 70	87% to 90%	217% to 250%	-18% to 87%	202% to 257%	106% to 373%
FT337P	-100% to -99%	-97% to -82%	-85% to -21%	54% to 65%	20% to 207%
Gulfstream I	-5% to -4%	86% to 92%	-43% to -21%	-20% to -6%	-27% to 51%
Gulfstream II	62% to 63%	182% to 190%	-33% to -7%	7% to 25%	-27% to 51%
Gulfstream III	-38% to -37%	2% to 14%	-74% to -37%	11% to 29%	-22% to 76%
Gulfstream IV & V	-4% to -3%	62% to 71%	-63% to -38%	-15% to 4%	-34% to 45%
H-2 SEASPRITE, H-3 SEA KING, H-46 SEA KNIGHT, H-46E SEA KNIGHT, H-53D Sea Stallion	-97% to -91%	-90% to -52%	335% to 1713%	4100% to 4118%	422% to 1628%
H-60 Black Hawk, HH-3E GREEN GIANT, HH-3F	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
HS 125	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
HS 748's	16% to 17%	99% to 112%	-54% to -17%	20% to 49%	0% to 102%
IAI 1124, IAI Westwind	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
IAI-101-A, IAI-201-102, IAI-202	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
Il-62, Il-76	80% to 82%	124% to 144%	-59% to -14%	58% to 78%	-33% to 75%
Il-86	12% to 14%	43% to 63%	-70% to -25%	49% to 69%	-35% to 73%
Il-96-300	-39% to -36%	-24% to 2%	-80% to -29%	60% to 80%	-31% to 78%

Aircraft Name	CO Range	HC Range	NO_x Range	SO_x Range	PM₁₀ Range
II-96M	80% to 82%	123% to 142%	-60% to -19%	46% to 67%	-35% to 64%
Jetstar	-6% to -5%	95% to 109%	-35% to 13%	52% to 78%	56% to 324%
KC-10A, KC-135R	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
King Air 200's	-12.3% to -11.5%	62% to 75%	-48% to 8%	59% to 65%	0% to 149%
L-100's	-90% to -42%	-90% to -43%	-93% to -52%	51% to 73%	-34% to 93%
L-1011-1, -100, -50	145% to 152%	212% to 278%	-30% to 104%	327% to 383%	98% to 410%
L-1011-1F	147% to 160%	225% to 333%	-4% to 192%	524% to 544%	116% to 552%
L-1011-40	144% to 151%	204% to 267%	-34% to 92%	306% to 360%	88% to 383%
L-1011-150, -200, -250, -500's	145% to 151%	211% to 270%	-36% to 81%	276% to 333%	90% to 370%
L-188 A/C	16% to 18%	102% to 126%	-48% to 21%	104% to 151%	61% to 293%
Learjets	-6.1% to -5.6%	93% to 98%	-41% to -25%	-26% to -13%	-20% to 58%
MD-11, MD-11-11	145% to 151%	211% to 270%	-36% to 81%	276% to 333%	90% to 370%
MD-11-11C	146% to 156%	219% to 313%	-22% to 142%	425% to 480%	149% to 552%
MD-11-11F	147% to 159%	223% to 325%	-9% to 168%	473% to 494%	107% to 513%
MD-80's & MD-90's	34% to 37%	120% to 159%	-35% to 88%	244% to 299%	124% to 423%
Mercure-100	87% to 91%	217% to 248%	-19% to 66%	151% to 185%	44% to 262%
MIG-18-50	-99% to -96%	-98% to -89%	-14% to 258%	1972% to 1984%	30% to 342%
MU-300	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
N 22B Nomad 22C, N 24A Nomad 24A, OV-10 BRONCO, PAMPA IA.63, Porter PC6/B2	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
N262	-37% to -36%	3% to 22%	-66% to -4%	77% to 96%	-2% to 136%
PA-42 Cheyenne	-6.0% to -5.6%	93% to 97%	-39% to -24%	-24% to -19%	-42% to 24%
REG'L JET 200's	-4% to -3%	63% to 77%	-61% to -23%	19% to 45%	-9% to 128%
RF-5E TIGEREYE, S-3B Viking	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
RU-21J	-100% to -99%	-100% to -99%	-90% to -54%	192% to 204%	-76% to -35%
SA-227's, SF-340's, Swearingens	-4% to -3%	63% to 78%	-56% to -7%	47% to 64%	-18% to 92%
Sabreliner 75A, SF600 A CANGURO, SN601 Corvette	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
SD330 Sherpa	-37% to -36%	3% to 21%	-66% to -6%	73% to 90%	-6% to 123%
SH-3E Sea King, SH-3F Sea King, SH-60B Seahawk	-97% to -90%	-90% to -48%	353% to 1787%	4282% to 4300%	458% to 1753%
Shorts 360	-4.3% to -3.5%	62% to 70%	-63% to -40%	-20% to -3%	-39% to 32%
T-1A JAYHAWK	-68.9% to -68.6%	-83% to -82%	-74% to -59%	-11% to -3%	-75% to -36%
T-2C Buckeye, T-37 Tweet, T-43A	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
T-47A	-6% to -5%	95% to 108%	-34% to 5%	30% to 43%	18% to 196%
Tu-134	87% to 91%	217% to 248%	-19% to 66%	151% to 185%	44% to 262%
Tu-154	87% to 91%	218% to 251%	-16% to 76%	172% to 205%	50% to 287%
Tu-204	87% to 91%	218% to 258%	-14% to 107%	245% to 305%	129% to 486%
UC-12's, UV-18A, VC-25A, VC-9C	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
VFW 614 YS-11	-4% to -3%	62% to 71%	-63% to -38%	-15% to 4%	-34% to 45%
Vickers 953 Vanguard	3937% to 3971%	489% to 519%	-51% to -19%	57% to 86%	-35% to 52%
Westwind 1 & 2	-100% to -99%	-96% to -79%	-82% to -10%	72% to 85%	29% to 242%
YAK-42	-4% to -3%	64% to 81%	-61% to -11%	47% to 83%	23% to 182%

Table 3: Percent Change in Emission Factors of Replaced GSE.

Default GSE and AGE Assigned in 4.0	Replacement GSE in 4.1 D = Diesel G = Gasoline E = Electric	Replacement Frequency (out of 2,000)	1990					2020					
			CO	HC	NOx	SOx	PM	CO	HC	NOx	SOx	PM	
Diesel Aircraft Tug Narrow	Aircraft Tractor, Commuter/Reg Aircraft Tractor, Narrow Body Aircraft Tractor, Mid-Range	D	271	23%	-9%	9%	227%	158%	-69%	-83%	-75%	229%	-42%
Diesel Aircraft Tug Wide	Aircraft Tractor, Wide Body												
Gasoline Baggage Tug	Baggage Tractor, Commuter Baggage Tractor, Narrow Body Baggage Tractor, Wide Body	G	243	45%	218%	81%	-33%	*	45%	218%	81%	-33%	*
Diesel Belt Loader	Belt Loader, Commuter Belt Loader, Narrow Body Belt Loader, Wide Body	G	227	5927%	903%	-34%	-39%	-90%	5927%	903%	-34%	-39%	-90%
Diesel Lavatory Truck	Lavatory Truck, Narrow Body Lavatory Truck, Wide Body	D	215	-32%	-14%	14%	391%	325%	-97%	-89%	-94%	264%	65%
Diesel Food Truck	Catering Truck, Commuter/Reg Catering Truck, Narrow Body Catering Truck, Wide Body	D	199	-48%	-28%	7%	391%	201%	-98%	-90%	-97%	253%	77%
Diesel Cabin Service	Cabin Service Truck, Comm/Reg Cabin Service Truck, Narrow Cabin Service Truck, Wide Body	D	167	-48%	-28%	7%	391%	201%	-98%	-90%	-97%	253%	77%
Diesel Fuel Truck	Fuel Truck, Large, 8,000+ gal Fuel Truck, MidSize, 3-6,000 g Fuel Truck, Small, < 3,000 gal	D	113	4%	-12%	-31%	223%	294%	-96%	-89%	-98%	135%	72%
(Gasoline) H1 Heater	Other	D	78	-100%	-99%	-51%	-3%	-40%	-100%	-100%	-89%	-2%	-81%
(Gasoline) NF-2 Light Cart	Cart	D	77	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%
(Gasoline) MJ1 Bomblift	Lift	D	69	-95%	-96%	213%	1480%	671%	-99%	-99%	-25%	1496%	131%
(Diesel) 590G20P Generator	Generator	D	66	62%	22%	41%	1247%	65%	-52%	-75%	-66%	1254%	-50%
Diesel Airstart Unit	Air Start, 180 PPM Air Start, 300 PPM	D	64	-19%	-10%	18%	223%	118%	-76%	-85%	-72%	225%	-53%
Diesel Container Loader	Cargo Loader, Narrow Body Cargo Loader, Wide, Lower Lobe	D	62	28%	83%	102%	476%	304%	-63%	-65%	-54%	482%	33%
Diesel Water Truck	Water Service	E	50	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%
Gasoline Ground Power Unit	Ground Power Unit, 28VDC	G	43	0%	145%	81%	-32%	*	-0.1%	145%	81%	-32%	*
Diesel Lavatory Truck	Lavatory Truck, Narrow Body	G	14	628%	296%	-24%	38%	-87%	10%	-13%	-97%	81%	-88%
Diesel Belt Loader	Belt Loader, Commuter Belt Loader, Narrow Body	D	14	-12%	12%	4%	210%	58%	-36%	-81%	-70%	212%	-34%
Diesel Water Truck	Water Service	G	9	782%	369%	-18%	23%	-86%	11%	29%	-92%	81%	-88%
Gasoline Ground Power Unit	Ground Power Unit, 28VDC	D	9	-99%	-75%	196%	211%		-100%	-95%	-31%	213%	*
Diesel Transporter	Cart	D	5	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%
Diesel Water Truck	Water Service	D	5	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%

