SNAP CODES: **080501**
080502
080503
080504

SOURCE ACTIVITY TITLE: **AIR TRAFFIC**
Domestic airport traffic (LTO-cycles < 1000 m altitude)
International airport traffic (LTO-cycles < 1000 m altitude)
Domestic cruise traffic (> 1000 m altitude)
International cruise traffic (> 1000 m altitude)

NOSE CODES: **202.05.01**
202.05.02
202.05.03
202.05.04

NFR CODE: **1 A 3 a i (i)**
1 A 3 a i (ii)
1 A 3 a ii (i)
1 A 3 a ii (ii)

1 ACTIVITIES INCLUDED

This chapter presents common guidelines for estimation of emissions from air traffic. The guideline includes four activities (Table 1.1).

Table 1.1 Overview of the activities included in the present reporting guidelines

Activity	SNAP CODE	NOSE CODE	NFR CODE
Domestic airport traffic (LTO-cycles < 1000 m altitude)	080501	202.05.01	1 A 3 a ii (i)
International airport traffic (LTO-cycles < 1000 m altitude)	080502	202.05.02	1 A 3 a i (i)
Domestic cruise traffic (> 1000 m altitude)	080503	202.05.03	1 A 3 a ii (ii)
International cruise traffic (> 1000 m altitude)	080504	202.05.04	1 A 3 a i (ii)

LTO is an abbreviation for the Landing and Take-Off cycle.

Domestic aviation is associated with the SNAP codes 080501 + 080503;
International aviation is associated with the SNAP codes 080502 + 080504;
LTO-cycle activities include SNAP codes 080501 + 080502;
Cruise activities include SNAP codes 080503 + 080504.

Emissions associated with domestic and international aviation are to be reported to the UNFCCC. According to the new reporting guidelines, only emissions from domestic aviation shall be reported to the UNFCCC as a part of national totals. However, all the items above shall be reported. Formerly, only emissions associated with the LTO-cycle were to be reported

to the UNECE[1]. Activities include all use of aeroplanes consisting of scheduled and charter traffic of passengers and freight. This also includes taxiing, helicopter traffic and private aviation. Military aviation is included if it is possible to estimate.

2 CONTRIBUTION TO TOTAL EMISSIONS

The total contribution of aircraft emissions to total global anthropogenic CO_2 emissions is considered to be about 2% (IPCC, 1999). This relatively small contribution to global emissions should be seen in relation to the fact that most aircraft emissions are injected almost directly into the upper free troposphere and lower stratosphere. IPCC has estimated that the contribution to radiative forcing is about 3.5 %. The importance of this source is growing as the volume of air traffic is steadily increasing.

The importance of air traffic in Europe for various pollutants is illustrated in Table 2.1. The table reflects the current knowledge. It may be that the ranges actually are different from the figures given in the table. Emissions of H_2O are not covered in any reporting requirements, but can be estimated on the basis of the fuel consumption.

Table 2.1 Emissions from air traffic in Europe. Ranges of contribution to total emissions according to Corinair-94. Per cent of total excluding international cruise.

Category	LTO (%)	Domestic cruise (%)
SO_2	0-0.2	-
NO_x	0-3	0-2
NMVOC	0-0.6	-
CO	0-0.3	-
CO_2	0-2	0-1
CH_4	0	-
N_2O	0	-

3 GENERAL

3.1 Description

In principle the activities include all flights in a country. The traffic is often divided into four categories:

Category 1. Civil IFR (Instrumental Flight Rules) flights
Category 2. Civil VFR (Visual Flight Rules) flights, also called general aviation
Category 3. Civil Helicopters
Category 4. Operational Military flights

Flight data are often recorded for Category 1 only. Most emissions will, however, originate here. Category 2 contains small aircraft, used for leisure, taxi flights etc.

[1] However, UNECE wanted CO_2 emissions and other direct greenhouse gases estimated according to the UNFCCC definition.

Data are mostly available for turbofans only, but estimates also have to be made from turboprop and piston engine aircraft (which are currently not subject to any emissions regulation).

Aircraft in Category 1 can be classified into types and engines as outlined in Table 3.1. This table presents aircraft and engines most frequently used in European and American aviation, although other engines may be used in significant numbers. Also note that some large long distance planes not on this list may be important for fuel consumption (e.g. DC10, A340). In addition, emissions from tuboprop aircraft may be significant in national aviation in some countries. More types and engines exist and engines can be seen in ICAO (1995) or at http://www.dera.gov.uk.

Military aircraft activities (Category 4) are in principle included in the inventory. There may however be some difficulties in estimating these due to scarce and often confidential military data. One should also be aware that some movements of military aircraft might be included in Category 1, for example non-operational activities.

3.2 Definitions

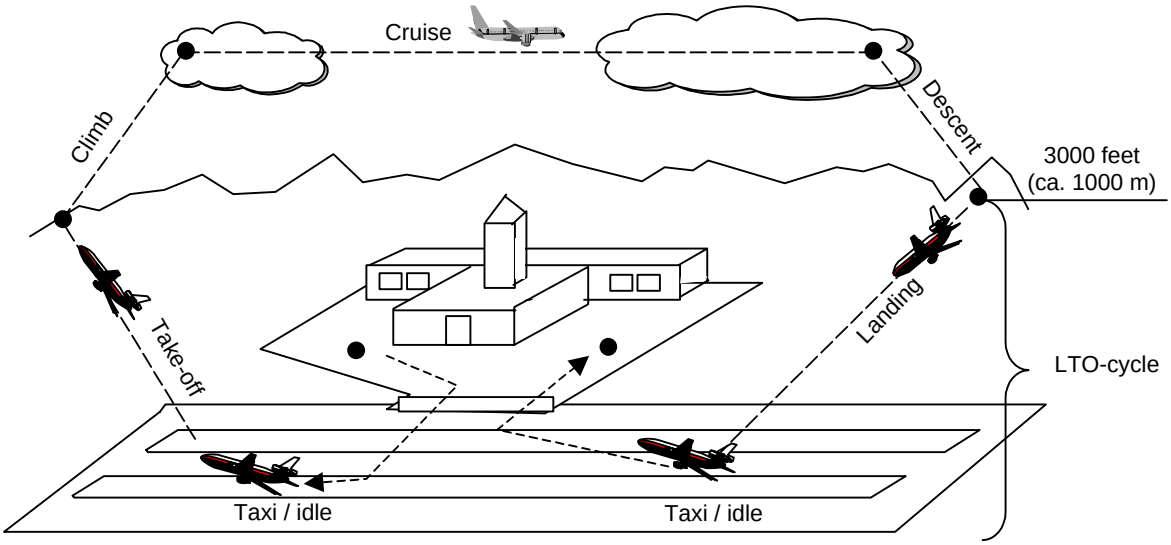
Abbreviations
AERONOX: EU-project "The impact of NO_x-emissions from aircraft upon the atmosphere at flight altitudes 8-15 km" (AERONOX, 1995)
ANCAT: Abatement of Nuisance Caused by Air Transport, a technical committee of the European Civil Aviation Conferences (ECAC)
ATC: Air Traffic Control
CAEP: Committee on Aviation Environmental Protection
ICAO: International Civil Aviation Organisation
LTO: Landing/Take-off (see below)

ICAO certification data prepared for the engines of an aircraft takes into account the population of engines fitted to that aircraft according to an aircraft registration database (ANCAT, 1998).

Operations of aircraft are divided into two parts:

- The *Landing/Take-off* (LTO) cycle which includes all activities near the airport that take place below the altitude of 3000 feet (1000 m). This therefore includes taxi-in and out, take-off, climb- out, and approach-landing. The LTO is defined in ICAO (1993).
- *Cruise* which here is defined as all activities that take place at altitudes above 3000 feet (1000 m). No upper limit of altitude is given. Cruise, in this report, includes climb from the end of climb-out in the LTO cycle to cruise altitude, cruise, and descent from cruise altitudes to the start of LTO operations of landing (figure 3.1).

Figure 3.1 Standard flying cycles



Some statistics count either a landing or a take-off as one operation. However it should be noted that *both* one landing and one take-off define a full LTO-cycle in this report.

The emission figures for national and international aviation have to be reported separately. The distinction between national and international aviation is as follows: *All traffic between two airports in one country is considered domestic* no matter the nationality of the carrier. The air traffic is considered international if it takes place between airports in two different countries. If an aircraft goes from one airport in one country to another in the same country and then leaves to a third airport in another country, the first trip is considered a domestic trip, while the second trip is considered an international trip. The only exceptions are technical refuelling stops, or domestic trips that only allow passenger or freight to board for an international trip or leave the aircraft after an international trip. These are not considered domestic but international. Further guidance on the allocation issue is given in the IPCC Good Practice Guidance for Inventory Preparation.

Emissions and fuel from over-flights are excluded from these calculations to avoid double counting of emissions.

Table 3.1 Civil aircraft classification. Movements in Europe per aircraft type*, 1998.

	Movements per aircraft type %	% local (non- trans Atlantic) movements for this type	Number of engines	Type of engine	Most used engine
Boeing B 737, unspecified	14.8	99.6	2	TF	PW JT8D-17, CFMI CFM56-3
Airbus A 320	8.6	99.6	2	TF	CFMI CFM56-5A
McDonnell Douglas MD 80	8.1	100	2	TF	PW JT8D-217
ATR	5.2	100	2	TP	PWC PW120, PW124
BAe 146	4.6	100	4	TF	LY ALF 502R-5
Boeing B 757	3.4	95.3	2	TF	PW 2037
Boeing 737-100	3.3	99.7	2	TF	PW JT8D-17, CFMI CFM56-3
Fokker F-50	3.1	100	2	TP	PW125B
De Havilland DASH-8	2.8	100	2	TP	PW 121/123
Boeing B 767	2.7	46.8	2	TF	GE CF6-80A2, GECF6-80C2B6
Canadair Regional Jet	2.1	100	2	TF	LY ALF 502L-2C
McDonnell Douglas DC 9	1.8	99.8	2	TF	JT8D-15
Boeing B 727	1.7	99.6	3	TF	JT8D-7B
Fokker 100	1.6	100	2	TF	RR TAY 620-15
Boeing B 747 100-300	1.5	43.4	4	TF	PWJT9D-7A, PW4056
SAAB 2000	1.4	100	2	TP	AN GMA2100A
SAAB 340	1.4	100	2	TP	GE CT7-5A2
Airbus A 310	1.3	88.5	2	TF	GE CF6-80C2A5, PW JT9-7R4El
Airbus A 300	1.0	93.7	2	TF	GE CF6-80C2A5, PW JT9-7R4El

Data source: Eurocontrol - STATFOR, The Norwegian Civil Aviation Administration (personal comm.)
TJ - turbojet, TF - turbofan, TP - turboprop, R - reciprocating piston, O - opposed piston.
*The number of movements does not necessarily reflect the relative importance with respect to fuel use and emissions, which in addition are mostly determined by aircraft size and flight distances.

3.3 Techniques

In general there are two types of engines; *reciprocating piston* engines, and *gas turbines* (Olivier, 1990). In *piston engines*, energy is extracted from fuel burned in a combustion chamber by means of a piston and crank mechanism, which drives the propellers to give the aircraft momentum. In *gas turbines* air is first compressed and then heated by combustion with fuel in a combustion chamber and the major part of this is used for propulsion of the aircraft. A part of the energy contained in the hot air flow is used to drive the turbine, which in turn drives the compressor. Turbojet engines use only energy from the expanding exhaust stream for propulsion, whereas turbofan and turboprop engines use energy from the turbine to drive a fan or propeller for propulsion.

3.4 Emissions

Air traffic as a source of combustion emissions will depend on the:

- type of aircraft;
- type of engines and fuel used;
- emission characteristics of the engines (emissions per unit of fuel used depending on engine load);
- location (altitude) of operation;
- traffic volume (number of flights and distance travelled).

The effect of engine ageing on emissions is not taken into account. It is, however, generally assumed that this effect is of minor importance compared with the total emissions since aircraft engines are continuously maintained to tighter standards than the engines used in e.g. automotive applications.

Emissions come from use of kerosene and aviation gasoline that are used as fuel for the aircraft. Gasoline is used in small (piston engined) aircraft only.

Other emissions:
Which are related to aircraft, but which are not included under the present SNAP codes. Examples of these are:

- fuelling and fuel handling (SNAP 050402) in general;
- maintenance of aircraft engines (SNAP 060204);
- painting of aircraft (SNAP 060108);
- service vehicles for catering and other services (SNAP 0808);
- anti-icing and de-icing of aircraft (SNAP 060412). Much of the substances used flows off the wings during idle, taxi, and take-off and evaporates.

Emissions from start up of engines:
These are not included in the LTO cycle. There is currently little information available to estimate these. This is not important for total national emissions, but they may have an impact on the air quality in the vicinity of airports.

Auxiliary power operations:
Considerations might be given to allocating a SNAP code to the operation of APUs (Auxiliary Power Unit) (see section 3.4 below). APU is used where no other power source is available for the aircraft and may vary from airport to airport. This is the case, for example, when the aircraft is parked away from the terminal building. The APU fuel use and the related emissions should be allocated on the basis of aircraft operations (number of landings and take-offs). However, currently no methodology has been developed. The use of APU is being severely restricted at some airports to maintain air quality, and therefore this source of fuel use and emissions may be declining.

Fuel dumping in emergencies:
From time to time aircraft will have to dump fuel before landing so that they do not to exceed a certain maximum landing weight. This is done at a location and altitude where there will be no local impact at ground level. Only large (long-range) aircraft will dump fuel. NMVOC emissions might become significant at very large airports with frequent long distance flights. However, since the most probable altitude of these emissions will be above 1000 m, these are currently not relevant for UNECE reporting. The airport authorities and airline companies might give information on the extent (frequency and amount) of dumping and the altitude at particular airports.

The use of energy, and therefore emissions, depends on the aircraft operations and the time spent at each stage. Table 3.2 shows engine power settings and times-in-mode for the LTO-cycle specified by ICAO (ICAO, 1993). The actual operational time-in-mode might vary from airport to airport depending on the traffic, environmental considerations, aircraft types as well as topographical conditions.

Table 3.2. Standard landing and take-off cycles in terms of thrust settings and time spent in the specific mode

Operating mode	Thrust setting (% of maximum sea level static thrust)	Time-In-Mode (min)
Take-off	100%	0.7
Climb-out	85%	2.2
Approach-landing	30%	4.0
Taxi/ground idle	7%	26.0

Source: ICAO, 1993

The proportion of fuel used in a mission which is attributed to LTO decreases as mission distance increases. Thus a substantial part of the fuel consumption takes place outside the LTO-cycle. Studies indicate that the major part of NO_x (60-80%), SO_2 and CO_2 (80-90%) is emitted at altitudes above 1000 m. For CO it is about 50% and for VOC it is about 20-40% (Olivier, 1991).

3.5 Controls

The current status of regulations of NO_x is found in ICAO (1993), see Table 3.3. Standards are given for engines first produced before and after 1996. Further regulations will be put on engines manufactured after 31.12.2003 as specified by ICAO's latest regulations set in the CAEP (1998). Aircraft manufacturers are also helping with respect to reducing the fuel consumption by improvements in the aerodynamic properties of the aircraft.

The regulations published by ICAO against which engines are certificated are given in the form of the total quantity of pollutants (D_p) emitted in an LTO cycle divided by the maximum sea level thrust (F_{oo}) and plotted against engine pressure ratio at maximum sea level thrust. The limit values are given by the formulae in Table 3.3.

Table 3.3 Current and future regulations. Certification limits for NO_x for turbo jet and turbo fan engines.

	CURRENT REGULATIONS		**RECOMMENDATION**
	engines first produced before 31.12.1995 & for engines manufactured up to 31.12.1999	engines first produced after 31.12.1995 & for engines manufactured after 31.12.1999	recommended regulation (CAEP 4th meeting, 1998, CAEP-SG/2-Report pp B-2, B-3) for engines manufactured after 31.12.2003
Applies to engines >26.7 kN	$D_p/F_{oo} = 40 + 2\pi^\circ_{oo}$	$D_p/F_{oo} = 32 + 1.6\pi^\circ_{oo}$	
Engines of pressure ratio less than 30			
Thrust more than 89 kN			$D_p/F_{oo} = 19 + 1.6\pi^\circ_{oo}$
Thrust between 26.7 kN and not more than 89 kN			$D_p/F_{oo} = 37.572 + 1.6\pi^\circ_{oo} - 0.208\ F_{oo}$
Engines of pressure ratio more than 30 and less than 62.5			
Thrust more than 89 kN			$D_p/F_{oo} = 7+2.0\pi^\circ_{oo}$
Thrust between 26.7 kN and not more than 89 kN			$D_p/F_{oo} = 42.71 +1.4286\pi^\circ_{oo} -0.4013\ F_{oo} +0.00642\pi^\circ_{oo} * F_{oo}$
Engines with pressure ratio 62.5 or more			$D_p/F_{oo} = 32+1.6\pi^\circ_{oo}$

Source: International Standards and Recommended Practices, Environmental Protection, ICAO Annex 16 Volume II Part III Paragraph 2.3.2, 2nd edition July 1993.

where:

D_p = the sum of emissions in the LTO cycle in g
F_{oo} = thrust at sea level take-off (100%)
π°_{oo} = pressure ratio at sea level take-off thrust point (100%)

The equivalent limits for HC and CO are D_p/F_{oo} = 19.6 for HC and D_p/F_{oo} = 118 for CO (ICAO Annex 16 Vol. II paragraph 2.2.2). Smoke is limited to a regulatory smoke number = 83 $(F_{oo})^{-0.274}$ or a value of 50, whichever is the lower.

The relevance of these data within this report is to indicate that whilst the certification limits for NO_x are getting lower, those for smoke, CO and HC are unchanged.

3.6 Projections

Future aircraft emissions will be determined by the volume of air traffic, new aircraft technologies and the rate at which the aircraft fleet changes.

According to the IPCC (1999), total global passenger-km will grow by 5 % annually between 1990 and 2015 with a corresponding growth in fuel use of 3 % per year over the same period. The difference is explained by an anticipated improvement in aircraft fuel efficiency. The anticipated growth rates in individual countries will probably be described in the transport plans, which should be available from national Ministries of Transport.

Over the last 30 years, aircraft engines have improved in efficiency, and due to the high cost of fuel, this trend is expected to continue. As mentioned in 3.7, it is expected that tightening the emission regulations will lead to a decrease in NO_x emission factors.
NO_x may be reduced by introducing engines fitted with double annular combustion chambers (MEET, 1998). This technology has been implemented in new aircraft e.g. B737-600.
Proposed average changes in emission factors are shown in Table 3.4. Note that these may be larger or smaller according to the rate at which the aircraft fleet is renewed (see below).

Table 3.4 Changes in emission factors relative to current level. Baseline scenario

	NO_x	CO	HC
2010	-10%	-6 %	-6 %
2020	-20 %	-27 %	-24 %

Research is being undertaken on engines to substantially reduce emissions of NO_x, CO and HC (MEET 1998). However, the time scale over which the results from this research will become commercially available is unclear, and therefore their use in baseline projections is not recommended.

Research is also ongoing to improve the aircraft design to further improve fuel efficiency. Also using new materials may prove to be beneficial (MEET, 1998). In a baseline scenario an annual improvement of average fuel efficiency of 1.5-2.5 % is recommended.

The rate of change of the aircraft fleet depends very much on the country of operation. Although an aircraft is expected to have a long life - typically 25 to 35 years, it will often be

sold to other operators, possibly in other countries, and possibly converted to other uses (for example for carrying freight). Noise regulations may also influence the rate of change of aircraft fleet. For a projection of national emissions, it is expected that the major airlines are in a position to provide the most accurate information on anticipated fleet changes as part of their long-term plans. An analysis of future aircraft fleet made by UK DTI (MEET, 1998) is shown in Table 3.5.

Table 3.5 World fleet age profile. 2010 and 2020, Per cent

Age (years)	2010	2020
0-5	27.6	32.5
6-10	20.5	22.9
11-15	19.7	17.8
16-20	23.5	16.2
21-25	8.6	10.6

* Growth of fleet from 2010 to 2020 is 26 %.

The commercial use of alternative fuels in aircraft is still a long way off and should not be incorporated into any national baseline emission projection. Hydrogen is the most likely alternative to kerosene (MEET, 1998). This fuel will be more efficient and has lower emissions compared to kerosene (producing NO_x and water vapour, but no carbon compounds). However, the life-cycle emissions depend on how the hydrogen is produced. Hydrogen is very energy-demanding to produce, and introducing hydrogen as an alternative fuel will also require massive investments in ground infrastructure in addition to rebuilding aircraft.

4 SIMPLE METHODOLOGIES

Within different countries, there may be large differences in the resources and data available as well as the relative importance of this emission source. Therefore, three methodologies, the Very Simple, the Simple and the Detailed Methodology, have been developed. The difference between the methodologies lies mainly in the aggregation level assumed for the aircraft.

In the very simple methodology, estimations are made without considering the actual aircraft types used. In the simple methodology, it is assumed that information is available on the types of aircraft that operate in the country. Finally, the detailed methodology takes into account cruise emissions for different flight distances and possibly specific LTO times-in-modes. The third (detailed) methodology will be explained in section 5. The differences between the methodologies are shown in Table 4.1. See section 10 for a discussion of the advantages and disadvantages of the various methods.

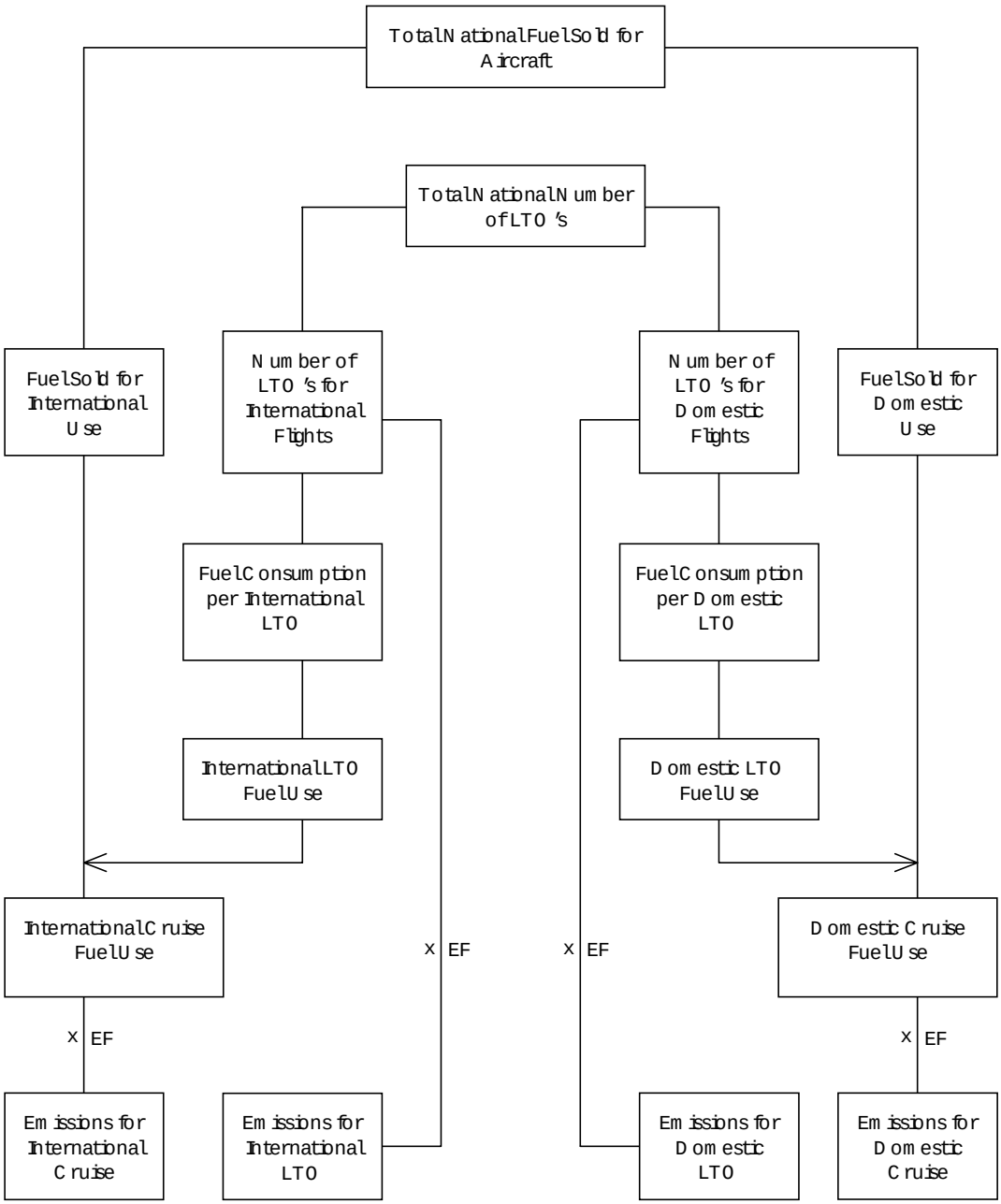
All three methodologies are based on landing/take-off data. Of the aircraft categories described above (3.1), flight data will be fully available for Category 1, but only partly available or missing for Categories 2, 3 and 4. Thus, these methodologies outlined might only be applicable to Category 1. However this will represent the major part of the emissions. Emissions from the other categories may be roughly estimated from fuel data or hours of operation, if available. Such data may be available from the operating companies. The

Detailed Methodology (section 5) will give some information in how to estimate emissions from these non-IFR flights.

Table 4.1 Basis for the methodologies.

		LTO	**Cruise and Climb**
Very Simple	*Activity*	LTO aggregated Time-in-mode (ICAO)	Fuel residual
	Emission factor	Generic aircraft	Generic aircraft
Simple	*Activity*	LTO per aircraft type (generic aircraft) Time-in-mode (ICAO)	Fuel residual
	Emission factor	Per aircraft type	One generic aircraft
Detailed	*Activity*	LTO per aircraft type (generic aircraft) (option also engine type) Time-in-mode: actual if available otherwise ICAO	Distances flown. Independent estimate of cruise fuel use.
	Emission factor	Per aircraft type (generic aircraft) (option also engine type)	Per aircraft type (generic aircraft) and distance flown

Figure 4.1 Estimation of aircraft emissions with the simple fuel based methodologies



The simple methodologies are both based on LTO data and the quantity of fuel sold or used as illustrated in Figure 4.1. It is assumed that fuel used equals fuel sold. From the total fuel sold for aircraft activities, allocations are made according to the requirements for IPCC and UNECE reporting. The emission estimation can be made following one of the two simple methodologies outlined below.

For estimating the total emissions of CO_2, SO_2 and heavy metals the Very Simple Methodology is sufficient, as the emissions of these pollutants are dependent of the fuel only and not technology. The Detailed Methodology may be used to get an independent estimate of fuel and CO_2 emissions from domestic air traffic.

See Table 4.2. for references to the recommended aircraft to be used for these calculations.

4.1 The Very Simple Methodology

Where the number of LTO cycles carried out on a per-aircraft type basis is not known, the Very Simple Methodology should be used. In this case information on the country's total number of LTOs needs to be available, preferably also the destination (long and short distance) for international LTOs, together with a general knowledge about the aircraft types carrying out aviation activities.

Aircraft emission estimates according to the Very Simple Methodology can be obtained by following the steps below:

1. Obtain the *total* amount of *fuel* sold for all aviation (in ktonnes)
2. Obtain the amount of *fuel* used for *domestic* aviation only (in ktonnes).
3. Calculate the total amount of *fuel* used for *international* aviation by subtracting the domestic aviation (step 2) from the total fuel sold (step 1).
4. Obtain the total *number of LTOs* carried out for domestic aviation.
5. Calculate the *total fuel use for LTO* activities for domestic aviation by multiplying the number of domestic LTOs by the domestic fuel use factors for one representative aircraft (Table 8.2) (step 4 x fuel use for representative aircraft). Fuel use factors are suggested for an old and an average fleet.
6. Calculate the *fuel used for cruise* activities for domestic aviation by subtracting the fuel used for domestic LTO (step 5) from the total domestic fuel used (step 2).
7. Estimate the *emissions related to domestic LTO activities* by multiplying the emission factors (per LTO) for domestic traffic with the number of LTO for domestic traffic. Emission factors are suggested for an old and an average fleet by representative aircraft (Table 8.2).
8. Estimate the *emissions related to domestic cruise activities* by multiplying the respective emission factors (in emission/fuel used) in Table 8.2 with the domestic cruise fuel use. Emission factors are suggested for an old and an average fleet by representative aircraft.
9. Repeat step 4 to 8 substituting domestic activities with *international*. It is for international flights preferable to distinguish between short (< 1000 nm[2]) and long distance flights (> 1000 nm). The latter is normally performed by large fuel consuming aircraft compared to the shorter distance flights (e.g. within Europe). If this distinction cannot be made the LTO emissions are expected to be largely overestimated in most countries.

[2] Where nm = nautical miles, 1nm = 1.852 km.

The estimated emissions are allocated to SNAP codes as follows:

- LTO, domestic aviation found in step 7 go under the SNAP code 080501;
- LTO, international aviation found in step 7 go under the SNAP code 080502;
- Cruise, domestic aviation found in step 8 go under SNAP code 080503;
- Cruise, international aviation found in step 8 go under SNAP code 080504.

4.2 The Simple Methodology

If it is possible to obtain information on LTOs per aircraft type but there is no information available on cruise distances, it is recommended to use the Simple Methodology. The level of detail necessary for this methodology is the aircraft types used for both domestic and international aviation, together with the number of LTOs carried out by the various aircraft types. The approach can best be described by following the steps:

1. Obtain the *total amount of fuel* sold for all aviation (in ktonnes).
2. Obtain the total amount of *fuel* used for *domestic aviation* (in ktonnes).
3. Calculate the amount of *fuel used for international aviation* by subtracting the domestic aviation (step 2) from the total fuel sold (step 1) (in ktonnes).
4. Obtain the total *number of LTOs* carried out *per aircraft type* for domestic aviation. Group the aircraft into the groups of generic aircraft given in Table 4.2. Use table 4.3 for miscellaneous smaller aircraft.
5. Calculate the *fuel use for LTO activities* per aircraft type for domestic aviation. For each aircraft type, multiply the fuel use factor in Table 8.3 corresponding to the specific aircraft type in Table 4.2 with the number of domestic LTOs carried out for the generic aircraft (fuel use factor in LTO for aircraft type * number of LTOs with the same aircraft type). The calculations are carried out for all types of generic aircraft. Calculate the total fuel use for LTO activities by summing all contributions found under step 5 for domestic aviation. If some types of national aircraft in use are not found in the table, use a similar type taking into account size and age. For LTOs for smaller aircraft and turboprops, see also section on non-IFR flights. Their emissions will have to be estimated separately, by a simpler method.
6. Calculate the total *fuel use for domestic cruise* by subtracting the total amount of fuel for LTO activities found in step 6 from the total in step 2 (estimated as in the Very Simple Methodology).
7. Estimate the *emissions from domestic LTO activities* per aircraft type. The number of LTOs for each aircraft type is multiplied by the emission factor related to the particular aircraft type and pollutant. This is done for all generic aircraft types. Relevant emission factors can again be found in Table 8.3. If some types of national aircraft in use are not found in the table, use a similar type taking into account size and age. For LTOs for smaller aircraft and turboprops, see also section on non-IFR flights. Their emissions will have to be estimated separately, by a simpler method.
8. Estimate the emissions from domestic *cruise activities*. Use the domestic cruise fuel use and the corresponding emission factor for the most common aircraft type used for domestic cruise activities (the Very Simple Methodology or Detailed Methodology). Relevant emission factors can be found in Table 8.2 or attached spreadsheets for Detailed Methodology (also available from the Task Force Secretariat & Website).

9. Calculate the *total emissions for LTO activities* for domestic aviation: Add up all contributions from the various aircraft types as found under step 7. The summations shall take place for each of the pollutants for which emissions are to be estimated (for CO_2, NO_x, SO_2, etc.).
10. Calculate the *total emissions for cruise activities* for domestic aviation. Add up all contributions from the various types of aircraft types as found under step 8). The summations shall take place for each of the pollutants for which emissions are to be estimated (for CO_2, NO_x, SO_2, etc.).
11. Repeat the calculation (step 4-10) for *international aviation*.

The estimated emissions are allocated to SNAP codes as follows:

- LTO, domestic activities found in step 9 go under the SNAP code 080501;
- LTO, international aviation found in step 9 go under the SNAP code 080502;
- Cruise, domestic aviation found in step 10 go under SNAP code 080503;
- Cruise, international aviation found in step 10 go under SNAP code 080504.

Table 4.2 Correspondence between aircraft type and representative aircraft

Generic Aircraft Type	ICAO	IATA	Generic Aircraft Type	ICAO	IATA	Generic Aircraft Type	ICAO	IATA
Airbus A310	A310	310	**Boeing 737-400**	B734	734	**Fokker 100**	F100	100
		312		B735	735	**Fokker F-28**	F28	F28
		313		B736	736			TU3
		A31		B737	737	**Boeing 737-100 * 2**	DC8	DC8
Airbus A320	A318	318			73A			D8F
	A319	319			73B			D8M
	A320	320			73F			D8S
	A321	321			73M			707
		32S			73S			70F
Airbus A330	A330	330			B86			IL6
		332			JET			B72
		333	**Boeing 747-100-300**	B741	741			VCX
Airbus A340	A340	340		B742	742	**McDonnell Douglas DC-9**	DC9	D92
		342		B743	743			D93
		343			747			D94
BAe 111	BA11	B11			74D			D95
		B15			74E			D98
		CRV			74F			D9S
		F23			A4F			DC9
		F24			74L			F21
		YK4			74M			YK2
BAe 146	BA46	141			74R	**McDonnell Douglas DC-10**	DC10	D10
		143			IL7			D11
		146			ILW			D1C
		14F			C51			D1F
Boeing 727	B721	721	**Boeing 747-400**	B744	744			L10
	B722	722	**Boeing 757**	B752	757			L11
	B727	727		B753	75F			L12
		72A			TR2			L15
		72F	**Boeing 767-300 ER**	B763	762			M11
		72M			763			M1F
		72S			767	**McDonnell Douglas M82**	MD81-88	717
		TU5			AB3		MD90	M80
		TRD			AB4			M81
Boeing 737-100	B731	731			AB6			M82
	B732	732			A3E			M83
	B733	733			ABF			M87
		DAM	**Boeing 777**	B772	777			M88
				B773	772			M90
					773			

* MD90 goes as MD81- 88 and B737- 600 goes as B737- 400.
** DC8 goes as double the B737- 100. F50, Dash8 - see separate table.

Table 4.3 Classification of turbopops

	Representative aircraft*
Up to 30 seats	Dornier 328
Up to 50 seats	Saab 2000
Up to 70 seats	ATR 72

* More representative aircraft are included in the full dataset (Grundstrøm 2000), if the actual turboprop in use is known.