* Previously the GSE in version 4.0 had no PM emissions, but its corresponding replacement in 4.1 does; hence the percent change is undefined.

Table 4: Changes in Default Parameter Values of Replaced GSE.

Default GSE and AGE Assigned in 4.0	Replacement GSE in 4.1 D = Diesel G = Gasoline E = Electric	Replacement Frequency (out of 2,000)	Default Values in 4.0			Default Values in 4.1			Percent Change				
			Operating Time per LTO (mins)	BHP	Load Factor	Operating Time per LTO (mins)	BHP	Load Factor	Operating Time per LTO	BHP	Load Factor	Total Work Output	
Diesel Lavatory Truck	Lavatory Truck, Narrow Body	D	131	20	172	0.2	15	56	0.25	-25%	-67%	25%	-69%
Gasoline Baggage Tug	Baggage Tractor, Narrow Body	G	115	85	100	0.55	75	107	0.55	-12%	7%	0%	-6%
Diesel Belt Loader	Belt Loader, Narrow Body	G	109	48	45	0.5	48	107	0.5	0%	138%	0%	138%
Diesel Fuel Truck	Fuel Truck, MidSize, 3-6,000 g	D	107	35	180	0.25	20	175	0.25	-43%	-3%	0%	-44%
Diesel Aircraft Tug Narrow	Aircraft Tractor, Commuter/Reg	D	103	6	175	0.8	5	86	0.8	-17%	-51%	0%	-59%
Diesel Food Truck	Catering Truck, Narrow Body	D	95	35	184	0.25	15	210	0.53	-57%	14%	112%	4%
Diesel Lavatory Truck	Lavatory Truck, Wide Body	D	84	20	172	0.2	25	235	0.25	25%	37%	25%	113%
Diesel Cabin Service	Cabin Service Truck, Narrow	D	83	15	172	0.2	20	210	0.53	33%	22%	165%	331%
(Gasoline) H1 Heater	Other	D	78	105	2.5	0.95	0	140	0.5	-100%	5500%	-47%	-100%
(Gasoline) NF-2 Light Cart	Cart	D	77	105	10.3	0.20	10	25	0.5	-90%	143%	150%	-42%
Diesel Aircraft Tug Narrow	Aircraft Tractor, Narrow Body	D	76	6	175	0.8	8	88	0.8	33%	-50%	0%	-33%
Diesel Belt Loader	Belt Loader, Wide Body	G	70	48	45	0.5	35	107	0.5	-27%	138%	0%	73%
Gasoline Baggage Tug	Baggage Tractor, Wide Body	G	70	85	100	0.55	120	107	0.55	41%	7%	0%	51%
(Gasoline) MJ1 Bomblift	Lift	D	69	95	30	0.59	10	115	0.5	-89%	283%	-15%	-66%
(Diesel) 590G20P Generator	Generator	D	66	20	148	0.86	120	158	0.82	500%	7%	-5%	511%
Diesel Food Truck	Catering Truck, Wide Body	D	63	35	184	0.25	20	210	0.53	-43%	14%	112%	38%
Diesel Cabin Service	Cabin Service Truck, Wide Body	D	62	15	172	0.2	35	210	0.53	133%	22%	165%	655%
Diesel Container Loader	Cargo Loader, Wide, Lower Lobe	D	59	92	172	0.2	80	80	0.5	-13%	-53%	150%	1%
Gasoline Baggage Tug	Baggage Tractor, Commuter	G	58	85	100	0.55	35	107	0.55	-59%	7%	0%	-56%
Diesel Airstart Unit	Air Start, 180 PPM	D	56	3	600	0.9	7	425	0.9	133%	-29%	0%	65%
Diesel Water Truck	Water Service	E	50	12	172	0.2	12	0	0.2	0%	-100%	0%	-100%
Diesel Belt Loader	Belt Loader, Commuter	G	48	48	45	0.5	30	107	0.5	-38%	138%	0%	49%
Diesel Aircraft Tug Narrow	Aircraft Tractor, Mid-Range	D	47	6	175	0.8	8	190	0.8	33%	9%	0%	45%
Diesel Aircraft Tug Wide	Aircraft Tractor, Wide Body	D	45	8	175	0.8	8	475	0.8	0%	171%	0%	171%
Gasoline Ground Power Unit	Ground Power Unit, 28VDC	G	43	30	150	0.75	40	107	0.75	33%	-29%	0%	-5%
Diesel Food Truck	Catering Truck, Commuter/Reg	D	41	35	184	0.25	10	71	0.53	-71%	-61%	112%	-77%
Diesel Cabin Service	Cabin Service Truck, Comm/Reg	D	22	15	172	0.2	10	71	0.53	-33%	-59%	165%	-27%
Diesel Lavatory Truck	Lavatory Truck, Narrow Body	G	14	20	172	0.2	15	97	0.25	-25%	-44%	25%	-47%
Diesel Belt Loader	Belt Loader, Narrow Body	D	11	48	45	0.5	48	71	0.5	0%	58%	0%	58%
Diesel Water Truck	Water Service	G	9	12	172	0.2	12	260	0.2	0%	51%	0%	51%
Gasoline Ground Power Unit	Ground Power Unit, 28VDC	D	9	30	150	0.75	40	71	0.75	33%	-53%	0%	-37%
Diesel Airstart Unit	Air Start, 300 PPM	D	8	3	600	0.9	7	850	0.9	133%	42%	0%	231%
Diesel Transporter	Cart	D	5	10	172	0.2	10	25	0.5	0%	-85%	150%	-64%
Diesel Water Truck	Water Service	D	5	12	172	0.2	12	235	0.2	0%	37%	0%	37%
Diesel Fuel Truck	Fuel Truck, Small, < 3,000 gal	D	4	35	180	0.25	10	175	0.25	-71%	-3%	0%	-72%
Diesel Belt Loader	Belt Loader, Commuter	D	3	48	45	0.5	30	71	0.5	-38%	58%	0%	-1%
Diesel Container Loader	Cargo Loader, Narrow Body	D	3	92	172	0.2	40	80	0.5	-57%	-53%	150%	-49%
Diesel Fuel Truck	Fuel Truck, Large, 8,000+ gal	D	2	35	180	0.25	45	300	0.25	29%	67%	0%	114%

Table 5: Removed Default GSE Assignments.