Table 4.4 Overview of smaller aircraft types

Aircraft type	Aircraft category/engine principle	Maximum Take Off Weight according to Frawley's	Rank in Danish inventory 1998
Can_CL604 (CL60)	L2J	18	19
Canadair RJ 100 (CARJ)	L2J	24	17
CitationI (C500)	L2J	5.2	10
Falcon2000 (F2TH)	L2J	16.2	-
Falcon900 (F900)	L3J	20.6	8
Avro_RJ85 (BA46)	L4J	42	1
C130 (C130)	L4T	70.3	1
P3B_Orion (L188)	L4T	52.7	2
AS50 (AS50)	H1T	2	2
S61 (S61)	H2T	8.6	1

* L = Landplane, H= Helicopter, J = Jet engine, T = Turboprop, 1, 2 or 4 equals the number of engines
Source: Supplied by Danmarks Miljøundersøkelser

5 THE DETAILED METHODOLOGY

The data sources available for performing a Detailed Methodology may vary between countries. Also the scope of such a study may vary. We will present two detailed methodologies for aircraft here, one based on *aircraft movement data* recommend for *IFR flights* and one based on *fuel statistics or operational hours* recommended for *non-IFR flights*. In addition, both methodologies could be used to prepare an airport inventory e.g. for inclusion in an urban emission inventory.

The *Aircraft Movement Methodology* (based on aircraft movement data) is the preferred option for IFR flights when detailed aircraft movement data for LTO and cruise together with technical information on the aircraft are available. Basically, the use of the Detailed Methodology means that emissions are estimated for all the different types of aircraft which are in use and have been registered by LTO movements in the airports of the country. The Detailed Methodology may also include the actual times-in-mode at individual airports. The primary use of this method is to determine the fuel used and emissions from national and international aviation activities of a country, but it may also be used for other applications that may be required by research or monitoring. The methodology may be quite time consuming to perform.

The *Fuel Consumption Methodology* is particularly suited to use for aircraft categories where LTO data may be incomplete or not available at all, e.g. military aircraft, and miscellaneous uncertificated aircraft such as helicopters, taxi aircraft and pleasure aircraft.

5.1 The aircraft movement methodology for IFR-flights

The total emissions from aircraft are given by the sum of emissions from various technologies of aircraft in a continuous set of flying modes. In this methodology we will simplify the calculations by classifying the aircraft into a representative set of generic aircraft types and into two classes of flying modes, that of LTO and that of cruise. However, the methodology allows adjustment for actual times-in-mode of LTO at individual airports. This method also permits the use of individual aircraft/engine combinations if the data are available.

The methodology involves the following steps:

1. Select the aircraft and flight details from National data, for example Civil Aviation records, airport records, an ATC provider such as Eurocontrol in Europe, or the OAG timetable. This will identify the aircraft that were used in the inventory period, the number of LTOs for each and the mission distance flown. For the aircraft actually flying, select the aircraft used to represent them from the table of equivalent aircraft (Table 4.2). This is called the 'representative aircraft'. Use Table 4.3 for turboprops and Table 4.4 for miscellaneous smaller aircraft. See also Section 5.2. on non-IFR flights. Their emissions will have to be estimated separately, by a simpler method.
2. Note the distance of the mission. See Section 6 "activity data" for a description of how this may be determined.
3. From the attached spreadsheets (also available from the Task Force Secretariat & Website) or Table 8.3, select the data corresponding to the LTO phase for the representative aircraft, for both fuel used and all emissions. The fuel used and associated emissions from this table represent the fuel and emissions in the boundary layer below 3000 ft (1000 m). This gives an estimate of emissions and fuel used during the LTO phase of the mission.
4. From the table of representative aircraft types vs mission distance (attached spreadsheets), select the aircraft, and select the missions which bracket the one which is actually being flown. The fuel used is determined as an interpolation between the two. This is an estimate of fuel used during operations above 3000 ft (1000 m) (cruise fuel use).
5. The total quantity of fuel used for the mission is the sum of the fuel used for LTO plus the fuel used in all operations above 3000 ft (1000 m).
6. Now apply step 4 to the table of pollutants (NO_x, CO and HC) emitted vs mission distance and here again interpolate between the missions, which bracket the one being flown. This is an estimate of emissions during operations above 3000 ft (1000 m) (cruise emissions).
7. The total pollutants emitted during the flight is the sum of the pollutants emitted in LTO plus the quantity emitted in the rest of the mission.

See Section 8.3 for an example on how to apply the method.

If a specific aircraft-engine combination is required, then the LTO data must be calculated from the data contained in the ICAO Engine Emissions Data Bank for which the standard method of calculation is included (ICAO, 1995). This may increase the accuracy in the LTO emission estimate, but the cruise estimate based on generic aircraft cannot be changed based on these individual ICAO data.

Where *times-in-modes* are different from the assumptions made in this report, corrections may be made from basic data in the spreadsheets (also available from the Task Force Secretariat & Website) or in the ICAO databank.

Please note: The total estimated fuel use for domestic aviation must be compared to sales statistics or direct reports from the airline companies. If the estimated fuel deviates from the direct observation, the main parameters used for estimating the fuel must be adjusted in proportion to ensure that the mass of fuel estimated is the same as the mass of fuel sold.

5.2 Non IFR-flights

For some types of military or pleasure aircraft the numbers of hours in flight is a better activity indicator for estimating the fuel used and the emissions produced than the number of LTOs. In some cases the quantity of fuel used may be directly available.

1. Compile information on fuel used by aircraft category. The fuel types kerosene and aviation gasoline should be reported separately. If not directly available, estimate the fuel used from the hours of operation and fuel consumption factors.
2. Select the appropriate emission factors and fuel use factors from Tables 8.6-8.10.
3. Multiply the fuel consumption data in tonnes by the fuel-based emission factors to obtain an annual emission estimate.

6 RELEVANT ACTIVITY STATISTICS

The activity statistics that are required will depend on the methodology. The available statistics may, however, to some extent determine the choice of methodology.

Fuel use statistics:
These should be split between national and international as defined above. Sources of these data include:

- The airline companies;
- The oil companies;
- Energy statistics;
- Estimations from LTOs and cruise distances (see also the Detailed Methodology);
- Estimation from time tables (see also the Detailed Methodology);
- Airport authorities.

The landing/take-off statistics:

These can be obtained directly from airports, from the official aviation authorities or from national reports providing aggregated information on the number of landings- and take-offs taking place for national and international aviation.

National time- in-mode LTO-data:
If data for individual aircraft at individual airports are to be used instead of standard ICAO values, these may be obtained from the airports or the operators of the aircraft.

Fuel use or numbers of hours in operation:
For particular aircraft types these may be obtained from the airline, taxi or helicopter companies (usually a limited number at national level). Also sales statistics of fuels and energy balances may give some information. Data on the quantity of fuel used in military aircraft may be obtained from fuel sales statistics and energy balances or directly from the defence authorities. These data may be classified information and therefore estimates might have to be made.

Distance tables:
Average cruise distances may be derived from timetables, national aircraft authorities or ATC providers. Note that distances given may be Great Circle and might not reflect the actual distances flown, for example deviations around restricted areas or stacking at busy airports. Total flight distance must be used and not only that part within the national territory.

7 POINT SOURCE CRITERIA

If an airport has more than 100.000 LTOs per year (national plus international), the airport should be considered as a point source.

8 EMISSION FACTORS, QUALITY CODES AND REFERENCES

The emission factors used for the three methodologies are based on different levels of detail of the aircraft used to represent the fleet in the calculations.

ICAO (1995) (exhaust emission databank) provides basic aircraft engine emission data for certificated turbojet and turbofan engines covering the rate of fuel used, and the emission factors for HC, CO and NO_x at the different thrust settings used. Other relevant emission data are derived from other sources.

The *heavy metal* emissions are, in principle, determined from the metal content of kerosene or gasoline. Thus, general emission factors for stationary combustion of kerosene and combustion of gasoline in cars may be applied. The only exception is *lead*. Lead is added to aviation gasoline to increase the octane number. The lead content is higher than in leaded car gasoline, and the maximum permitted levels in UK are shown in Table 8.1 below.

Table 8.1 Lead content of aviation gasoline, UK.

AVGAS designation	Maximum lead content (as Tetra ethyl lead)
AVGAS 80	0.14 g/l
AVGAS Low Lead 100	0.56 g/l
AVGAS 100	0.85 g/l

A value of 0.6 g lead per litre gasoline should be used as the default value if there is an absence of better information. Actual data may be obtained from the oil companies.

There is not much information on particulate matter from aircraft. In Petzol et al. (1999) and Döpelheuer et al. (1998) data are published for various aircraft types. Petzol (1999) also describes the particle size. For newer aircraft the size distribution is dominated by particles with a diameter between 0.025 and 0.15 μm. This indicates that these emissions can be considered as $PM_{2.5}$. For newer aircraft (certificated after 1976), e.g. A300, B737 and DC10 is the emission facto about 0,01 g/kg fuel. Döpelheuer (1998) also gives data for different phases of the flight for A300. The factor is higher at take-off (0,05 g/kg) and lower at cruise (0,0067 g/kg), while the factor for climb and descent is about 0,01.

Little information is currently available about possible exhaust emissions of POPs (Persistent Organic Pollutants) from aircraft engines. USEPA has derived a PAH-16/VOC fraction of $1.2*10^{-4}$ and a PAH-7/VOC fraction of $1.0*10^{-6}$ for commercial aviation (USEPA 1999). PAH-7 here includes the four UNECE PAHs and three additional species.

Emissions of *water* (H_2O) may be derived from the fuel consumption at the rate of 1.237 kg water/kg fuel.

8.1 Very Simple Methodology

The emission factors in Table 8.2 should be applied when using the Very Simple Methodology. The average international aircraft fleet is represented by a long distance aircraft (large aircraft). If the international trips from the inventory country are mostly short distance (smaller aircraft), it may be more accurate to use the information for domestic aircraft, or to make an appropriate split into short (< 1000 nm) and long (> 1000 nm) distance flights, see 4.1. The emission factors may also be averaged whenever appropriate. LTO emission estimates will in most countries be far too high using the average aircraft only. Such a distinction cannot be made for cruise emissions using the simple methodology. This is, however, a small error as the emissions are estimated from the fuel residual.

Table 8.2 Emission factors and fuel use for the *Very Simple* methodology. Emission factors are given on a representative aircraft basis.

Domestic	**Fuel**	**SO_2**	**CO_2**	**CO**	**NO_x**	**NM-VOC**	**CH_4**	**N_2O**
LTO (kg/LTO) – Average fleet (B737-400)	825	0.8	2600	11.8	8.3	0.5	0.1	0.1
LTO (kg/LTO) – Old fleet (B737-100)	920	0.9	2900	4.8	8.0	0.5	0.1	0.1
Cruise (kg/tonne) – Average fleet (B737-400)	-	1.0	3150	2.0	10.3	0.1	0	0.1
Cruise (kg/tonne)- Old fleet (B737-100)	-	1.0	3150	2.0	9.4	0.8	0	0.1
International	**Fuel**	**SO_2**	**CO_2**	**CO**	**NO_x**	**NM-VOC**	**CH_4**	**N_2O**
LTO (kg/LTO) – Average fleet (B767)	1617	1.6	5094	6.1	26.0	0.2	0.0	0.2
- LTO (kg/LTO) – Average fleet (short distance, B737-400)	825	0.8	2600	11.8	8.3	0.5	0.1	0.1
- LTO (kg/LTO) – Average fleet (long distance, B747-400)	3400	3.4	10717	19.5	56.6	1.7	0.2	0.3
LTO (kg/LTO) – Old fleet (DC10)	2400	2.4	7500	61.6	41.7	20.5	2.3	0.2
- LTO (kg/LTO) – Old fleet (short distance, B737-100)	920	0.9	2900	4.8	8.0	0.5	0.1	0.1
- LTO (kg/LTO) – Old fleet (long distance, B747-100)	3400	3.4	10754	78.2	55.9	33.6	3.7	0.3
Cruise (kg/tonne)- Average fleet (B767)	-	1.0	3150	1.1	12.8	0.5	0.0	0.1
Cruise (kg/tonne)- Old fleet (DC10)	-	1.0	3150	1.0	17.6	0.8	0.0	0.1

*Sulphur content of the fuel is assumed to be 0.05% S (by mass) for both LTO and cruise activities.
** Assuming a cruise distance of 500 nm for short distance flights and 3000 nm for long distance flights.
Source: Derived from ANCAT/EC2 1998, Falk 1999 and MEET 1999.

The emission factors for the new fleet can well be higher than that for the fleet it replaces. The reason is that the newer fleet has engines which, in comparison with those of the older fleet, have higher pressure ratios and therefore operate more efficiently, but, at higher combustion temperatures, thus producing more emissions of NO_x. Other pollutants increase for other reasons. However, the increase in aircraft seating capacity of the newer fleet over the old one may lead to a reduction in emissions per passenger.

8.2 Simple Methodology

For the Simple Methodology emission factors in Table 8.3 should be used. For aircraft not contained here, the general factors (Table 8.2) may be used, or use correspondence tables for the Detailed Methodology.

Table 8.3 Examples of aircraft types and emission factors for LTO cycles as well as fuel consumption per aircraft type, kg/LTO

Aircraft type[a)]	CO_2	CH_4	N_2O[b)]	NO_x	CO	NMVOC	SO_2[c)]	Fuel
A310	4853	0.5	0.2	23.2	25.8	5.0	1.5	1540.5
A320	2527	0.2	0.1	10.8	17.6	1.7	0.8	802.3
A330	7029	0.2	0.2	36.1	21.5	1.9	2.2	2231.5
A340	6363	1.9	0.2	35.4	50.6	16.9	2.0	2019.9
BAC1-11	2147	2.1	0.1	4.9	37.7	19.3	0.7	681.6
BAe146	1794	0.1	0.1	4.2	9.7	0.9	0.6	569.5
B727	4450	0.7	0.1	12.6	26.4	6.5	1.4	1412.8
B737 100	2897	0.1	0.1	8.0	4.8	0.5	0.9	919.7
B737 400	2600	0.1	0.1	8.3	11.8	0.6	0.8	825.4
B747 100-300	10754	3.7	0.3	55.9	78.2	33.6	3.4	3413.9
B747 400	10717	0.2	0.3	56.6	19.5	1.6	3.4	3402.2
B757	3947	0.1	0.1	19.7	12.5	1.1	1.3	1253.0
B767 300 ER	5094	0.1	0.2	26.0	6.1	0.8	1.6	1617.1
B777	8073	2.3	0.3	53.6	61.4	20.5	2.6	2562.8
DC9	2760	0.1	0.1	7.3	5.4	0.7	0.9	876.1
DC10	7501	2.3	0.2	41.7	61.6	20.5	2.4	2381.2
F28	2098	3.3	0.1	5.2	32.7	29.6	0.7	666.1
F100	2345	0.1	0.1	5.8	13.7	1.3	0.7	744.4
MD81-88	3160	0.2	0.1	12.3	6.5	1.4	1.0	1003.1

(a) For CH_4 and NMVOC it is assumed that the emission factors for LTO cycles be 10% and 90% of total VOC (HC), respectively (Olivier, 1991). Studies indicate that during cruise no methane is emitted (Wiesen et al., 1994).

(b) Estimates based on IPCC Tier 1 default values.

(c) Sulphur content of the fuel is assumed to be 0.05% for both LTO and cruise activities.

For the DC8 use double the fuel consumption of the B737-100 because it is fitted with four engines instead of two. MD90 goes as MD81-88 and B737-600 goes as B737-400.
Source: Derived from ANCAT/EC2 1998, Falk (1999) and MEET 1999.

The CO_2 emissions are based on the following factor: 3.15 kg CO_2 /kg fuel.

We recommend that the Very Simple Methodology (emission factor for a generic aircraft) is used to estimate the cruise emissions also when using the Simple Methodology. Alternatively pick another aircraft from Table 8.4 or Table 8.5 that may be assumed to be more representative and assume an appropriate cruise distance. The reason is that the residual step of the Simple Methodology does not rely on any knowledge of the proportion of aircraft types in the cruise mode nor the cruise distances.

Using the emission factors, special emphasis should be put on the assumptions of the weight percent of sulphur (assumed at 0.05%). If the sulphur percent of the fuel used is different, this should be taken into account. If the sulphur percent used for example is 0.01% instead of 0.05%, the emission factor should be divided by 5 to show the true factor.

8.3 Detailed Methodology

8.3.1 IFR-flights

For the Detailed Methodology emission factors for the representative aircraft are given in Table 8.4. The correspondence between actual aircraft and representative aircraft is given in Table 4.2 and 4.3.

Table 8.4 Emission factors and fuel use factors for various aircraft per LTO and distance cruised.

Table is given in associated spreadsheets available in the internet version of this Guidebook. Extracts of the tables are displayed below.

B737 400

		Standard flight distances (nm)			[1nm = 1.852 km]			
		125	**250**	**500**	**750**	**1000**	**1500**	**2000**
Distance (km)	Climb/cruise/descent	231.5	463	926	1389	1852	2778	3704
Fuel (kg)	Flight total	1603.1	2268.0	3612.8	4960.3	6302.6	9187.7	12167.6
	LTO	825.4	825.4	825.4	825.4	825.4	825.4	825.4
	Taxi out	183.5	183.5	183.5	183.5	183.5	183.5	183.5
	Take off	86.0	86.0	86.0	86.0	86.0	86.0	86.0
	Climb out	225.0	225.0	225.0	225.0	225.0	225.0	225.0
	Climb/cruise/descent	777.7	1442.6	2787.4	4134.9	5477.2	8362.3	11342.2
	Approach landing	147.3	147.3	147.3	147.3	147.3	147.3	147.3
	Taxi in	183.5	183.5	183.5	183.5	183.5	183.5	183.5
NO_x (kg)	Flight total	17.7	23.6	36.9	48.7	60.2	86.3	114.4
	LTO	8.3	8.3	8.3	8.3	8.3	8.3	8.3
	Taxi out	0.784	0.784	0.784	0.784	0.784	0.784	0.784
	Take off	1.591	1.591	1.591	1.591	1.591	1.591	1.591
	Climb out	3.855	3.855	3.855	3.855	3.855	3.855	3.855
	Climb/cruise/descent	9.462	15.392	28.635	40.425	51.952	78.047	106.169
	Approach landing	1.240	1.240	1.240	1.240	1.240	1.240	1.240
	Taxi in	0.784	0.784	0.784	0.784	0.784	0.784	0.784
$EINO_x$ (g/kg fuel)	Taxi out	4.27	4.27	4.27	4.27	4.27	4.27	4.27
	Take off	18.51	18.51	18.51	18.51	18.51	18.51	18.51
	Climb out	17.13	17.13	17.13	17.13	17.13	17.13	17.13
	Climb/cruise/descent	12.17	10.67	10.27	9.78	9.49	9.33	9.36
	Approach landing	8.42	8.42	8.42	8.42	8.42	8.42	8.42
	Taxi in	4.27	4.27	4.27	4.27	4.27	4.27	4.27
HC (g)	Flight total	817.6	912.9	995.8	1065.2	1118.1	1240.4	1374.1
	LTO	666.8	666.8	666.8	666.8	666.8	666.8	666.8
	Taxi out	321.18	321.18	321.18	321.18	321.18	321.18	321.18
	Take off	3.09	3.09	3.09	3.09	3.09	3.09	3.09
	Climb out	10.58	10.58	10.58	10.58	10.58	10.58	10.58
	Climb/cruise/descent	150.78	246.13	329.05	398.47	451.33	573.67	707.37
	Approach landing	10.74	10.74	10.74	10.74	10.74	10.74	10.74
	Taxi in	321.18	321.18	321.18	321.18	321.18	321.18	321.18
EIHC (g/kg fuel)	Taxi out	1.75	1.75	1.75	1.75	1.75	1.75	1.75
	Take off	0.04	0.04	0.04	0.04	0.04	0.04	0.04
	Climb out	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Climb/cruise/descent	0.19	0.17	0.12	0.10	0.08	0.07	0.06
	Approach landing	0.07	0.07	0.07	0.07	0.07	0.07	0.07
	Taxi in	1.75	1.75	1.75	1.75	1.75	1.75	1.75
CO (g)	Flight total	14252.5	15836.0	17525.5	19060.6	20369.3	23298.2	26426.3
	LTO	11830.9	11830.9	11830.9	11830.9	11830.9	11830.9	11830.9
	Taxi out	5525.45	5525.45	5525.45	5525.45	5525.45	5525.45	5525.45
	Take off	77.19	77.19	77.19	77.19	77.19	77.19	77.19
	Climb out	202.29	202.29	202.29	202.29	202.29	202.29	202.29
	Climb/cruise/descent	2421.54	4005.06	5694.59	7229.65	8538.39	11467.26	14595.41
	Approach landing	500.54	500.54	500.54	500.54	500.54	500.54	500.54
	Taxi in	5525.45	5525.45	5525.45	5525.45	5525.45	5525.45	5525.45

B737 400		Standard flight distances (nm) [1nm = 1.852 km]						
		125	**250**	**500**	**750**	**1000**	**1500**	**2000**
EICO (g/kg fuel)	Taxi out	30.11	30.11	30.11	30.11	30.11	30.11	30.11
	Take off	0.90	0.90	0.90	0.90	0.90	0.90	0.90
	Climb out	0.90	0.90	0.90	0.90	0.90	0.90	0.90
	Climb/cruise/descent	3.11	2.78	2.04	1.75	1.56	1.37	1.29
	Approach landing	3.40	3.40	3.40	3.40	3.40	3.40	3.40
	Taxi in	30.11	30.11	30.11	30.11	30.11	30.11	30.11

Example:

A B737-400 aircraft is travelling a mission distance of 1723 nm. We want to estimate the fuel use:

The fuel use for LTO is taken directly from the table and is 825 kg (independent of mission distance).

For operation above 3000 feet (cruise/climb/descent), the fuel used is 8362 + ((11342-8362)*(1723-1500)/(2000-1500)) = 9691 kg

The emissions of the various pollutants may be estimated in the same way:

The LTO NO_x may be read directly from the table = 8.3 kg.

For operation above 3000 feet (flight less LTO), the NO_x is 78+ ((106-78)*(1723-1500)/(2000-1500)) = 90.5 kg

EINOx for the mission is therefore (8.3+90.5)kg/(826+9691)kg = 8.9 g NO_x per kg fuel. This may be used as a check to ensure that no arithmetic error has been made in the calculations.

For pollutants not given in the Table 8.3 we recommend using the Simple Methodologies based on the estimated fuel use in the Detailed Methodology.

Emissions from smaller IFR flight aircraft engines are not certificated, and emission data are less well known. Larger turboprops may be in use for domestic flights and short international flights. Though they do not contribute to emissions on a larger scale, they may be important when estimating domestic emissions. Default emission factors are given in Table 8.5.

Table 8.5 Fuel consumption and emission factors for turboprops.

Table is given in associated spreadsheets available in the internet version of this Guidebook (also available from the Task Force Secretariat & Website).

8.3.2 Non-IFR

There is little information available on emission factors for non-IFR flights. Generally, the NO_x emission factors will be lower and the CO and VOC factors substantially higher than for IFR flights.

It is at present not possible to recommend default emission factors.

Fuel consumption factors are given for two categories of aircraft (Cessna and others) to be used if other information of fuel used not is available (Table 8.6). Please note that the tables apply to single engine aircraft only. If the aircraft is fitted with two engines (e.g. Cessna 500), then double the fuel consumption. Ranges of emission factors are shown in MEET (1997). A summary is given in Table 8.7.

Some emission factors and fuel use factors for helicopters and military flights are given in Tables 8.8, 8.9 and 8.10. Also note that many types of military aircraft may have civil equivalents. Helicopters are also included in Table 8.5.

Table 8.6 Fuel consumption for piston engined aircraft, litre/hour

Cessna C 152, C 172, C 182 (single engine)	0 feet altitude	2000 feet alt.	4000 feet alt
75 % power (=135 HP)	41	42	no data
70 % power (=126 HP)	37	38	39
65 % power (=117 HP)	33.5	34	34.5

For an average use 36 litre/hour.

Robin (French aircraft), various Piper types (single engine)	0 feet altitude	4000 feet alt.
70 % power	36.5	no data
64 % power	34	33.5
58 % power	31	31

For an average use 33 litre/hour.

Table 8.7 Examples of emission factors for piston engined aircraft, g/kg fuel

		NO_x	HC	CO	SO_2
Netherlands	FL 0-30	2.70	20.09	1,054	0.21
	FL 30-180	4.00	12.50	1,080	0.17
Germany		3.14	18.867	798	0.42

* Multiply FL by 100 to obtain the altitude in feet.
Source: MEET Deliverable No 18.

Table 8.8 Examples of emission factors for helicopters and military flights. g/kg fuel

	Nature of flights	NO_x	HC	CO	SO_2
Germany	LTO-cycle	8.3	10.9	39.3	1.1
	Helicopter cruise	2.6	8.0	38.8	1.0
	combat jet	10.9	1.2	10.0	0.9
	cruise 0.46-3 km	10.7	1.6	12.4	0.9
	cruise >3 km	8.5	1.1	8.2	0.9
Netherlands	average	15.8	4.0	126	0.2
	F-16	15.3	3.36	102	0.2
Switzerland	LTO-Cycle	4.631	2.59	33.9	1.025
	cruise	5.034	0.67	14.95	0.999

Source: MEET Deliverable No 18.

Table 8.9 Emission factors for Helicopters of Germany

g/kg	NO_x	HC	CO	SO_2
Germany: cruise	2.6	8.0	38.8	0.99
Netherlands: cruise	3.1	3.6	11.1	0.20
Switzerland	13.3	0.3	1.1	0.97

Source: MEET Deliverable No 18.

Table 8.10 Fuel consumption factors for military aircraft

Group	Sub-group	Representative type	Fuel flow kg/hour
1. Combat	Fast Jet- High Thrust	F16	3283
	Fast Jet - Low Thrust	Tiger F-5E	2100
2. Trainer	Jet trainers	Hawk	720
	Turboprop trainers	PC-7	120
3. Tanker/transport	Large Tanker/Transport	C-130	2225
	Small Transport	ATP	499
4. Other	MPAs, Maritime Patrol	C-130	2225

Source: ANCAT, British Aerospace/Airbus

9 SPECIES PROFILES

Since very few experiments have been reported where the exhaust gas from aircraft turbines has been analysed in detail, it is not possible to give a specific species profile. In terms of NO_x and VOC, the profiles vary, amongst other reasons, with the thrust setting of the aircraft and therefore on the activity. In terms of aircraft cruise, it is not possible to obtain accurate estimates for emission factors.

In terms of the LTO activity, the situation is similar. Attempts have been made to estimate the composition of the VOC profile. Shareef et al., (1988) have estimated a VOC profile for a jet engine based on an average LTO cycle for commercial and general aviation. The composition is presented in Table 9.1.

PAH species profiles can be found in USEPA (1999), but not all species are available.

Table 9.1 The VOC profile for a jet engine based on an average LTO cycle for commercial and general aviation.

Compound in VOC profile	Percentage of total VOC (weight)	
	Commercial aircraft	General aviation
Ethylene	17.4	15.5
Formaldehyde	15.0	14.1
$C_6H_{18}O_3Si_3$	9.1	11.8
Methane	9.6	11.0
Propene	5.2	4.6
Acetaldehyde	4.6	4.3
$C_8H_{24}O_4Si_4$	2.9	4.2
Ethyne	4.2	3.7
Acetone	2.4	2.9
Glyoxal	2.5	2.5
Acrolein	2.3	2.1
Butene	2.0	1.8
Benzene	1.9	1.8
1,3-butadiene	1.8	1.6
Methyl glyoxal	2.0	1.8
n-dodecane	1.1	1.2
Butyraldehyde	1.2	1.2
Others < 1%	14.8	13.9
Others	<1	<1
Total	100	100

Source: Shareef et al., 1988

Please note that the thrust setting during the landing and the take-off of the aircraft are different (see Table 3.1). Therefore, it is likely that the species profile will be different for the two situations. Again nothing is known on these aspects.

10 UNCERTAINTY ESTIMATES

The uncertainties of the estimated aircraft emissions are closely associated with the emission factors assigned to the estimations.

The emissions of NO_x (and fuel use) are generally determined with a higher accuracy than the other pollutants.

10.1 Very Simple Methodology

The accuracy of the distribution of fuel between domestic and international will depend on the national conditions.

The use of 'representative' emission factors may contribute significantly to the uncertainty. In terms of the factors relating to the LTO activities, the accuracy is better than for cruise (due to the origin of the factors from which the average values are derived from). It would be hard to calculate a quantitative uncertainty estimate. The uncertainty may however lie between 20-30% for LTO factors and 20-45% for the cruise factors.

10.2 Simple Methodology

The accuracy of the distribution of fuel between domestic and international will depend on the national conditions.

The uncertainties lie mainly in the origin of the emission factors. There is a high uncertainty associated with the cruise emission factors.

10.3 Detailed Methodology

Uncertainties lie in emission factors for the engines. ICAO (1995) estimates that the uncertainties of the different LTO factors are about 5-10%. For cruise, the uncertainties are assumed to be 15-40%.

11 WEAKEST ASPECTS/PRIORITY AREAS FOR IMPROVEMENT IN CURRENT METHODOLOGY

The list given below summarises causes for concern and areas where further work may be required.

LTO

- Estimates of fuel used and emissions based on ICAO cycles (refer to ICAP Annex 16, Volume I) it may not reflect accurately the situation of aircraft and airport operations.
- The relationship between the minor pollutants and the regulated pollutants (HC, CO, NO_x) may need to be investigated in more detail.

Emissions above 3000 ft (3000 m)

- The emission factors and fuel use for short distances (125 and 250 nm) are difficult to model and the suggested values are highly uncertain.
- The actual distance flown compared with Great Circle distances that are given in the OAG timetable may vary by up to 10 to 11 % in Europe (ANCAT/EC2 1998).
- The actual altitude flown will vary according to air traffic management constraints compared with ideal altitudes flown by the PIANO computer model used by the UK DTI. Altitude will influence fuel consumed (lower cruise altitudes equal higher fuel consumption rate and hence also the emissions) and also the rate of production of NO_x.

12 SPATIAL DISAGGREGATION CRITERIA FOR AREA SOURCES

Airports and emissions should be associated with the appropriate territorial unit (for example country). The airports can be divided into territorial units in the following way:

1. The fuel and emissions from specific airports can be identified, and then summed to show the emissions from region, which in turn can be summed for a country as a whole. Airports located in the various territorial areas should be identified

2. From the total national emission estimate emissions can be distributed to the territorial areas and airports using a key reflecting the aviation activity (e.g. the number of landings and take-off cycles) between territorial areas and airports.

13 TEMPORAL DISAGGREGATION CRITERIA

The temporal data may be obtained from flight timetables. There may be diurnal variations as well as variations over months and weekdays.

14 ADDITIONAL COMMENTS

The methodologies and data described in this chapter reflect the current state of the art knowledge. Obviously, the methods and data may be improved in the future.

15 SUPPLEMENTARY DOCUMENTS

16 VERIFICATION PROCEDURES

The methodology presented here could be used with international flight statistics (for example ATC providers) to provide a crosscheck against estimates made by individual national experts on the basis of national fuel and flight statistics.

National estimates may be checked against central inventories like ANCAT (1998) and NASA (1996) for 1991/92 and 1992, respectively.

Estimated emissions and fuel use per available seat kilometres travelled may also be compared between countries and aircraft types to ensure the credibility of the data which have been collected.

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19 RELEASE VERSION, DATE AND SOURCE

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Documentation

Standard flights from 125 nm to 6500 nm
Only regional and short/medium haul have 125 and 250 nm
Original unedited ANCAT/EC2 aircraft (long haul) do not have 750 nm calculation
BAC1-11 does NOT have 125, 250, 750 nm calculations
These data are consequently approximated.

All calculations are done at mid cell altitudes (intermediate 500 m levels)
Where aircraft cruise at below 7000 m (applies only to F28, DC9) calculations have been done at 7500m mid cell altitude

Origin of data (fuel and NOx):
ANCAT/EC2 aircraft for 500, 1000, 1500 nm etc - PIANO version 2.5
A330, A340, B777 - PIANO version 3.3
125, 250, 750 nm for ANCAT/EC2 regional and short/medium haul aircraft - PIANO version 3.5

NOx calculation by DLR semi empirical fuel flow method

Original Data on files STDFLGT2.XLS, A330FLGT.XLS, A340FLGT.XLS, B777FLGT.XLS

Data for BAe 146 and F28 recalculated after discrepancies were found between original ANCTA/EC2 aircraft data and those used to predoue the shorter distances

Emission data for *HC and CO* are based on the MEET methodology, which use the ATEMIS calculation model.
The MEET project -'Methodologies for estimating air pollutant emissions from tansport' has been undertaken in order to provide a basic, Europe-wide procedure for evaluating the impact of transport on air pollutant emissions and energy consumption and was supported by the European Commission under the transport RTD programe of the 4th framework programme. Details of methodology and emission factors for air traffic are described in the MEET final report published by the European Commission, DG VII/E: MEET - Methodologies for estimating air pollutant emissions from transport. Office for Official Publications of the European Communities, Luxembourg 1999, ISBN 92-828-6785-4.

This spreadsheet was established 31 March 1999

GENERIC AIRCRAFT TYPE	ICAO	IATA AIRCRAFT IN GROUP	GENERIC AIRCRAFT TYPE	ICAO	IATA AIRCRAFT IN GROUP	GENERIC AIRCRAFT TYPE	ICAO	IATA AIRCRAFT IN GROUP	GENERIC AIRCRAFT TYPE	ICAO	IATA AIRCRAFT IN GROUP
BAe 146	BA46	141	**Airbus A320**	A320	320	**Boeing 747-400**	B744	744	**McDonnell Douglas DC10**	DC10	D10
		143			32S	**Boeing 757**		757			D11
		146			321			75F			D1C
		14F	**Airbus A 319**	A319	319			TR2			D1F
Airbus A310	A310	310	**Airbus A 330**	A330	330	**Boeing 767**		762			L10
		312			332			763			L11
		313			333			767			L12
		A31	**Airbus A 340**	A340	340			AB3			L15
Boeing 727-100	B721	721			342			AB6			M11
Boeing 727-200	B722	722			343			A3E			M1F
Boeing 727-300	B727	727	**BAe 111**	BA11	B11			ABF	**McDonnell Douglas DC8**		DC8
		72A			B15			AB4			D8F
		72F			CRV	**Boeing 777**		777			D8M
		72M			F23	**Boeing 777-200**	B772	772			D8S
		72S			F24	**Boeing 777-300**	B773	773			707
		TU5			YK4	**McDonnell Douglas DC-9**		D92			70F
Boeing 737-200	B732	732	**Boeing 747-100-300**	B741	741			D93			IL6
Boeing 737-500	B735	735		B742	742			D94			B72
		73A		B743	743			D95			
		73B			747			D98			
		73F			74D			D9S			
		73M			74E			DC9			
		73S			74F			F21			
		D86			A4F			TRD			
		JET			74L			YK2			
		DAM			74M	**McDonnell Douglas M81-M88**	MD81-88	M80			
Boeing 737-400	B734	734			74R			M81			
Boeing 737-300	B733	733			IL7			M82			
Boeing 737-700	B737	737			ILW			M83			
Fokker 100	F100	100			NIM			M87			
Fokker F-28	F28	F28			VCX			M88			
		TU3			C51						

NOTE:
The abbreviations are taken from the OAG
This table excludes business jets

IATA	ICAO	TYPE
100	F100	Fokker 100 (F28 Mk0100)
313	A310	Airbus Ind. A310-304 (F) (CC-150) Polari
319	A319	Airbus Industrie A319-111
320	A320	Airbus Industrie A320-111
321	A321	Airbus Industrie A321-111
332	A330	Airbus Industrie A330-202
342	A340	Airbus Industrie A340-211
703	B703	Boeing 707-307C
707	B707	Boeing 707-436
707	C135	Boeing VC-135B
707	K35A	Boeing KC-135A
70F	B701	Boeing 707-123B
717	B712	Boeing 717-200
72A	B722	Boeing 727-208 Advanced
72F	B721	Boeing 727-108C (QF)
731	B731	Boeing 737-112
733	B733	Boeing 737-301
734	B734	Boeing 737-400
735	B735	Boeing 737-505
735	B736	Boeing 737-5Q8
738	B738	Boeing 737-804
73A	B732	Boeing 737-200 Advanced
73G	B737	Boeing 737-700
741	B741	Boeing 747-121
741	B74R	Boeing 747-146B (SR / SUD)
742	B742	Boeing 747-206B
74D	B743	Boeing 747-306 (M)
74L	B74S	Boeing 747SP-09
74Y	B744	Boeing 747-400F (SCD)
752	B752	Boeing 757-200
753	B753	Boeing 757-300
762	B762	Boeing 767-200
763	B763	Boeing 767-304 (ER)
772	B772	Boeing 777-200
773	B773	Boeing 777-312
A4F	A124	Antonov 124 Ruslan
AB6	A306	Airbus Industrie A300-601 (A300B4-601)
ABF	A30B	Airbus Ind.A300B4-203 (F) (Eurofreighter
ABF	A3ST	Airbus Ind.A300-608ST Beluga (A300-600ST
ACP	AC50	Twin (Aero) Commander 500
ACP	AC52	Twin (Aero) Commander 520
ACP	AC56	Twin (Aero) Commander 560
ACP	AC68	Twin (Aero) Commander 680E
ACP	CM11	Commander (Rockwell) 114
ACP	FA30	Twin (Aero) Commander 700
ACT	AC90	Twin (Aero) Jetprop Commander 840 (690C)
ACT	AC95	Twin (Aero) Jetprop Commander 1000 (695A
AN2	A225	Antonov 225 Mriya
AN2	AN22	Antonov 22
AN4	AN24	Antonov 24
AN6	AN26	Antonov 26
AN6	AN30	Antonov 30
AN6	AN32	Antonov 32
AN7	AN72	Antonov 72
ANF	AN12	Antonov 12
AR1	BA46	Avro RJ100 (Avro 146-RJ100)
AT3	AT43	ATR 42-300
AT5	AT45	ATR 42-500
AT7	AT72	ATR 72-102
ATP	ATP	BAe ATP
B12	BA11	BAe (BAC) One-Eleven 201AC
B72	B720	Boeing 720-022
BE2	BE18	Beech 3N (18)
BE2	BE50	Beech Twin Bonanza C50
BE2	BE55	Beech Baron 95-55
BE2	BE56	Beech Baron 56TC
BE2	BE58	Beech Baron 58
BE2	BE60	Beech Duke 60
BE2	BE65	Beech Queen Air 65
BE2	BE70	Beech Queen Air 70
BE2	BE76	Beech Duchess 76
BE2	BE80	Beech Excalibur Queenaire 8800
BE2	BE88	Beech Excalibur Queenaire 8200
BE2	BE95	Beech Travel Air 95
BEC	T34T	Beech Mentor T-34C

IATA	ICAO	TYPE
BEP	BE33	Beech Bonanza F33A
BEP	BE35	Beech Bonanza 35-E33
BEP	BE36	Beech Bonanza 36
BES	B190	Beech 1900 Airliner
BET	B18T	Hamilton Westwind I Tri-gear
BET	B350	Beech King Air 350 (B300)
BET	BE10	Beech King Air 100
BET	BE20	Beech 1300 Airliner
BET	BE30	Beech King Air 300
BET	BE40	Beech Beechjet 400
BET	BE99	Beech 99 Airliner
BET	BE9L	Beech Jetcrafters Taurus A90
BET	BE9T	Beech King Air F90
BET	STAR	Beech Starship 2000
BH2	B222	Bell 222
BH2	B407	Bell 407
BH2	B427	Bell 427
BH2	BSTP	Bell 214ST
BH2	HUCO	Bell AH-1P (209) Cobra Lifter
BH2	XV15	Bell 301 (XV-15)
BNI	BN2P	Britten-Norman BN-2A Islander
BNI	BN2T	Britten-Norman BN-2T Turbine Islander
BNT	TRIS	Britten-Norman BN-2A Mk.III Trislander
CCJ	CL60	Canadair CL-600S (CC-144) Challenger
CD2	NOMA	GAF N22B Nomad
CL4	CL44	Canadair CL-44-6
CL4	CL4G	Canadair CL-44-0 Guppy
CN1	C182	Cessna 182Q Skylane II
CN1	C185	Cessna 185 Skywagon
CN1	C188	Cessna A188B AgTruck
CN1	C195	Cessna 195
CN1	C205	Cessna 205
CN1	C206	Cessna 206 Super Skywagon
CN1	C207	Cessna 207 Skywagon
CN1	C210	Cessna 210B
CN1	C21C	Cessna 210F Centurion
CN1	C82R	Cessna R182 Skylane RG II
CN1	P210	Cessna P210N Pressurized Centurion II
CN2	C303	Cessna T303 Crusader
CN2	C310	Cessna 310
CN2	C320	Cessna 320A SkyKnight
CN2	C335	Cessna 335
CN2	C336	Cessna 336 Skymaster
CN2	C337	Cessna 337 Super Skymaster
CN2	C340	Cessna 340
CN2	C402	Cessna 401
CN2	C404	Cessna 404 Titan
CN2	C411	Cessna 411
CN2	C414	Cessna 414
CN2	C421	Cessna 421
CN2	P337	Cessna P337H Press. Skymaster II
CNC	C208	Cessna 208 Caravan I
CNJ	C500	Cessna 500 Citation
CNJ	C501	Cessna 501 Citation I/SP
CNJ	C525	Cessna 525 CitationJet
CNJ	C550	Cessna 550 Citation Bravo
CNJ	C551	Cessna 551 Citation II/SP
CNJ	C560	Cessna 560 Citation V
CNJ	C56X	Cessna 560XL Citation Excel
CNJ	C650	Cessna 650 Citation III
CNJ	C750	Cessna 750 Citation X
CNT	C425	Cessna 425 Conquest I
CNT	C441	Cessna 441 Conquest II
CNT	F406	Reims/Cessna F406 Caravan II
CRJ	CARJ	Canadair 200ER JetLiner (CL-600-2B19)
CRV	S210	Aerosp. (Sud) SE210 Caravelle 10B1R
CS2	C212	CASA 212 Aviocar Series 100
CS5	CN35	CASA (IPTN) CN-235-10
CVY	CVLT	Convair 580
CWC	C46	Curtiss C-46A-35-CU Commando
D11	DC10	Boeing (Douglas) DC-10-10
D28	D228	Dornier 228-100
D38	D328	Dornier 328-110
D85	DC85	Boeing (Douglas) DC-8-51
D86	DC86	Boeing (Douglas) DC-8-61

IATA	ICAO	TYPE
D8Y	DC87	Boeing (Douglas) DC-8-71F
D9F	DC9	Boeing (Douglas) C-9A (DC-9-32F)
DC3	DC3	AMI Turbo DC-3C
DC4	DC4	Boeing (Douglas) DC-4 (C-54-DO)
DC6	DC6	Boeing (Douglas) DC-6
DC7	DC7	Boeing (Douglas) DC-7
DF2	F2TH	Dassault Falcon 2000
DF2	FA10	Dassault (Breguet) Mercure 100
DF2	FA20	Dassault Falcon 200
DF3	F900	Dassault Falcon 900
DF3	FA50	Dassault Falcon 50
DF3	FA90	Dassault Falcon 900B
DH1	DH8A	De Havilland DHC-8-102 Dash 8
DH1	DH8B	De Havilland DHC-8-201 Dash 8
DH3	DH8C	De Havilland DHC-8-301 Dash 8
DH4	DH8D	De Havilland DHC-8-401 Dash 8Q
DH4	DHC4	De Havilland DHC-4A Caribou
DH7	DHC7	De Havilland DHC-7-102 Dash 7
DHD	DOVE	BAe (DH) 104 Dove 1B
DHH	HERN	BAe (DH) 114 Heron 2
DHP	DHC2	De Havilland DHC-2 Beaver I
DHR	DH2T	De Havilland DHC-2 Turbo Beaver AI
DHS	DHC3	De Havilland DHC-3 Otter
DHT	DHC6	De Havilland DHC-6 Twin Otter 100
EM2	E120	Embraer 120ER (QC) Brasilia
EM3	E135	Embraer RJ135 (EMB-135)
EM4	E145	Embraer RJ145EP (EMB-145EP)
EMB	E110	Embraer 110 Bandeirante (EMB-110)
F21	F28	Fokker F28 Fellowship 1000 (F28 Mk1000)
F27	F27	Conair Firebomber (Fokker F27 Mk600)
F50	F50	Fokker 50 (F27 Mk050)
F70	F70	Fokker 70 (F28 Mk0070)
FDJ	J328	Dornier 328JET (328-300)
GRG	G21	Grumman (McKinnon) G-21G Turbo Goose
GRJ	GLF2	GAC (Grumman) G-1159 Gulfstream II
GRJ	GLF3	GAC C-20A (G-1159A Gulfstream III)
GRJ	GLF4	GAC C-20G (G-IV Gulfstream IV)
GRM	G73	Grumman G-73 Mallard
GRM	G73T	Grumman G-73 Turbo Mallard
GRS	G159	GAC (Grumman) G-159 (F/SCD) Gulfstream I
GRS	GLF5	GAC C-37A (G-V Gulfstream V)
GUP	SGUP	Aero Spacelines Super Guppy 377SGT-201
H25	H25A	Hawker 1A (HS 125-1A)
H25	H25B	Hawker 700A (HS 125-700A)
H25	H25C	Hawker 1000A (BAe 125-1000A)
HEC	COUR	Helio H-250 Courier
HPH	HPR7	BAe (Handley Page) Herald 206
HS7	A748	BAe (HS) 748-101 Srs 1A
I14	I114	Ilyushin 114
IL6	IL62	Ilyushin 62
IL7	IL76	Ilyushin 76LL
IL8	IL18	Ilyushin 18D
IL9	IL96	Ilyushin 96-300
ILW	IL86	Ilyushin 86
J31	JS31	BAe 3100 Jetstream 31
J31	JS32	BAe 3200 Jetstream 32
J41	JS41	BAe 4100 Jetstream 41
JU5	JU52	CASA 352-L (Junkers Ju 52/3m G4E)
L11	L101	Lockheed L-1011-385-1 TriStar 1
L4T	L410	Let 410A
LOF	L188	Lockheed L-188A (F) Electra
LOH	C130	Lockheed L-182 (C-130A) Hercules
LRJ	LJ23	Learjet 23
LRJ	LJ24	Learjet 24
LRJ	LJ25	Learjet 25
LRJ	LJ31	Learjet 31
LRJ	LJ35	Learjet 35
LRJ	LJ45	Learjet 45
LRJ	LJ55	Learjet 55
LRJ	LJ60	Learjet 60
M11	MD11	Boeing (Douglas) MD-11
M81	MD80	Boeing (Douglas) MD-81 (DC-9-81)
M90	MD90	Boeing (Douglas) MD-90-30
MBH	B105	Eurocopter (IPTN/MBB) NBO105CB
MU2	MU2	Mitsubishi MU-2B (MU-2B-10) Cargoliner

IATA	ICAO	TYPE
ND2	N262	Aerospatiale (Nord) 262A-12
NDC	S601	Aerospatiale SN601 Corvette
NDE	AS50	Euroc.(Helibras/Aerosp.) AS350B2 Esquilo
NDE	AS55	Eurocopter (Aerosp.) AS355E TwinStar
NDH	AS65	Eurocopter (Aerosp.) AS365N2 Dauphin 2
NDH	S360	Eurocopter (Aerosp.) SA360C Dauphin
NDH	S65C	Eurocopter (Aerosp.) SA365C Dauphin 2
PA1	P28A	Piper PA-28-180 Cherokee Archer
PA1	P28B	Piper PA-28-235 Pathfinder
PA1	P32T	Piper PA-32RT-300 Lance II
PA1	PA24	Piper PA-24-260 Comanche B
PA1	PA36	Piper PA-36-300 Brave
PA1	PA46	Piper PA-46-310P Malibu
PA2	PA23	Piper PA-23-150 Apache
PA2	PA27	Piper PA-23-235 Apache
PA2	PA30	Piper PA-30-160 Twin Comanche
PA2	PA44	Piper PA-44-180 Seminole
PAG	AEST	AAC (Piper) Aerostar 600A
PAT	PAY1	Piper PA-31T1 Cheyenne I
PAT	PAY2	Piper PA-31T Cheyenne II
PAT	PAY3	Piper PA-42 Cheyenne III
PAT	PAY4	Piper PA-42-1000 Cheyenne 400LS
PN6	P68	Partenavia P.68
PN6	P68T	Partenavia AP68TP-300 Spartacus
S20	SB20	Saab 2000
S58	S58P	Sikorsky S-58 (H-34A)
S58	S58T	Sikorsky S-58BT
S61	S61	Sikorsky S-61A
S61	S61R	Sikorsky S-61R
S76	H60	Sikorsky S-70A
S76	S76	Sikorsky S-76A
SF3	SF34	S 100B Argus (Saab 340B AEW)
SH3	SH33	Shorts 330 (SD3-30 Variant 100)
SH6	SH36	Shorts 360 (SD3-60 Variant 300)
SHB	BELF	Shorts SC.5 Belfast
SHS	SC7	Shorts Skyliner 3A Variant 100 (SC-7)
SSC	CONC	Aerospatiale / BAe Concorde 101
SWM	SW3	Fairchild (Swear.) SA227TT Merlin 300
SWM	SW4	Fairch. (Swearingen) SA227DC Metro 23 (E
TU3	T134	Tupolev 134
TU3	T144	Tupolev 144LL
TU5	T154	Tupolev 154
WWP	WW24	IAI 1124 Westwind
YK4	YK40	Yakovlev 40
YN2	Y12	Harbin Yunshuji Y12 II
YS1	YS11	NAMC YS-11-102
	A109	Agusta A109A
	ALO2	Eurocopter (Aerosp.) SA318C Alouette II
	ALO3	Eurocopter (Aerosp.) SA316B Alouette III
	AN2	Antonov An-2
	AN28	PZL Mielec (Antonov) An-28
	AN38	Antonov 38-100
	AN8	Antonov 8
	ARVA	IAI 101B Arava
	AS32	Eurocopter (Aerosp.) AS332C Super Puma
	ASTR	IAI 1125 Astra
	AT8T	Air Tractor AT-802
	B06	Agusta-Bell 206A JetRanger
	B12	Agusta-Bell 212
	B170	BAe (Bristol) 170 Mk. 31 Freighter
	B23	Boeing (Douglas) B-23 (UC-67) Dragon
	B25	North American B-25J Mitchell
	B26	Boeing (Douglas) B-26B Invader
	B52	Boeing B-52G Stratofortress
	BK17	Eurocopter (MBB) BK117A-1
	BU20	AHC Bushmaster 2000
	C119	Fairchild C-119G Flying Boxcar
	C123	Blumenthal (Fairchild) C-123K Provider
	C133	Boeing (Douglas) C-133A Cargomaster
	C150	FMA IA.50 Guarani II
	C160	Aerospatiale/MBB Transall C-160NG
	C82	Fairchild C-82A-FA Jet Packet
	CARV	ATL-98 Carvair
	CAT	Consolidated 28-5ACF Canso
	CL2P	Canadair CL-215 (CL-215-1A10)

IATA	ICAO	TYPE
	CL2T	Canadair CL-215T (CL-215-6B11)
	CONI	Lockh. L-1049F (C-121C) S. Constellation
	CVLP	Convair 240 (T-29B)
	D28T	Dornier 128-6 Turbo Skyservant
	DC2	Boeing (Douglas) DC-2-112
	DH89	BAe (DH) DH.89A Dragon Rapide
	DHC5	De Havilland DHC-5 Buffalo
	DO27	Dornier DO 27B-1
	DO28	Dornier DO 28A-1
	E121	Embraer 121A Xingu (EMB-121A)
	EC20	Eurocopter EC120B Colibri
	EC35	Eurocopter EC135P1
	EGRT	Grob G-520T Egrett II
	EVAN	Evangel 4500
	EXPL	MD Helicopters MD 900 Explorer
	F15	Boeing (McDonnell Aircraft) F-15B Eagle
	F16	General Dynamics F-16A Falcon
	F18	Boeing (McDonnell Aircraft) F-18A Hornet
	F600	SIAI-Marchetti SF.600 Canguro
	F86	Canadair F-86E Sabre 6
	FBA2	Found FBA-2C
	FREL	Eurocopter (Aerosp.) AS321J Super Frelon
	G44	Grumman G-44 Widgeon
	GA7	Gulfstream American GA-7 Cougar
	GALX	IAI 1126 Galaxy
	GAZL	Eurocopter (Aerosp.) SA341G Gazelle
	GLEX	Bombardier BD-700-1A10 Global Express
	H43B	Kaman HH-43F (K600) Huskie
	H46	Boeing Vertol 107-II
	H47	Boeing Vertol 234UT Chinook
	H500	Breda Nardi (Hughes) NH-500D
	HF20	HFB 320 Hansa Jet
	IL14	Avia 14-40 (Ilyushin 14M)
	JCOM	IAI 1121 Jet Commander
	JS1	BAe (H.P.) 137 Jetstream Century III
	JS20	BAe (Handley Page) 137 Jetstream 200
	KA26	Kamov Ka-26
	KA27	Kamov Ka-32
	KMAX	Kaman K-1200 K-Max
	L18	Lockheed 18-56 (C-60A) Lodestar
	L200	Let 200A Morava
	L29A	Lockheed L-1329 JetStar 6
	L37	Lockheed PV-2 (Model 15) Harpoon
	L60	Orlican L-60SF Brigadyr
	L610	Let 610
	LA25	Lake LA-250 Renegade
	LA60	Aeronautica Macchi AL.60-B2
	LAMA	Eurocopter (Aerosp.) SA315B Lama
	LOAD	Ayres LM200 Loadmaster
	LYNX	Westland WG.13 Super Lynx Mk. 95
	M18	PZL Mielec M-18 Dromader
	M20T	Mooney TLS (M20M)
	M404	Martin 404
	MARS	Martin JRM-3 Mars (Waterbomber Seaplane)
	MD52	MD Helicopters MD 520N (Hughes 500N)
	MD60	MD Helicopters MD 600N (Hughes 600N)
	MI10	Mil Mi-10K
	MI14	Isolair (Mil Mi-14BT) Terminator II
	MI2	PZL Swidnik (Mil) Mi-2
	MI26	Mil Mi-26
	MI34	Mil Mi-34
	MI6	Mil Mi-6
	MI8	Mil Mi-17
	MU30	Mitsubishi MU-300 Diamond I
	N250	IPTN N-250-100
	NORA	Nord 2501TC Noratlas
	NORS	Noorduyn Norseman IV
	O3	Lockheed YO-3A Q-Star
	P149	Piaggio FWP.149D
	P180	Piaggio P.180 Avanti
	P2	Lockheed P-2E Neptune
	P3	Lockheed P-3A (P3V-1) Orion
	P32R	Embraer 721C Sertanejo (EMB-721C)
	P66P	Piaggio P.166S Albatross
	P808	Piaggio PD-808

IATA	ICAO	TYPE
	PA28	Embraer 710C Carioca (EMB-710C)
	PA31	Embraer 820C Navajo (EMB-820C)
	PA32	Embraer 720C Minuano (EMB-720C)
	PA34	Embraer 810C Seneca II (EMB-810C)
	PAT4	Neiva NE-821 Caraja
	PC12	Pilatus PC-12
	PC6P	Pilatus PC-6/350-H2 Porter
	PC6T	Fairchild (Pilatus) PC-6/B1-H2 Porter
	PC9	Pilatus PC-9/B
	PRCE	Percival P.57 Sea Prince T.1
	PUMA	Eurocopter (Aerosp.) SA330BA Puma
	PZ01	PZL Warszawa PZL-101A Gawron
	RB57	Martin/General Dynamics WB-57F
	RC3	Republic RC-3 Seabee
	S2P	Conair Firecat
	S2T	Conair Turbo Firecat
	S55P	Sikorsky S-55B
	S55T	Sikorsky (Vertical Avn Techn.) S-55QT
	S62	Sikorsky S-62
	S64	Erickson (Sikorsky) S-64E Skycrane
	SBR1	Sabreliner 40 (Rockwell NA265-40)
	SBR2	Sabreliner 75A (Rockwell NA265-80)
	SR71	Lockheed SR-71B
	STLN	Helio HST-550 Stallion
	T204	Tupolev 155
	T33	Canadair T-33AN Silver Star
	T334	Tupolev 334
	T38	Northrop T-38A Talon
	T6	CCF Harvard 4 (N.A. T-6J)
	TBM	Grumman TBM-3 Avenger
	TBM7	Socata TBM 700
	TPIN	Scottish Aviation Twin Pioneer 3
	TRID	BAe (HS) 121 Super Trident 3B
	TRIN	Socata TB 20 Trinidad
	U16	Grumman G-111 Albatross
	U2	Lockheed ER-2
	UH1	Agusta-Bell 204B
	UH12	Hiller UH-12E
	V10	Rockwell (N.A.) OV-10A Bronco
	VC10	BAe (Vickers) VC10 C1K Srs. 1180
	VECT	Embraer-FAMA CBA-123 Vector
	VF14	VFW-614
	VISC	BAe (Vickers) Freightmaster 806
	W3	PZL Swidnik W-3 Sokol
	WACC	Waco YKS-7
	WG30	Westland 30-100
	WW23	IAI 1123 Jet Commander
	Y11	Harbin Yunshuji Y11
	Y18T	Yakovlev 18T
	YK12	Yakovlev 12A
	YK42	Yakovlev 142
	Z37P	Let Z-37-2C Cmelak

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

A310

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000	2500	3000	3500
Distance (km)											
	Climb/cruise/descent	232	463	926	1389	1852	2778	3704	4630	5556	6482
Fuel (kg)											
	Flight total	2810.6	3899.5	5990.4	8081.3	10172.2	14532.6	18981.6	23699.4	28675.3	33763.8
	LTO	1540.5	1540.5	1540.5	1540.5	1540.5	1540.5	1540.5	1540.5	1540.5	1540.5
	Taxi out	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3
	Take off	182.2	182.2	182.2	182.2	182.2	182.2	182.2	182.2	182.2	182.2
	Climb out	472.5	472.5	472.5	472.5	472.5	472.5	472.5	472.5	472.5	472.5
	Climb/cruise/descent	1270.0	2358.9	4449.8	6540.7	8631.6	12992.0	17441.1	22158.8	27134.7	32223.3
	Approach landing	297.3	297.3	297.3	297.3	297.3	297.3	297.3	297.3	297.3	297.3
	Taxi in	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3
NOx (kg)											
	Flight total	53.3	72.2	87.6	111.8	136.3	189.3	237.5	296.2	363.1	431.6
	LTO	23.2	23.2	23.2	23.2	23.2	23.2	23.2	23.2	23.2	23.2
	Taxi out	1.256	1.256	1.256	1.256	1.256	1.256	1.256	1.256	1.256	1.256
	Take off	5.532	5.532	5.532	5.532	5.532	5.532	5.532	5.532	5.532	5.532
	Climb out	12.192	12.192	12.192	12.192	12.192	12.192	12.192	12.192	12.192	12.192
	Climb/cruise/descent	30.107	48.976	64.385	88.604	113.153	166.093	214.259	272.966	339.891	408.417
	Approach landing	2.960	2.960	2.960	2.960	2.960	2.960	2.960	2.960	2.960	2.960
	Taxi in	1.256	1.256	1.256	1.256	1.256	1.256	1.256	1.256	1.256	1.256
EINOx (g/kg fuel)											
	Taxi out	4.27	4.27	4.27	4.27	4.27	4.27	4.27	4.27	4.27	4.27
	Take off	30.37	30.37	30.37	30.37	30.37	30.37	30.37	30.37	30.37	30.37
	Climb out	25.80	25.80	25.80	25.80	25.80	25.80	25.80	25.80	25.80	25.80
	Climb/cruise/descent	23.71	20.76	14.47	13.55	13.11	12.78	12.28	12.32	12.53	12.67
	Approach landing	9.96	9.96	9.96	9.96	9.96	9.96	9.96	9.96	9.96	9.96
	Taxi in	4.27	4.27	4.27	4.27	4.27	4.27	4.27	4.27	4.27	4.27
HC (g)											
	Flight total	5834.3	6034.2	6307.1	6569.7	6832.3	7379.7	7921.8	8503.5	9128.7	9767.1
	LTO	5544.0	5544.0	5544.0	5544.0	5544.0	5544.0	5544.0	5544.0	5544.0	5544.0
	Taxi out	2709.63	2709.63	2709.63	2709.63	2709.63	2709.63	2709.63	2709.63	2709.63	2709.63
	Take off	14.57	14.57	14.57	14.57	14.57	14.57	14.57	14.57	14.57	14.57
	Climb out	47.16	47.16	47.16	47.16	47.16	47.16	47.16	47.16	47.16	47.16
	Climb/cruise/descent	290.28	490.22	763.14	1025.74	1288.34	1835.70	2377.80	2959.54	3584.70	4223.13
	Approach landing	62.13	62.13	62.13	62.13	62.13	62.13	62.13	62.13	62.13	62.13
	Taxi in	2710.51	2710.51	2710.51	2710.51	2710.51	2710.51	2710.51	2710.51	2710.51	2710.51
EIHC (g/kg fuel)											
	Taxi out	9.21	9.21	9.21	9.21	9.21	9.21	9.21	9.21	9.21	9.21
	Take off	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
	Climb out	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Climb/cruise/descent	0.23	0.21	0.17	0.16	0.15	0.14	0.14	0.13	0.13	0.13
	Approach landing	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
	Taxi in	9.21	9.21	9.21	9.21	9.21	9.21	9.21	9.21	9.21	9.21
CO (g)											
	Flight total	27426.7	28490.6	29687.8	30752.5	31817.2	34032.4	36185.0	38518.0	41045.3	43629.7
	LTO	25839.7	25839.7	25839.7	25839.7	25839.7	25839.7	25839.7	25839.7	25839.7	25839.7
	Taxi out	12410.37	12410.37	12410.37	12410.37	12410.37	12410.37	12410.37	12410.37	12410.37	12410.37
	Take off	107.47	107.47	107.47	107.47	107.47	107.47	107.47	107.47	107.47	107.47
	Climb out	268.87	268.87	268.87	268.87	268.87	268.87	268.87	268.87	268.87	268.87
	Climb/cruise/descent	1587.02	2650.92	3848.12	4912.79	5977.46	8192.71	10345.31	12678.34	15205.59	17789.99
	Approach landing	638.79	638.79	638.79	638.79	638.79	638.79	638.79	638.79	638.79	638.79
	Taxi in	12414.20	12414.20	12414.20	12414.20	12414.20	12414.20	12414.20	12414.20	12414.20	12414.20
EICO (g/kg fuel)											
	Taxi out	42.17	42.17	42.17	42.17	42.17	42.17	42.17	42.17	42.17	42.17
	Take off	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
	Climb out	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57
	Climb/cruise/descent	1.25	1.12	0.86	0.75	0.69	0.63	0.59	0.57	0.56	0.55
	Approach landing	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
	Taxi in	42.18	42.18	42.18	42.18	42.18	42.18	42.18	42.18	42.18	42.18

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

A320

		Standard flight distan	Standard flight distances (nm)						
		125	**250**	**500**	**750**	**1000**	**1500**	**2000**	**2500**
Distance (km)									
	Climb/cruise/descent	232	463.048	926	1389	1852	2778	3704	4630
Fuel (kg)									
	Flight total	1644.4	2497.3	3660.6	4705.0	6027.2	8332.0	10865.9	13441.3
	LTO	802.3	802.3	802.3	802.3	802.3	802.3	802.3	802.3
	Taxi out	167.3	167.3	167.3	167.3	167.3	167.3	167.3	167.3
	Take off	89.9	89.9	89.9	89.9	89.9	89.9	89.9	89.9
	Climb out	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5
	Climb/cruise/descent	842.1	1695.0	2858.3	3902.7	5224.9	7529.7	10063.6	12638.9
	Approach landing	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4
	Taxi in	167.3	167.3	167.3	167.3	167.3	167.3	167.3	167.3
NOx (kg)									
	Flight total	28.0	37.9	56.0	66.8	83.9	109.4	141.1	169.9
	LTO	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8
	Taxi out	0.775	0.775	0.775	0.775	0.775	0.775	0.775	0.775
	Take off	2.491	2.491	2.491	2.491	2.491	2.491	2.491	2.491
	Climb out	5.450	5.450	5.450	5.450	5.450	5.450	5.450	5.450
	Climb/cruise/descent	17.199	27.094	45.126	55.928	73.040	98.550	130.220	159.051
	Approach landing	1.344	1.344	1.344	1.344	1.344	1.344	1.344	1.344
	Taxi in	0.775	0.775	0.775	0.775	0.775	0.775	0.775	0.775
EINOx (g/kg fuel)									
	Taxi out	4.63	4.63	4.63	4.63	4.63	4.63	4.63	4.63
	Take off	27.71	27.71	27.71	27.71	27.71	27.71	27.71	27.71
	Climb out	23.44	23.44	23.44	23.44	23.44	23.44	23.44	23.44
	Climb/cruise/descent	20.43	15.98	15.79	14.33	13.98	13.09	12.94	12.58
	Approach landing	9.24	9.24	9.24	9.24	9.24	9.24	9.24	9.24
	Taxi in	4.63	4.63	4.63	4.63	4.63	4.63	4.63	4.63
HC (g)									
	Flight total	2072.4	2190.7	2431.3	2607.4	2838.1	3234.3	3669.8	4112.7
	LTO	1923.2	1923.2	1923.2	1923.2	1923.2	1923.2	1923.2	1923.2
	Taxi out	284.40	284.40	284.40	284.40	284.40	284.40	284.40	284.40
	Take off	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90
	Climb out	23.25	23.25	23.25	23.25	23.25	23.25	23.25	23.25
	Climb/cruise/descent	149.19	267.45	508.06	684.24	914.92	1311.06	1746.56	2189.46
	Approach landing	1322.25	1322.25	1322.25	1322.25	1322.25	1322.25	1322.25	1322.25
	Taxi in	284.40	284.40	284.40	284.40	284.40	284.40	284.40	284.40
EIHC (g/kg fuel)									
	Taxi out	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
	Take off	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Climb out	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Climb/cruise/descent	0.18	0.16	0.18	0.18	0.18	0.17	0.17	0.17
	Approach landing	9.10	9.10	9.10	9.10	9.10	9.10	9.10	9.10
	Taxi in	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
CO (g)									
	Flight total	18689.5	19334.9	20701.4	21164.5	22280.9	23759.5	25442.4	27125.5
	LTO	17593.2	17593.2	17593.2	17593.2	17593.2	17593.2	17593.2	17593.2
	Taxi out	5689.03	5689.03	5689.03	5689.03	5689.03	5689.03	5689.03	5689.03
	Take off	53.94	53.94	53.94	53.94	53.94	53.94	53.94	53.94
	Climb out	581.17	581.17	581.17	581.17	581.17	581.17	581.17	581.17
	Climb/cruise/descent	1096.32	1741.71	3108.18	3571.29	4687.69	6166.31	7849.17	9532.27
	Approach landing	5580.06	5580.06	5580.06	5580.06	5580.06	5580.06	5580.06	5580.06
	Taxi in	5689.03	5689.03	5689.03	5689.03	5689.03	5689.03	5689.03	5689.03
EICO (g/kg fuel)									
	Taxi out	34.01	34.01	34.01	34.01	34.01	34.01	34.01	34.01
	Take off	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
	Climb out	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
	Climb/cruise/descent	1.30	1.03	1.09	0.92	0.90	0.82	0.78	0.75
	Approach landing	38.38	38.38	38.38	38.38	38.38	38.38	38.38	38.38
	Taxi in	34.01	34.01	34.01	34.01	34.01	34.01	34.01	34.01