Frequency of Removal (out of 738)	GSE Type Removed	Emission Factors (grams/BHP-hour)					BHP	Load Factor	Operating Time per LTO (mins)	Emission Contribution per LTO (Kilograms)				
		CO	HC	NOx	SOx	PM				CO	HC	NOx	SOx	PM
190	Diesel Fuel Truck	4	1.2	11	0.25	0.5	180	0.25	35	0.105	0.032	0.289	0.006	0.013
78	Diesel Cabin Service	6.431	1.28	6.727	0.1647	0.498	172	0.20	15	0.055	0.011	0.058	0.002	0.004
71	(Gasoline) 9MC2A Compressor	1203.62	75.81	23.94	0.66	1.99	10.3	0.15	36	1.086	0.068	0.022	0.001	0.002
71	(Gasoline) M32T1 Pressure Tester	176	6.94	4.57	0.02	0.29	175	0.50	6	1.540	0.061	0.040	0.000	0.003
71	(Gasoline) TTU228E Hydraulic Test Stand	176	6.87	4.57	0.02	0.29	175	0.75	28	10.780	0.421	0.280	0.001	0.018
64	Diesel Airstart Transporter	6.431	1.28	6.727	0.1647	0.498	128	0.25	3	0.010	0.002	0.011	0.000	0.001
59	Diesel Transporter	6.431	1.28	6.727	0.1647	0.498	172	0.20	10	0.037	0.007	0.039	0.001	0.003
46	Diesel Food Truck	6.431	1.28	6.727	0.1647	0.498	184	0.25	35	0.172	0.034	0.180	0.005	0.013
26	Diesel Aircraft Tug Wide	4	1.2	11	0.25	0.5	500	0.80	8	0.213	0.064	0.587	0.013	0.027
16	Diesel Lavatory Truck	6.431	1.28	6.727	0.1647	0.498	172	0.20	20	0.074	0.015	0.077	0.002	0.006
12	Diesel Aircraft Tug Narrow	4	1.2	11	0.25	0.5	175	0.80	6	0.056	0.017	0.154	0.004	0.007
9	Diesel Container Loader	6.431	1.28	6.727	0.1647	0.498	172	0.20	92	0.339	0.067	0.354	0.009	0.026
7	Diesel Cargo Loader	4	1.2	11	0.25	0.5	76	0.50	92	0.233	0.071	0.641	0.015	0.029
5	(Diesel) 590G20P Generator	2	0.88	9.19	0.06	0.66	148	0.86	20	0.085	0.037	0.390	0.003	0.028
4	Diesel Belt Loader	4	1	11	0.29	0.7	45	0.50	48	0.072	0.018	0.198	0.006	0.013
3	(Gasoline) NF-2 Light Cart	1197.09	75.24	23.79	0.36	2.14	10.3	0.20	105	4.316	0.271	0.086	0.001	0.008
2	Gasoline Baggage Tug	240	4	4	0.26	0	100	0.55	85	18.700	0.312	0.312	0.020	0.000
2	(Gasoline) H1 Heater	1204.21	75.37	24	0.84	2.11	2.5	0.95	105	5.005	0.313	0.100	0.004	0.009
2	(Gasoline) MJ1 Bomblift	176.27	61.02	4.58	0.06	0.28	30	0.59	95	4.940	1.710	0.128	0.002	0.008

Table 6: Added Default GSE Assignments.

Frequency of Addition (out of 1,012)	GSE Type Added D = Diesel G = Gasoline E = Electric		1990 Emission Factors (grams/BHP-hour)					BHP	Load Factor	Operating Time per LTO (mins)	1990 Emission Contribution per LTO (Kilograms)				
			CO	HC	NOx	SOx	PM				CO	HC	NOx	SOx	PM
246	Service Truck	D	4.262	1.074	7.603	0.808	2.032	235	0.2	15	0.050	0.013	0.089	0.009	0.024
104	Hydrant Truck, Narrow Body	D	4.481	1.112	7.710	0.808	2.157	235	0.7	12	0.147	0.037	0.254	0.027	0.071
99	Water Service	E	0.000	0.000	0.000	0.000	0.000	0	0.2	12	0.000	0.000	0.000	0.000	0.000
93	Air Start, 180 PPM	D	3.247	1.075	12.982	0.808	1.088	425	0.9	7	0.145	0.048	0.579	0.036	0.049
86	Hydrant Truck, Wide Body	D	4.481	1.112	7.710	0.808	2.157	235	0.7	20	0.246	0.061	0.423	0.044	0.118
85	Air Conditioner, Narrow Body	E	0.000	1.112	0.000	0.000	0.000	0	0.75	30	0.000	0.000	0.000	0.000	0.000
63	Air Conditioner, Wide Body	E	0.000	0.000	0.000	0.000	0.000	0	0.75	30	0.000	0.000	0.000	0.000	0.000
32	Cargo Loader, Narrow Body	D	8.257	2.346	13.605	0.948	2.012	80	0.5	40	0.220	0.063	0.363	0.025	0.054
32	Ground Power Unit, 28VDC	D	3.185	0.984	11.850	0.809	0.955	71	0.75	40	0.113	0.035	0.421	0.029	0.034
25	Air Conditioner, Narrow Body	D	3.172	0.969	11.663	0.809	0.929	210	0.75	30	0.250	0.076	0.918	0.064	0.073
22	Water Service	G	56.749	5.998	5.513	0.203	0.068	260	0.2	12	0.590	0.062	0.057	0.002	0.001
17	Fuel Truck, Small, < 3,000 gal	D	4.151	1.056	7.550	0.808	1.968	175	0.25	10	0.030	0.008	0.055	0.006	0.014
16	Cargo Loader, Wide, Main Deck	D	8.257	2.346	13.605	0.948	2.012	133	0.5	100	0.915	0.260	1.508	0.105	0.223
16	Aircraft Tractor, Mid-Range	D	4.940	1.091	11.944	0.817	1.289	190	0.8	8	0.100	0.022	0.242	0.017	0.026
12	Generator	D	3.247	1.075	12.982	0.808	1.088	158	0.82	120	0.841	0.278	3.364	0.209	0.282
9	Cargo Loader, Wide, Lower Lobe	D	8.257	2.346	13.605	0.948	2.012	80	0.5	80	0.440	0.125	0.726	0.051	0.107
8	Lift	D	8.347	2.466	14.326	0.948	2.160	115	0.5	10	0.080	0.024	0.137	0.009	0.021
6	Air Conditioner, Wide Body	D	3.172	0.969	11.663	0.809	0.929	300	0.75	30	0.357	0.109	1.312	0.091	0.105
5	Aircraft Tractor, Narrow Body	D	4.940	1.091	11.944	0.817	1.289	88	0.8	8	0.046	0.010	0.112	0.008	0.012
4	Baggage Tractor, Commuter	G	347.958	12.707	7.240	0.174	0.068	107	0.55	35	11.945	0.436	0.249	0.006	0.002
4	Other	D	4.919	1.072	11.735	0.817	1.256	140	0.5	0	0.000	0.000	0.000	0.000	0.000
4	Ground Power Unit, 400 Hz	D	3.185	0.984	11.850	0.809	0.955	194	0.75	50	0.386	0.119	1.437	0.098	0.116
3	Baggage Tractor, Narrow Body	G	347.958	12.707	7.240	0.174	0.068	107	0.55	75	25.597	0.935	0.533	0.013	0.005
3	Belt Loader, Narrow Body	G	241.064	10.025	7.243	0.176	0.068	107	0.5	48	10.318	0.429	0.310	0.008	0.003
3	Aircraft Tractor, Wide Body	D	4.940	1.091	11.944	0.817	1.289	475	0.8	8	0.250	0.055	0.605	0.041	0.065
3	Cart	D	0.000	0.000	0.000	0.000	0.000	25	0.5	10	0.000	0.000	0.000	0.000	0.000
3	Fork Lift	D	8.347	2.466	14.327	0.948	2.160	55	0.3	0	0.000	0.000	0.000	0.000	0.000
2	Catering Truck, Narrow Body	D	3.367	0.926	7.180	0.809	1.501	210	0.53	15	0.094	0.026	0.200	0.023	0.042
2	Lavatory Truck, Narrow Body	D	4.404	1.098	7.672	0.808	2.114	56	0.25	15	0.015	0.004	0.027	0.003	0.007
2	Cabin Service Truck, Narrow	D	3.367	0.926	7.180	0.809	1.501	210	0.53	20	0.125	0.034	0.266	0.030	0.056
1	Ground Power Unit, 28VDC	G	239.851	9.812	7.240	0.176	0.068	107	0.75	40	12.832	0.525	0.387	0.009	0.004
1	Aircraft Tractor, Commuter/Reg	D	4.940	1.091	11.944	0.817	1.289	86	0.8	5	0.028	0.006	0.068	0.005	0.007
1	Belt Loader, Narrow Body	D	3.506	1.120	11.463	0.899	1.108	71	0.5	48	0.100	0.032	0.326	0.026	0.031

Table 7: Default GSE Assignments for B737-300 in EDMS 4.0.