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

A330

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000	2500	3000	3500	4000
Distance (km)												
	Climb/cruise/descent	231.5	463	926	1389	1852	2778	3704	4630	5556	6482	7408
Fuel (kg)												
	Flight total	4093.7	5862.4	8615.5	11360.0	14121.5	19790.5	25634.2	31714.8	38043.5	44311.9	51005.7
	LTO	2231.5	2231.5	2231.5	2231.5	2231.5	2231.5	2231.5	2231.5	2231.5	2231.5	2231.5
	Taxi out	436.8	436.8	436.8	436.8	436.8	436.8	436.80	436.80	436.80	436.80	436.80
	Take off	268.8	268.8	268.8	268.8	268.8	268.8	268.8	268.8	268.8	268.8	268.8
	Climb out	681.1	681.1	681.1	681.1	681.1	681.1	681.1	681.1	681.1	681.1	681.1
	Climb/cruise/descent	1862.1	3630.9	6383.9	9128.4	11890.0	17558.9	23402.7	29483.3	35812.0	42080.4	48774.2
	Approach landing	408.0	408.0	408.0	408.0	408.0	408.0	408.0	408.0	408.0	408.0	408.0
	Taxi in	436.8	436.8	436.8	436.8	436.8	436.8	436.8	436.8	436.8	436.8	436.8
NOx (kg)												
	Flight total	88.2	129.5	141.4	173.5	205.9	274.0	346.5	424.8	509.5	587.6	677.8
	LTO	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1
	Taxi out	2.057	2.057	2.057	2.057	2.057	2.057	2.06	2.06	2.06	2.06	2.06
	Take off	9.241	9.241	9.241	9.241	9.241	9.241	9.241	9.241	9.241	9.241	9.241
	Climb out	18.464	18.464	18.464	18.464	18.464	18.464	18.464	18.464	18.464	18.464	18.464
	Climb/cruise/descent	52.116	93.371	105.285	137.360	169.728	237.920	310.367	388.681	473.361	551.479	641.642
	Approach landing	4.309	4.309	4.309	4.309	4.309	4.309	4.309	4.309	4.309	4.309	4.309
	Taxi in	2.057	2.057	2.057	2.057	2.057	2.057	2.057	2.057	2.057	2.057	2.057
EINOx (g/kg fuel)												
	Taxi out	4.710	4.710	4.710	4.710	4.710	4.710	4.71	4.71	4.71	4.71	4.71
	Take off	34.380	34.380	34.380	34.380	34.380	34.380	34.380	34.380	34.380	34.380	34.380
	Climb out	27.108	27.108	27.108	27.108	27.108	27.108	27.108	27.108	27.108	27.108	27.108
	Climb/cruise/descent	27.987	25.716	16.492	15.048	14.275	13.550	13.262	13.183	13.218	13.105	13.155
	Approach landing	10.560	10.560	10.560	10.560	10.560	10.560	10.560	10.560	10.560	10.560	10.560
	Taxi in	4.710	4.710	4.710	4.710	4.710	4.710	4.710	4.710	4.710	4.710	4.710
HC (g)												
	Flight total	4118.7	6079.2	8755.3	11335.6	13932.0	19262.8	24755.5	30472.9	36422.1	42274.4	48567.4
	LTO	2113.1	2113.1	2113.1	2113.1	2113.1	2113.1	2113.1	2113.1	2113.1	2113.1	2113.1
	Taxi out	987.17	987.17	987.17	987.17	987.17	987.17	987.17	987.17	987.17	987.17	987.17
	Take off	13.17	13.17	13.17	13.17	13.17	13.17	13.17	13.17	13.17	13.17	13.17
	Climb out	40.73	40.73	40.73	40.73	40.73	40.73	40.73	40.73	40.73	40.73	40.73
	Climb/cruise/descent	2005.58	3966.17	6642.24	9222.51	11818.90	17149.74	22642.43	28359.80	34309.02	40161.29	46454.34
	Approach landing	85.27	85.27	85.27	85.27	85.27	85.27	85.27	85.27	85.27	85.27	85.27
	Taxi in	986.73	986.73	986.73	986.73	986.73	986.73	986.73	986.73	986.73	986.73	986.73
EIHC (g/kg fuel)												
	Taxi out	2.26	2.26	2.26	2.26	2.26	2.26	2.26	2.26	2.26	2.26	2.26
	Take off	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Climb out	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
	Climb/cruise/descent	1.08	1.09	1.04	1.01	0.99	0.98	0.97	0.96	0.96	0.95	0.95
	Approach landing	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
	Taxi in	2.26	2.26	2.26	2.26	2.26	2.26	2.26	2.26	2.26	2.26	2.26
CO (g)												
	Flight total	25554.2	29744.3	33729.7	37112.5	40516.4	47511.2	54705.4	62206.2	70004.2	77416.8	85664.4
	LTO	21500.0	21500.0	21500.0	21500.0	21500.0	21500.0	21500.0	21500.0	21500.0	21500.0	21500.0
	Taxi out	10087.90	10087.90	10087.90	10087.90	10087.90	10087.90	10087.90	10087.90	10087.90	10087.90	10087.90
	Take off	107.25	107.25	107.25	107.25	107.25	107.25	107.25	107.25	107.25	107.25	107.25
	Climb out	279.19	279.19	279.19	279.19	279.19	279.19	279.19	279.19	279.19	279.19	279.19
	Climb/cruise/descent	4054.18	8244.24	12229.65	15612.52	19016.42	26011.22	33205.42	40706.18	48504.20	55916.76	64164.36
	Approach landing	937.79	937.79	937.79	937.79	937.79	937.79	937.79	937.79	937.79	937.79	937.79
	Taxi in	10087.90	10087.90	10087.90	10087.90	10087.90	10087.90	10087.90	10087.90	10087.90	10087.90	10087.90
EICO (g/kg fuel)												
	Taxi out	23.10	23.10	23.10	23.10	23.10	23.10	23.10	23.10	23.10	23.10	23.10
	Take off	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
	Climb out	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
	Climb/cruise/descent	2.18	2.27	1.92	1.71	1.60	1.48	1.42	1.38	1.35	1.33	1.32
	Approach landing	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
	Taxi in	23.10	23.10	23.10	23.10	23.10	23.10	23.10	23.10	23.10	23.10	23.10

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

A340

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500
Distance (km)																	
	Climb/cruise/descent	231.5	464.0	926	1389	1852	2778	3704	4630	5556	6482	7408	8334	9260	10186	11112	
Fuel (kg)																	
	Flight total	3832.9	5669.1	8482.4	11310.9	14201.2	20133.2	26279.8	32695.5	39114.8	45873.9	52895.2	60079.4	67669.7	75568.3	83692.0	
	LTO	2019.9	2019.9	2019.9	2019.9	2019.9	2019.9	2019.9	2019.9	2019.9	2019.9	2019.9	2019.9	2019.9	2019.9	2019.9	
	Taxi out	386.9	386.9	386.9	386.9	386.9	386.9	386.88	386.88	386.88	386.88	386.88	386.88	386.88	386.9	386.9	
	Take off	244.6	244.6	244.6	244.6	244.6	244.6	244.6	244.6	244.6	244.6	244.6	244.6	244.6	244.6	244.6	
	Climb out	631.0	631.0	631.0	631.0	631.0	631.0	631.0	631.0	631.0	631.0	631.0	631.0	631.0	631.0	631.0	
	Climb/cruise/descent	1813.0	3649.2	6462.5	9291.0	12181.3	18113.3	24259.9	30675.7	37094.9	43854.0	50875.3	58059.5	65649.8	73548.4	81672.1	
	Approach landing	370.6	370.6	370.6	370.6	370.6	370.6	370.6	370.6	370.6	370.6	370.6	370.6	370.6	370.6	370.6	
	Taxi in	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9	
NOx (kg)																	
	Flight total	77.7	112.7	159.8	200.2	242.7	332.1	428.3	533.1	634.2	744.0	864.0	989.9	1128.8	1280.7	1441.5	
	LTO	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	
	Taxi out	1.656	1.656	1.656	1.656	1.656	1.656	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.656	1.656	
	Take off	9.214	9.214	9.214	9.214	9.214	9.214	9.214	9.214	9.214	9.214	9.214	9.214	9.214	9.214	9.214	
	Climb out	18.792	18.792	18.792	18.792	18.792	18.792	18.792	18.792	18.792	18.792	18.792	18.792	18.792	18.792	18.792	
	Climb/cruise/descent	42.362	77.356	124.445	164.870	207.287	296.751	392.878	497.727	598.856	708.644	828.662	954.548	#######	#######	#######	
	Approach landing	4.054	4.054	4.054	4.054	4.054	4.054	4.054	4.054	4.054	4.054	4.054	4.054	4.054	4.054	4.054	
	Taxi in	1.656	1.656	1.656	1.656	1.656	1.656	1.656	1.656	1.656	1.656	1.656	1.656	1.656	1.656	1.656	
EINOx (g/kg fuel)																	
	Taxi out	4.280	4.280	4.280	4.280	4.280	4.280	4.28	4.28	4.28	4.28	4.28	4.28	4.28	4.280	4.280	
	Take off	37.670	37.670	37.670	37.670	37.670	37.670	37.670	37.670	37.670	37.670	37.670	37.670	37.670	37.670	37.670	
	Climb out	29.784	29.784	29.784	29.784	29.784	29.784	29.784	29.784	29.784	29.784	29.784	29.784	29.784	29.784	29.784	
	Climb/cruise/descent	23.366	21.198	19.256	17.745	17.017	16.383	16.195	16.225	16.144	16.159	16.288	16.441	16.655	16.932	17.217	
	Approach landing	10.940	10.940	10.940	10.940	10.940	10.940	10.940	10.940	10.940	10.940	10.940	10.940	10.940	10.940	10.940	
	Taxi in	4.280	4.280	4.280	4.280	4.280	4.280	4.280	4.280	4.280	4.280	4.280	4.280	4.280	4.280	4.280	
HC (g)																	
	Flight total	28206.8	38886.0	41190.2	42514.3	43940.0	46906.5	50046.6	53440.4	52551.8	55672.9	59108.8	62230.7	65875.7	70072.5	69882.3	
	LTO	18752.5	18752.5	18752.5	18752.5	18752.5	18752.5	18752.5	18752.5	18752.5	18752.5	18752.5	18752.5	18752.5	18752.5	18752.5	
	Taxi out	8895.92	8895.92	8895.92	8895.92	8895.92	8895.92	8895.92	8895.92	8895.92	8895.92	8895.92	8895.92	8895.92	8895.9	8895.9	
	Take off	146.76	146.76	146.76	146.76	146.76	146.76	146.76	146.76	146.76	146.76	146.76	146.76	146.76	146.8	146.8	
	Climb out	441.04	441.04	441.04	441.04	441.04	441.04	441.04	441.04	441.04	441.04	441.04	441.04	441.04	441.0	441.0	
	Climb/cruise/descent	9454.28	20133.45	22437.68	23761.77	25187.51	28154.02	31294.06	34687.88	33799.29	36920.40	40356.30	43478.22	47123.17	51320.0	51129.8	
	Approach landing	370.56	370.56	370.56	370.56	370.56	370.56	370.56	370.56	370.56	370.56	370.56	370.56	370.56	370.6	370.6	
	Taxi in	8898.24	8898.24	8898.24	8898.24	8898.24	8898.24	8898.24	8898.24	8898.24	8898.24	8898.24	8898.24	8898.24	8898.24	8898.24	

A340

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500
EIHC (g/kg fuel)																	
	Taxi out	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	23.0	23.0	
	Take off	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.6	0.6	
	Climb out	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.7	0.7	
	Climb/cruise/descent	5.21	5.52	3.47	2.56	2.07	1.55	1.29	1.13	0.91	0.84	0.79	0.75	0.72	0.70	0.63	
	Approach landing	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.0	1.0	
	Taxi in	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	
CO (g)																	
	Flight total	59764.2	71033.2	74751.6	76765.7	78857.2	83043.4	87448.3	92007.3	95131.6	99931.1	104914.1	109977.0	114946.9	120543.7	124964.0	
	LTO	50564.9	50564.9	50564.9	50564.9	50564.9	50564.9	50564.9	50564.9	50564.9	50564.9	50564.9	50564.9	50564.9	50564.9	50564.9	
	Taxi out	24096.43	24096.43	24096.43	24096.43	24096.43	24096.43	24096.43	24096.43	24096.43	24096.43	24096.43	24096.43	24096.43	24096.4	24096.4	
	Take off	122.30	122.30	122.30	122.30	122.30	122.30	122.30	122.30	122.30	122.30	122.30	122.30	122.30	122.3	122.3	
	Climb out	315.48	315.48	315.48	315.48	315.48	315.48	315.48	315.48	315.48	315.48	315.48	315.48	315.48	315.5	315.5	
	Climb/cruise/descent	9199.32	20468.27	24186.70	26200.74	28292.31	32478.49	36883.42	41442.35	44566.73	49366.21	54349.17	59412.08	64382.00	69978.8	74399.0	
	Approach landing	1926.91	1926.91	1926.91	1926.91	1926.91	1926.91	1926.91	1926.91	1926.91	1926.91	1926.91	1926.91	1926.91	1926.9	1926.9	
	Taxi in	24103.78	24103.78	24103.78	24103.78	24103.78	24103.78	24103.78	24103.78	24103.78	24103.78	24103.78	24103.78	24103.78	24103.8	24103.8	
EICO (g/kg fuel)																	
	Taxi out	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.3	62.3	
	Take off	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.5	0.5	
	Climb out	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.5	0.5	
	Climb/cruise/descent	5.07	5.61	3.74	2.82	2.32	1.79	1.52	1.35	1.20	1.13	1.07	1.02	0.98	0.95	0.91	
	Approach landing	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.2	5.2	
	Taxi in	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.3	62.3	

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

BAC1-11

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000
Distance (km)								
	Climb/cruise/descent	231.5	462.99	926	1389	1852	2778	3704
Fuel (kg)								
	Flight total	1393.8	2082.4	3110.1	4194.8	5279.5	7641.6	10160.0
	LTO	681.6	681.6	681.6	681.6	681.6	681.6	681.6
	Taxi out	179.4	179.4	179.4	179.4	179.4	179.4	179.4
	Take off	60.5	60.5	60.5	60.5	60.5	60.5	60.5
	Climb out	155.6	155.6	155.6	155.6	155.6	155.6	155.6
	Climb/cruise/descent	712.3	1400.8	2428.5	3513.2	4597.9	6960.0	9478.5
	Approach landing	106.6	106.6	106.6	106.6	106.6	106.6	106.6
	Taxi in	179.4	179.4	179.4	179.4	179.4	179.4	179.4
NOx (kg)								
	Flight total	14.8	20.6	32.2	42.6	53.5	78.6	106.9
	LTO	4.9	4.9	4.9	4.9	4.9	4.9	4.9
	Taxi out	0.402	0.402	0.402	0.402	0.402	0.402	0.402
	Take off	1.125	1.125	1.125	1.125	1.125	1.125	1.125
	Climb out	2.425	2.425	2.425	2.425	2.425	2.425	2.425
	Climb/cruise/descent	9.874	15.674	27.288	37.664	48.532	73.671	102.011
	Approach landing	0.575	0.575	0.575	0.575	0.575	0.575	0.575
	Taxi in	0.402	0.402	0.402	0.402	0.402	0.402	0.402
EINOx (g/kg fuel)								
	Taxi out	2.24	2.24	2.24	2.24	2.24	2.24	2.24
	Take off	18.59	18.59	18.59	18.59	18.59	18.59	18.59
	Climb out	15.58	15.58	15.58	15.58	15.58	15.58	15.58
	Climb/cruise/descent	13.86	11.19	11.24	10.72	10.56	10.58	10.76
	Approach landing	5.39	5.39	5.39	5.39	5.39	5.39	5.39
	Taxi in	2.24	2.24	2.24	2.24	2.24	2.24	2.24
HC (g)								
	Flight total	21570.2	21676.6	21927.4	22046.9	22166.3	22445.7	22746.5
	LTO	21394.1	21394.1	21394.1	21394.1	21394.1	21394.1	21394.1
	Taxi out	10179.51	10179.51	10179.51	10179.51	10179.51	10179.51	10179.51
	Take off	59.38	59.38	59.38	59.38	59.38	59.38	59.38
	Climb out	205.43	205.43	205.43	205.43	205.43	205.43	205.43
	Climb/cruise/descent	176.17	282.51	533.36	652.79	772.22	1051.60	1352.44
	Approach landing	770.24	770.24	770.24	770.24	770.24	770.24	770.24
	Taxi in	10179.51	10179.51	10179.51	10179.51	10179.51	10179.51	10179.51
EIHC (g/kg fuel)								
	Taxi out	56.74	56.74	56.74	56.74	56.74	56.74	56.74
	Take off	0.98	0.98	0.98	0.98	0.98	0.98	0.98
	Climb out	1.32	1.32	1.32	1.32	1.32	1.32	1.32
	Climb/cruise/descent	0.25	0.20	0.22	0.19	0.17	0.15	0.14
	Approach landing	7.23	7.23	7.23	7.23	7.23	7.23	7.23
	Taxi in	56.74	56.74	56.74	56.74	56.74	56.74	56.74
CO (g)								
	Flight total	39166.3	39918.1	41632.3	42206.4	42780.5	44248.2	45849.8
	LTO	37742.1	37742.1	37742.1	37742.1	37742.1	37742.1	37742.1
	Taxi out	17577.61	17577.61	17577.61	17577.61	17577.61	17577.61	17577.61
	Take off	109.68	109.68	109.68	109.68	109.68	109.68	109.68
	Climb out	320.59	320.59	320.59	320.59	320.59	320.59	320.59
	Climb/cruise/descent	1424.13	2176.00	3890.20	4464.30	5038.39	6506.05	8107.70
	Approach landing	2156.47	2156.47	2156.47	2156.47	2156.47	2156.47	2156.47
	Taxi in	17577.79	17577.79	17577.79	17577.79	17577.79	17577.79	17577.79
EICO (g/kg fuel)								
	Taxi out	97.98	97.98	97.98	97.98	97.98	97.98	97.98
	Take off	1.81	1.81	1.81	1.81	1.81	1.81	1.81
	Climb out	2.06	2.06	2.06	2.06	2.06	2.06	2.06
	Climb/cruise/descent	2.00	1.55	1.60	1.27	1.10	0.93	0.86
	Approach landing	20.23	20.23	20.23	20.23	20.23	20.23	20.23
	Taxi in	97.98	97.98	97.98	97.98	97.98	97.98	97.98

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

BAe146

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500
Distance (km)							
	Climb/cruise/descent	231.5	463	926	1389	1852	2778
Fuel (kg)							
	Flight total	1245.1	1860.5	3124.5	4374.5	5652.6	8270.1
	LTO	569.5	569.5	569.5	569.5	569.5	569.5
	Taxi out	127.7	127.7	127.7	127.7	127.7	127.7
	Take off	59.8	59.8	59.8	59.8	59.8	59.8
	Climb out	155.2	155.2	155.2	155.2	155.2	155.2
	Climb/cruise/descent	675.6	1291.0	2555.0	3805.0	5083.1	7700.6
	Approach landing	99.1	99.1	99.1	99.1	99.1	99.1
	Taxi in	127.7	127.7	127.7	127.7	127.7	127.7
NOx (kg)							
	Flight total	12.9	17.1	23.9	32.5	41.5	60.3
	LTO	4.2	4.2	4.2	4.2	4.2	4.2
	Taxi out	0.523	0.523	0.523	0.523	0.523	0.523
	Take off	0.770	0.770	0.770	0.770	0.770	0.770
	Climb out	1.780	1.780	1.780	1.780	1.780	1.780
	Climb/cruise/descent	8.722	12.936	19.682	28.350	37.311	56.113
	Approach landing	0.597	0.597	0.597	0.597	0.597	0.597
	Taxi in	0.523	0.523	0.523	0.523	0.523	0.523
EINOx (g/kg fuel)							
	Taxi out	4.10	4.10	4.10	4.10	4.10	4.10
	Take off	12.87	12.87	12.87	12.87	12.87	12.87
	Climb out	11.47	11.47	11.47	11.47	11.47	11.47
	Climb/cruise/descent	12.91	10.02	7.70	7.45	7.34	7.29
	Approach landing	6.03	6.03	6.03	6.03	6.03	6.03
	Taxi in	4.10	4.10	4.10	4.10	4.10	4.10
HC (g)							
	Flight total	1366.0	1603.0	1985.7	2363.7	2742.3	3527.9
	LTO	1013.1	1013.1	1013.1	1013.1	1013.1	1013.1
	Taxi out	420.26	420.26	420.26	420.26	420.26	420.26
	Take off	22.13	22.13	22.13	22.13	22.13	22.13
	Climb out	63.46	63.46	63.46	63.46	63.46	63.46
	Climb/cruise/descent	352.93	589.96	972.65	1350.58	1729.25	2514.81
	Approach landing	86.97	86.97	86.97	86.97	86.97	86.97
	Taxi in	420.26	420.26	420.26	420.26	420.26	420.26
EIHC (g/kg fuel)							
	Taxi out	3.29	3.29	3.29	3.29	3.29	3.29
	Take off	0.37	0.37	0.37	0.37	0.37	0.37
	Climb out	0.41	0.41	0.41	0.41	0.41	0.41
	Climb/cruise/descent	0.52	0.46	0.38	0.35	0.34	0.33
	Approach landing	0.88	0.88	0.88	0.88	0.88	0.88
	Taxi in	3.29	3.29	3.29	3.29	3.29	3.29
CO (g)							
	Flight total	11131.6	12062.1	13141.7	14155.7	15135.2	17214.6
	LTO	9692.4	9692.4	9692.4	9692.4	9692.4	9692.4
	Taxi out	4314.50	4314.50	4314.50	4314.50	4314.50	4314.50
	Take off	104.13	104.13	104.13	104.13	104.13	104.13
	Climb out	311.72	311.72	311.72	311.72	311.72	311.72
	Climb/cruise/descent	1439.17	2369.66	3449.31	4463.31	5442.83	7522.16
	Approach landing	647.42	647.42	647.42	647.42	647.42	647.42
	Taxi in	4314.63	4314.63	4314.63	4314.63	4314.63	4314.63
EICO (g/kg fuel)							
	Taxi out	33.78	33.78	33.78	33.78	33.78	33.78
	Take off	1.74	1.74	1.74	1.74	1.74	1.74
	Climb out	2.01	2.01	2.01	2.01	2.01	2.01
	Climb/cruise/descent	2.13	1.84	1.35	1.17	1.07	0.98
	Approach landing	6.54	6.54	6.54	6.54	6.54	6.54
	Taxi in	33.78	33.78	33.78	33.78	33.78	33.78

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

B727

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000	2500
Distance (km)									
	Climb/cruise/descent	231.5	463	926	1389	1852	2778	3704	4630
Fuel (kg)									
	Flight total	2716.8	3754.7	5660.2	7493.2	9471.2	13544.2	17872.3	22238.1
	LTO	1412.8	1412.8	1412.8	1412.8	1412.8	1412.8	1412.8	1412.8
	Taxi out	332.7	332.7	332.7	332.7	332.7	332.7	332.7	332.7
	Take off	145.1	145.1	145.1	145.1	145.1	145.1	145.1	145.1
	Climb out	365.9	365.9	365.9	365.9	365.9	365.9	365.9	365.9
	Climb/cruise/descent	1303.9	2341.8	4247.3	6080.4	8058.3	12131.4	16459.4	20825.2
	Approach landing	236.5	236.5	236.5	236.5	236.5	236.5	236.5	236.5
	Taxi in	332.7	332.7	332.7	332.7	332.7	332.7	332.7	332.7
NOx (kg)									
	Flight total	23.5	29.5	55.7	70.2	86.2	121.0	159.3	197.7
	LTO	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6
	Taxi out	1.171	1.171	1.171	1.171	1.171	1.171	1.171	1.171
	Take off	2.842	2.842	2.842	2.842	2.842	2.842	2.842	2.842
	Climb out	5.880	5.880	5.880	5.880	5.880	5.880	5.880	5.880
	Climb/cruise/descent	10.889	16.894	43.087	57.673	73.617	108.441	146.697	185.141
	Approach landing	1.509	1.509	1.509	1.509	1.509	1.509	1.509	1.509
	Taxi in	1.171	1.171	1.171	1.171	1.171	1.171	1.171	1.171
EINOx (g/kg fuel)									
	Taxi out	3.52	3.52	3.52	3.52	3.52	3.52	3.52	3.52
	Take off	19.60	19.60	19.60	19.60	19.60	19.60	19.60	19.60
	Climb out	16.07	16.07	16.07	16.07	16.07	16.07	16.07	16.07
	Climb/cruise/descent	8.35	7.21	10.14	9.49	9.14	8.94	8.91	8.89
	Approach landing	6.38	6.38	6.38	6.38	6.38	6.38	6.38	6.38
	Taxi in	3.52	3.52	3.52	3.52	3.52	3.52	3.52	3.52
HC (g)									
	Flight total	8107.3	9406.6	9511.5	10272.7	10946.3	12479.1	14071.4	15677.7
	LTO	7200.5	7200.5	7200.5	7200.5	7200.5	7200.5	7200.5	7200.5
	Taxi out	3323.45	3323.45	3323.45	3323.45	3323.45	3323.45	3323.45	3323.45
	Take off	57.88	57.88	57.88	57.88	57.88	57.88	57.88	57.88
	Climb out	164.67	164.67	164.67	164.67	164.67	164.67	164.67	164.67
	Climb/cruise/descent	906.74	2206.04	2310.92	3072.16	3745.78	5278.53	6870.86	8477.13
	Approach landing	331.09	331.09	331.09	331.09	331.09	331.09	331.09	331.09
	Taxi in	3323.45	3323.45	3323.45	3323.45	3323.45	3323.45	3323.45	3323.45
EIHC (g/kg fuel)									
	Taxi out	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99
	Take off	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
	Climb out	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
	Climb/cruise/descent	0.70	0.94	0.54	0.51	0.46	0.44	0.42	0.41
	Approach landing	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
	Taxi in	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99
CO (g)									
	Flight total	29832.1	32241.9	35209.2	38214.3	40941.1	47060.8	53447.6	59887.9
	LTO	26372.7	26372.7	26372.7	26372.7	26372.7	26372.7	26372.7	26372.7
	Taxi out	11640.40	11640.40	11640.40	11640.40	11640.40	11640.40	11640.40	11640.40
	Take off	173.92	173.92	173.92	173.92	173.92	173.92	173.92	173.92
	Climb out	694.91	694.91	694.91	694.91	694.91	694.91	694.91	694.91
	Climb/cruise/descent	3459.41	5869.24	8836.57	11841.59	14568.44	20688.10	27074.91	33515.24
	Approach landing	2223.03	2223.03	2223.03	2223.03	2223.03	2223.03	2223.03	2223.03
	Taxi in	11640.40	11640.40	11640.40	11640.40	11640.40	11640.40	11640.40	11640.40
EICO (g/kg fuel)									
	Taxi out	34.99	34.99	34.99	34.99	34.99	34.99	34.99	34.99
	Take off	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
	Climb out	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90
	Climb/cruise/descent	2.65	2.51	2.08	1.95	1.81	1.71	1.64	1.61
	Approach landing	9.40	9.40	9.40	9.40	9.40	9.40	9.40	9.40
	Taxi in	34.99	34.99	34.99	34.99	34.99	34.99	34.99	34.99

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

B737 100

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000
Distance (km)								
	Climb/cruise/descent	231.5	463	926	1389	1852	2778	3704
Fuel (kg)								
	Flight total	1800.0	2495.3	3727.1	4949.7	6190.7	8721.8	11438.0
	LTO	919.7	919.7	919.7	919.7	919.7	919.7	919.7
	Taxi out	217.0	217.0	217.0	217.0	217.0	217.0	217.0
	Take off	94.1	94.1	94.1	94.1	94.1	94.1	94.1
	Climb out	238.3	238.3	238.3	238.3	238.3	238.3	238.3
	Climb/cruise/descent	880.3	1575.6	2807.4	4030.0	5271.0	7802.1	10518.3
	Approach landing	153.4	153.4	153.4	153.4	153.4	153.4	153.4
	Taxi in	217.0	217.0	217.0	217.0	217.0	217.0	217.0
NOx (kg)								
	Flight total	17.9	24.4	34.3	43.0	52.0	69.8	90.8
	LTO	8.0	8.0	8.0	8.0	8.0	8.0	8.0
	Taxi out	0.751	0.751	0.751	0.751	0.751	0.751	0.751
	Take off	1.790	1.790	1.790	1.790	1.790	1.790	1.790
	Climb out	3.729	3.729	3.729	3.729	3.729	3.729	3.729
	Climb/cruise/descent	9.898	16.422	26.342	35.074	43.986	61.837	82.853
	Approach landing	0.952	0.952	0.952	0.952	0.952	0.952	0.952
	Taxi in	0.751	0.751	0.751	0.751	0.751	0.751	0.751
EINOx (g/kg fuel)								
	Taxi out	3.46	3.46	3.46	3.46	3.46	3.46	3.46
	Take off	19.03	19.03	19.03	19.03	19.03	19.03	19.03
	Climb out	15.65	15.65	15.65	15.65	15.65	15.65	15.65
	Climb/cruise/descent	11.24	10.42	9.38	8.70	8.34	7.93	7.88
	Approach landing	6.21	6.21	6.21	6.21	6.21	6.21	6.21
	Taxi in	3.46	3.46	3.46	3.46	3.46	3.46	3.46
HC (g)								
	Flight total	1532.2	2158.8	2877.3	3538.0	4164.6	5431.0	6843.4
	LTO	577.4	577.4	577.4	577.4	577.4	577.4	577.4
	Taxi out	206.15	206.15	206.15	206.15	206.15	206.15	206.15
	Take off	19.76	19.76	19.76	19.76	19.76	19.76	19.76
	Climb out	64.09	64.09	64.09	64.09	64.09	64.09	64.09
	Climb/cruise/descent	954.81	1581.40	2299.89	2960.55	3587.21	4853.58	6266.03
	Approach landing	81.28	81.28	81.28	81.28	81.28	81.28	81.28
	Taxi in	206.12	206.12	206.12	206.12	206.12	206.12	206.12
EIHC (g/kg fuel)								
	Taxi out	0.95	0.95	0.95	0.95	0.95	0.95	0.95
	Take off	0.21	0.21	0.21	0.21	0.21	0.21	0.21
	Climb out	0.27	0.27	0.27	0.27	0.27	0.27	0.27
	Climb/cruise/descent	1.08	1.00	0.82	0.73	0.68	0.62	0.60
	Approach landing	0.53	0.53	0.53	0.53	0.53	0.53	0.53
	Taxi in	0.95	0.95	0.95	0.95	0.95	0.95	0.95
CO (g)								
	Flight total	7420.3	9023.5	10474.7	11781.3	12957.8	15319.5	18033.9
	LTO	4816.8	4816.8	4816.8	4816.8	4816.8	4816.8	4816.8
	Taxi out	2046.27	2046.27	2046.27	2046.27	2046.27	2046.27	2046.27
	Take off	89.29	89.29	89.29	89.29	89.29	89.29	89.29
	Climb out	245.41	245.41	245.41	245.41	245.41	245.41	245.41
	Climb/cruise/descent	2603.55	4206.76	5657.90	6964.53	8141.03	10502.75	13217.14
	Approach landing	389.53	389.53	389.53	389.53	389.53	389.53	389.53
	Taxi in	2046.27	2046.27	2046.27	2046.27	2046.27	2046.27	2046.27
EICO (g/kg fuel)								
	Taxi out	9.43	9.43	9.43	9.43	9.43	9.43	9.43
	Take off	0.95	0.95	0.95	0.95	0.95	0.95	0.95
	Climb out	1.03	1.03	1.03	1.03	1.03	1.03	1.03
	Climb/cruise/descent	2.96	2.67	2.02	1.73	1.54	1.35	1.26
	Approach landing	2.54	2.54	2.54	2.54	2.54	2.54	2.54
	Taxi in	9.43	9.43	9.43	9.43	9.43	9.43	9.43

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

B737 400

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000
Distance (km)								
	Climb/cruise/descent	231.5	463	926	1389	1852	2778	3704
Fuel (kg)								
	Flight total	1603.1	2268.0	3612.8	4960.3	6302.6	9187.7	12167.6
	LTO	825.4	825.4	825.4	825.4	825.4	825.4	825.4
	Taxi out	183.5	183.5	183.5	183.5	183.5	183.5	183.5
	Take off	86.0	86.0	86.0	86.0	86.0	86.0	86.0
	Climb out	225.0	225.0	225.0	225.0	225.0	225.0	225.0
	Climb/cruise/descent	777.7	1442.6	2787.4	4134.9	5477.2	8362.3	11342.2
	Approach landing	147.3	147.3	147.3	147.3	147.3	147.3	147.3
	Taxi in	183.5	183.5	183.5	183.5	183.5	183.5	183.5
NOx (kg)								
	Flight total	17.7	23.6	36.9	48.7	60.2	86.3	114.4
	LTO	8.3	8.3	8.3	8.3	8.3	8.3	8.3
	Taxi out	0.784	0.784	0.784	0.784	0.784	0.784	0.784
	Take off	1.591	1.591	1.591	1.591	1.591	1.591	1.591
	Climb out	3.855	3.855	3.855	3.855	3.855	3.855	3.855
	Climb/cruise/descent	9.462	15.392	28.635	40.425	51.952	78.047	106.169
	Approach landing	1.240	1.240	1.240	1.240	1.240	1.240	1.240
	Taxi in	0.784	0.784	0.784	0.784	0.784	0.784	0.784
EINOx (g/kg fuel)								
	Taxi out	4.27	4.27	4.27	4.27	4.27	4.27	4.27
	Take off	18.51	18.51	18.51	18.51	18.51	18.51	18.51
	Climb out	17.13	17.13	17.13	17.13	17.13	17.13	17.13
	Climb/cruise/descent	12.17	10.67	10.27	9.78	9.49	9.33	9.36
	Approach landing	8.42	8.42	8.42	8.42	8.42	8.42	8.42
	Taxi in	4.27	4.27	4.27	4.27	4.27	4.27	4.27
HC (g)								
	Flight total	817.6	912.9	995.8	1065.2	1118.1	1240.4	1374.1
	LTO	666.8	666.8	666.8	666.8	666.8	666.8	666.8
	Taxi out	321.18	321.18	321.18	321.18	321.18	321.18	321.18
	Take off	3.09	3.09	3.09	3.09	3.09	3.09	3.09
	Climb out	10.58	10.58	10.58	10.58	10.58	10.58	10.58
	Climb/cruise/descent	150.78	246.13	329.05	398.47	451.33	573.67	707.37
	Approach landing	10.74	10.74	10.74	10.74	10.74	10.74	10.74
	Taxi in	321.18	321.18	321.18	321.18	321.18	321.18	321.18
EIHC (g/kg fuel)								
	Taxi out	1.75	1.75	1.75	1.75	1.75	1.75	1.75
	Take off	0.04	0.04	0.04	0.04	0.04	0.04	0.04
	Climb out	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Climb/cruise/descent	0.19	0.17	0.12	0.10	0.08	0.07	0.06
	Approach landing	0.07	0.07	0.07	0.07	0.07	0.07	0.07
	Taxi in	1.75	1.75	1.75	1.75	1.75	1.75	1.75
CO (g)								
	Flight total	14252.5	15836.0	17525.5	19060.6	20369.3	23298.2	26426.3
	LTO	11830.9	11830.9	11830.9	11830.9	11830.9	11830.9	11830.9
	Taxi out	5525.45	5525.45	5525.45	5525.45	5525.45	5525.45	5525.45
	Take off	77.19	77.19	77.19	77.19	77.19	77.19	77.19
	Climb out	202.29	202.29	202.29	202.29	202.29	202.29	202.29
	Climb/cruise/descent	2421.54	4005.06	5694.59	7229.65	8538.39	11467.26	14595.41
	Approach landing	500.54	500.54	500.54	500.54	500.54	500.54	500.54
	Taxi in	5525.45	5525.45	5525.45	5525.45	5525.45	5525.45	5525.45
EICO (g/kg fuel)								
	Taxi out	30.11	30.11	30.11	30.11	30.11	30.11	30.11
	Take off	0.90	0.90	0.90	0.90	0.90	0.90	0.90
	Climb out	0.90	0.90	0.90	0.90	0.90	0.90	0.90
	Climb/cruise/descent	3.11	2.78	2.04	1.75	1.56	1.37	1.29
	Approach landing	3.40	3.40	3.40	3.40	3.40	3.40	3.40
	Taxi in	30.11	30.11	30.11	30.11	30.11	30.11	30.11

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

B747 100-300

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500
Distance (km)																	
	Climb/cruise/descent	231.5	463	926	1389	1852	2778	3704	4630	5556	6482	7408	8334	9260	10186		
Fuel (kg)																	
	Flight total	6564.8	9419.8	14308.0	19196.3	24084.5	34170.5	44419.0	55255.2	66562.3	77909.2	90362.1	103265.9	116703.3	130411.0		
	LTO	3413.9	3413.9	3413.9	3413.9	3413.9	3413.9	3413.9	3413.9	3413.9	3413.9	3413.9	3413.9	3413.9	3413.9		
	Taxi out	702.4	702.4	702.4	702.4	702.4	702.4	702.4	702.4	702.4	702.4	702.4	702.4	702.4	702.4		
	Take off	387.2	387.2	387.2	387.2	387.2	387.2	387.2	387.2	387.2	387.2	387.2	387.2	387.2	387.2		
	Climb out	996.1	996.1	996.1	996.1	996.1	996.1	996.1	996.1	996.1	996.1	996.1	996.1	996.1	996.1		
	Climb/cruise/descent	3151.0	6005.9	10894.2	15782.4	20670.7	30756.7	41005.1	51841.3	63148.4	74495.4	86948.2	99852.0	113289.4	126997.1		
	Approach landing	625.7	625.7	625.7	625.7	625.7	625.7	625.7	625.7	625.7	625.7	625.7	625.7	625.7	625.7		
	Taxi in	702.4	702.4	702.4	702.4	702.4	702.4	702.4	702.4	702.4	702.4	702.4	702.4	702.4	702.4		
NOx (kg)																	
	Flight total	127.6	181.2	276.1	355.4	436.3	608.7	787.8	941.3	1151.3	1351.0	1589.3	1844.9	2124.8	2422.0		
	LTO	55.9	55.9	55.9	55.9	55.9	55.9	55.9	55.9	55.9	55.9	55.9	55.9	55.9	55.9		
	Taxi out	2.321	2.321	2.321	2.321	2.321	2.321	2.321	2.321	2.321	2.321	2.321	2.321	2.321	2.321		
	Take off	15.358	15.358	15.358	15.358	15.358	15.358	15.358	15.358	15.358	15.358	15.358	15.358	15.358	15.358		
	Climb out	30.595	30.595	30.595	30.595	30.595	30.595	30.595	30.595	30.595	30.595	30.595	30.595	30.595	30.595		
	Climb/cruise/descent	71.613	125.278	220.198	299.503	380.338	552.776	731.877	885.371	1095.341	1295.102	1533.376	1788.934	2068.891	2366.055		
	Approach landing	5.348	5.348	5.348	5.348	5.348	5.348	5.348	5.348	5.348	5.348	5.348	5.348	5.348	5.348		
	Taxi in	2.321	2.321	2.321	2.321	2.321	2.321	2.321	2.321	2.321	2.321	2.321	2.321	2.321	2.321		
EINOx (g/kg fuel)																	
	Taxi out	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30		
	Take off	39.66	39.66	39.66	39.66	39.66	39.66	39.66	39.66	39.66	39.66	39.66	39.66	39.66	39.66		
	Climb out	30.72	30.72	30.72	30.72	30.72	30.72	30.72	30.72	30.72	30.72	30.72	30.72	30.72	30.72		
	Climb/cruise/descent	22.73	20.86	20.21	18.98	18.40	17.97	17.85	17.08	17.35	17.38	17.64	17.92	18.26	18.63		
	Approach landing	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55		
	Taxi in	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30		
HC (g)																	
	Flight total	41242.4	44639.3	46540.5	47455.8	48371.1	50248.9	52145.4	54004.0	56109.9	57813.3	60132.5	62525.2	64996.8	67405.6		
	LTO	37253.7	37253.7	37253.7	37253.7	37253.7	37253.7	37253.7	37253.7	37253.7	37253.7	37253.7	37253.7	37253.7	37253.7		
	Taxi out	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24		
	Take off	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16	116.16		
	Climb out	298.82	298.82	298.82	298.82	298.82	298.82	298.82	298.82	298.82	298.82	298.82	298.82	298.82	298.82		
	Climb/cruise/descent	3988.72	7385.61	9286.82	10202.13	11117.44	12995.22	14891.68	16750.30	18856.22	20559.64	22878.77	25271.48	27743.10	30151.95		
	Approach landing	312.23	312.23	312.23	312.23	312.23	312.23	312.23	312.23	312.23	312.23	312.23	312.23	312.23	312.23		
	Taxi in	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24	18263.24		
EIHC (g/kg fuel)																	
	Taxi out	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00		
	Take off	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30		

B747 100-300

Standard flight distances (nm) [1nm = 1.852 km]

	125	250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500
Climb out	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30		
Climb/cruise/descent	1.27	1.23	0.85	0.65	0.54	0.42	0.36	0.32	0.30	0.28	0.26	0.25	0.24	0.24		
Approach landing	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50		
Taxi in	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00		

CO (g)

Flight total	88557.6	97265.5	102616.0	105806.3	108996.5	115552.8	122189.2	128853.4	136203.7	142615.8	150710.9	159073.9	167733.2	176313.3	
LTO	78233.2	78233.2	78233.2	78233.2	78233.2	78233.2	78233.2	78233.2	78233.2	78233.2	78233.2	78233.2	78233.2	78233.2	
Taxi out	37931.34	37931.34	37931.34	37931.34	37931.34	37931.34	37931.34	37931.34	37931.34	37931.34	37931.34	37931.34	37931.34	37931.34	
Take off	154.88	154.88	154.88	154.88	154.88	154.88	154.88	154.88	154.88	154.88	154.88	154.88	154.88	154.88	
Climb out	397.44	397.44	397.44	397.44	397.44	397.44	397.44	397.44	397.44	397.44	397.44	397.44	397.44	397.44	
Climb/cruise/descent	10324.42	19032.38	24382.89	27573.12	30763.34	37319.69	43956.06	50620.24	57970.58	64382.68	72477.77	80840.72	89500.07	98080.12	
Approach landing	1813.95	1813.95	1813.95	1813.95	1813.95	1813.95	1813.95	1813.95	1813.95	1813.95	1813.95	1813.95	1813.95	1813.95	
Taxi in	37935.55	37935.55	37935.55	37935.55	37935.55	37935.55	37935.55	37935.55	37935.55	37935.55	37935.55	37935.55	37935.55	37935.55	

EICO (g/kg fuel)

Taxi out	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	
Take off	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	
Climb out	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	
Climb/cruise/descent	3.28	3.17	2.24	1.75	1.49	1.21	1.07	0.98	0.92	0.86	0.83	0.81	0.79	0.77	
Approach landing	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	
Taxi in	54.01	54.01	54.01	54.01	54.01	54.01	54.01	54.01	54.01	54.01	54.01	54.01	54.01	54.01	

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

B747 400

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500
Distance (km)																	
	Climb/cruise/descent	231.5	463	926	1389	1852	2778	3704	4630	5556	6482	7408	8334	9260	10186	11112	12038
Fuel (kg)																	
	Flight total	6330.9	9058.3	13404.6	17750.9	22097.2	30921.6	40266.7	49480.2	59576.9	69888.3	80789.2	91986.5	103611.4	115553.0	128170.8	141254.2
	LTO	3402.2	3402.2	3402.2	3402.2	3402.2	3402.2	3402.2	3402.2	3402.2	3402.2	3402.2	3402.2	3402.2	3402.2	3402.2	3402.2
	Taxi out	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4
	Take off	411.9	411.9	411.9	411.9	411.9	411.9	411.9	411.9	411.9	411.9	411.9	411.9	411.9	411.9	411.9	411.9
	Climb out	1043.4	1043.4	1043.4	1043.4	1043.4	1043.4	1043.4	1043.4	1043.4	1043.4	1043.4	1043.4	1043.4	1043.4	1043.4	1043.4
	Climb/cruise/descent	2928.7	5656.1	10002.4	14348.7	18695.0	27519.4	36864.5	46078.1	56174.7	66486.1	77387.1	88584.3	100209.2	112150.9	124768.7	137852.1
	Approach landing	624.0	624.0	624.0	624.0	624.0	624.0	624.0	624.0	624.0	624.0	624.0	624.0	624.0	624.0	624.0	624.0
	Taxi in	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4	661.4
NOx (kg)																	
	Flight total	118.7	168.0	226.9	280.9	335.6	447.1	574.0	687.4	826.8	973.2	1137.3	1311.1	1492.3	1687.0	1899.7	2129.3
	LTO	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6
	Taxi out	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165
	Take off	14.872	14.872	14.872	14.872	14.872	14.872	14.872	14.872	14.872	14.872	14.872	14.872	14.872	14.872	14.872	14.872
	Climb out	29.554	29.554	29.554	29.554	29.554	29.554	29.554	29.554	29.554	29.554	29.554	29.554	29.554	29.554	29.554	29.554
	Climb/cruise/descent	62.062	111.391	170.253	224.240	278.954	390.487	517.395	630.723	770.134	916.523	1080.706	1254.489	1435.658	1630.340	1843.103	2072.679
	Approach landing	5.881	5.881	5.881	5.881	5.881	5.881	5.881	5.881	5.881	5.881	5.881	5.881	5.881	5.881	5.881	5.881
	Taxi in	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165	3.165
EINOx (g/kg fuel)																	
	Taxi out	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79
	Take off	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11
	Climb out	28.32	28.32	28.32	28.32	28.32	28.32	28.32	28.32	28.32	28.32	28.32	28.32	28.32	28.32	28.32	28.32
	Climb/cruise/descent	21.19	19.69	17.02	15.63	14.92	14.19	14.04	13.69	13.71	13.79	13.96	14.16	14.33	14.54	14.77	15.04
	Approach landing	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42
	Taxi in	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79
HC (g)																	
	Flight total	5873.2	9346.5	11166.2	11834.8	12503.3	13898.0	15321.1	16119.7	17680.1	19263.0	20946.8	22649.3	24414.4	25900.0	27817.3	29807.6
	LTO	1849.5	1849.5	1849.5	1849.5	1849.5	1849.5	1849.5	1849.5	1849.5	1849.5	1849.5	1849.5	1849.5	1849.5	1849.5	1849.5
	Taxi out	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67
	Take off	160.64	160.64	160.64	160.64	160.64	160.64	160.64	160.64	160.64	160.64	160.64	160.64	160.64	160.64	160.64	160.64
	Climb out	280.67	280.67	280.67	280.67	280.67	280.67	280.67	280.67	280.67	280.67	280.67	280.67	280.67	280.67	280.67	280.67
	Climb/cruise/descent	4023.70	7496.95	9316.70	9985.24	10653.78	12048.48	13471.60	14270.19	15830.52	17413.51	19097.25	20799.79	22564.82	24050.50	25967.78	27958.11
	Approach landing	230.89	230.89	230.89	230.89	230.89	230.89	230.89	230.89	230.89	230.89	230.89	230.89	230.89	230.89	230.89	230.89
	Taxi in	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67	588.67
EIHC (g/kg fuel)																	
	Taxi out	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
	Take off	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
	Climb out	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
	Climb/cruise/descent	1.37	1.33	0.93	0.70	0.57	0.44	0.37	0.31	0.28	0.26	0.25	0.23	0.23	0.21	0.21	0.20
	Approach landing	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37

B747 400

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500
	Taxi in	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
CO (g)																	
	Flight total	31566.9	41952.9	47670.9	50789.3	53907.6	60238.3	66939.4	71469.0	78705.3	86094.5	93927.3	101923.2	110223.6	117364.7	126348.2	135687.0
	LTO	19497.2	19497.2	19497.2	19497.2	19497.2	19497.2	19497.2	19497.2	19497.2	19497.2	19497.2	19497.2	19497.2	19497.2	19497.2	19497.2
	Taxi out	9087.96	9087.96	9087.96	9087.96	9087.96	9087.96	9087.96	9087.96	9087.96	9087.96	9087.96	9087.96	9087.96	9087.96	9087.96	9087.96
	Take off	243.02	243.02	243.02	243.02	243.02	243.02	243.02	243.02	243.02	243.02	243.02	243.02	243.02	243.02	243.02	243.02
	Climb out	448.65	448.65	448.65	448.65	448.65	448.65	448.65	448.65	448.65	448.65	448.65	448.65	448.65	448.65	448.65	448.65
	Climb/cruise/descent	12069.69	22455.68	28173.73	31292.04	34410.36	40741.08	47442.19	51971.75	59208.09	66597.26	74430.08	82426.01	90726.40	97867.50	106850.96	116189.80
	Approach landing	630.28	630.28	630.28	630.28	630.28	630.28	630.28	630.28	630.28	630.28	630.28	630.28	630.28	630.28	630.28	630.28
	Taxi in	9087.30	9087.30	9087.30	9087.30	9087.30	9087.30	9087.30	9087.30	9087.30	9087.30	9087.30	9087.30	9087.30	9087.30	9087.30	9087.30
EICO (g/kg fuel)																	
	Taxi out	13.74	13.74	13.74	13.74	13.74	13.74	13.74	13.74	13.74	13.74	13.74	13.74	13.74	13.74	13.74	13.74
	Take off	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
	Climb out	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
	Climb/cruise/descent	4.12	3.97	2.82	2.18	1.84	1.48	1.29	1.13	1.05	1.00	0.96	0.93	0.91	0.87	0.86	0.84
	Approach landing	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
	Taxi in	13.739	13.739	13.739	13.739	13.739	13.739	13.739	13.739	13.739	13.739	13.739	13.739	13.739	13.739	13.739	13.739

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

B767 300 ER

Standard flight distances (nm) [1nm = 1.852 km]

		125	**250**	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000
Distance (km)														
	Climb/cruise/descent	231.5	463	926	1389	1852	2778	3704	4630	5556	6482	7408	8334	9260
Fuel (kg)														
	Flight total	3030.3	4305.2	6485.2	8665.1	10845.1	15408.6	20086.6	24804.4	29909.4	35239.1	40630.9	46313.7	52208.0
	LTO	1617.1	1617.1	1617.1	1617.1	1617.1	1617.1	1617.1	1617.1	1617.1	1617.1	1617.1	1617.1	1617.1
	Taxi out	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0
	Take off	195.4	195.4	195.4	195.4	195.4	195.4	195.4	195.4	195.4	195.4	195.4	195.4	195.4
	Climb out	500.2	500.2	500.2	500.2	500.2	500.2	500.2	500.2	500.2	500.2	500.2	500.2	500.2
	Climb/cruise/descent	1413.2	2688.1	4868.1	7048.0	9228.0	13791.5	18469.5	23187.3	28292.3	33622.0	39013.8	44696.6	50590.9
	Approach landing	321.4	321.4	321.4	321.4	321.4	321.4	321.4	321.4	321.4	321.4	321.4	321.4	321.4
	Taxi in	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0
NOx (kg)														
	Flight total	52.0	74.0	103.5	129.4	155.6	213.0	273.1	320.3	388.1	462.1	535.7	617.8	706.0
	LTO	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
	Taxi out	1.269	1.269	1.269	1.269	1.269	1.269	1.269	1.269	1.269	1.269	1.269	1.269	1.269
	Take off	6.534	6.534	6.534	6.534	6.534	6.534	6.534	6.534	6.534	6.534	6.534	6.534	6.534
	Climb out	13.702	13.702	13.702	13.702	13.702	13.702	13.702	13.702	13.702	13.702	13.702	13.702	13.702
	Climb/cruise/descent	25.998	47.926	77.442	103.334	129.578	186.974	247.061	294.293	362.113	436.101	509.712	591.753	680.008
	Approach landing	3.257	3.257	3.257	3.257	3.257	3.257	3.257	3.257	3.257	3.257	3.257	3.257	3.257
	Taxi in	1.269	1.269	1.269	1.269	1.269	1.269	1.269	1.269	1.269	1.269	1.269	1.269	1.269
EINOx (g/kg fuel)														
	Taxi out	4.23	4.23	4.23	4.23	4.23	4.23	4.23	4.23	4.23	4.23	4.23	4.23	4.23
	Take off	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44
	Climb out	27.39	27.39	27.39	27.39	27.39	27.39	27.39	27.39	27.39	27.39	27.39	27.39	27.39
	Climb/cruise/descent	18.40	17.83	15.91	14.66	14.04	13.56	13.38	12.69	12.80	12.97	13.06	13.24	13.44
	Approach landing	10.13	10.13	10.13	10.13	10.13	10.13	10.13	10.13	10.13	10.13	10.13	10.13	10.13
	Taxi in	4.23	4.23	4.23	4.23	4.23	4.23	4.23	4.23	4.23	4.23	4.23	4.23	4.23
HC (g)														
	Flight total	1123.9	1434.5	2550.4	3666.2	4782.1	7094.4	9474.4	12109.0	14718.8	17415.5	20197.0	23082.5	26076.5
	LTO	881.0	881.0	881.0	881.0	881.0	881.0	881.0	881.0	881.0	881.0	881.0	881.0	881.0
	Taxi out	375.06	375.06	375.06	375.06	375.06	375.06	375.06	375.06	375.06	375.06	375.06	375.06	375.06
	Take off	29.12	29.12	29.12	29.12	29.12	29.12	29.12	29.12	29.12	29.12	29.12	29.12	29.12
	Climb out	60.03	60.03	60.03	60.03	60.03	60.03	60.03	60.03	60.03	60.03	60.03	60.03	60.03
	Climb/cruise/descent	242.85	553.50	1669.35	2785.19	3901.04	6213.33	8593.34	11228.01	13837.72	16534.44	19315.98	22201.50	25195.44
	Approach landing	41.78	41.78	41.78	41.78	41.78	41.78	41.78	41.78	41.78	41.78	41.78	41.78	41.78
	Taxi in	375.06	375.06	375.06	375.06	375.06	375.06	375.06	375.06	375.06	375.06	375.06	375.06	375.06
EIHC (g/kg fuel)														
	Taxi out	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
	Take off	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Climb out	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
	Climb/cruise/descent	0.17	0.21	0.34	0.40	0.42	0.45	0.47	0.48	0.49	0.49	0.50	0.50	0.50
	Approach landing	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
	Taxi in	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
CO (g)														
	Flight total	9710.3	12531.4	15362.5	17537.8	19713.1	24229.9	28869.2	33258.5	38345.0	43614.3	48997.1	54624.5	60462.0
	LTO	6077.3	6077.3	6077.3	6077.3	6077.3	6077.3	6077.3	6077.3	6077.3	6077.3	6077.3	6077.3	6077.3
	Taxi out	2648.80	2648.80	2648.80	2648.80	2648.80	2648.80	2648.80	2648.80	2648.80	2648.80	2648.80	2648.80	2648.80
	Take off	99.47	99.47	99.47	99.47	99.47	99.47	99.47	99.47	99.47	99.47	99.47	99.47	99.47
	Climb out	239.61	239.61	239.61	239.61	239.61	239.61	239.61	239.61	239.61	239.61	239.61	239.61	239.61
	Climb/cruise/descent	3632.95	6454.08	9285.21	11460.49	13635.76	18152.57	22791.86	27181.21	32267.64	37536.95	42919.75	48547.22	54384.72
	Approach landing	437.04	437.04	437.04	437.04	437.04	437.04	437.04	437.04	437.04	437.04	437.04	437.04	437.04
	Taxi in	2652.40	2652.40	2652.40	2652.40	2652.40	2652.40	2652.40	2652.40	2652.40	2652.40	2652.40	2652.40	2652.40
EICO (g/kg fuel)														
	Taxi out	8.83	8.83	8.83	8.83	8.83	8.83	8.83	8.83	8.83	8.83	8.83	8.83	8.83
	Take off	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
	Climb out	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
	Climb/cruise/descent	2.57	2.40	1.91	1.63	1.48	1.32	1.23	1.17	1.14	1.12	1.10	1.09	1.07
	Approach landing	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36
	Taxi in	8.84	8.84	8.84	8.84	8.84	8.84	8.84	8.84	8.84	8.84	8.84	8.84	8.84

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

B757

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000	2500
Distance (km)									
	Climb/cruise/descent	231.5	463	926	1389	1852	2778	3704	4630
Fuel (kg)									
	Flight total	2422.9	3410.2	5070.4	6724.4	8390.7	11845.7	15407.0	19025.9
	LTO	1253.0	1253.0	1253.0	1253.0	1253.0	1253.0	1253.0	1253.0
	Taxi out	255.8	255.8	255.8	255.8	255.8	255.8	255.8	255.8
	Take off	144.3	144.3	144.3	144.3	144.3	144.3	144.3	144.3
	Climb out	370.7	370.7	370.7	370.7	370.7	370.7	370.7	370.7
	Climb/cruise/descent	1169.9	2157.2	3817.3	5471.4	7137.7	10592.7	14154.0	17772.9
	Approach landing	226.3	226.3	226.3	226.3	226.3	226.3	226.3	226.3
	Taxi in	255.8	255.8	255.8	255.8	255.8	255.8	255.8	255.8
NOx (kg)									
	Flight total	53.2	74.5	84.0	105.2	125.5	170.7	218.1	256.5
	LTO	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7
	Taxi out	1.051	1.051	1.051	1.051	1.051	1.051	1.051	1.051
	Take off	5.193	5.193	5.193	5.193	5.193	5.193	5.193	5.193
	Climb out	10.474	10.474	10.474	10.474	10.474	10.474	10.474	10.474
	Climb/cruise/descent	33.515	54.780	64.274	85.464	105.757	151.015	198.398	236.732
	Approach landing	1.962	1.962	1.962	1.962	1.962	1.962	1.962	1.962
	Taxi in	1.051	1.051	1.051	1.051	1.051	1.051	1.051	1.051
EINOx (g/kg fuel)									
	Taxi out	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11
	Take off	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98
	Climb out	28.25	28.25	28.25	28.25	28.25	28.25	28.25	28.25
	Climb/cruise/descent	28.65	25.39	16.84	15.62	14.82	14.26	14.02	13.32
	Approach landing	8.67	8.67	8.67	8.67	8.67	8.67	8.67	8.67
	Taxi in	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11
HC (g)									
	Flight total	2460.6	3495.8	5101.1	6677.3	8222.5	11470.4	14809.2	18207.1
	LTO	1232.5	1232.5	1232.5	1232.5	1232.5	1232.5	1232.5	1232.5
	Taxi out	578.12	578.12	578.12	578.12	578.12	578.12	578.12	578.12
	Take off	7.07	7.07	7.07	7.07	7.07	7.07	7.07	7.07
	Climb out	22.17	22.17	22.17	22.17	22.17	22.17	22.17	22.17
	Climb/cruise/descent	1228.05	2263.32	3868.61	5444.79	6990.00	10237.86	13576.65	16974.58
	Approach landing	47.30	47.30	47.30	47.30	47.30	47.30	47.30	47.30
	Taxi in	577.86	577.86	577.86	577.86	577.86	577.86	577.86	577.86
EIHC (g/kg fuel)									
	Taxi out	2.26	2.26	2.26	2.26	2.26	2.26	2.26	2.26
	Take off	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Climb out	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
	Climb/cruise/descent	1.05	1.05	1.01	1.00	0.98	0.97	0.96	0.96
	Approach landing	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
	Taxi in	2.26	2.26	2.26	2.26	2.26	2.26	2.26	2.26
CO (g)									
	Flight total	14898.2	16860.2	19168.7	21349.8	23259.7	27516.3	31835.1	36256.0
	LTO	12545.4	12545.4	12545.4	12545.4	12545.4	12545.4	12545.4	12545.4
	Taxi out	5907.83	5907.83	5907.83	5907.83	5907.83	5907.83	5907.83	5907.83
	Take off	57.59	57.59	57.59	57.59	57.59	57.59	57.59	57.59
	Climb out	151.97	151.97	151.97	151.97	151.97	151.97	151.97	151.97
	Climb/cruise/descent	2352.85	4314.82	6623.29	8804.37	10714.30	14970.86	19289.67	23710.61
	Approach landing	520.19	520.19	520.19	520.19	520.19	520.19	520.19	520.19
	Taxi in	5907.83	5907.83	5907.83	5907.83	5907.83	5907.83	5907.83	5907.83
EICO (g/kg fuel)									
	Taxi out	23.10	23.10	23.10	23.10	23.10	23.10	23.10	23.10
	Take off	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
	Climb out	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
	Climb/cruise/descent	2.01	2.00	1.74	1.61	1.50	1.41	1.36	1.33
	Approach landing	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
	Taxi in	23.10	23.10	23.10	23.10	23.10	23.10	23.10	23.10

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

B777

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500
Distance (km)																	
	Climb/cruise/descent	231.5	462.99	926	1389	1852	2778	3704	4630	5556	6482	7408	8334	9260	10186	11112	
Fuel (kg)																	
	Flight total	4819.6	7035.1	10130.4	13226.4	16363.8	22576.4	29225.7	36026.7	43143.2	50294.6	57904.3	65763.5	73655.1	82067.4	90693.2	
	LTO	2562.8	2562.8	2562.8	2562.8	2562.8	2562.8	2562.8	2562.8	2562.8	2562.8	2562.8	2562.8	2562.8	2562.8	2562.8	
	Taxi out	468.0	468.0	468.0	468.0	468.0	468.0	468.00	468.00	468.00	468.00	468.00	468.00	468.00	468.0	468.0	
	Take off	328.4	328.4	328.4	328.4	328.4	328.4	328.4	328.4	328.4	328.4	328.4	328.4	328.4	328.4	328.4	
	Climb out	818.4	818.4	818.4	818.4	818.4	818.4	818.4	818.4	818.4	818.4	818.4	818.4	818.4	818.4	818.4	
	Climb/cruise/descent	2256.7	4472.3	7567.5	10663.6	13801.0	20013.6	26662.8	33463.8	40580.4	47731.8	55341.5	63200.7	71092.3	79504.6	88130.4	
	Approach landing	480.0	480.0	480.0	480.0	480.0	480.0	480.0	480.0	480.0	480.0	480.0	480.0	480.0	480.0	480.0	
	Taxi in	468.0	468.0	468.0	468.0	468.0	468.0	468.0	468.0	468.0	468.0	468.0	468.0	468.0	468.0	468.0	
NOx (kg)																	
	Flight total	106.2	130.9	209.1	251.0	294.0	374.9	471.7	571.8	683.2	792.9	910.0	1044.5	1167.5	1315.8	1472.9	
	LTO	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	
	Taxi out	2.494	2.494	2.494	2.494	2.494	2.494	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.494	2.494	
	Take off	15.010	15.010	15.010	15.010	15.010	15.010	15.010	15.010	15.010	15.010	15.010	15.010	15.010	15.010	15.010	
	Climb out	27.941	27.941	27.941	27.941	27.941	27.941	27.941	27.941	27.941	27.941	27.941	27.941	27.941	27.941	27.941	
	Climb/cruise/descent	52.514	77.276	155.497	197.389	240.328	321.275	418.088	518.156	629.587	739.264	856.375	990.870	#######	#######	#######	
	Approach landing	5.699	5.699	5.699	5.699	5.699	5.699	5.699	5.699	5.699	5.699	5.699	5.699	5.699	5.699	5.699	
	Taxi in	2.494	2.494	2.494	2.494	2.494	2.494	2.494	2.494	2.494	2.494	2.494	2.494	2.494	2.494	2.494	
EINOx (g/kg fuel)																	
	Taxi out	5.330	5.330	5.330	5.330	5.330	5.330	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.330	5.330	
	Take off	45.700	45.700	45.700	45.700	45.700	45.700	45.700	45.700	45.700	45.700	45.700	45.700	45.700	45.700	45.700	
	Climb out	34.141	34.141	34.141	34.141	34.141	34.141	34.141	34.141	34.141	34.141	34.141	34.141	34.141	34.141	34.141	
	Climb/cruise/descent	23.270	17.279	20.548	18.510	17.414	16.053	15.681	15.484	15.515	15.488	15.474	15.678	15.667	15.875	16.104	
	Approach landing	11.873	11.873	11.873	11.873	11.873	11.873	11.873	11.873	11.873	11.873	11.873	11.873	11.873	11.873	11.873	
	Taxi in	5.330	5.330	5.330	5.330	5.330	5.330	5.330	5.330	5.330	5.330	5.330	5.330	5.330	5.330	5.330	
HC (g)																	
	Flight total	24877.8	26130.4	50442.7	52025.4	53604.0	54921.0	58223.8	60775.0	64477.8	66080.9	69993.9	74049.6	75052.7	79307.6	81322.1	
	LTO	22774.3	22774.3	22774.3	22774.3	22774.3	22774.3	22774.3	22774.3	22774.3	22774.3	22774.3	22774.3	22774.3	22774.3	22774.3	
	Taxi out	10761.19	10761.19	10761.19	10761.19	10761.19	10761.19	10761.19	10761.19	10761.19	10761.19	10761.19	10761.19	10761.19	10761.19	10761.19	
	Take off	197.06	197.06	197.06	197.06	197.06	197.06	197.06	197.06	197.06	197.06	197.06	197.06	197.06	197.06	197.06	
	Climb out	572.06	572.06	572.06	572.06	572.06	572.06	572.06	572.06	572.06	572.06	572.06	572.06	572.06	572.06	572.06	
	Climb/cruise/descent	2103.43	3356.10	27668.41	29251.07	30829.71	32146.69	35449.51	38000.72	41703.49	43306.57	47219.63	51275.28	52278.34	56533.29	58547.73	
	Approach landing	480.00	480.00	480.00	480.00	480.00	480.00	480.00	480.00	480.00	480.00	480.00	480.00	480.00	480.00	480.00	
	Taxi in	10764.00	10764.00	10764.00	10764.00	10764.00	10764.00	10764.00	10764.00	10764.00	10764.00	10764.00	10764.00	10764.00	10764.00	10764.00	

B777

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500
EIHC (g/kg fuel)																	
	Taxi out	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	
	Take off	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	
	Climb out	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	
	Climb/cruise/descent	0.93	0.75	3.66	2.74	2.23	1.61	1.33	1.14	1.03	0.91	0.85	0.81	0.74	0.71	0.66	
	Approach landing	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	Taxi in	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	
CO (g)																	
	Flight total	69519.8	73335.7	91509.3	93744.8	95975.0	100015.9	104738.4	108847.8	113931.6	118526.8	123921.5	129490.8	133953.5	139909.9	144817.5	
	LTO	61376.1	61376.1	61376.1	61376.1	61376.1	61376.1	61376.1	61376.1	61376.1	61376.1	61376.1	61376.1	61376.1	61376.1	61376.1	
	Taxi out	29148.91	29148.91	29148.91	29148.91	29148.91	29148.91	29148.91	29148.91	29148.91	29148.91	29148.91	29148.91	29148.91	29148.91	29148.91	
	Take off	164.22	164.22	164.22	164.22	164.22	164.22	164.22	164.22	164.22	164.22	164.22	164.22	164.22	164.22	164.22	
	Climb out	409.20	409.20	409.20	409.20	409.20	409.20	409.20	409.20	409.20	409.20	409.20	409.20	409.20	409.20	409.20	
	Climb/cruise/descent	8143.68	11959.60	30133.16	32368.70	34598.86	38639.78	43362.29	47471.68	52555.45	57150.70	62545.34	68114.62	72577.33	78533.75	83441.37	
	Approach landing	2496.00	2496.00	2496.00	2496.00	2496.00	2496.00	2496.00	2496.00	2496.00	2496.00	2496.00	2496.00	2496.00	2496.00	2496.00	
	Taxi in	29157.80	29157.80	29157.80	29157.80	29157.80	29157.80	29157.80	29157.80	29157.80	29157.80	29157.80	29157.80	29157.80	29157.80	29157.80	
EICO (g/kg fuel)																	
	Taxi out	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	
	Take off	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
	Climb out	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
	Climb/cruise/descent	3.61	2.67	3.98	3.04	2.51	1.93	1.63	1.42	1.30	1.20	1.13	1.08	1.02	0.99	0.95	
	Approach landing	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	
	Taxi in	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

DC9

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000
Distance (km)								
	Climb/cruise/descent	231.5	463	926	1389	1852	2778	3704
Fuel (kg)								
	Flight total	1743.9	2478.0	3815.3	5067.1	6490.0	9354.9	12353.9
	LTO	876.1	876.1	876.1	876.1	876.1	876.1	876.1
	Taxi out	209.1	209.1	209.1	209.1	209.1	209.1	209.1
	Take off	87.9	87.9	87.9	87.9	87.9	87.9	87.9
	Climb out	224.9	224.9	224.9	224.9	224.9	224.9	224.9
	Climb/cruise/descent	867.8	1601.9	2939.2	4191.0	5613.9	8478.8	11477.8
	Approach landing	145.0	145.0	145.0	145.0	145.0	145.0	145.0
	Taxi in	209.1	209.1	209.1	209.1	209.1	209.1	209.1
NOx (kg)								
	Flight total	16.7	23.6	35.9	45.3	57.4	81.4	107.9
	LTO	7.3	7.3	7.3	7.3	7.3	7.3	7.3
	Taxi out	0.694	0.694	0.694	0.694	0.694	0.694	0.694
	Take off	1.596	1.596	1.596	1.596	1.596	1.596	1.596
	Climb out	3.409	3.409	3.409	3.409	3.409	3.409	3.409
	Climb/cruise/descent	9.486	16.289	28.643	38.054	50.108	74.165	100.682
	Approach landing	0.871	0.871	0.871	0.871	0.871	0.871	0.871
	Taxi in	0.694	0.694	0.694	0.694	0.694	0.694	0.694
EINOx (g/kg fuel)								
	Taxi out	3.32	3.32	3.32	3.32	3.32	3.32	3.32
	Take off	18.15	18.15	18.15	18.15	18.15	18.15	18.15
	Climb out	15.15	15.15	15.15	15.15	15.15	15.15	15.15
	Climb/cruise/descent	10.93	10.17	9.75	9.08	8.93	8.75	8.77
	Approach landing	6.01	6.01	6.01	6.01	6.01	6.01	6.01
	Taxi in	3.32	3.32	3.32	3.32	3.32	3.32	3.32
HC (g)								
	Flight total	1394.8	1872.3	2602.4	3246.4	3972.1	5419.8	6954.3
	LTO	774.3	774.3	774.3	774.3	774.3	774.3	774.3
	Taxi out	305.34	305.34	305.34	305.34	305.34	305.34	305.34
	Take off	21.10	21.10	21.10	21.10	21.10	21.10	21.10
	Climb out	62.76	62.76	62.76	62.76	62.76	62.76	62.76
	Climb/cruise/descent	620.52	1098.02	1828.12	2472.14	3197.86	4645.56	6180.01
	Approach landing	79.74	79.74	79.74	79.74	79.74	79.74	79.74
	Taxi in	305.34	305.34	305.34	305.34	305.34	305.34	305.34
EIHC (g/kg fuel)								
	Taxi out	1.46	1.46	1.46	1.46	1.46	1.46	1.46
	Take off	0.24	0.24	0.24	0.24	0.24	0.24	0.24
	Climb out	0.28	0.28	0.28	0.28	0.28	0.28	0.28
	Climb/cruise/descent	0.72	0.69	0.62	0.59	0.57	0.55	0.54
	Approach landing	0.55	0.55	0.55	0.55	0.55	0.55	0.55
	Taxi in	1.46	1.46	1.46	1.46	1.46	1.46	1.46
CO (g)								
	Flight total	7732.3	9321.9	10859.6	12131.9	13622.6	16328.4	19427.4
	LTO	5352.1	5352.1	5352.1	5352.1	5352.1	5352.1	5352.1
	Taxi out	2300.52	2300.52	2300.52	2300.52	2300.52	2300.52	2300.52
	Take off	90.54	90.54	90.54	90.54	90.54	90.54	90.54
	Climb out	258.68	258.68	258.68	258.68	258.68	258.68	258.68
	Climb/cruise/descent	2380.17	3969.76	5507.45	6779.80	8270.41	10976.30	14075.25
	Approach landing	401.90	401.90	401.90	401.90	401.90	401.90	401.90
	Taxi in	2300.52	2300.52	2300.52	2300.52	2300.52	2300.52	2300.52
EICO (g/kg fuel)								
	Taxi out	11.00	11.00	11.00	11.00	11.00	11.00	11.00
	Take off	1.03	1.03	1.03	1.03	1.03	1.03	1.03
	Climb out	1.15	1.15	1.15	1.15	1.15	1.15	1.15
	Climb/cruise/descent	2.74	2.48	1.87	1.62	1.47	1.29	1.23
	Approach landing	2.77	2.77	2.77	2.77	2.77	2.77	2.77
	Taxi in	11.00	11.00	11.00	11.00	11.00	11.00	11.00