Shaded Cells Indicate GSE Phased-Out in EDMS 4.1.

GSE Types Assigned	Emission Factors (grams/BHP-hour)					BHP	Load Factor	Operating Time per LTO (mins)	Emission Contribution per LTO (Kilograms)				
	CO	HC	NOx	SOx	PM				CO	HC	NOx	SOx	PM
Diesel Aircraft Tug Narrow	4	1.2	11	0.25	0.5	175	0.80	6	0.056	0.017	0.154	0.004	0.007
Diesel Belt Loader	4	1	11	0.29	0.7	45	0.50	48	0.072	0.018	0.198	0.006	0.013
Diesel Cabin Service	6.431	1.28	6.727	0.1647	0.498	172	0.20	15	0.055	0.011	0.058	0.002	0.004
Diesel Food Truck	6.431	1.28	6.727	0.1647	0.498	184	0.25	35	0.172	0.034	0.180	0.005	0.013
Diesel Fuel Truck	4	1.2	11	0.25	0.5	180	0.25	35	0.105	0.032	0.289	0.006	0.013
Diesel Lavatory Truck	6.431	1.28	6.727	0.1647	0.498	172	0.20	20	0.074	0.015	0.077	0.002	0.006
Gasoline Baggage Tug	240	4	4	0.26	0	100	0.55	85	18.700	0.312	0.312	0.020	0.000
TOTAL									19.234	0.439	1.268	0.045	0.056

Table 8: Default GSE Assignments for B737-300 in EDMS 4.1.

Shaded Cells Indicate New Default GSE in EDMS 4.1.

GSE Types Assigned D = Diesel G = Gasoline E = Electric	1990 Emission Factors (grams/BHP-hour)					BHP	Load Factor	Operating Time per LTO (mins)	1990 Emission Contribution per LTO (Kilograms)					
	CO	HC	NOx	SOx	PM				CO	HC	NOx	SOx	PM	
Air Conditioner, Narrow Body	E	0.000	1.112	0.000	0.000	0	0.75	30	0.000	0.000	0.000	0.000	0.000	
Air Start, 180 PPM	D	3.247	1.075	12.982	0.808	1.088	425	0.9	7	0.145	0.048	0.579	0.036	0.049
Aircraft Tractor, Narrow Body	D	4.940	1.091	11.944	0.817	1.289	88	0.8	8	0.046	0.010	0.112	0.008	0.012
Baggage Tractor, Narrow Body	G	347.958	12.707	7.240	0.174	0.068	107	0.55	75	25.597	0.935	0.533	0.013	0.005
Belt Loader, Narrow Body	G	241.064	10.025	7.243	0.176	0.068	107	0.5	48	10.318	0.429	0.310	0.008	0.003
Cabin Service Truck, Narrow	D	3.367	0.926	7.180	0.809	1.501	210	0.53	20	0.125	0.034	0.266	0.030	0.056
Catering Truck, Narrow Body	D	3.367	0.926	7.180	0.809	1.501	210	0.53	15	0.094	0.026	0.200	0.023	0.042
Hydrant Truck, Narrow Body	D	4.481	1.112	7.710	0.808	2.157	235	0.7	12	0.147	0.037	0.254	0.027	0.071
Lavatory Truck, Narrow Body	D	4.404	1.098	7.672	0.808	2.114	56	0.25	15	0.015	0.004	0.027	0.003	0.007
Service Truck	D	4.262	1.074	7.603	0.808	2.032	235	0.2	15	0.050	0.013	0.089	0.009	0.024
Water Service	E	0.000	0.000	0.000	0.000	0	0.2	12	0.000	0.000	0.000	0.000	0.000	
TOTAL									36.537	1.536	2.37	0.157	0.269	

Table 9: Percent Change in GSE Emission Rates (i.e., kilograms/hour).

GSE Name in 4.0	Replacement GSE in 4.1	Fuel	CO	HC	NO _x	SO _x	PM ₁₀
1H1 Heater	Other	D	56% to 438%	-50% to 168%	-36% to 182%	717% to 722%	25% to 319%
1MC1A Compressor	Other	D	11% to 283%	-71% to 56%	99% to 774%	1330% to 1338%	1217% to 4296%
590G20P Generator	Generator	D	-51% to 65%	-75% to 24%	-66% to 44%	1209% to 1216%	-50% to 68%
6AN32A60A Generator	Generator	D	-92% to -73%	116% to 971%	33% to 455%	45%	2% to 244%
9MC2A Compressor	Other	D	-94% to -81%	-88% to -34%	419% to 2182%	5621% to 5651%	778% to 2831%
DH-600 Compressor	Other	D	-81% to -35%	-94% to -68%	-92% to -66%	101% to 102%	-85% to -49%
Diesel Air Conditioning Unit	Air Conditioner, Narrow Body	D	-84% to -44%	-89% to -43%	-82% to -26%	128% to 129%	-59% to 30%
	Air Conditioner, Wide Body	D	-77% to -21%	-84% to -19%	-75% to 6%	225% to 227%	-42% to 85%
Diesel Aircraft Tug Narrow	Aircraft Tractor, Commuter/Reg	D	-85% to -39%	-92% to -55%	-88% to -47%	61%	-72% to 27%
	Aircraft Tractor, Mid-Range	D	-67% to 34%	-82% to -1%	-73% to 18%	255% to 257%	-37% to 180%
	Aircraft Tractor, Narrow Body	D	-85% to -38%	-92% to -54%	-88% to -45%	64%	-71% to 30%
	Aircraft Tug Towbarless Narrow	D	-85% to -38%	-92% to -54%	-88% to -45%	64%	-71% to 30%
Diesel Aircraft Tug Wide	Aircraft Tractor, Wide Body	D	-71% to 17%	-84% to -14%	-77% to 3%	211% to 212%	-45% to 145%
	Aircraft Tug Towbarless Wide	D	-62% to 52%	-79% to 12%	-70% to 34%	303% to 306%	-29% to 218%
Diesel Airstart Transporter	Cart	D	-100%	-100%	-100%	-100%	-100%
Diesel Airstart Unit	Air Start, 180 PPM	D	-83% to -43%	-89% to -37%	-80% to -16%	129% to 130%	-67% to 54%
	Air Start, 300 PPM	D	-67% to 15%	-78% to 27%	-61% to 67%	358% to 361%	-34% to 208%
Diesel Baggage Tug	Baggage Tractor, Commuter	D	-13% to 33%	-85% to -13%	-74% to -13%	222% to 224%	-8% to 139%
	Baggage Tractor, Narrow Body	D	-13% to 33%	-85% to -13%	-74% to -13%	222% to 224%	-8% to 139%
	Baggage Tractor, Wide Body	D	-13% to 33%	-85% to -13%	-74% to -13%	222% to 224%	-8% to 139%
Diesel Belt Loader	Belt Loader, Commuter	D	0% to 50%	-71% to 73%	-52% to 64%	356% to 358%	-3% to 146%
	Belt Loader, Narrow Body	D	0% to 50%	-71% to 73%	-52% to 64%	356% to 358%	-3% to 146%
	Belt Loader, Wide Body	D	0% to 50%	-71% to 73%	-52% to 64%	356% to 358%	-3% to 146%
Diesel Cabin Service	Cabin Service Truck, Comm/Reg	D	-98% to -35%	-87% to -11%	-97% to 31%	311% to 474%	-72% to 274%
	Cabin Service Truck, Narrow	D	-93% to 70%	-67% to 134%	-91% to 244%	980% to 1406%	-26% to 883%
	Cabin Service Truck, Wide Body	D	-93% to 70%	-67% to 134%	-91% to 244%	980% to 1406%	-26% to 883%
Diesel Cargo Loader	Cargo Loader, Narrow Body	D	-37% to 117%	-61% to 104%	-70% to 30%	279% to 283%	28% to 324%
	Cargo Loader, Wide, Lower Lobe	D	-37% to 117%	-61% to 104%	-70% to 30%	279% to 283%	28% to 324%
	Cargo Loader, Wide, Main Deck	D	5% to 261%	-36% to 239%	-51% to 116%	531% to 537%	113% to 604%
Diesel Container Loader	Cargo Loader, Narrow Body	D	-57% to 49%	-60% to 113%	-46% to 136%	532% to 539%	43% to 373%
	Cargo Loader, Wide, Lower Lobe	D	-57% to 49%	-60% to 113%	-46% to 136%	532% to 539%	43% to 373%
	Cargo Loader, Wide, Main Deck	D	-28% to 148%	-33% to 255%	-11% to 292%	951% to 962%	138% to 687%
Diesel Deicer	Deicer, Dual Engine	D	-100%	-100%	-100%	-100%	-100%
	Deicer, Single Engine	D	-100%	-100%	-100%	-100%	-100%
Diesel Food Truck	Catering Truck, Commuter/Reg	D	-98% to -52%	-91% to -33%	-98% to -1%	208% to 330%	-79% to 177%
	Catering Truck, Narrow Body	D	-95% to 27%	-75% to 75%	-93% to 159%	710% to 1030%	-45% to 626%
	Catering Truck, Wide Body	D	-95% to 27%	-75% to 75%	-93% to 159%	710% to 1030%	-45% to 626%
Diesel Forklift	Fork Lift	D	-35% to 122%	-56% to 114%	-67% to 37%	291% to 295%	31% to 346%
Diesel Fuel Truck	Fuel Truck, Ground Equipment	D	-95% to 35%	-85% to 15%	-97% to -10%	214% to 334%	-68% to 403%