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

DC10-30

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000
Distance (km)														
	Climb/cruise/descent	231.5	463	926	1389	1852	2778	3704	4630	5556	6482	7408	8334	9260
Fuel (kg)														
	Flight total	4727.7	6804.4	10487.5	14170.5	17853.6	25476.2	33218.6	41492.3	50361.3	59452.4	69037.9	79034.1	89398.0
	LTO	2381.2	2381.2	2381.2	2381.2	2381.2	2381.2	2381.2	2381.2	2381.2	2381.2	2381.2	2381.2	2381.2
	Taxi out	472.4	472.4	472.4	472.4	472.4	472.4	472.4	472.4	472.4	472.4	472.4	472.4	472.4
	Take off	283.1	283.1	283.1	283.1	283.1	283.1	283.1	283.1	283.1	283.1	283.1	283.1	283.1
	Climb out	716.8	716.8	716.8	716.8	716.8	716.8	716.8	716.8	716.8	716.8	716.8	716.8	716.8
	Climb/cruise/descent	2346.5	4423.2	8106.3	11789.4	15472.5	23095.0	30837.4	39111.2	47980.2	57071.2	66656.7	76652.9	87016.8
	Approach landing	436.5	436.5	436.5	436.5	436.5	436.5	436.5	436.5	436.5	436.5	436.5	436.5	436.5
	Taxi in	472.4	472.4	472.4	472.4	472.4	472.4	472.4	472.4	472.4	472.4	472.4	472.4	472.4
NOx (kg)														
	Flight total	97.8	133.8	205.4	265.8	327.3	457.6	588.6	718.1	886.4	1058.5	1250.2	1457.9	1677.9
	LTO	41.7	41.7	41.7	41.7	41.7	41.7	41.7	41.7	41.7	41.7	41.7	41.7	41.7
	Taxi out	1.822	1.822	1.822	1.822	1.822	1.822	1.822	1.822	1.822	1.822	1.822	1.822	1.822
	Take off	10.892	10.892	10.892	10.892	10.892	10.892	10.892	10.892	10.892	10.892	10.892	10.892	10.892
	Climb out	22.547	22.547	22.547	22.547	22.547	22.547	22.547	22.547	22.547	22.547	22.547	22.547	22.547
	Climb/cruise/descent	56.064	92.084	163.705	224.068	285.563	415.854	546.939	676.361	844.646	1016.839	1208.526	1416.176	1636.202
	Approach landing	4.621	4.621	4.621	4.621	4.621	4.621	4.621	4.621	4.621	4.621	4.621	4.621	4.621
	Taxi in	1.822	1.822	1.822	1.822	1.822	1.822	1.822	1.822	1.822	1.822	1.822	1.822	1.822
EINOx (g/kg fuel)														
	Taxi out	3.86	3.86	3.86	3.86	3.86	3.86	3.86	3.86	3.86	3.86	3.86	3.86	3.86
	Take off	38.47	38.47	38.47	38.47	38.47	38.47	38.47	38.47	38.47	38.47	38.47	38.47	38.47
	Climb out	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46
	Climb/cruise/descent	23.89	20.82	20.19	19.01	18.46	18.01	17.74	17.29	17.60	17.82	18.13	18.48	18.80
	Approach landing	10.59	10.59	10.59	10.59	10.59	10.59	10.59	10.59	10.59	10.59	10.59	10.59	10.59
	Taxi in	3.86	3.86	3.86	3.86	3.86	3.86	3.86	3.86	3.86	3.86	3.86	3.86	3.86
HC (g)														
	Flight total	34368.1	43406.9	46147.9	48105.2	50062.4	54078.8	54353.6	58275.1	62622.6	65748.1	70951.0	75846.9	78250.3
	LTO	22835.1	22835.1	22835.1	22835.1	22835.1	22835.1	22835.1	22835.1	22835.1	22835.1	22835.1	22835.1	22835.1
	Taxi out	10862.44	10862.44	10862.44	10862.44	10862.44	10862.44	10862.44	10862.44	10862.44	10862.44	10862.44	10862.44	10862.44
	Take off	169.86	169.86	169.86	169.86	169.86	169.86	169.86	169.86	169.86	169.86	169.86	169.86	169.86
	Climb out	501.03	501.03	501.03	501.03	501.03	501.03	501.03	501.03	501.03	501.03	501.03	501.03	501.03
	Climb/cruise/descent	11533.00	20571.79	23312.83	25270.08	27227.33	31243.67	31518.53	35439.95	39787.46	42912.98	48115.85	53011.75	55415.20
	Approach landing	436.48	436.48	436.48	436.48	436.48	436.48	436.48	436.48	436.48	436.48	436.48	436.48	436.48

DC10-30

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000
	Taxi in	10865.28	10865.28	10865.28	10865.28	10865.28	10865.28	10865.28	10865.28	10865.28	10865.28	10865.28	10865.28	10865.28
EIHC (g/kg fuel)														
	Taxi out	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99	22.99
	Take off	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
	Climb out	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
	Climb/cruise/descent	4.92	4.65	2.88	2.14	1.76	1.35	1.02	0.91	0.83	0.75	0.72	0.69	0.64
	Approach landing	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Taxi in	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
CO (g)														
	Flight total	71545.0	80256.7	84288.5	86883.5	89478.4	94847.8	99309.2	104973.1	110807.5	116865.9	123574.7	130232.0	137385.7
	LTO	61625.0	61625.0	61625.0	61625.0	61625.0	61625.0	61625.0	61625.0	61625.0	61625.0	61625.0	61625.0	61625.0
	Taxi out	29423.17	29423.17	29423.17	29423.17	29423.17	29423.17	29423.17	29423.17	29423.17	29423.17	29423.17	29423.17	29423.17
	Take off	141.55	141.55	141.55	141.55	141.55	141.55	141.55	141.55	141.55	141.55	141.55	141.55	141.55
	Climb out	358.39	358.39	358.39	358.39	358.39	358.39	358.39	358.39	358.39	358.39	358.39	358.39	358.39
	Climb/cruise/descent	9920.06	18631.77	22663.56	25258.49	27853.43	33222.78	37684.21	43348.13	49182.49	55240.93	61949.76	68606.98	75760.77
	Approach landing	2269.71	2269.71	2269.71	2269.71	2269.71	2269.71	2269.71	2269.71	2269.71	2269.71	2269.71	2269.71	2269.71
	Taxi in	29432.15	29432.15	29432.15	29432.15	29432.15	29432.15	29432.15	29432.15	29432.15	29432.15	29432.15	29432.15	29432.15
EICO (g/kg fuel)														
	Taxi out	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28	62.28
	Take off	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	Climb out	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	Climb/cruise/descent	4.23	4.21	2.80	2.14	1.80	1.44	1.22	1.11	1.03	0.97	0.93	0.90	0.87
	Approach landing	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20
	Taxi in	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30	62.30

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

F28

Standard flight distances (nm) [1nm = 1.852 km]

		125	250	500	750	1000	1500
Distance (km)							
	Climb/cruise/descent	231.5	463	926	1389	1852	2778
Fuel (kg)							
	Flight total	1357.4	1889.2	2984.5	3985.7	5174.9	7318.9
	LTO	666.1	666.1	666.1	666.1	666.1	666.1
	Taxi out	171.5	171.5	171.5	171.5	171.5	171.5
	Take off	60.8	60.8	60.8	60.8	60.8	60.8
	Climb out	155.7	155.7	155.7	155.7	155.7	155.7
	Climb/cruise/descent	691.4	1223.2	2318.4	3319.7	4508.8	6652.8
	Approach landing	106.4	106.4	106.4	106.4	106.4	106.4
	Taxi in	171.5	171.5	171.5	171.5	171.5	171.5
NOx (kg)							
	Flight total	13.9	18.6	29.7	38.1	48.6	68.7
	LTO	5.2	5.2	5.2	5.2	5.2	5.2
	Taxi out	0.455	0.455	0.455	0.455	0.455	0.455
	Take off	1.180	1.180	1.180	1.180	1.180	1.180
	Climb out	2.494	2.494	2.494	2.494	2.494	2.494
	Climb/cruise/descent	8.671	13.378	24.493	32.874	43.433	63.496
	Approach landing	0.610	0.610	0.610	0.610	0.610	0.610
	Taxi in	0.455	0.455	0.455	0.455	0.455	0.455
EINOx (g/kg fuel)							
	Taxi out	2.65	2.65	2.65	2.65	2.65	2.65
	Take off	19.41	19.41	19.41	19.41	19.41	19.41
	Climb out	16.02	16.02	16.02	16.02	16.02	16.02
	Climb/cruise/descent	12.54	10.94	10.56	9.90	9.63	9.54
	Approach landing	5.73	5.73	5.73	5.73	5.73	5.73
	Taxi in	2.65	2.65	2.65	2.65	2.65	2.65
HC (g)							
	Flight total	34542.6	35965.8	36940.4	37815.9	38703.7	40534.6
	LTO	32860.9	32860.9	32860.9	32860.9	32860.9	32860.9
	Taxi out	15908.16	15908.16	15908.16	15908.16	15908.16	15908.16
	Take off	53.52	53.52	53.52	53.52	53.52	53.52
	Climb out	249.32	249.32	249.32	249.32	249.32	249.32
	Climb/cruise/descent	1681.73	3104.95	4079.51	4955.00	5842.83	7673.70
	Approach landing	741.72	741.72	741.72	741.72	741.72	741.72
	Taxi in	15908.16	15908.16	15908.16	15908.16	15908.16	15908.16
EIHC (g/kg fuel)							
	Taxi out	92.74	92.74	92.74	92.74	92.74	92.74
	Take off	0.88	0.88	0.88	0.88	0.88	0.88
	Climb out	1.60	1.60	1.60	1.60	1.60	1.60
	Climb/cruise/descent	2.43	2.54	1.76	1.49	1.30	1.15
	Approach landing	6.97	6.97	6.97	6.97	6.97	6.97
	Taxi in	92.74	92.74	92.74	92.74	92.74	92.74
CO (g)							
	Flight total	34573.4	36055.8	36426.8	36777.3	36978.8	37668.6
	LTO	32722.3	32722.3	32722.3	32722.3	32722.3	32722.3
	Taxi out	15134.37	15134.37	15134.37	15134.37	15134.37	15134.37
	Take off	26.76	26.76	26.76	26.76	26.76	26.76
	Climb out	62.29	62.29	62.29	62.29	62.29	62.29
	Climb/cruise/descent	1851.08	3333.48	3704.50	4054.99	4256.50	4946.25
	Approach landing	2364.38	2364.38	2364.38	2364.38	2364.38	2364.38
	Taxi in	15134.54	15134.54	15134.54	15134.54	15134.54	15134.54
EICO (g/kg fuel)							
	Taxi out	88.23	88.23	88.23	88.23	88.23	88.23
	Take off	0.44	0.44	0.44	0.44	0.44	0.44
	Climb out	0.40	0.40	0.40	0.40	0.40	0.40
	Climb/cruise/descent	2.68	2.73	1.60	1.22	0.94	0.74
	Approach landing	22.21	22.21	22.21	22.21	22.21	22.21
	Taxi in	88.23	88.23	88.23	88.23	88.23	88.23

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

F100

		Standard flight distances (nm) [1nm = 1.852 km]					
		125	**250**	**500**	**750**	**1000**	**1500**
Distance (km)							
	Climb/cruise/descent	231.5	463	926	1389	1852	2778
Fuel (kg)							
	Flight total	1467.6	2078.7	3212.4	4285.7	5479.7	7796.3
	LTO	744.4	744.4	744.4	744.4	744.4	744.4
	Taxi out	183.5	183.5	183.5	183.5	183.5	183.5
	Take off	71.9	71.9	71.9	71.9	71.9	71.9
	Climb out	185.3	185.3	185.3	185.3	185.3	185.3
	Climb/cruise/descent	723.2	1334.4	2468.0	3541.4	4735.3	7051.9
	Approach landing	120.2	120.2	120.2	120.2	120.2	120.2
	Taxi in	183.5	183.5	183.5	183.5	183.5	183.5
NOx (kg)							
	Flight total	15.1	20.0	27.9	33.5	40.5	53.8
	LTO	5.8	5.8	5.8	5.8	5.8	5.8
	Taxi out	0.304	0.304	0.304	0.304	0.304	0.304
	Take off	1.459	1.459	1.459	1.459	1.459	1.459
	Climb out	3.111	3.111	3.111	3.111	3.111	3.111
	Climb/cruise/descent	9.339	14.206	22.092	27.733	34.715	48.011
	Approach landing	0.615	0.615	0.615	0.615	0.615	0.615
	Taxi in	0.304	0.304	0.304	0.304	0.304	0.304
EINOx (g/kg fuel)							
	Taxi out	1.66	1.66	1.66	1.66	1.66	1.66
	Take off	20.28	20.28	20.28	20.28	20.28	20.28
	Climb out	16.79	16.79	16.79	16.79	16.79	16.79
	Climb/cruise/descent	12.91	10.65	8.95	7.83	7.33	6.81
	Approach landing	5.12	5.12	5.12	5.12	5.12	5.12
	Taxi in	1.66	1.66	1.66	1.66	1.66	1.66
HC (g)							
	Flight total	1792.5	2068.9	2412.5	2741.3	3088.9	3786.3
	LTO	1415.2	1415.2	1415.2	1415.2	1415.2	1415.2
	Taxi out	603.66	603.66	603.66	603.66	603.66	603.66
	Take off	26.62	26.62	26.62	26.62	26.62	26.62
	Climb out	75.79	75.79	75.79	75.79	75.79	75.79
	Climb/cruise/descent	377.28	653.63	997.31	1326.08	1673.65	2371.09
	Approach landing	105.49	105.49	105.49	105.49	105.49	105.49
	Taxi in	603.66	603.66	603.66	603.66	603.66	603.66
EIHC (g/kg fuel)							
	Taxi out	3.29	3.29	3.29	3.29	3.29	3.29
	Take off	0.37	0.37	0.37	0.37	0.37	0.37
	Climb out	0.41	0.41	0.41	0.41	0.41	0.41
	Climb/cruise/descent	0.52	0.49	0.40	0.37	0.35	0.34
	Approach landing	0.88	0.88	0.88	0.88	0.88	0.88
	Taxi in	3.29	3.29	3.29	3.29	3.29	3.29
CO (g)							
	Flight total	15214.5	16416.9	17405.6	18307.4	19175.8	21028.6
	LTO	13677.8	13677.8	13677.8	13677.8	13677.8	13677.8
	Taxi out	6197.36	6197.36	6197.36	6197.36	6197.36	6197.36
	Take off	125.26	125.26	125.26	125.26	125.26	125.26
	Climb out	372.30	372.30	372.30	372.30	372.30	372.30
	Climb/cruise/descent	1536.75	2739.15	3727.87	4629.58	5498.04	7350.80
	Approach landing	785.31	785.31	785.31	785.31	785.31	785.31
	Taxi in	6197.55	6197.55	6197.55	6197.55	6197.55	6197.55
EICO (g/kg fuel)							
	Taxi out	33.78	33.78	33.78	33.78	33.78	33.78
	Take off	1.74	1.74	1.74	1.74	1.74	1.74
	Climb out	2.01	2.01	2.01	2.01	2.01	2.01
	Climb/cruise/descent	2.12	2.05	1.51	1.31	1.16	1.04
	Approach landing	6.54	6.54	6.54	6.54	6.54	6.54
	Taxi in	33.78	33.78	33.78	33.78	33.78	33.78

Fuel Consumption and emission factors for Dash 8, Fokker 50 andsimilar size turboprops

MD 82

		Standard flight distances (nm) [1nm = 1.852 km]						
		125	250	500	750	1000	1500	2000
Distance (km)								
	Climb/cruise/descent	231.5	463	926	1389	1852	2778	3704
Fuel (kg)								
	Flight total	2102.9	3111.0	4563.9	5913.1	7469.8	10523.3	13738.7
	LTO	1003.1	1003.1	1003.1	1003.1	1003.1	1003.1	1003.1
	Taxi out	211.9	211.9	211.9	211.9	211.9	211.9	211.9
	Take off	111.6	111.6	111.6	111.6	111.6	111.6	111.6
	Climb out	284.4	284.4	284.4	284.4	284.4	284.4	284.4
	Climb/cruise/descent	1099.8	2107.9	3560.9	4910.0	6466.7	9520.3	12735.6
	Approach landing	183.2	183.2	183.2	183.2	183.2	183.2	183.2
	Taxi in	211.9	211.9	211.9	211.9	211.9	211.9	211.9
NOx (kg)								
	Flight total	31.2	44.4	62.0	74.6	91.6	122.9	158.5
	LTO	12.3	12.3	12.3	12.3	12.3	12.3	12.3
	Taxi out	0.847	0.847	0.847	0.847	0.847	0.847	0.847
	Take off	2.873	2.873	2.873	2.873	2.873	2.873	2.873
	Climb out	6.177	6.177	6.177	6.177	6.177	6.177	6.177
	Climb/cruise/descent	18.814	32.040	49.703	62.295	79.289	110.516	146.181
	Approach landing	1.599	1.599	1.599	1.599	1.599	1.599	1.599
	Taxi in	0.847	0.847	0.847	0.847	0.847	0.847	0.847
EINOx (g/kg fuel)								
	Taxi out	4.00	4.00	4.00	4.00	4.00	4.00	4.00
	Take off	25.74	25.74	25.74	25.74	25.74	25.74	25.74
	Climb out	21.72	21.72	21.72	21.72	21.72	21.72	21.72
	Climb/cruise/descent	17.11	15.20	13.96	12.69	12.26	11.61	11.48
	Approach landing	8.72	8.72	8.72	8.72	8.72	8.72	8.72
	Taxi in	4.00	4.00	4.00	4.00	4.00	4.00	4.00
HC (g)								
	Flight total	2516.4	3082.5	3718.1	4296.1	4942.1	6209.9	7563.8
	LTO	1915.5	1915.5	1915.5	1915.5	1915.5	1915.5	1915.5
	Taxi out	737.36	737.36	737.36	737.36	737.36	737.36	737.36
	Take off	30.14	30.14	30.14	30.14	30.14	30.14	30.14
	Climb out	119.45	119.45	119.45	119.45	119.45	119.45	119.45
	Climb/cruise/descent	600.90	1167.00	1802.67	2380.60	3026.60	4294.40	5648.36
	Approach landing	291.36	291.36	291.36	291.36	291.36	291.36	291.36
	Taxi in	737.15	737.15	737.15	737.15	737.15	737.15	737.15
EIHC (g/kg fuel)								
	Taxi out	3.48	3.48	3.48	3.48	3.48	3.48	3.48
	Take off	0.27	0.27	0.27	0.27	0.27	0.27	0.27
	Climb out	0.42	0.42	0.42	0.42	0.42	0.42	0.42
	Climb/cruise/descent	0.55	0.55	0.51	0.48	0.47	0.45	0.44
	Approach landing	1.59	1.59	1.59	1.59	1.59	1.59	1.59
	Taxi in	3.48	3.48	3.48	3.48	3.48	3.48	3.48
CO (g)								
	Flight total	8328.2	10011.8	11849.6	13501.7	15337.0	18936.5	22794.4
	LTO	6521.1	6521.1	6521.1	6521.1	6521.1	6521.1	6521.1
	Taxi out	2676.93	2676.93	2676.93	2676.93	2676.93	2676.93	2676.93
	Take off	81.37	81.37	81.37	81.37	81.37	81.37	81.37
	Climb out	341.30	341.30	341.30	341.30	341.30	341.30	341.30
	Climb/cruise/descent	1807.10	3490.70	5328.45	6980.55	8815.91	12415.43	16273.31
	Approach landing	745.63	745.63	745.63	745.63	745.63	745.63	745.63
	Taxi in	2675.87	2675.87	2675.87	2675.87	2675.87	2675.87	2675.87
EICO (g/kg fuel)								
	Taxi out	12.63	12.63	12.63	12.63	12.63	12.63	12.63
	Take off	0.73	0.73	0.73	0.73	0.73	0.73	0.73
	Climb out	1.20	1.20	1.20	1.20	1.20	1.20	1.20
	Climb/cruise/descent	1.64	1.66	1.50	1.42	1.36	1.30	1.28
	Approach landing	4.07	4.07	4.07	4.07	4.07	4.07	4.07
	Taxi in	12.63	12.63	12.63	12.63	12.63	12.63	12.63

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Swearingen Metro III
Hurdy_Gurdy Key	Swearingen Metro III, Cabin Factor 65%
Emission_key	TPE331-11U-601G
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**
Flight Altitude [ft]	25000	25000	25000	25000	25000
Flight Altitude [m]	7620	7620	7620	7620	7620
Takeoff Mass [kg]	5430	5529	5728	5927	6126
Landing Mass [kg]	5314	5314	5314	5314	5314
Sum Total Time [min]	41.35	74.35	140.34	206.33	272.3
Sum Lto Time [min]	16.58	16.6	16.64	16.69	16.73
Time Taxi Out [min]	5	5	5	5	5
Time Take Off [min]	0.26	0.26	0.27	0.28	0.29
Time Climb Out [min]	1.08	1.1	1.13	1.17	1.2
Time Climb Cruise Descent 3000 ft [min]	24.77	57.75	123.7	189.64	255.57
Time Approach Landing [min]	5.24	5.24	5.24	5.24	5.24
Time Taxi In [min]	5	5	5	5	5
Sum Total Fuel [kg]	147.2	246.1	444	641.9	839.8
Sum Lto Fuel [kg]	45.7	45.8	46.2	46.5	46.8
Fuel Taxi Out [kg]	8.7	8.8	8.8	8.9	9
Fuel Take Off [kg]	1.8	1.9	1.9	2	2
Fuel Climb Out [kg]	6.3	6.4	6.6	6.8	7
Fuel Climb Cruise Descent 3000 ft [kg]	101.5	200.3	397.8	595.4	793
Fuel Approach Landing [kg]	20.1	20.1	20.1	20.1	20.1
Fuel Taxi In [kg]	8.7	8.7	8.7	8.7	8.7
Sum Total NOx [kg]	1.386	2.366	4.327	6.288	8.25
Sum Lto NOx [kg]	0.38	0.382	0.385	0.388	0.392
NOx Taxi Out [kg]	0.041	0.041	0.042	0.042	0.042
NOx Take Off [kg]	0.021	0.021	0.022	0.022	0.023
NOx Climb Out [kg]	0.069	0.071	0.073	0.075	0.077
NOx Climb Cruise Descent 3000 ft [kg]	1.006	1.984	3.941	5.899	7.858
NOx Approach Landing [kg]	0.208	0.208	0.208	0.208	0.208
NOx Taxi In [kg]	0.041	0.041	0.041	0.041	0.041
Sum Total HC [g]	100.8	163.9	290.2	416.4	542.5
Sum Lto HC [g]	43.9	44	44.2	44.3	44.5
HC Taxi Out [g]	17.5	17.5	17.7	17.8	17.9
HC Take Off [g]	0.2	0.2	0.2	0.2	0.2
HC Climb Out [g]	0.7	0.7	0.7	0.7	0.8
HC Climb Cruise Descent 3000 ft [g]	56.8	119.9	246	372	498
HC Approach Landing [g]	8.2	8.2	8.2	8.2	8.2
HC Taxi In [g]	17.4	17.4	17.4	17.4	17.4
Sum Total CO [g]	1219.7	2116.4	3909.5	5702.1	7494.2
Sum Lto CO [g]	505.8	506.9	509	511.1	513.2
CO Taxi Out [g]	187.7	188.4	189.9	191.4	192.9
CO Take Off [g]	4	4	4.2	4.3	4.4
CO Climb Out [g]	15	15.3	15.8	16.2	16.7
CO Climb Cruise Descent 3000 ft [g]	713.9	1609.6	3400.5	5191	6981
CO Approach Landing [g]	112.4	112.4	112.4	112.4	112.4
CO Taxi In [g]	186.8	186.8	186.8	186.8	186.8

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Shorts SC.7 Srs3M-200
Hurdy_Gurdy Key	Shorts SC.7 Srs3M-200, Cabin Factor 65%
Emission_key	TPE331-2-201A
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**
Flight Altitude [ft]	10000	10000	10000	10000	10000
Flight Altitude [m]	3048	3048	3048	3048	3048
Takeoff Mass [kg]	5280	5453	5799	6141	6479
Landing Mass [kg]	5100	5100	5100	5100	5100
Sum Total Time [min]	56.57	102.87	194.43	284.21	371.53
Sum Lto Time [min]	17.95	17.99	18.06	18.13	18.2
Time Taxi Out [min]	5	5	5	5	5
Time Take Off [min]	0.35	0.36	0.38	0.4	0.42
Time Climb Out [min]	1.68	1.71	1.76	1.8	1.85
Time Climb Cruise Descent 3000 ft [min]	38.61	84.88	176.37	266.07	353.33
Time Approach Landing [min]	5.93	5.93	5.93	5.93	5.93
Time Taxi In [min]	5	5	5	5	5
Sum Total Fuel [kg]	188	361.5	706.5	1048.2	1385.4
Sum Lto Fuel [kg]	24.3	24.5	25	25.4	25.8
Fuel Taxi Out [kg]	2.8	2.8	2.9	3	3.1
Fuel Take Off [kg]	1.9	2	2.1	2.3	2.4
Fuel Climb Out [kg]	8	8.1	8.4	8.6	8.8
Fuel Climb Cruise Descent 3000 ft [kg]	163.7	337	681.5	1022.8	1359.6
Fuel Approach Landing [kg]	8.8	8.8	8.8	8.8	8.8
Fuel Taxi In [kg]	2.8	2.8	2.8	2.8	2.8
Sum Total NOx [kg]	1.783	3.52	6.97	10.378	13.734
Sum Lto NOx [kg]	0.178	0.18	0.184	0.187	0.191
NOx Taxi Out [kg]	0.007	0.007	0.007	0.007	0.007
NOx Take Off [kg]	0.019	0.019	0.02	0.022	0.023
NOx Climb Out [kg]	0.075	0.076	0.078	0.08	0.082
NOx Climb Cruise Descent 3000 ft [kg]	1.605	3.34	6.786	10.191	13.543
NOx Approach Landing [kg]	0.072	0.072	0.072	0.072	0.072
NOx Taxi In [kg]	0.006	0.006	0.006	0.006	0.006
Sum Total HC [g]	730.6	908	1254	1585.1	1895
Sum Lto HC [g]	648.8	653.1	661.7	670.3	678.7
HC Taxi Out [g]	304	308.3	316.9	325.4	333.8
HC Take Off [g]	0.3	0.3	0.3	0.4	0.4
HC Climb Out [g]	0.4	0.4	0.4	0.4	0.4
HC Climb Cruise Descent 3000 ft [g]	81.8	254.9	592.3	914.8	1216.2
HC Approach Landing [g]	44.5	44.5	44.5	44.5	44.5
HC Taxi In [g]	299.6	299.6	299.6	299.6	299.6
Sum Total CO [g]	1233.6	2414.3	4722.6	6940.6	9031.5
Sum Lto CO [g]	493.7	496.3	501.5	506.7	511.8
CO Taxi Out [g]	163.5	165.9	170.5	175.1	179.6
CO Take Off [g]	2.2	2.3	2.4	2.5	2.7
CO Climb Out [g]	15.9	16.1	16.6	17.1	17.5
CO Climb Cruise Descent 3000 ft [g]	739.9	1917.9	4221.1	6433.9	8519.7
CO Approach Landing [g]	150.9	150.9	150.9	150.9	150.9
CO Taxi In [g]	161.1	161.1	161.1	161.1	161.1

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Shorts 360-300
Hurdy_Gurdy Key	Shorts 360-300, Cabin Factor 65%
Emission_key	PT6A-67R
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**
Flight Altitude [ft]	25000	25000	25000	25000	25000
Flight Altitude [m]	7620	7620	7620	7620	7620
Takeoff Mass [kg]	10441	10621	10983	11345	11707
Landing Mass [kg]	10186	10186	10186	10186	10186
Sum Total Time [min]	54.12	91.97	167.56	242.99	318.24
Sum Lto Time [min]	17.36	17.42	17.54	17.65	17.77
Time Taxi Out [min]	5	5	5	5	5
Time Take Off [min]	0.42	0.42	0.44	0.45	0.47
Time Climb Out [min]	2.26	2.31	2.42	2.52	2.63
Time Climb Cruise Descent 3000 ft [min]	36.77	74.55	150.02	225.34	300.46
Time Approach Landing [min]	4.68	4.68	4.68	4.68	4.68
Time Taxi In [min]	5	5	5	5	5
Sum Total Fuel [kg]	285	465.3	826.1	1187	1548.3
Sum Lto Fuel [kg]	83	83.6	84.8	86	87.2
Fuel Taxi Out [kg]	16	16	16.1	16.3	16.4
Fuel Take Off [kg]	4.9	5	5.2	5.3	5.5
Fuel Climb Out [kg]	19.5	20	20.9	21.8	22.7
Fuel Climb Cruise Descent 3000 ft [kg]	202	381.8	741.3	1101	1461.1
Fuel Approach Landing [kg]	26.7	26.7	26.7	26.7	26.7
Fuel Taxi In [kg]	15.9	15.9	15.9	15.9	15.9
Sum Total NOx [kg]	1.572	2.425	4.134	5.847	7.568
Sum Lto NOx [kg]	0.398	0.402	0.411	0.419	0.427
NOx Taxi Out [kg]	0.048	0.048	0.048	0.049	0.049
NOx Take Off [kg]	0.038	0.038	0.04	0.041	0.042
NOx Climb Out [kg]	0.139	0.142	0.148	0.155	0.161
NOx Climb Cruise Descent 3000 ft [kg]	1.174	2.022	3.723	5.429	7.142
NOx Approach Landing [kg]	0.126	0.126	0.126	0.126	0.126
NOx Taxi In [kg]	0.048	0.048	0.048	0.048	0.048
Sum Total HC [g]	1643.2	2209.3	3338.6	4463.1	5581.7
Sum Lto HC [g]	677.1	678.3	680.9	683.4	685.9
HC Taxi Out [g]	298.3	299.5	302	304.4	306.9
HC Take Off [g]	0	0	0	0	0
HC Climb Out [g]	2	2	2.1	2.2	2.3
HC Climb Cruise Descent 3000 ft [g]	966.1	1531	2657.7	3779.7	4895.8
HC Approach Landing [g]	80.2	80.2	80.2	80.2	80.2
HC Taxi In [g]	296.6	296.6	296.6	296.6	296.6
Sum Total CO [g]	8294.9	12521	20955.1	29360.8	37731.1
Sum Lto CO [g]	3177	3184.3	3198.9	3213.5	3228.1
CO Taxi Out [g]	1281	1286.2	1296.7	1307.2	1317.7
CO Take Off [g]	12.8	13	13.4	13.9	14.3
CO Climb Out [g]	80.1	82	85.6	89.3	93
CO Climb Cruise Descent 3000 ft [g]	5118	9336.7	17756.2	26147.3	34502.9
CO Approach Landing [g]	529.5	529.5	529.5	529.5	529.5
CO Taxi In [g]	1273.6	1273.6	1273.6	1273.6	1273.6

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Shorts 330
Hurdy_Gurdy Key	Shorts 330, Cabin Factor 65%
Emission_key	PT6A-45R
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**
Flight Altitude [ft]	25000	25000	25000	25000	25000
Flight Altitude [m]	7620	7620	7620	7620	7620
Takeoff Mass [kg]	8822	8999	9352	9706	10060
Landing Mass [kg]	8608	8608	8608	8608	8608
Sum Total Time [min]	52.93	94.39	177.12	259.5	341.41
Sum Lto Time [min]	17.64	17.7	17.83	17.96	18.08
Time Taxi Out [min]	5	5	5	5	5
Time Take Off [min]	0.4	0.41	0.42	0.44	0.46
Time Climb Out [min]	2.2	2.25	2.37	2.48	2.59
Time Climb Cruise Descent 3000 ft [min]	35.29	76.69	159.29	241.54	323.32
Time Approach Landing [min]	5.04	5.04	5.04	5.04	5.04
Time Taxi In [min]	5	5	5	5	5
Sum Total Fuel [kg]	247.9	408.5	730	1051.6	1373.4
Sum Lto Fuel [kg]	70	70.5	71.7	72.9	74
Fuel Taxi Out [kg]	12.4	12.5	12.6	12.7	12.9
Fuel Take Off [kg]	4	4.1	4.3	4.4	4.6
Fuel Climb Out [kg]	17.1	17.6	18.4	19.3	20.2
Fuel Climb Cruise Descent 3000 ft [kg]	177.9	338	658.3	978.7	1299.4
Fuel Approach Landing [kg]	24.1	24.1	24.1	24.1	24.1
Fuel Taxi In [kg]	12.3	12.3	12.3	12.3	12.3
Sum Total NOx [kg]	1.519	2.329	3.951	5.581	7.221
Sum Lto NOx [kg]	0.376	0.38	0.389	0.397	0.405
NOx Taxi Out [kg]	0.043	0.044	0.044	0.045	0.045
NOx Take Off [kg]	0.033	0.034	0.035	0.036	0.038
NOx Climb Out [kg]	0.13	0.133	0.14	0.147	0.153
NOx Climb Cruise Descent 3000 ft [kg]	1.143	1.948	3.563	5.184	6.816
NOx Approach Landing [kg]	0.126	0.126	0.126	0.126	0.126
NOx Taxi In [kg]	0.043	0.043	0.043	0.043	0.043
Sum Total HC [g]	246.8	247.1	247.8	248.4	249
Sum Lto HC [g]	114.5	114.8	115.5	116.1	116.7
HC Taxi Out [g]	55.8	56.1	56.7	57.3	57.9
HC Take Off [g]	0	0	0	0	0
HC Climb Out [g]	0	0	0	0	0
HC Climb Cruise Descent 3000 ft [g]	132.3	132.3	132.3	132.3	132.3
HC Approach Landing [g]	3.4	3.4	3.4	3.4	3.4
HC Taxi In [g]	55.4	55.4	55.4	55.4	55.4
Sum Total CO [g]	2043.8	3141.8	5331.8	7511.4	9676.1
Sum Lto CO [g]	786.7	789.4	795	800.5	806
CO Taxi Out [g]	307.3	309.1	312.5	315.9	319.3
CO Take Off [g]	9.3	9.5	9.8	10.2	10.6
CO Climb Out [g]	34.3	35.1	36.9	38.6	40.3
CO Climb Cruise Descent 3000 ft [g]	1257.1	2352.4	4536.9	6710.9	8870.1
CO Approach Landing [g]	130.5	130.5	130.5	130.5	130.5
CO Taxi In [g]	305.3	305.3	305.3	305.3	305.3

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Saab 340B
Hurdy_Gurdy Key	Saab 340B, Cabin Factor 65%
Emission_key	CT7-9B
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**
Flight Altitude [ft]	25000	25000	25000	25000	25000	25000
Flight Altitude [m]	7620	7620	7620	7620	7620	7620
Takeoff Mass [kg]	10662	10831	11170	11509	11849	12532
Landing Mass [kg]	10468	10468	10468	10468	10468	10468
Sum Total Time [min]	50.91	78.02	132.26	186.53	240.85	349.66
Sum Lto Time [min]	16.27	16.26	16.26	16.25	16.24	16.23
Time Taxi Out [min]	5	5	5	5	5	5
Time Take Off [min]	0.36	0.37	0.38	0.39	0.4	0.42
Time Climb Out [min]	1.24	1.23	1.21	1.2	1.18	1.14
Time Climb Cruise Descent 3000 ft [min]	34.65	61.76	116	170.28	224.61	333.43
Time Approach Landing [min]	4.66	4.66	4.66	4.66	4.66	4.66
Time Taxi In [min]	5	5	5	5	5	5
Sum Total Fuel [kg]	259.6	428.9	767.8	1107.3	1447.4	2130.5
Sum Lto Fuel [kg]	74.9	75	75	75.1	75.2	75.3
Fuel Taxi Out [kg]	16.5	16.5	16.6	16.7	16.8	17
Fuel Take Off [kg]	4.3	4.3	4.5	4.6	4.7	5
Fuel Climb Out [kg]	10.6	10.5	10.4	10.2	10.1	9.8
Fuel Climb Cruise Descent 3000 ft [kg]	184.7	354	692.8	1032.2	1372.2	2055.1
Fuel Approach Landing [kg]	27.2	27.2	27.2	27.2	27.2	27.2
Fuel Taxi In [kg]	16.4	16.4	16.4	16.4	16.4	16.4
Sum Total NOx [kg]	2.353	4.112	7.635	11.167	14.709	21.834
Sum Lto NOx [kg]	0.499	0.499	0.499	0.5	0.5	0.501
NOx Taxi Out [kg]	0.052	0.052	0.053	0.053	0.053	0.054
NOx Take Off [kg]	0.067	0.069	0.071	0.073	0.075	0.079
NOx Climb Out [kg]	0.146	0.145	0.143	0.141	0.138	0.134
NOx Climb Cruise Descent 3000 ft [kg]	1.854	3.613	7.136	10.667	14.209	21.334
NOx Approach Landing [kg]	0.182	0.182	0.182	0.182	0.182	0.182
NOx Taxi In [kg]	0.052	0.052	0.052	0.052	0.052	0.052
Sum Total HC [g]	694.6	1071.5	1825.4	2579.7	3334.4	4845.4
Sum Lto HC [g]	223.3	223.5	223.9	224.3	224.7	225.4
HC Taxi Out [g]	72.1	72.4	72.8	73.2	73.6	74.5
HC Take Off [g]	3	3	3.1	3.2	3.3	3.5
HC Climb Out [g]	9.3	9.3	9.1	9	8.9	8.6
HC Climb Cruise Descent 3000 ft [g]	471.3	848	1601.5	2355.4	3109.7	4619.9
HC Approach Landing [g]	67	67	67	67	67	67
HC Taxi In [g]	71.9	71.9	71.9	71.9	71.9	71.9
Sum Total CO [g]	1383.2	2022.2	3301	4580.7	5861.5	8428.2
Sum Lto CO [g]	425.5	426	426.8	427.7	428.5	430.2
CO Taxi Out [g]	148.2	148.7	149.5	150.4	151.3	153
CO Take Off [g]	8.6	8.7	9	9.2	9.5	10
CO Climb Out [g]	20.1	20	19.7	19.4	19.1	18.5
CO Climb Cruise Descent 3000 ft [g]	957.6	1596.3	2874.1	4153	5433	7998
CO Approach Landing [g]	100.9	100.9	100.9	100.9	100.9	100.9
CO Taxi In [g]	147.7	147.7	147.7	147.7	147.7	147.7

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Saab 2000
Hurdy_Gurdy Key	Saab 2000, Cabin Factor 65%
Emission_key	AE2100A
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**
Flight Altitude [ft]	25000	25000	25000	25000	25000	25000
Flight Altitude [m]	7620	7620	7620	7620	7620	7620
Takeoff Mass [kg]	18063	18401	19077	19754	20431	21784
Landing Mass [kg]	17759	17759	17759	17759	17759	17759
Sum Total Time [min]	38.48	59.6	101.83	144.06	186.29	270.74
Sum Lto Time [min]	15.49	15.51	15.55	15.59	15.63	15.7
Time Taxi Out [min]	5	5	5	5	5	5
Time Take Off [min]	0.36	0.37	0.38	0.39	0.4	0.43
Time Climb Out [min]	0.9	0.91	0.94	0.97	0.99	1.04
Time Climb Cruise Descent 3000 ft [min]	22.99	44.09	86.28	128.47	170.66	255.04
Time Approach Landing [min]	4.23	4.23	4.23	4.23	4.23	4.23
Time Taxi In [min]	5	5	5	5	5	5
Sum Total Fuel [kg]	476.1	814.1	1490.1	2166.2	2842.3	4194.5
Sum Lto Fuel [kg]	145	145.6	146.7	147.8	149	151.2
Fuel Taxi Out [kg]	31.4	31.6	31.8	32	32.3	32.7
Fuel Take Off [kg]	9.8	10	10.4	10.7	11	11.7
Fuel Climb Out [kg]	19.1	19.4	19.9	20.4	21	22.1
Fuel Climb Cruise Descent 3000 ft [kg]	331	668.5	1343.4	2018.3	2693.3	4043.3
Fuel Approach Landing [kg]	53.3	53.3	53.3	53.3	53.3	53.3
Fuel Taxi In [kg]	31.3	31.3	31.3	31.3	31.3	31.3
Sum Total NOx [kg]	4.743	8.324	15.487	22.651	29.816	44.148
Sum Lto NOx [kg]	1.022	1.028	1.04	1.052	1.064	1.087
NOx Taxi Out [kg]	0.126	0.127	0.128	0.128	0.129	0.131
NOx Take Off [kg]	0.131	0.133	0.138	0.142	0.147	0.156
NOx Climb Out [kg]	0.226	0.23	0.236	0.242	0.249	0.262
NOx Climb Cruise Descent 3000 ft [kg]	3.721	7.296	14.448	21.6	28.753	43.061
NOx Approach Landing [kg]	0.413	0.413	0.413	0.413	0.413	0.413
NOx Taxi In [kg]	0.126	0.126	0.126	0.126	0.126	0.126
Sum Total HC [g]	68.9	74.4	85.4	96.3	107.3	129.3
Sum Lto HC [g]	35.4	35.5	35.6	35.7	35.9	36.1
HC Taxi Out [g]	16.3	16.3	16.4	16.6	16.7	16.9
HC Take Off [g]	0	0	0	0	0	0
HC Climb Out [g]	0.1	0.1	0.1	0.1	0.1	0.1
HC Climb Cruise Descent 3000 ft [g]	33.5	38.9	49.8	60.6	71.5	93.2
HC Approach Landing [g]	2.8	2.8	2.8	2.8	2.8	2.8
HC Taxi In [g]	16.2	16.2	16.2	16.2	16.2	16.2
Sum Total CO [g]	2187.7	3442.2	5951.3	8460.3	10969.1	15986.5
Sum Lto CO [g]	820.3	822.2	826	829.8	833.6	841.3
CO Taxi Out [g]	283	284.1	286.2	288.3	290.4	294.7
CO Take Off [g]	19.7	20	20.7	21.4	22.1	23.4
CO Climb Out [g]	36.3	36.8	37.8	38.8	39.9	41.9
CO Climb Cruise Descent 3000 ft [g]	1367.4	2620	5125.3	7630.4	10135.5	15145.2
CO Approach Landing [g]	199.2	199.2	199.2	199.2	199.2	199.2
CO Taxi In [g]	282.1	282.1	282.1	282.1	282.1	282.1

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Reims F406 Caravan II
Hurdy_Gurdy Key	Reims F406 Caravan II, Cabin Factor 65%
Emission_key	PT6A-112
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**
Flight Altitude [ft]	20000	20000	20000	20000	20000	20000
Flight Altitude [m]	6096	6096	6096	6096	6096	6096
Takeoff Mass [kg]	3388	3461	3607	3753	3900	4191
Landing Mass [kg]	3298	3298	3298	3298	3298	3298
Sum Total Time [min]	51.84	93.6	176.99	260.21	343.21	508.16
Sum Lto Time [min]	18.13	18.17	18.26	18.36	18.45	18.63
Time Taxi Out [min]	5	5	5	5	5	5
Time Take Off [min]	0.38	0.39	0.4	0.42	0.44	0.47
Time Climb Out [min]	1.98	2.01	2.09	2.16	2.24	2.38
Time Climb Cruise Descent 3000 ft [min]	33.71	75.42	158.73	241.86	324.76	489.54
Time Approach Landing [min]	5.77	5.77	5.77	5.77	5.77	5.77
Time Taxi In [min]	5	5	5	5	5	5
Sum Total Fuel [kg]	113.4	186.3	332.1	477.9	623.6	914.4
Sum Lto Fuel [kg]	40.3	40.5	41	41.4	41.9	42.8
Fuel Taxi Out [kg]	7.6	7.6	7.7	7.7	7.8	7.9
Fuel Take Off [kg]	1.9	2	2	2.1	2.2	2.4
Fuel Climb Out [kg]	8.4	8.5	8.8	9.2	9.5	10.1
Fuel Climb Cruise Descent 3000 ft [kg]	73.1	145.8	291.1	436.5	581.7	871.6
Fuel Approach Landing [kg]	14.9	14.9	14.9	14.9	14.9	14.9
Fuel Taxi In [kg]	7.5	7.5	7.5	7.5	7.5	7.5
Sum Total NOx [kg]	0.603	0.938	1.609	2.28	2.951	4.296
Sum Lto NOx [kg]	0.209	0.211	0.214	0.217	0.22	0.226
NOx Taxi Out [kg]	0.03	0.03	0.031	0.031	0.031	0.032
NOx Take Off [kg]	0.014	0.014	0.014	0.015	0.016	0.017
NOx Climb Out [kg]	0.057	0.058	0.06	0.062	0.064	0.069
NOx Climb Cruise Descent 3000 ft [kg]	0.394	0.728	1.395	2.063	2.732	4.071
NOx Approach Landing [kg]	0.078	0.078	0.078	0.078	0.078	0.078
NOx Taxi In [kg]	0.03	0.03	0.03	0.03	0.03	0.03
Sum Total HC [g]	89.9	195.8	407.1	617.5	826.7	1240
Sum Lto HC [g]	37	37.1	37.2	37.4	37.5	37.7
HC Taxi Out [g]	15.9	16	16.1	16.2	16.4	16.6
HC Take Off [g]	0	0	0	0	0	0
HC Climb Out [g]	0	0	0	0	0	0
HC Climb Cruise Descent 3000 ft [g]	52.9	158.7	369.9	580.1	789.2	1202.3
HC Approach Landing [g]	5.3	5.3	5.3	5.3	5.3	5.3
HC Taxi In [g]	15.8	15.8	15.8	15.8	15.8	15.8
Sum Total CO [g]	1128.1	2348.9	4784.8	7211.3	9626.2	14404.5
Sum Lto CO [g]	440.2	441.1	442.9	444.6	446.4	449.9
CO Taxi Out [g]	171.4	172.1	173.5	174.8	176.2	179
CO Take Off [g]	1.9	2	2	2.1	2.2	2.4
CO Climb Out [g]	8.4	8.5	8.8	9.2	9.5	10.1
CO Climb Cruise Descent 3000 ft [g]	687.9	1907.9	4341.9	6766.7	9179.8	13954.6
CO Approach Landing [g]	88	88	88	88	88	88
CO Taxi In [g]	170.6	170.6	170.6	170.6	170.6	170.6

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Lockheed P-3B Orion
Hurdy_Gurdy Key	Lockheed P-3B Orion, Cabin Factor 100%
Emission_key	T56-A-14
No of Engines	4
Engine Category	**Turboprop**
Cabin Factor	100%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**	**2000**	**2500**	**3000**	**3500**	**4000**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**	**3704**	**4630**	**5556**	**6482**	**7408**
Flight Altitude [ft]	25000	30000	30000	30000	30000	30000	30000	30000	30000	30000	30000
Flight Altitude [m]	7620	9144	9144	9144	9144	9144	9144	9144	9144	9144	9144
Takeoff Mass [kg]	36355	37010	38320	39630	40940	43559	46177	48792	51400	53989	56481
Landing Mass [kg]	36044	36044	36044	36044	36044	36044	36044	36044	36044	36044	36044
Sum Total Time [min]	44.12	68.46	117.13	165.79	214.43	311.66	408.79	505.72	602.3	698	789.8
Sum Lto Time [min]	15.13	15.16	15.22	15.28	15.34	15.45	15.57	15.68	15.8	15.91	16.02
Time Taxi Out [min]	5	5	5	5	5	5	5	5	5	5	5
Time Take Off [min]	0.21	0.22	0.23	0.25	0.26	0.29	0.31	0.34	0.36	0.39	0.41
Time Climb Out [min]	0.71	0.73	0.78	0.82	0.87	0.96	1.05	1.14	1.23	1.32	1.4
Time Climb Cruise Descent 3000 ft [min]	28.99	53.3	101.91	150.51	199.1	296.21	393.22	490.04	586.5	682.08	773.78
Time Approach Landing [min]	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21	4.21
Time Taxi In [min]	5	5	5	5	5	5	5	5	5	5	5
Sum Total Fuel [kg]	943.7	1598.4	2907.8	4217.1	5526.4	8144.4	10761.1	13375.1	15982.3	18570.5	21061.4
Sum Lto Fuel [kg]	252.2	253.4	255.8	258.1	260.5	265.2	270	274.7	279.4	284.1	288.6
Fuel Taxi Out [kg]	59.1	59.3	59.6	59.9	60.2	60.8	61.3	61.9	62.5	63.1	63.6
Fuel Take Off [kg]	10	10.3	10.9	11.5	12.1	13.3	14.6	15.8	17	18.2	19.3
Fuel Climb Out [kg]	23.1	23.9	25.3	26.8	28.3	31.2	34.1	37.1	40	42.9	45.7
Fuel Climb Cruise Descent 3000 ft [kg]	691.4	1345	2652	3959	5265.8	7879.1	10491.1	13100.4	15702.9	18286.5	20772.8
Fuel Approach Landing [kg]	100.9	100.9	100.9	100.9	100.9	100.9	100.9	100.9	100.9	100.9	100.9
Fuel Taxi In [kg]	59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1
Sum Total NOx [kg]	9.899	15.585	26.961	38.341	49.727	72.514	95.322	118.148	140.975	163.722	185.768
Sum Lto NOx [kg]	1.713	1.725	1.749	1.773	1.797	1.846	1.894	1.942	1.99	2.038	2.084
NOx Taxi Out [kg]	0.337	0.337	0.339	0.341	0.342	0.346	0.349	0.352	0.356	0.359	0.362
NOx Take Off [kg]	0.121	0.125	0.132	0.139	0.147	0.161	0.176	0.19	0.205	0.219	0.233
NOx Climb Out [kg]	0.239	0.246	0.261	0.276	0.292	0.322	0.352	0.382	0.413	0.443	0.471
NOx Climb Cruise Descent 3000 ft [kg]	8.186	13.86	25.212	36.568	47.929	70.668	93.428	116.206	138.985	161.685	183.684
NOx Approach Landing [kg]	0.681	0.681	0.681	0.681	0.681	0.681	0.681	0.681	0.681	0.681	0.681
NOx Taxi In [kg]	0.336	0.336	0.336	0.336	0.336	0.336	0.336	0.336	0.336	0.336	0.336
Sum Total HC [g]	2358.5	2668	3286.9	3905.4	4523.5	5758.4	6990.9	8219.6	9441.7	10650	11804
Sum Lto HC [g]	835.3	836.2	838.1	839.9	841.8	845.5	849.2	853	856.7	860.4	863.9
HC Taxi Out [g]	356.7	357.5	359.3	361.1	362.8	366.4	369.9	373.4	376.9	380.4	383.8
HC Take Off [g]	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.6
HC Climb Out [g]	1.3	1.3	1.4	1.5	1.6	1.7	1.9	2.1	2.2	2.4	2.5
HC Climb Cruise Descent 3000 ft [g]	1523.2	1831.8	2448.8	3065.4	3681.7	4912.9	6141.6	7366.6	8585.1	9789.6	10940.1
HC Approach Landing [g]	120.8	120.8	120.8	120.8	120.8	120.8	120.8	120.8	120.8	120.8	120.8
HC Taxi In [g]	356.2	356.2	356.2	356.2	356.2	356.2	356.2	356.2	356.2	356.2	356.2
Sum Total CO [g]	5086.8	6741.8	10050.9	13358.5	16664.4	23269.9	29863.9	36439.8	42983.9	49457.7	55648.6
Sum Lto CO [g]	1786.7	1789.5	1794.9	1800.4	1805.8	1816.7	1827.6	1838.4	1849.3	1860.1	1870.4
CO Taxi Out [g]	682	683.7	687	690.4	693.8	700.5	707.2	714	720.7	727.4	733.8
CO Take Off [g]	8.5	8.8	9.3	9.8	10.3	11.3	12.3	13.4	14.4	15.4	16.4
CO Climb Out [g]	24.6	25.4	26.9	28.5	30.1	33.2	36.3	39.4	42.5	45.6	48.6
CO Climb Cruise Descent 3000 ft [g]	3300.1	4952.4	8255.9	11558.1	14858.6	21453.2	28036.3	34601.4	41134.6	47597.7	53778.2
CO Approach Landing [g]	390.5	390.5	390.5	390.5	390.5	390.5	390.5	390.5	390.5	390.5	390.5
CO Taxi In [g]	681.2	681.2	681.2	681.2	681.2	681.2	681.2	681.2	681.2	681.2	681.2

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Lockheed C-130H Hercules
Hurdy_Gurdy Key	Lockheed C-130H Hercules, Cabin Factor 65%
Emission_key	T56-A-15
No of Engines	4
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**	**2000**	**2500**	**3000**	**3500**	**4000**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**	**3704**	**4630**	**5556**	**6482**	**7408**
Flight Altitude [ft]	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000
Flight Altitude [m]	6096	6096	6096	6096	6096	6096	6096	6096	6096	6096	6096
Takeoff Mass [kg]	42964	43827	45552	47278	49004	52457	55912	59369	62828	66290	69756
Landing Mass [kg]	42175	42175	42175	42175	42175	42175	42175	42175	42175	42175	42175
Sum Total Time [min]	44.63	70.43	122.05	173.66	225.28	328.51	431.75	535	638.24	741.49	844.74
Sum Lto Time [min]	15.69	15.73	15.82	15.9	15.98	16.15	16.32	16.48	16.65	16.82	16.99
Time Taxi Out [min]	5	5	5	5	5	5	5	5	5	5	5
Time Take Off [min]	0.26	0.27	0.29	0.31	0.32	0.36	0.4	0.44	0.48	0.52	0.56
Time Climb Out [min]	0.89	0.92	0.98	1.05	1.11	1.24	1.37	1.5	1.63	1.75	1.88
Time Climb Cruise Descent 3000 ft [min]	28.94	54.7	106.23	157.76	209.29	312.36	415.44	518.51	621.59	724.68	827.76
Time Approach Landing [min]	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55
Time Taxi In [min]	5	5	5	5	5	5	5	5	5	5	5
Sum Total Fuel [kg]	1101	1960.7	3680.5	5400.6	7121	10563	14006.6	17452.2	20900.2	24351	27805.3
Sum Lto Fuel [kg]	273.7	275.4	278.9	282.3	285.8	292.7	299.6	306.5	313.4	320.3	327.2
Fuel Taxi Out [kg]	61.5	61.7	62.1	62.5	62.9	63.8	64.6	65.5	66.3	67.1	68
Fuel Take Off [kg]	12	12.5	13.4	14.3	15.2	17	18.8	20.6	22.4	24.2	26
Fuel Climb Out [kg]	29.3	30.4	32.5	34.7	36.8	41	45.3	49.5	53.8	58.1	62.3
Fuel Climb Cruise Descent 3000 ft [kg]	827.3	1685.3	3401.6	5118.3	6835.2	10270.3	13707	17145.8	20586.8	24030.7	27478.1
Fuel Approach Landing [kg]	109.6	109.6	109.6	109.6	109.6	109.6	109.6	109.6	109.6	109.6	109.6
Fuel Taxi In [kg]	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3
Sum Total NOx [kg]	12.039	20.767	38.228	55.698	73.178	108.169	143.208	178.304	213.47	248.72	284.077
Sum Lto NOx [kg]	1.887	1.905	1.94	1.975	2.01	2.081	2.151	2.222	2.292	2.363	2.433
NOx Taxi Out [kg]	0.35	0.351	0.353	0.356	0.358	0.363	0.368	0.373	0.377	0.382	0.387
NOx Take Off [kg]	0.145	0.151	0.162	0.173	0.184	0.205	0.227	0.249	0.271	0.292	0.314
NOx Climb Out [kg]	0.303	0.314	0.336	0.358	0.38	0.423	0.467	0.511	0.555	0.599	0.643
NOx Climb Cruise Descent 3000 ft [kg]	10.152	18.862	36.288	53.723	71.168	106.088	141.057	176.083	211.178	246.357	281.644
NOx Approach Landing [kg]	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74
NOx Taxi In [kg]	0.349	0.349	0.349	0.349	0.349	0.349	0.349	0.349	0.349	0.349	0.349
Sum Total HC [g]	2013.9	2135.5	2378.6	2621.7	2864.7	3350.5	3836	4321.2	4806	5290.3	5773.9
Sum Lto HC [g]	869.9	871.2	873.9	876.5	879.2	884.6	889.9	895.3	900.7	906	911.4
HC Taxi Out [g]	370.7	372	374.5	377	379.6	384.6	389.7	394.8	399.8	404.9	410
HC Take Off [g]	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8
HC Climb Out [g]	1.6	1.7	1.8	1.9	2.1	2.3	2.5	2.8	3	3.2	3.5
HC Climb Cruise Descent 3000 ft [g]	1144.1	1264.3	1504.7	1745.1	1985.4	2465.9	2946.1	3425.9	3905.4	4384.3	4862.5
HC Approach Landing [g]	127.6	127.6	127.6	127.6	127.6	127.6	127.6	127.6	127.6	127.6	127.6
HC Taxi In [g]	369.6	369.6	369.6	369.6	369.6	369.6	369.6	369.6	369.6	369.6	369.6
Sum Total CO [g]	4574.1	5912.2	8588.1	11263.4	13938.3	19286.3	24631.6	29973.7	35311.8	40644.8	45971.1
Sum Lto CO [g]	1875.4	1879.3	1887.1	1895	1902.9	1918.6	1934.3	1950.1	1965.9	1981.6	1997.4
CO Taxi Out [g]	708.8	711.3	716.1	720.9	725.8	735.5	745.1	754.8	764.5	774.2	784
CO Take Off [g]	10.2	10.6	11.4	12.1	12.9	14.4	15.9	17.5	19	20.5	22.1
CO Climb Out [g]	31.2	32.3	34.6	36.9	39.1	43.7	48.2	52.7	57.2	61.8	66.3
CO Climb Cruise Descent 3000 ft [g]	2698.8	4032.9	6700.9	9368.4	12035.4	17367.7	22697.3	28023.6	33345.9	38663.1	43973.7
CO Approach Landing [g]	418.5	418.5	418.5	418.5	418.5	418.5	418.5	418.5	418.5	418.5	418.5
CO Taxi In [g]	706.6	706.6	706.6	706.6	706.6	706.6	706.6	706.6	706.6	706.6	706.6

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Fokker 50 Srs 100
Hurdy_Gurdy Key	Fokker 50 Srs 100, Cabin Factor 65%
Emission_key	PW125B
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**
Flight Altitude [ft]	25000	25000	25000	25000	25000	25000
Flight Altitude [m]	7620	7620	7620	7620	7620	7620
Takeoff Mass [kg]	16280	16534	17043	17553	18063	19085
Landing Mass [kg]	15950	15950	15950	15950	15950	15950
Sum Total Time [min]	53.26	83.45	143.83	204.23	264.66	385.59
Sum Lto Time [min]	16.35	16.38	16.44	16.5	16.56	16.68
Time Taxi Out [min]	5	5	5	5	5	5
Time Take Off [min]	0.31	0.31	0.32	0.33	0.33	0.35
Time Climb Out [min]	1.2	1.22	1.28	1.33	1.38	1.48
Time Climb Cruise Descent 3000 ft [min]	36.91	67.07	127.39	187.73	248.1	368.91
Time Approach Landing [min]	4.85	4.85	4.85	4.85	4.85	4.85
Time Taxi In [min]	5	5	5	5	5	5
Sum Total Fuel [kg]	427.8	681.6	1189.5	1697.9	2206.8	3226.3
Sum Lto Fuel [kg]	124.1	124.6	125.7	126.7	127.7	129.7
Fuel Taxi Out [kg]	28.8	28.9	29	29.1	29.2	29.4
Fuel Take Off [kg]	5.6	5.7	5.8	6	6.1	6.4
Fuel Climb Out [kg]	18.1	18.5	19.3	20.1	20.9	22.4
Fuel Climb Cruise Descent 3000 ft [kg]	303.6	557	1063.9	1571.2	2079.1	3096.5
Fuel Approach Landing [kg]	42.7	42.7	42.7	42.7	42.7	42.7
Fuel Taxi In [kg]	28.8	28.8	28.8	28.8	28.8	28.8
Sum Total NOx [kg]	5.378	8.214	13.893	19.58	25.277	36.705
Sum Lto NOx [kg]	1.244	1.252	1.268	1.284	1.3	1.332
NOx Taxi Out [kg]	0.208	0.208	0.209	0.21	0.21	0.212
NOx Take Off [kg]	0.103	0.104	0.107	0.109	0.112	0.117
NOx Climb Out [kg]	0.296	0.302	0.315	0.327	0.34	0.365
NOx Climb Cruise Descent 3000 ft [kg]	4.134	6.962	12.625	18.296	23.977	35.373
NOx Approach Landing [kg]	0.43	0.43	0.43	0.43	0.43	0.43
NOx Taxi In [kg]	0.207	0.207	0.207	0.207	0.207	0.207
Sum Total HC [g]	0	0	0	0	0	0
Sum Lto HC [g]	0	0	0	0	0	0
HC Taxi Out [g]	0	0	0	0	0	0
HC Take Off [g]	0	0	0	0	0	0
HC Climb Out [g]	0	0	0	0	0	0
HC Climb Cruise Descent 3000 ft [g]	0	0	0	0	0	0
HC Approach Landing [g]	0	0	0	0	0	0
HC Taxi In [g]	0	0	0	0	0	0
Sum Total CO [g]	2580.9	3717.1	5990.1	8264	10539	15092.6
Sum Lto CO [g]	724.1	725.4	728.1	730.8	733.5	738.9
CO Taxi Out [g]	259.5	260	261	261.9	262.8	264.7
CO Take Off [g]	11.3	11.4	11.7	12	12.2	12.8
CO Climb Out [g]	34.5	35.2	36.7	38.1	39.6	42.6
CO Climb Cruise Descent 3000 ft [g]	1856.8	2991.7	5262	7533.3	9805.5	14353.7
CO Approach Landing [g]	159.8	159.8	159.8	159.8	159.8	159.8
CO Taxi In [g]	258.9	258.9	258.9	258.9	258.9	258.9

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Fokker 27 Friendship
Hurdy_Gurdy Key	Fokker 27 Friendship, Cabin Factor 65%
Emission_key	DART 552-7 (RDa.7)
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**	**2000**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**	**3704**
Flight Altitude [ft]	25000	25000	25000	25000	25000	25000	25000
Flight Altitude [m]	7620	7620	7620	7620	7620	7620	7620
Takeoff Mass [kg]	16278	16510	16973	17436	17898	18820	19738
Landing Mass [kg]	15995	15995	15995	15995	15995	15995	15995
Sum Total Time [min]	52.89	85.71	151.31	216.84	282.28	412.8	542.56
Sum Lto Time [min]	18.04	18.2	18.51	18.83	19.14	19.77	20.39
Time Taxi Out [min]	5	5	5	5	5	5	5
Time Take Off [min]	0.42	0.43	0.44	0.45	0.45	0.47	0.49
Time Climb Out [min]	2.81	2.96	3.27	3.58	3.88	4.49	5.09
Time Climb Cruise Descent 3000 ft [min]	34.85	67.51	132.8	198.01	263.14	393.03	522.17
Time Approach Landing [min]	4.81	4.81	4.81	4.81	4.81	4.81	4.81
Time Taxi In [min]	5	5	5	5	5	5	5
Sum Total Fuel [kg]	374.6	606.8	1070.8	1534.4	1997.6	2921.8	3841.5
Sum Lto Fuel [kg]	160.8	163.3	168.5	173.6	178.8	189	199.2
Fuel Taxi Out [kg]	30.9	31	31.1	31.3	31.4	31.7	32
Fuel Take Off [kg]	9	9.1	9.3	9.5	9.7	10.1	10.5
Fuel Climb Out [kg]	44.2	46.6	51.4	56.2	61	70.6	80.1
Fuel Climb Cruise Descent 3000 ft [kg]	213.9	443.4	902.3	1360.8	1818.8	2732.8	3642.2
Fuel Approach Landing [kg]	45.8	45.8	45.8	45.8	45.8	45.8	45.8
Fuel Taxi In [kg]	30.8	30.8	30.8	30.8	30.8	30.8	30.8
Sum Total NOx [kg]	0.716	0.912	1.303	1.694	2.086	2.868	3.65
Sum Lto NOx [kg]	0.331	0.342	0.364	0.387	0.41	0.454	0.499
NOx Taxi Out [kg]	0.022	0.022	0.022	0.022	0.022	0.022	0.022
NOx Take Off [kg]	0.05	0.051	0.052	0.053	0.054	0.056	0.058
NOx Climb Out [kg]	0.197	0.207	0.229	0.25	0.272	0.314	0.356
NOx Climb Cruise Descent 3000 ft [kg]	0.386	0.57	0.938	1.307	1.676	2.414	3.151
NOx Approach Landing [kg]	0.04	0.04	0.04	0.04	0.04	0.04	0.04
NOx Taxi In [kg]	0.022	0.022	0.022	0.022	0.022	0.022	0.022
Sum Total HC [g]	5274.7	6725.1	9623.7	12518.7	15409.2	21172.5	26899.1
Sum Lto HC [g]	1710.4	1714.9	1724	1733	1742.1	1760.1	1778.1
HC Taxi Out [g]	738	739.8	743.4	747	750.6	757.7	764.8
HC Take Off [g]	8.8	8.8	9	9.2	9.4	9.8	10.2
HC Climb Out [g]	48.6	51.3	56.6	61.8	67.1	77.6	88.1
HC Climb Cruise Descent 3000 ft [g]	3564.3	5010.2	7899.7	10785.7	13667.2	19412.4	25121
HC Approach Landing [g]	179.2	179.2	179.2	179.2	179.2	179.2	179.2
HC Taxi In [g]	735.8	735.8	735.8	735.8	735.8	735.8	735.8
Sum Total CO [g]	21701.7	34228	59260.7	84262.7	109227.2	159005.3	208470.4
Sum Lto CO [g]	7454.8	7470.3	7501.2	7532.1	7562.9	7624.5	7685.8
CO Taxi Out [g]	2822.3	2829.2	2842.9	2856.6	2870.3	2897.7	2924.9
CO Take Off [g]	28.4	28.7	29.3	30	30.6	31.8	33
CO Climb Out [g]	152.6	160.8	177.4	194	210.5	243.5	276.4
CO Climb Cruise Descent 3000 ft [g]	14246.9	26757.7	51759.5	76730.6	101664.2	151380.7	200784.6
CO Approach Landing [g]	1637.6	1637.6	1637.6	1637.6	1637.6	1637.6	1637.6
CO Taxi In [g]	2813.9	2813.9	2813.9	2813.9	2813.9	2813.9	2813.9

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Embraer 110P2A
Hurdy_Gurdy Key	Embraer 110P2A, Cabin Factor 65%
Emission_key	PT6A-34
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**
Flight_Distance [km]	**232**	**463**	**926**	**1389**
Flight Altitude [ft]	10000	10000	10000	10000
Flight Altitude [m]	3048	3048	3048	3048
Takeoff Mass [kg]	4981	5101	5340	5579
Landing Mass [kg]	4846	4846	4846	4846
Sum Total Time [min]	51.43	90.55	168.7	246.71
Sum Lto Time [min]	17.99	18.06	18.2	18.35
Time Taxi Out [min]	5	5	5	5
Time Take Off [min]	0.34	0.34	0.36	0.38
Time Climb Out [min]	2.03	2.09	2.22	2.35
Time Climb Cruise Descent 3000 ft [min]	33.45	72.49	150.5	228.36
Time Approach Landing [min]	5.63	5.63	5.63	5.63
Time Taxi In [min]	5	5	5	5
Sum Total Fuel [kg]	154.2	273.6	512.1	750.2
Sum Lto Fuel [kg]	48.5	48.9	49.8	50.7
Fuel Taxi Out [kg]	8.5	8.5	8.6	8.7
Fuel Take Off [kg]	2.3	2.3	2.4	2.6
Fuel Climb Out [kg]	11.3	11.7	12.4	13.1
Fuel Climb Cruise Descent 3000 ft [kg]	105.8	224.7	462.2	699.4
Fuel Approach Landing [kg]	17.9	17.9	17.9	17.9
Fuel Taxi In [kg]	8.4	8.4	8.4	8.4
Sum Total NOx [kg]	0.898	1.585	2.957	4.327
Sum Lto NOx [kg]	0.273	0.276	0.283	0.289
NOx Taxi Out [kg]	0.037	0.038	0.038	0.038
NOx Take Off [kg]	0.017	0.018	0.018	0.019
NOx Climb Out [kg]	0.082	0.084	0.089	0.094
NOx Climb Cruise Descent 3000 ft [kg]	0.625	1.309	2.674	4.038
NOx Approach Landing [kg]	0.1	0.1	0.1	0.1
NOx Taxi In [kg]	0.037	0.037	0.037	0.037
Sum Total HC [g]	47.3	73.1	124.6	176.1
Sum Lto HC [g]	24.4	24.4	24.5	24.6
HC Taxi Out [g]	10.2	10.2	10.3	10.5
HC Take Off [g]	0	0	0	0
HC Climb Out [g]	0	0	0	0
HC Climb Cruise Descent 3000 ft [g]	22.9	48.6	100.1	151.4
HC Approach Landing [g]	4.1	4.1	4.1	4.1
HC Taxi In [g]	10.1	10.1	10.1	10.1
Sum Total CO [g]	779.8	1240.5	2161	3079.8
Sum Lto CO [g]	370.2	371.4	373.8	376.2
CO Taxi Out [g]	144.1	144.9	146.5	148.1
CO Take Off [g]	2.1	2.1	2.2	2.3
CO Climb Out [g]	11.3	11.7	12.4	13.1
CO Climb Cruise Descent 3000 ft [g]	409.6	869.2	1787.2	2703.6
CO Approach Landing [g]	69.4	69.4	69.4	69.4
CO Taxi In [g]	143.2	143.2	143.2	143.2