GSE Name in 4.0	Replacement GSE in 4.1	Fuel	CO	HC	NO _x	SO _x	PM ₁₀
	Fuel Truck, Large, 8,000+ gal	D	-94% to 73%	-81% to 47%	-96% to 14%	301% to 454%	-59% to 542%
	Fuel Truck, MidSize, 3-6,000 g	D	-96% to 1%	-89% to -14%	-98% to -33%	134% to 223%	-76% to 274%
	Fuel Truck, Small, < 3,000 gal	D	-96% to 1%	-89% to -14%	-98% to -33%	134% to 223%	-76% to 274%
Diesel GPU Transporter	Cart	D	-100%	-100%	-100%	-100%	-100%
Diesel Ground Power Unit	Ground Power Unit, 28VDC	D	-89% to -61%	-92% to -60%	-88% to -47%	60%	-71% to -6%
	Ground Power Unit, 400 Hz	D	-69% to 7%	-79% to 9%	-66% to 44%	336% to 338%	-20% to 157%
Diesel Lavatory Truck	Lavatory Truck, Narrow Body	D	-99% to -72%	-95% to -65%	-97% to -54%	40% to 89%	-83% to 74%
	Lavatory Truck, Wide Body	D	-95% to 17%	-80% to 47%	-89% to 94%	487% to 695%	-29% to 631%
Diesel Service Truck	Service Truck	D	-94% to 47%	-84% to 23%	-96% to -4%	209% to 324%	-59% to 462%
Diesel Transporter	Cart	D	-100%	-100%	-100%	-100%	-100%
Diesel Water Truck	Water Service	D	-100%	-100%	-100%	-100%	-100%
Gasoline Aircraft Tug Narrow	Aircraft Tractor, Commuter/Reg	G	38%	205%	73%	-36%	*
	Aircraft Tractor, Narrow Body	G	38%	205%	73%	-36%	*
Gasoline Aircraft Tug Wide	Aircraft Tractor, Commuter/Reg	G	-64%	-21%	-55%	-83%	*
	Aircraft Tractor, Narrow Body	G	-64%	-21%	-55%	-83%	*
Gasoline Airstart Transporter	Cart	G	211%	-26%	13%	118%	-72%
Gasoline Baggage Tug	Baggage Tractor, Commuter	G	55%	240%	94%	-27%	*
	Baggage Tractor, Narrow Body	G	55%	240%	94%	-27%	*
	Baggage Tractor, Wide Body	G	55%	240%	94%	-27%	*
Gasoline Belt Loader	Belt Loader, Commuter	G	79%	347%	223%	17%	*
	Belt Loader, Narrow Body	G	79%	347%	223%	17%	*
	Belt Loader, Wide Body	G	79%	347%	223%	17%	*
Gasoline Cabin Service	Cabin Service Truck, Comm/Reg	G	-73% to 96%	-83% to -11%	-83% to 251%	1120% to 1591%	13% to 27%
	Cabin Service Truck, Narrow	G	-35% to 377%	-58% to 115%	-59% to 753%	2864% to 4009%	176% to 209%
	Cabin Service Truck, Wide Body	G	-35% to 377%	-58% to 115%	-59% to 753%	2864% to 4009%	176% to 209%
Gasoline Cargo Loader	Cargo Loader, Narrow Body	G	123%	395%	177%	4%	*
	Cargo Loader, Wide, Lower Lobe	G	123%	395%	177%	4%	*
Gasoline Cart	Cart	G	101%	288%	654%	118%	-15%
Gasoline Container Loader	Cargo Loader, Narrow Body	G	969%	107%	287%	832%	22%
	Cargo Loader, Wide, Lower Lobe	G	969%	107%	287%	832%	22%
Gasoline Deicer	Deicer, Dual Engine	G	190%	683%	426%	96%	*
	Deicer, Single Engine	G	15%	210%	108%	-22%	*
Gasoline Food Truck	Catering Truck, Commuter/Reg	G	-80% to 47%	-87% to -33%	-87% to 165%	510% to 746%	-15% to -5%
	Catering Truck, Narrow Body	G	-51% to 258%	-68% to 62%	-69% to 543%	1382% to 1955%	107% to 132%
	Catering Truck, Wide Body	G	-51% to 258%	-68% to 62%	-69% to 543%	1382% to 1955%	107% to 132%
Gasoline Forklift	Fork Lift	G	57%	262%	95%	-6%	*
Gasoline Fuel Truck	Fuel Truck, Ground Equipment	G	-94% to -54%	-43% to 174%	-81% to 173%	49% to 115%	*
	Fuel Truck, MidSize, 3-6,000 g	G	-90% to -26%	-7% to 342%	-69% to 341%	141% to 248%	*
	Fuel Truck, Small, < 3,000 gal	G	-90% to -26%	-7% to 342%	-69% to 341%	141% to 248%	*
Gasoline GPU Transporter	Cart	G	118%	-48%	-21%	9%	-79%
Gasoline Ground Power Unit	Ground Power Unit, 28VDC	G	-29%	75%	29%	-51%	*

GSE Name in 4.0	Replacement GSE in 4.1	Fuel	CO	HC	NO _x	SO _x	PM ₁₀
Gasoline Lavatory Truck	Lavatory Truck, Narrow Body	G	-98% to -85%	-79% to -6%	-96% to -4%	-39% to -20%	*
	Lavatory Truck, Wide Body	G	-94% to -61%	-44% to 153%	-90% to 156%	64% to 115%	*
Gasoline Service Truck	Service Truck	G	-96% to -66%	-38% to 119%	-82% to 99%	17% to 72%	*
Gasoline Transporter	Cart	G	190%	-30%	5%	118%	-72%
Gasoline Water Truck	Water Service	G	-95% to -59%	-29% to 160%	-78% to 139%	32% to 94%	*
H1 Heater	Other	D	-97% to -88%	-92% to -58%	228% to 1341%	2760% to 2775%	427% to 1658%
HF2 Pressure Tester	Other	D	-95% to -82%	-87% to -33%	379% to 2006%	5621% to 5651%	778% to 2831%
M27M1 Jacking Manifold	Other	D	-98% to -94%	-93% to -60%	33% to 487%	5621% to 5651%	193% to 877%
M32T1 Pressure Tester	Other	D	-99% to -98%	-98% to -88%	-53% to 105%	2760% to 2775%	5% to 252%
MA1A Compressor	Other	D	-90% to -66%	76% to 838%	-7% to 311%	19%	1% to 238%
MA3 Cooler	Other	D	-100% to -98%	-82% to -5%	-65% to 55%	1807% to 1817%	-23% to 159%
MC11 Compressor	Other	D	-96% to -87%	-84% to -15%	179% to 1126%	5621% to 5651%	558% to 2098%
MC1A Compressor	Other	D	-97% to -91%	-90% to -45%	81% to 697%	5621% to 5651%	339% to 1365%
MD3 Generator	Generator	D	-99% to -98%	-67% to 66%	-27% to 206%	3391% to 3409%	16% to 292%
MHU83AE Bomblift	Lift	D	-96% to -86%	-75% to 22%	127% to 847%	5350% to 5406%	510% to 1970%
MJ1 Bomblift	Lift	D	-95% to -85%	-97% to -87%	144% to 917%	5350% to 5406%	632% to 2384%
MJ1 Hydraulic Test Stand	Other	D	-99% to -98%	-98% to -88%	-54% to 102%	1807% to 1817%	1% to 238%
MJ1A Bomblift	Lift	D	-97% to -90%	-82% to -12%	62% to 575%	5350% to 5406%	357% to 1453%
MJ2A Hydraulic Test Stand	Other	D	-100%	-99% to -93%	-74% to 14%	1330% to 1338%	-43% to 91%
NF-2 Light Cart	Cart	D	-100%	-100%	-100%	-100%	-100%
TTU228E Hydraulic Test Stand	Other	D	-100% to -99%	-98% to -92%	-69% to 37%	1807% to 1817%	-31% to 131%
TTU228E1B Hydraulic Tester	Other	D	-85% to -50%	-95% to -75%	-94% to -74%	172% to 174%	-88% to -61%

* Previously this GSE in version 4.0 had no PM emissions, but its corresponding replacement in 4.1 does; hence the percent change is undefined.

EDMS *Reference Manual* Supplement Attachment B

- EDMS 4.12 Default Aircraft Engine Revisions -

EDMS 4.12 revises the default engine of 31 aircraft and assigns default engines for an additional 49 aircraft based on recent U.S. fleet information. Table 1 is a list of the 31 aircraft for which their default engine was revised to another engine. Table 2 is a list of the 49 aircraft, which previously had no default engine, but are assigned one in version 4.12. The revised assignments for version 4.12 are based on the extracted U.S. fleet from the January 2003 BACK database (<http://www.backaviation.com/>). The default engine assignments for the remaining aircraft in EDMS have not been revised either because they are still applicable based on the BACK database or are not contained in the U.S. fleet reported by the January 2003 BACK database.

Table 1: Revised Default Engines.

Aircraft	Default Engine in 4.11	Default Engine in 4.12
500 Citation	JT15D-1	JT15D-1A & 1B
A300-600F	CF6-80C2A5F	PW4158
A310-200	JT9D-7R4E1	CF6-80A3
A320-200	CFM56-5A1	V2527-A5
A330	PW4168	PW4168A
A330-300	PW4168	PW4168A
B727-100	JT8D-7B	JT8D-9A
B727-100C	JT8D-7B	TAY 651 (Transply)
B737-900	CFM56-7B27	CFM56-7B26
B747-200F	JT9D-7F	CF6-50E 2
B747-300	JT9D-7R4G2	CF6-50E2
BAC-111-400	SPEY MK511 New Comb	SPEY MK511
BAE146-100	ALF502R-3	ALF502R-5
BH-1900	PT6A-67B	PT6A-67D
Canadair Reg-100	CF34-3A1	CF34-3B
CITATION I	JT15D-1	JT15D-1A & 1B
CL600	ALF 502L-2	CF34-3B
DC10-10	CF6-6D	CF6-6K
DC10-40	JT9D-20	JT9D-59A
DC8-62F	JT3D-3B	JT3D-7 SERIES
DC9-30	JT8D-9A	JT8D-7B
DC9-30F	JT8D-11	JT8D-9A
DHC-6	PT6A-27	PT6A-20
Embraer ERJ 145	AE3007A1	AE3007A1/2
Falcon 100	TFE731-3	TFE731-2
L-1011-200	RB211-524B4	RB211-524B
Learjet 31	TFE 731-2-2B	TFE 731-2
MD-11	CF6-80C2D1F	PW4460
MD-11-11	CF6-80C2D1F	PW4460
MD-90-30	V2528-D5	V2525-D5
SD330 Sherpa	PT6A-45	PT6A-45R

Table 2: New Default Engines.

Aircraft Name	Default Engine
A300-F4-200	CF6-80C2A5F
A310-200C	CF6-80A3
A310-300	PW4152
A310-304	CF6-80C2A2
A321	CFM56-5B3/P
A330B	PW4168A
AVRO-RJ85	LF507 SERIES
B707-300	JT3D-3B
B707-E	TF33-P-100
B717-200	BR700-715C1-30
B747-200	JT9D-7Q
B757-200F	RB211-535E4
B767-300F	CF6-80C2B7F
B777-200 IGW	Trent 892
Beech King Air 300	PT6A-60, -60A, -60AG
BH-C99	PT6A-36
Bombardier Global Ex	BR700-710A2-20
C Citation	JT15D-4 (B,C,D)
C-21-A	TFE 731-2-2B
C-9A	JT8D-9
C-9B	JT8D-9
Canadair Reg-700	CF34-8C1
Citation Bravo	JT15D-4 (B,C,D)
Citation VII	TFE731-3
Dash 8-200	PW123D
DC10-30ER	CF6-50C2B
DC9-15F	JT8D-7B
DC9-80	JT8D-217C
DHC-8-200	PW123D
EMB-110	PT6A-34
EMB-110KQ1	PT6A-34
F-28-1000	RR SPEY-MK555-15
Falcon 50	TFE731-3
FH-227	RDa7
Fokker 70	TAY620-15
IAI 1124	TFE731-3
IAI Westwind	TFE731-3
KC-10A	CF6-50C2
L-1011-150	RB211-22B
N 22B Nomad 22C	250B17B
REG'L JET 200	CF34-3B
REG'L JET 200 ER	CF34-3B
REG'L JET 200 LR	CF34-3B
Shorts 330	PT6A-45R
Swearingen Merlin	TPE331-3
T-1A JAYHAWK	JT15D-5 (A & B)
VC-9C	JT8D-9A
Westwind 1	TFE731-3
Westwind 2	TFE731-3

EDMS *Reference Manual* Supplement Attachment C

- EDMS 4.12 Aircraft Performance Data Revisions -

EDMS 4.12 incorporates 22 new INM aircraft flight profiles and updates the EDMS aircraft application of the profiles to utilize the new additions. In addition, several of the INM flight profiles have been revised to reflect the best available data. The following tables explain the changes in more detail for the new profiles, reassigned aircraft, and profiles that have been revised.

Previously, there was no INM equivalent for some EDMS aircraft and therefore the best INM match was used instead. With the incorporation of new INM aircraft, the matching is improved. For example, previously all Boeing 737-600, -700, -800 and -900 EDMS aircraft used the 737500 INM flight profiles. In EDMS 4.12, 737-700 aircraft use the new 737700 INM flight profile, but 737-900 aircraft are matched with the 737800 INM flight profile, the closest match. Table 1 below lists the new additions.

Table 1: Newly Added INM Flight Profiles.

New INM Flight Profile Names	EDMS Aircraft Application	Previous INM Flight Profile Used
717200	B717-200	MD9028
737700	B737-600 B737-700	737500
737800	B737-800 B737-900	
757300	B757-300	(New aircraft in version 4.12.)
767400	B767-400ER	(New aircraft in version 4.12.)
777300	B777-300	777200
A30062	A300-600 A300-600C A300-600F A300-600R	A300
A319	A319	A320
A32023	A320-211 A320-200	
A32123	A321 A321-100	
A330	A330 (w/o Trent engines) A330B A330-300	A310
A33034	A330 (w/ Trent engines only)	
A340	A340-200 A340-300 A340-642	DC870
CNA172	Cessna 172 Skyhawk	GASEPF
CNA206	(Not used.)	-
CNA20T	(Not used.)	-
CNA55B	Citation Bravo (w/ PW530 engines)	MU3001
CNA750	Citation X	CL600
EMB120	EMB-120	CL601
EMB14L	Embraer ERJ 145LR	(New aircraft in version 4.12.)
GII	Gulfstream II	HS748A
GV	Gulfstream V	GIV

A few EDMS aircraft had their best INM match revised to another INM flight profile that had already been incorporated in EDMS. Table 2 lists these revisions.

Table 2: EDMS Aircraft Reassigned to Preexisting INM Flight Profiles.

EDMS Aircraft	Previous INM Flight Profile Used	Current INM Flight Profile Used
Gulfstream III	HS748A	GIIB
Embraer ERJ 135/140	CL601	EMB145
Embraer ERJ 145		
Falcon 20	LEAR25	FAL20
F-16	F16A	F16GE, F16PW0, F16PW9 (depending on the engine)
A-7 CORSAIR II	F16A	A7D
L-188 A/C	DHC7	L188

Several of the previously incorporated INM flight profiles are revised to include more accurate data, which impacts times in mode. Table 3 lists the INM flight profiles for which the impact on the landing roll time is significant.

Table 3: INM Flight Profiles with Revised Landing Roll Times

INM Flight Profile	Affected EDMS Aircraft	Previous Landing Roll Time (sec)	Current Landing Roll Time (sec)	Percent Change
777200	B777-200 B777-200 IGW	55.61253	34.71176	-38%
A310	A310 A310-200 A310-200C A310-200F A310-300 A310-304	23.80784	34.93354	47%
A320	A320 A320-100	4.043308	22.28254	451%
F16A	A-4 SKYHAWK A-4M SKYHAWK A-6 INTRUDER A-7 CORSAIR II A-7E CORSAIR AV-8B Harrier II AV-8B+ Harrier II F/A-18 HORNET F-117 Night Hawk F-14A Tomcat F-14B Super Tomcat F-15 F-15 C/D F-16	21.63855	0.043888	-100%
F16GE	(Not previously used.)	21.63855	0.04232	-100%
F16PW9	(Not previously used.)	21.63855	0.035908	-100%
GIIB	C-21-A	13.52914	10.63633	-21%
GIV	Gulfstream IV	12.94562	13.2306	2%

Table 4 lists the INM flight profiles for which the impact on the approach time is significant.

Table 4: INM Flight Profiles with Revised Approach Times (from 3000 feet)

INM Flight Profile	Affected EDMS Aircraft	Previous Approach Time (sec)	Current Approach Time (sec)	Percent Change
A310	A310 A310-200 A310-200C A310-200F A310-300 A310-304	222.4649	225.9286	-2%
A320	A320 A320-100	215.3516	239.3234	2%
F16A	A-4 SKYHAWK A-4M SKYHAWK A-6 INTRUDER A-7 CORSAIR II A-7E CORSAIR AV-8B Harrier II AV-8B+ Harrier II F/A-18 HORNET F-117 Night Hawk F-14A Tomcat F-14B Super Tomcat F-15 F-15 C/D F-16	193.1402511	219.0475123	13%
F16GE	(Not previously used.)	193.1403	256.0410797	33%
F16PW9	(Not previously used.)	193.1403	179.4788919	-7%
GIIB	C-21-A	227.7392	219.1967	-4%
GIV	Gulfstream IV	218.9396	215.0137	-2%

Table 5 lists the INM flight profiles for which the impact on the takeoff time is significant. There is often a percentage range within which the change falls due to the different possible stage lengths, which are based on takeoff weight.

Table 5: INM Flight Profiles with Revised Takeoff Times

INM Flight Profile	Affected EDMS Aircraft	Percent Change	INM Flight Profile	Affected EDMS Aircraft	Percent Change
707320	B707-120 B707-300 B707-300C C-141 C-141B I-62	10.3% to 12.2%	747200	B747-200's & B747-300 (w/ CFM56-80 or some JT9D-7, -70) I-96-300 I-96M VC-25A	10.2% to 12.4%
720B	B720-00B	11.7% to 12.4%	74720A	B747-200's & B747-300 (w/ JT9D-7A)	10.8% to 12.9%
727100	B727-100 B727-100C (w/ JT8D-7) YAK-42	11.5% to 12.2%	74720B	B747-200's & B747-300 (w/ RB211 or some other JT9D-7) C-5 Galaxy	11.2% to 13.0%
727D15	B727-200 (w/ JT8D-15) B727-200F (w/ JT8D-15) Mercurie-100 MIG-18-50	11.3% to 12.7%	747400	B747-400 B747-400F	11.0% to 12.8%
727D17	B727-200 (w/ JT8D-17) B727-200F (w/ JT8D-17) B727-200RE B727-200RF Tu-154	11.8% to 12.7%	747SP	B747-SP	11.5% to 13.4%
727Q9	B727-100C (w/ JT8D-9 or TAY) B727-100F B727-100RE B727-100RF B727-200's (w/ JT8D-9)	11.2% to 12.3%	757PW	B757-200's (w/ PW2000)	12.7% to 13.6%
737	B737-100 (w/ JT8D-7 or -9) B737-200's (w/ JT8D-7 or -9) T-43A	12.2% to 12.9%	757RR	B757-200's (w/ RB211) Tu-204	13.1% to 13.8%
7373B2	B737-300 B737-300F B737-400 (w/ CMF56-3B2 or -3B4)	12.6% to 13.4%	767300	B767-200's & -300's (w/ PW4000)	11.8% to 12.9%
737400	B737-400 (w/ any other engine)	12.2% to 13.1%	767CF6	B767-200's & -300's (w/ CF6)	12.9% to 14.2%
737500	B737-500	12.4% to 13.2%	767JT9	B767-200's & -300 (w/ JT9D)	12.3% to 13.4%
737D17	B737-100 (w/ JT8D-15 or -17) B737-200 (w/ JT8D-15 or -17) B737-200C (w/ JT8D-15 or -17) B737-200F (w/ JT8D-15 or -17)	12.6% to 13.1%	777200	B777-200 B777-200 IGW	12.2% to 13.4%
74710Q	B747-100 B747-100B B747-100F B747-100SR	11.4% to 12.7%	A300	A300B A300-B2-100 A300-B2-200 A300-B4 A300-B4-100 A300-B4-200 A300-B4-605R A300-B4-622R A300-C4-200 A300-F4-200 KC-10A	11.5% to 12.7%
			A310	A310 A310-200 A310-200C A310-200F A310-300 A310-304	7.1% to 20.7%
			A320	A320 A320-100	-2.0% to 16.6%
			BAC111	BAC-111-100 BAC-111-200 BAC-111-300 BAC-111-400 BAC-111-400F	12.3% to 12.9%

INM Flight Profile	Affected EDMS Aircraft	Percent Change
BAE146	A-3 Skywarrior AVRO-RJ100 AVRO-RJ115 AVRO-RJ70 AVRO-RJ85 B-57 Canberra Bae Nimrod MRA4 BAE146-100 BAE146-200 BAE146-300 (w/ LF507) BAE146-RJ F-111 Raven Jetstar	8.2% to 9.3%
BAE300	BAE146-300 (w/ ALF502R-5)	7.9% to 9.0%
BEC58P	337H Skymaster Aztec Cessna T337 Navajo	10%
C130	B-1B B-2 Spirit B52 B52-H C-130 HERCULES C-130E HERCULES (w/ T56 I or II) C-135 C-135B C-135FR E-2 HAWKEYE EA-6B PROWLER EC-135B EC-135C L-100 HERCULES L-100-30	11.9% to 13.4%
C130E	C-130E HERCULES (w/ T56-A)	10.8% to 12.6%
CIT3	Citation VII	11%
CL600	CITATION X CL600 CL600S VFW 614	12%
CL601	Canadair Reg-100 Canadair Reg-700 CL601-3A CL601-3R CL604 REG'L JET 200 REG'L JET 200 ER REG'L JET 200 LR	12%
CNA441	PA-31T Cheyenne PA-42 Cheyenne Swearingen Merlin	11%
CNA500	500 Citation C Citation CITATION I CITATION I SP SN601 Corvette T-47A	13%
CONCRD	CONCORDE-101 CONCORDE-102	10.2% to 10.5%
CVR580	Vickers 953 Vanguard	14.6% to 16.2%

INM Flight Profile	Affected EDMS Aircraft	Percent Change
DC1010	DC10-10 DC10-10C DC10-10F DC10-15 DC10-30 (w/ CF6-50A)	10.6% to 12.3%
DC1030	DC10-30 (w/ any other CF6-50) DC10-30C DC10-30CF Series DC10-30ER DC10-30F	11.0% to 12.9%
DC1040	DC10-40	9.8% to 12.4%
DC850	DC8 DC8-50F DC8-51 DC8-51F DC8-52 DC8-52F DC8-53 DC8-53F DC8-54F DC8-55 DC8-55C DC8-55F DC8-60 (w/ JT3D-3B) DC8-60 (w/ JT3D-7)	11.2% to 12.7%
DC860	DC8-61 DC8-61F DC8-62 DC8-62C DC8-62F DC8-63 DC8-63C DC8-63F I-76 I-86	10.5% to 12.3%
DC870	C-17A DC8-70 DC8-71 DC8-71F DC8-72 DC8-72C DC8-73C DC8-73F	10.9% to 12.6%
DC910	Caravelle-10 DC9-10 DC9-10C DC9-10F DC9-15F	12.2% to 12.5%
DC930	AN-72 AN-74 C-9A C-9B Caravelle-12 DC9-20 DC9-30 DC9-30C DC9-30F DC9-40 DC9-40F Tu-134 VC-9C	11.1% to 11.8%
DC950	DC9-50 DC9-80	11.5% to 12.0%

INM Flight Profile	Affected EDMS Aircraft	Percent Change
DHC6	400A Hustler B. 99A Beech King Air 100 Beech King Air 200 Beech King Air 300 Beech King Air 350 Beech King Air 90 Beech King Air B200 BH-1900 BH-1900C BH-C99 C-12A/B/C C-1A TRADER Caraja NE-821 Cessna 208 Caravan DHC-6 DHC-6/300 EMB-110 EMB-110KQ1 Equator P-550 Turbo IAI-101-A IAI-201-102 IAI-202 King Air 200 King Air B200 N 22B Nomad 22C N 24A Nomad 24A OV-10 BRONCO Porter PC6/B2 RU-21J SA-227 AC Metro3 SA-227 AT Exped SA-227 AT Metro3 SF600 A CANGURO Swearingen Metro 2 UC-12F/M UC-12J UV-18A	11%
DHC7	Dash 7 DHC-7 L-188 A/C	8%
DHC8	ATR42 ATR42-400 ATR42-500 ATR72-500 Bae ATP Dash 8-100 Dash 8-200 Dash 8-300 Dash 8-400 DHC-8-100 DHC-8-200 DHC-8-300 DHC-8-400 DO 328 Shorts 330 Shorts 360	12%
DHC830	Fokker 50 Fokker 50 HI Perf Fokker 60 Utility	12%
EMB145	(Not previously used.)	12.6% to 13.2%
F10062	Fokker 100 (w/ TAY620) Fokker 70	12.2% to 12.7%

INM Flight Profile	Affected EDMS Aircraft	Percent Change
F10065	Fokker 100 (w/ TAY650)	12.2% to 12.7%
F16A	A-4 SKYHAWK A-4M SKYHAWK A-6 INTRUDER A-7 CORSAIR II A-7E CORSAIR AV-8B Harrier II AV-8B+ Harrier II F/A-18 HORNET F-117 Night Hawk F-14A Tomcat F-14B Super Tomcat F-14D Super Tomcat F-15 F-15 C/D F-16	-32%
F28MK2	F-28-1000 F-28-1000C F-28-2000 F-28-3000 F-28-3000C	12.3% to 12.7%
F28MK4	F-28-4000 F-28-4000/600	12.0% to 12.6%
F4C	A-10A Thunderbolt II ES-3A Shadow F-4 PHANTOM II F-4B PHANTOM II F-4N PHANTOM II F-4S PHANTOM II F-5F TIGER II F-8 Crusader PAMPA IA.63 RF-5E TIGEREYE S-3B Viking T-2C Buckeye	10.0% to 11.4%
GASEPF	Alpha 70 Cessna 150 Cherokee six Piper PA-28 Robin DR 400 Robin R 2160 Robin R 3000 Socata Tampico	5%
GASEPV	Air Tractor AT502 Air Tractor AT602 Ayres S2R-T34 Cessna 441 Conquest2 Commanche FT337P H-550A Stallion P-337P Skymaster Rockwell Commander Socata Tobago Spencer S-12 Air Car	8%
GIIB	C-21-A	47%
GIV	Gulfstream IV	-12%
HS748A	ATR72-200 ATR72-210 Convair liner F-27 SERIES FH-227 Gulfstream I HS 748 2A SERIES HS 748 2B SERIES YS-11	9%

INM Flight Profile	Affected EDMS Aircraft	Percent Change
IA1125	IAI 1124 IAI Westwind Westwind 1 Westwind 2	10%
KC135R	B707-E KC-135R	11%
L1011	L-1011-1 L-1011-100 L-1011-150 L-1011-1F L-1011-200 L-1011-250 L-1011-40	12.2% to 13.7%
L10115	L-1011-50 L-1011-500 L-1011-500 TR	12.2% to 14.0%
LEAR25	BAE 125-700 C-101 AVIOJET Falcon 100 Falcon 20 Falcon 50 HS 125 Learjet 24D Learjet 25B Learjet 25C Learjet 31 Learjet 35/36 Saberliner 75A T-37 Tweet	11%
LEAR35	Beechjet 400 Beechjet 400A Beechjet 400T DIAMOND 300	10%
MD11GE	MD-11's (w/ CF6)	11.3% to 13.2%
MD11PW	MD-11's (w/ PW4000)	10.9% to 13.0%
MD81	MD-80's (w/ JT8D-209)	12.2% to 13.0%
MD82	MD-80's (w/ JT8D-217)	12.1% to 13.0%
MD83	MD-80's (w/ JT8D-219)	12.1% to 13.0%
MD9025	MD-90-10 MD-90-30 (w/ V2522, V2524 or V2525) MD-90-40	12.3% to 13.0%
MD9028	Bombardier Global Ex MD-90-30 (w/ V2528) MD-95	12.5% to 13.3%
MU3001	550 Citation 551 Citation 552 Citation 560 Citation V Citation Bravo CITATION II CITATION II SP CITATION SII CITATION T-47A Citation Ultra CITATION V MU-300 S550 Citation T-1A JAYHAWK	12%

INM Flight Profile	Affected EDMS Aircraft	Percent Change
SD330	N262 SD330 Sherpa	11%
SF340	CN-235-200 SF-340-A SF-340-B PLUS	10.7% to 11.2%

Table 6 lists the INM flight profiles for which the impact on the climb out time is significant. Each percentage change only applies to the EDMS stage length specified. EDMS stage 1 corresponds to the heaviest takeoff weight and is also the default stage assigned. The higher EDMS stage numbers correspond to lighter takeoff weights.

Table 6: INM Flight Profiles with Revised Climb Out Times (to 3000 feet)

INM Flight Profile	Affected EDMS Aircraft	EDMS Stage	Previous Approach Time (sec)	Current Approach Time (sec)	Percent Change
A310	A310 A310-200 A310-200C A310-200F A310-300 A310-304	1	60.91115	49.98039	-18%
		2	54.14559	47.04506	-13%
		3	47.71552	42.98009	-10%
		4	44.51049	40.19789	-10%
		5	41.26579	38.66621	-6%
		6	38.55639	37.35108	-3%
A320	A320 A320-100	1	70.90438	60.64931	-14%
		2	63.47254	58.93195	-7%
		3	56.47192	54.42099	-4%
F16A	A-4 SKYHAWK A-4M SKYHAWK A-6 INTRUDER A-7 CORSAIR II A-7E CORSAIR AV-8B Harrier II AV-8B+ Harrier II F/A-18 HORNET F-117 Night Hawk F-14A Tomcat F-14B Super Tomcat F-14D Super Tomcat F-15 F-15 C/D F-16	1	18.71561	22.62154	21%
F16GE	(Not previously used.)	1	18.71561	30.89288	65%
F16PW9	(Not previously used.)	1	18.71561	28.66054	53%
GIIB	C-21-A	1	40.18658	76.50438	90%
GIV	Gulfstream IV	1	40.94137	35.14957	-14%