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Dornier 328-110
Hurdy_Gurdy Key	Dornier 328-110, Cabin Factor 65%
Emission_key	PW119B
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**
Flight Altitude [ft]	25000	25000	25000	25000	25000	25000
Flight Altitude [m]	7620	7620	7620	7620	7620	7620
Takeoff Mass [kg]	10237	10409	10754	11099	11444	12134
Landing Mass [kg]	10008	10008	10008	10008	10008	10008
Sum Total Time [min]	49	78.5	137.49	196.48	255.46	373.39
Sum Lto Time [min]	16.24	16.27	16.34	16.4	16.47	16.6
Time Taxi Out [min]	5	5	5	5	5	5
Time Take Off [min]	0.27	0.27	0.28	0.29	0.3	0.31
Time Climb Out [min]	1.16	1.19	1.25	1.3	1.36	1.47
Time Climb Cruise Descent 3000 ft [min]	32.76	62.23	121.16	180.08	238.99	356.8
Time Approach Landing [min]	4.81	4.81	4.81	4.81	4.81	4.81
Time Taxi In [min]	5	5	5	5	5	5
Sum Total Fuel [kg]	308.1	480.2	824.4	1168.6	1512.8	2201.4
Sum Lto Fuel [kg]	124.4	124.8	125.8	126.7	127.7	129.6
Fuel Taxi Out [kg]	30.9	31	31	31.1	31.2	31.4
Fuel Take Off [kg]	4.7	4.7	4.9	5	5.2	5.5
Fuel Climb Out [kg]	14.8	15.1	15.8	16.6	17.3	18.7
Fuel Climb Cruise Descent 3000 ft [kg]	183.8	355.4	698.6	1041.8	1385.1	2071.8
Fuel Approach Landing [kg]	43.1	43.1	43.1	43.1	43.1	43.1
Fuel Taxi In [kg]	30.9	30.9	30.9	30.9	30.9	30.9
Sum Total NOx [kg]	2.94	4.347	7.159	9.973	12.788	18.423
Sum Lto NOx [kg]	1.193	1.2	1.214	1.228	1.242	1.27
NOx Taxi Out [kg]	0.232	0.232	0.233	0.233	0.234	0.235
NOx Take Off [kg]	0.079	0.08	0.083	0.085	0.088	0.093
NOx Climb Out [kg]	0.224	0.23	0.241	0.252	0.262	0.284
NOx Climb Cruise Descent 3000 ft [kg]	1.747	3.146	5.945	8.745	11.546	17.152
NOx Approach Landing [kg]	0.426	0.426	0.426	0.426	0.426	0.426
NOx Taxi In [kg]	0.232	0.232	0.232	0.232	0.232	0.232
Sum Total HC [g]	0	0	0	0	0	0
Sum Lto HC [g]	0	0	0	0	0	0
HC Taxi Out [g]	0	0	0	0	0	0
HC Take Off [g]	0	0	0	0	0	0
HC Climb Out [g]	0	0	0	0	0	0
HC Climb Cruise Descent 3000 ft [g]	0	0	0	0	0	0
HC Approach Landing [g]	0	0	0	0	0	0
HC Taxi In [g]	0	0	0	0	0	0
Sum Total CO [g]	2152.3	3538.3	6309.9	9081	11851.5	17390.4
Sum Lto CO [g]	705.6	706.7	709	711.3	713.6	718.2
CO Taxi Out [g]	250.5	250.8	251.5	252.1	252.8	254.1
CO Take Off [g]	8.9	9	9.3	9.6	9.9	10.4
CO Climb Out [g]	28	28.7	30.1	31.5	32.8	35.5
CO Climb Cruise Descent 3000 ft [g]	1446.8	2831.6	5600.9	8369.7	11137.9	16672.2
CO Approach Landing [g]	168.1	168.1	168.1	168.1	168.1	168.1
CO Taxi In [g]	250.1	250.1	250.1	250.1	250.1	250.1

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	De Havilland DHC-3 Turbo-Otter
Hurdy_Gurdy Key	De Havilland DHC-3 Turbo-Otter, Cabin Factor 65%
Emission_key	PT6A-135A
No of Engines	1
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**
Flight Altitude [ft]	20000	20000	20000	20000	20000	20000
Flight Altitude [m]	6096	6096	6096	6096	6096	6096
Takeoff Mass [kg]	2653	2726	2872	3017	3163	3454
Landing Mass [kg]	2568	2568	2568	2568	2568	2568
Sum Total Time [min]	75.78	137.42	260.55	383.43	505.97	749.46
Sum Lto Time [min]	20.14	20.2	20.32	20.45	20.58	20.83
Time Taxi Out [min]	5	5	5	5	5	5
Time Take Off [min]	0.33	0.34	0.36	0.38	0.4	0.43
Time Climb Out [min]	2.22	2.28	2.39	2.49	2.6	2.82
Time Climb Cruise Descent 3000 ft [min]	55.64	117.22	240.22	362.98	485.39	728.64
Time Approach Landing [min]	7.58	7.58	7.58	7.58	7.58	7.58
Time Taxi In [min]	5	5	5	5	5	5
Sum Total Fuel [kg]	100.7	173.4	318.8	464.1	609.4	899.6
Sum Lto Fuel [kg]	31.1	31.3	31.7	32.2	32.6	33.6
Fuel Taxi Out [kg]	5	5	5.1	5.1	5.2	5.3
Fuel Take Off [kg]	1.1	1.2	1.2	1.3	1.3	1.5
Fuel Climb Out [kg]	6.9	7.1	7.4	7.8	8.1	8.8
Fuel Climb Cruise Descent 3000 ft [kg]	69.6	142.1	287	431.9	576.8	866
Fuel Approach Landing [kg]	13.1	13.1	13.1	13.1	13.1	13.1
Fuel Taxi In [kg]	5	5	5	5	5	5
Sum Total NOx [kg]	0.547	0.889	1.573	2.259	2.946	4.324
Sum Lto NOx [kg]	0.171	0.172	0.175	0.178	0.182	0.188
NOx Taxi Out [kg]	0.019	0.02	0.02	0.02	0.02	0.021
NOx Take Off [kg]	0.009	0.009	0.009	0.01	0.01	0.011
NOx Climb Out [kg]	0.05	0.052	0.054	0.057	0.059	0.064
NOx Climb Cruise Descent 3000 ft [kg]	0.376	0.717	1.398	2.081	2.764	4.136
NOx Approach Landing [kg]	0.073	0.073	0.073	0.073	0.073	0.073
NOx Taxi In [kg]	0.019	0.019	0.019	0.019	0.019	0.019
Sum Total HC [g]	69.1	136.2	270	403.2	535.7	797.4
Sum Lto HC [g]	16.4	16.4	16.5	16.6	16.7	16.9
HC Taxi Out [g]	8	8	8.1	8.2	8.3	8.5
HC Take Off [g]	0	0	0	0	0	0
HC Climb Out [g]	0	0	0	0	0	0
HC Climb Cruise Descent 3000 ft [g]	52.7	119.8	253.5	386.6	519	780.5
HC Approach Landing [g]	0.5	0.5	0.5	0.5	0.5	0.5
HC Taxi In [g]	7.9	7.9	7.9	7.9	7.9	7.9
Sum Total CO [g]	1044.3	2024.3	3979.9	5928.3	7867.4	11702.7
Sum Lto CO [g]	261.7	262.5	264	265.6	267.2	270.3
CO Taxi Out [g]	106.9	107.5	108.7	109.9	111	113.4
CO Take Off [g]	1	1	1.1	1.2	1.2	1.3
CO Climb Out [g]	6.9	7.1	7.4	7.8	8.1	8.8
CO Climb Cruise Descent 3000 ft [g]	782.6	1761.8	3715.9	5662.7	7600.2	11432.4
CO Approach Landing [g]	40.7	40.7	40.7	40.7	40.7	40.7
CO Taxi In [g]	106.2	106.2	106.2	106.2	106.2	106.2

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	De Havilland Dash 7
Hurdy_Gurdy Key	De Havilland Dash 7, Cabin Factor 65%
Emission_key	PT6A-50
No of Engines	4
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**
Flight Altitude [ft]	25000	25000	25000	25000	25000	25000
Flight Altitude [m]	7620	7620	7620	7620	7620	7620
Takeoff Mass [kg]	16719	16964	17454	17944	18433	19412
Landing Mass [kg]	16433	16433	16433	16433	16433	16433
Sum Total Time [min]	53.94	88.05	156.23	224.36	292.43	428.27
Sum Lto Time [min]	17.64	17.67	17.71	17.76	17.8	17.89
Time Taxi Out [min]	5	5	5	5	5	5
Time Take Off [min]	0.43	0.43	0.45	0.46	0.47	0.5
Time Climb Out [min]	2.08	2.1	2.13	2.16	2.2	2.26
Time Climb Cruise Descent 3000 ft [min]	36.3	70.38	138.52	206.61	274.63	410.38
Time Approach Landing [min]	5.13	5.13	5.13	5.13	5.13	5.13
Time Taxi In [min]	5	5	5	5	5	5
Sum Total Fuel [kg]	385.3	629.9	1119.3	1608.6	2097.8	3075.8
Sum Lto Fuel [kg]	141.2	141.7	142.6	143.5	144.4	146.3
Fuel Taxi Out [kg]	26.1	26.2	26.4	26.6	26.8	27.2
Fuel Take Off [kg]	8.4	8.6	8.8	9	9.3	9.7
Fuel Climb Out [kg]	31.5	31.7	32.2	32.7	33.2	34.2
Fuel Climb Cruise Descent 3000 ft [kg]	244.1	488.3	976.7	1465.1	1953.4	2929.5
Fuel Approach Landing [kg]	49.2	49.2	49.2	49.2	49.2	49.2
Fuel Taxi In [kg]	26	26	26	26	26	26
Sum Total NOx [kg]	2.105	3.314	5.734	8.155	10.577	15.425
Sum Lto NOx [kg]	0.759	0.762	0.769	0.775	0.781	0.794
NOx Taxi Out [kg]	0.094	0.094	0.095	0.096	0.096	0.098
NOx Take Off [kg]	0.069	0.07	0.072	0.074	0.076	0.08
NOx Climb Out [kg]	0.239	0.241	0.245	0.249	0.252	0.26
NOx Climb Cruise Descent 3000 ft [kg]	1.346	2.552	4.965	7.38	9.796	14.631
NOx Approach Landing [kg]	0.263	0.263	0.263	0.263	0.263	0.263
NOx Taxi In [kg]	0.094	0.094	0.094	0.094	0.094	0.094
Sum Total HC [g]	554.9	595.4	676.2	756.8	837.2	997.1
Sum Lto HC [g]	187.5	187.9	188.5	189.2	189.9	191.3
HC Taxi Out [g]	91.3	91.7	92.3	93	93.7	95.1
HC Take Off [g]	0	0	0	0	0	0
HC Climb Out [g]	0	0	0	0	0	0
HC Climb Cruise Descent 3000 ft [g]	367.4	407.5	487.6	567.6	647.3	805.9
HC Approach Landing [g]	5.3	5.3	5.3	5.3	5.3	5.3
HC Taxi In [g]	90.9	90.9	90.9	90.9	90.9	90.9
Sum Total CO [g]	4394.7	6225.5	9884.8	13540.7	17192.1	24474.6
Sum Lto CO [g]	1481.9	1484.9	1490.7	1496.6	1502.4	1514.1
CO Taxi Out [g]	576.6	578.7	583	587.3	591.6	600.2
CO Take Off [g]	20.3	20.5	21.1	21.7	22.3	23.4
CO Climb Out [g]	63	63.5	64.4	65.4	66.4	68.4
CO Climb Cruise Descent 3000 ft [g]	2912.8	4740.6	8394.1	12044.1	15689.7	22960.5
CO Approach Landing [g]	248.1	248.1	248.1	248.1	248.1	248.1
CO Taxi In [g]	574.1	574.1	574.1	574.1	574.1	574.1

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Dash 8 Q400
Hurdy_Gurdy Key	Dash 8 Q400, Cabin Factor 65%
Emission_key	PW150A
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**	**2000**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**	**3704**
Flight Altitude [ft]	25000	25000	25000	25000	25000	25000	25000
Flight Altitude [m]	7620	7620	7620	7620	7620	7620	7620
Takeoff Mass [kg]	23026	23409	24174	24939	25704	27234	28764
Landing Mass [kg]	22601	22601	22601	22601	22601	22601	22601
Sum Total Time [min]	39.87	65.46	116.63	167.79	218.96	321.28	423.59
Sum Lto Time [min]	16.1	16.16	16.29	16.42	16.55	16.81	17.06
Time Taxi Out [min]	5	5	5	5	5	5	5
Time Take Off [min]	0.37	0.37	0.38	0.4	0.41	0.43	0.45
Time Climb Out [min]	1.43	1.48	1.6	1.72	1.84	2.07	2.31
Time Climb Cruise Descent 3000 ft [min]	23.78	49.3	100.34	151.37	202.41	304.47	406.52
Time Approach Landing [min]	4.3	4.3	4.3	4.3	4.3	4.3	4.3
Time Taxi In [min]	5	5	5	5	5	5	5
Sum Total Fuel [kg]	625.2	1006.6	1769.6	2532.7	3295.7	4821.8	6348.1
Sum Lto Fuel [kg]	206.1	208	211.7	215.4	219.2	226.6	234.1
Fuel Taxi Out [kg]	42.6	42.7	43	43.3	43.6	44.1	44.7
Fuel Take Off [kg]	12.8	13	13.3	13.7	14	14.8	15.5
Fuel Climb Out [kg]	37.3	38.8	41.9	45	48.1	54.3	60.5
Fuel Climb Cruise Descent 3000 ft [kg]	419	798.7	1557.9	2317.2	3076.5	4595.2	6114
Fuel Approach Landing [kg]	71	71	71	71	71	71	71
Fuel Taxi In [kg]	42.4	42.4	42.4	42.4	42.4	42.4	42.4
Sum Total NOx [kg]	9.419	14.063	23.354	32.646	41.939	60.529	79.124
Sum Lto NOx [kg]	2.331	2.363	2.427	2.49	2.554	2.682	2.809
NOx Taxi Out [kg]	0.302	0.303	0.305	0.307	0.309	0.313	0.317
NOx Take Off [kg]	0.261	0.264	0.272	0.279	0.287	0.301	0.316
NOx Climb Out [kg]	0.656	0.683	0.738	0.792	0.846	0.955	1.064
NOx Climb Cruise Descent 3000 ft [kg]	7.088	11.7	20.927	30.155	39.385	57.847	76.315
NOx Approach Landing [kg]	0.811	0.811	0.811	0.811	0.811	0.811	0.811
NOx Taxi In [kg]	0.301	0.301	0.301	0.301	0.301	0.301	0.301
Sum Total HC [g]	0	0	0	0	0	0	0
Sum Lto HC [g]	0	0	0	0	0	0	0
HC Taxi Out [g]	0	0	0	0	0	0	0
HC Take Off [g]	0	0	0	0	0	0	0
HC Climb Out [g]	0	0	0	0	0	0	0
HC Climb Cruise Descent 3000 ft [g]	0	0	0	0	0	0	0
HC Approach Landing [g]	0	0	0	0	0	0	0
HC Taxi In [g]	0	0	0	0	0	0	0
Sum Total CO [g]	2945.6	4698	8202.8	11707.4	15211.9	22220.5	29228.4
Sum Lto CO [g]	1126.5	1131.1	1140.2	1149.3	1158.4	1176.5	1194.7
CO Taxi Out [g]	383.3	384.5	387	389.5	392	397	402
CO Take Off [g]	25.6	25.9	26.6	27.4	28.1	29.5	31
CO Climb Out [g]	70.8	73.8	79.6	85.5	91.4	103.1	114.9
CO Climb Cruise Descent 3000 ft [g]	1819.1	3566.9	7062.6	10558.1	14053.6	21043.9	28033.7
CO Approach Landing [g]	264.9	264.9	264.9	264.9	264.9	264.9	264.9
CO Taxi In [g]	381.9	381.9	381.9	381.9	381.9	381.9	381.9

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Cessna 208 Caravan
Hurdy_Gurdy Key	Cessna 208 Caravan, Cabin Factor 65%
Emission_key	PT6A-114A
No of Engines	1
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**	**2000**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**	**3704**
Flight Altitude [ft]	10000	10000	10000	10000	10000	10000	10000
Flight Altitude [m]	3048	3048	3048	3048	3048	3048	3048
Takeoff Mass [kg]	2432	2582	2883	3184	3484	3243	3530
Landing Mass [kg]	2410	2410	2410	2410	2410	2307	2307
Sum Total Time [min]	59.31	103.12	190.74	278.35	365.95	550.13	725.73
Sum Lto Time [min]	19.64	19.76	20	20.24	20.47	20.24	20.57
Time Taxi Out [min]	5	5	5	5	5	5	5
Time Take Off [min]	0.36	0.38	0.42	0.46	0.5	0.44	0.5
Time Climb Out [min]	2.14	2.24	2.44	2.63	2.83	2.57	2.85
Time Climb Cruise Descent 3000 ft [min]	39.66	83.36	170.74	258.11	345.48	529.89	705.16
Time Approach Landing [min]	7.15	7.15	7.15	7.15	7.15	7.22	7.22
Time Taxi In [min]	5	5	5	5	5	5	5
Sum Total Fuel [kg]	92.5	163.9	306.8	449.7	592.6	887.9	1174.9
Sum Lto Fuel [kg]	28.3	28.7	29.6	30.4	31.3	30	31.1
Fuel Taxi Out [kg]	4.5	4.6	4.7	4.8	5	4.9	5
Fuel Take Off [kg]	1.2	1.2	1.4	1.5	1.6	1.4	1.6
Fuel Climb Out [kg]	6.3	6.6	7.2	7.7	8.3	7.3	8.1
Fuel Climb Cruise Descent 3000 ft [kg]	64.2	135.2	277.2	419.3	561.4	857.8	1143.8
Fuel Approach Landing [kg]	11.9	11.9	11.9	11.9	11.9	12	12
Fuel Taxi In [kg]	4.5	4.5	4.5	4.5	4.5	4.4	4.4
Sum Total NOx [kg]	0.526	0.939	1.765	2.59	3.416	5.112	6.77
Sum Lto NOx [kg]	0.152	0.155	0.161	0.166	0.172	0.163	0.171
NOx Taxi Out [kg]	0.017	0.017	0.018	0.018	0.019	0.018	0.019
NOx Take Off [kg]	0.009	0.009	0.01	0.011	0.012	0.011	0.012
NOx Climb Out [kg]	0.045	0.047	0.051	0.055	0.059	0.052	0.057
NOx Climb Cruise Descent 3000 ft [kg]	0.374	0.784	1.604	2.424	3.244	4.948	6.599
NOx Approach Landing [kg]	0.065	0.065	0.065	0.065	0.065	0.066	0.066
NOx Taxi In [kg]	0.017	0.017	0.017	0.017	0.017	0.017	0.017
Sum Total HC [g]	37.8	44.3	57.3	70.4	83.5	95.4	111.7
Sum Lto HC [g]	25.2	25.4	25.7	26.1	26.4	26	26.4
HC Taxi Out [g]	11.7	11.9	12.2	12.6	12.9	12.6	13
HC Take Off [g]	0	0	0	0	0	0	0
HC Climb Out [g]	0	0	0	0	0	0	0
HC Climb Cruise Descent 3000 ft [g]	12.6	18.9	31.6	44.3	57	69.3	85.4
HC Approach Landing [g]	1.8	1.8	1.8	1.8	1.8	1.8	1.8
HC Taxi In [g]	11.7	11.7	11.7	11.7	11.7	11.6	11.6
Sum Total CO [g]	545.1	785.3	1265.6	1745.9	2226	3559.2	4598.8
Sum Lto CO [g]	280.6	282.7	286.8	290.9	295	290.3	294.6
CO Taxi Out [g]	114.3	116	119.4	122.8	126.2	123.5	126.7
CO Take Off [g]	1.2	1.2	1.4	1.5	1.6	1.4	1.6
CO Climb Out [g]	6.3	6.6	7.2	7.7	8.3	7.3	8.1
CO Climb Cruise Descent 3000 ft [g]	264.5	502.6	978.8	1455	1931	3268.9	4304.2
CO Approach Landing [g]	44.9	44.9	44.9	44.9	44.9	45.3	45.3
CO Taxi In [g]	114	114	114	114	114	112.8	112.8

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Beech Super King Air 350
Hurdy_Gurdy Key	Beech Super King Air 350, Cabin Factor 65%
Emission_key	PT6A-60A
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**	**2000**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**	**3704**
Flight Altitude [ft]	25000	25000	25000	25000	25000	25000	25000
Flight Altitude [m]	7620	7620	7620	7620	7620	7620	7620
Takeoff Mass [kg]	5086	5189	5394	5599	5805	6216	6627
Landing Mass [kg]	4991	4991	4991	4991	4991	4991	4991
Sum Total Time [min]	54.04	89.8	161.31	232.83	304.37	447.46	590.62
Sum Lto Time [min]	16.91	16.93	16.96	16.99	17.02	17.08	17.14
Time Taxi Out [min]	5	5	5	5	5	5	5
Time Take Off [min]	0.26	0.26	0.27	0.28	0.29	0.31	0.33
Time Climb Out [min]	1.15	1.17	1.19	1.21	1.23	1.27	1.32
Time Climb Cruise Descent 3000 ft [min]	37.13	72.87	144.35	215.85	287.35	430.38	573.48
Time Approach Landing [min]	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Time Taxi In [min]	5	5	5	5	5	5	5
Sum Total Fuel [kg]	167	269.4	474.2	679.2	884.3	1294.8	1706.1
Sum Lto Fuel [kg]	58.3	58.4	58.8	59.1	59.4	60	60.7
Fuel Taxi Out [kg]	11.4	11.4	11.5	11.6	11.6	11.8	12
Fuel Take Off [kg]	2.3	2.4	2.5	2.5	2.6	2.8	2.9
Fuel Climb Out [kg]	8.2	8.3	8.4	8.6	8.7	9	9.3
Fuel Climb Cruise Descent 3000 ft [kg]	108.7	210.9	415.5	620.1	824.9	1234.8	1645.4
Fuel Approach Landing [kg]	25.1	25.1	25.1	25.1	25.1	25.1	25.1
Fuel Taxi In [kg]	11.3	11.3	11.3	11.3	11.3	11.3	11.3
Sum Total NOx [kg]	0.695	1.062	1.797	2.533	3.27	4.745	6.224
Sum Lto NOx [kg]	0.244	0.245	0.247	0.248	0.25	0.253	0.257
NOx Taxi Out [kg]	0.035	0.035	0.036	0.036	0.036	0.037	0.037
NOx Take Off [kg]	0.015	0.015	0.016	0.016	0.017	0.018	0.019
NOx Climb Out [kg]	0.049	0.05	0.051	0.051	0.052	0.054	0.056
NOx Climb Cruise Descent 3000 ft [kg]	0.451	0.817	1.551	2.285	3.02	4.491	5.967
NOx Approach Landing [kg]	0.11	0.11	0.11	0.11	0.11	0.11	0.11
NOx Taxi In [kg]	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Sum Total HC [g]	778.8	1272.9	2261.1	3249	4236.7	6211.4	8184.8
Sum Lto HC [g]	229.8	230.1	230.9	231.7	232.4	234	235.5
HC Taxi Out [g]	105.6	105.9	106.7	107.5	108.2	109.8	111.3
HC Take Off [g]	0	0	0	0	0	0	0
HC Climb Out [g]	0	0	0	0	0	0	0
HC Climb Cruise Descent 3000 ft [g]	549	1042.8	2030.2	3017.3	4004.3	5977.4	7949.3
HC Approach Landing [g]	19	19	19	19	19	19	19
HC Taxi In [g]	105.2	105.2	105.2	105.2	105.2	105.2	105.2
Sum Total CO [g]	6100	10510.3	19330.7	28150.7	36970.2	54608.1	72244.5
Sum Lto CO [g]	1867.1	1870	1875.8	1881.6	1887.5	1899.1	1910.8
CO Taxi Out [g]	656.1	658.5	663.2	668	672.7	682.2	691.8
CO Take Off [g]	8.4	8.6	8.8	9.1	9.4	10	10.6
CO Climb Out [g]	40.9	41.3	42.1	42.9	43.6	45.2	46.7
CO Climb Cruise Descent 3000 ft [g]	4232.9	8640.3	17454.9	26269	35082.8	52709	70333.7
CO Approach Landing [g]	507.8	507.8	507.8	507.8	507.8	507.8	507.8
CO Taxi In [g]	653.9	653.9	653.9	653.9	653.9	653.9	653.9

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Beech Super King Air 200B
Hurdy_Gurdy Key	Beech Super King Air 200B, Cabin Factor 65%
Emission_key	PT6A-42
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**
Flight Altitude [ft]	25000	25000	25000	25000	25000	25000
Flight Altitude [m]	7620	7620	7620	7620	7620	7620
Takeoff Mass [kg]	4480	4571	4752	4934	5117	5483
Landing Mass [kg]	4372	4372	4372	4372	4372	4372
Sum Total Time [min]	52.22	93.51	176.07	258.61	341.11	505.99
Sum Lto Time [min]	17.1	17.14	17.23	17.33	17.42	17.61
Time Taxi Out [min]	5	5	5	5	5	5
Time Take Off [min]	0.24	0.25	0.26	0.28	0.3	0.33
Time Climb Out [min]	1.24	1.28	1.35	1.43	1.51	1.66
Time Climb Cruise Descent 3000 ft [min]	35.13	76.37	158.84	241.28	323.69	488.38
Time Approach Landing [min]	5.62	5.62	5.62	5.62	5.62	5.62
Time Taxi In [min]	5	5	5	5	5	5
Sum Total Fuel [kg]	150.5	241.3	423	604.9	787.1	1152.6
Sum Lto Fuel [kg]	51.8	52.2	52.9	53.6	54.3	55.7
Fuel Taxi Out [kg]	9.8	9.9	10	10	10.1	10.3
Fuel Take Off [kg]	1.9	1.9	2	2.1	2.3	2.5
Fuel Climb Out [kg]	8	8.2	8.7	9.2	9.7	10.7
Fuel Climb Cruise Descent 3000 ft [kg]	98.7	189.1	370.1	551.3	732.8	1097
Fuel Approach Landing [kg]	22.4	22.4	22.4	22.4	22.4	22.4
Fuel Taxi In [kg]	9.8	9.8	9.8	9.8	9.8	9.8
Sum Total NOx [kg]	0.721	1.048	1.703	2.36	3.019	4.348
Sum Lto NOx [kg]	0.242	0.244	0.249	0.253	0.258	0.267
NOx Taxi Out [kg]	0.033	0.033	0.033	0.033	0.033	0.034
NOx Take Off [kg]	0.014	0.014	0.015	0.016	0.017	0.018
NOx Climb Out [kg]	0.055	0.057	0.06	0.064	0.067	0.074
NOx Climb Cruise Descent 3000 ft [kg]	0.479	0.804	1.454	2.107	2.761	4.081
NOx Approach Landing [kg]	0.109	0.109	0.109	0.109	0.109	0.109
NOx Taxi In [kg]	0.032	0.032	0.032	0.032	0.032	0.032
Sum Total HC [g]	421.8	930.2	1946.1	2960.3	3972.7	5989.9
Sum Lto HC [g]	127.7	128	128.5	129	129.5	130.5
HC Taxi Out [g]	62	62.3	62.8	63.3	63.8	64.8
HC Take Off [g]	0	0	0	0	0	0
HC Climb Out [g]	0	0	0	0	0	0
HC Climb Cruise Descent 3000 ft [g]	294.1	802.3	1817.6	2831.4	3843.2	5859.4
HC Approach Landing [g]	3.9	3.9	3.9	3.9	3.9	3.9
HC Taxi In [g]	61.8	61.8	61.8	61.8	61.8	61.8
Sum Total CO [g]	2508.4	5306.4	10898.2	16484.1	22062.7	33191.3
Sum Lto CO [g]	755.3	757.1	760.6	764.1	767.7	774.8
CO Taxi Out [g]	284.6	285.8	288.1	290.4	292.7	297.4
CO Take Off [g]	3.5	3.6	3.9	4.1	4.3	4.7
CO Climb Out [g]	15.9	16.4	17.4	18.4	19.4	21.4
CO Climb Cruise Descent 3000 ft [g]	1753.1	4549.3	10137.6	15719.9	21295	32416.5
CO Approach Landing [g]	167.9	167.9	167.9	167.9	167.9	167.9
CO Taxi In [g]	283.3	283.3	283.3	283.3	283.3	283.3

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Beech 1900C Airliner
Hurdy_Gurdy Key	Beech 1900C Airliner, Cabin Factor 65%
Emission_key	PT6A-65B
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**	**2000**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**	**3704**
Flight Altitude [ft]	25000	25000	25000	25000	25000	25000	25000
Flight Altitude [m]	7620	7620	7620	7620	7620	7620	7620
Takeoff Mass [kg]	5779	5889	6109	6330	6551	6995	7442
Landing Mass [kg]	5648	5648	5648	5648	5648	5648	5648
Sum Total Time [min]	51.26	84.76	151.77	218.81	285.9	420.26	555
Sum Lto Time [min]	16.31	16.33	16.35	16.37	16.4	16.45	16.5
Time Taxi Out [min]	5	5	5	5	5	5	5
Time Take Off [min]	0.26	0.27	0.28	0.3	0.31	0.35	0.38
Time Climb Out [min]	0.98	0.98	0.99	1	1	1.02	1.04
Time Climb Cruise Descent 3000 ft [min]	34.95	68.43	135.42	202.44	269.5	403.81	538.5
Time Approach Landing [min]	5.08	5.08	5.08	5.08	5.08	5.08	5.08
Time Taxi In [min]	5	5	5	5	5	5	5
Sum Total Fuel [kg]	186	296.4	517.4	738.8	960.6	1406.3	1856
Sum Lto Fuel [kg]	60	60.2	60.5	60.8	61.1	61.7	62.3
Fuel Taxi Out [kg]	12.7	12.7	12.8	12.9	13	13.2	13.3
Fuel Take Off [kg]	2.4	2.5	2.7	2.8	3	3.3	3.6
Fuel Climb Out [kg]	7.4	7.4	7.5	7.5	7.6	7.7	7.8
Fuel Climb Cruise Descent 3000 ft [kg]	126	236.2	456.9	678	899.6	1344.6	1793.7
Fuel Approach Landing [kg]	24.9	24.9	24.9	24.9	24.9	24.9	24.9
Fuel Taxi In [kg]	12.6	12.6	12.6	12.6	12.6	12.6	12.6
Sum Total NOx [kg]	0.842	1.26	2.098	2.939	3.783	5.483	7.21
Sum Lto NOx [kg]	0.253	0.254	0.256	0.258	0.259	0.263	0.267
NOx Taxi Out [kg]	0.037	0.037	0.037	0.037	0.038	0.038	0.039
NOx Take Off [kg]	0.017	0.018	0.019	0.02	0.021	0.023	0.026
NOx Climb Out [kg]	0.049	0.05	0.05	0.05	0.051	0.052	0.052
NOx Climb Cruise Descent 3000 ft [kg]	0.589	1.006	1.842	2.681	3.523	5.22	6.943
NOx Approach Landing [kg]	0.113	0.113	0.113	0.113	0.113	0.113	0.113
NOx Taxi In [kg]	0.037	0.037	0.037	0.037	0.037	0.037	0.037
Sum Total HC [g]	1862.1	2931.3	5069.4	7207	9344.1	13616.4	17886.1
Sum Lto HC [g]	623.6	624.6	626.4	628.3	630.1	633.9	637.7
HC Taxi Out [g]	260.9	261.8	263.6	265.4	267.3	271	274.7
HC Take Off [g]	0.2	0.3	0.3	0.3	0.3	0.3	0.4
HC Climb Out [g]	1.5	1.5	1.5	1.5	1.5	1.5	1.6
HC Climb Cruise Descent 3000 ft [g]	1238.5	2306.8	4443	6578.7	8713.9	12982.5	17248.4
HC Approach Landing [g]	101.3	101.3	101.3	101.3	101.3	101.3	101.3
HC Taxi In [g]	259.8	259.8	259.8	259.8	259.8	259.8	259.8
Sum Total CO [g]	6990.8	12179.7	22557.9	32936.8	43316.8	64082.7	84865.1
Sum Lto CO [g]	2203.5	2206.8	2213.4	2220.1	2226.7	2240.1	2253.7
CO Taxi Out [g]	797.8	800.6	806.2	811.8	817.4	828.7	840.1
CO Take Off [g]	10.8	11.1	11.8	12.5	13.1	14.5	15.9
CO Climb Out [g]	45	45.1	45.5	45.9	46.3	47	47.8
CO Climb Cruise Descent 3000 ft [g]	4787.3	9972.9	20344.4	30716.7	41090.1	61842.6	82611.5
CO Approach Landing [g]	555.5	555.5	555.5	555.5	555.5	555.5	555.5
CO Taxi In [g]	794.4	794.4	794.4	794.4	794.4	794.4	794.4

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	BAe Jetstream 41
Hurdy_Gurdy Key	BAe Jetstream 41, Cabin Factor 65%
Emission_key	TPE331-14GR
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**
Flight Altitude [ft]	20000	20000	20000	20000	20000
Flight Altitude [m]	6096	6096	6096	6096	6096
Takeoff Mass [kg]	8290	8460	8802	9143	9485
Landing Mass [kg]	8125	8125	8125	8125	8125
Sum Total Time [min]	48.11	77.5	136.29	195.08	253.86
Sum Lto Time [min]	15.8	15.8	15.82	15.83	15.85
Time Taxi Out [min]	5	5	5	5	5
Time Take Off [min]	0.29	0.3	0.31	0.33	0.34
Time Climb Out [min]	0.99	1	1	1	1
Time Climb Cruise Descent 3000 ft [min]	32.31	61.7	120.47	179.24	238.01
Time Approach Landing [min]	4.51	4.51	4.51	4.51	4.51
Time Taxi In [min]	5	5	5	5	5
Sum Total Fuel [kg]	228.2	398.5	739	1079.6	1420.3
Sum Lto Fuel [kg]	62	62.2	62.4	62.7	62.9
Fuel Taxi Out [kg]	13.6	13.6	13.7	13.8	13.9
Fuel Take Off [kg]	3.2	3.3	3.4	3.6	3.7
Fuel Climb Out [kg]	8.1	8.1	8.1	8.1	8.2
Fuel Climb Cruise Descent 3000 ft [kg]	166.2	336.3	676.6	1016.9	1357.4
Fuel Approach Landing [kg]	23.6	23.6	23.6	23.6	23.6
Fuel Taxi In [kg]	13.6	13.6	13.6	13.6	13.6
Sum Total NOx [kg]	2.058	3.775	7.211	10.647	14.086
Sum Lto NOx [kg]	0.467	0.468	0.471	0.473	0.475
NOx Taxi Out [kg]	0.068	0.068	0.069	0.069	0.07
NOx Take Off [kg]	0.037	0.038	0.039	0.041	0.042
NOx Climb Out [kg]	0.09	0.091	0.091	0.091	0.092
NOx Climb Cruise Descent 3000 ft [kg]	1.591	3.307	6.74	10.174	13.61
NOx Approach Landing [kg]	0.204	0.204	0.204	0.204	0.204
NOx Taxi In [kg]	0.068	0.068	0.068	0.068	0.068
Sum Total HC [g]	227	262	332.1	402.1	472.1
Sum Lto HC [g]	88.4	88.6	88.9	89.2	89.4
HC Taxi Out [g]	40	40.1	40.4	40.7	40.9
HC Take Off [g]	0.2	0.2	0.2	0.2	0.3
HC Climb Out [g]	0.6	0.6	0.6	0.7	0.7
HC Climb Cruise Descent 3000 ft [g]	138.5	173.4	243.2	313	382.7
HC Approach Landing [g]	7.8	7.8	7.8	7.8	7.8
HC Taxi In [g]	39.8	39.8	39.8	39.8	39.8
Sum Total CO [g]	2233.7	3015.7	4579.4	6142.7	7705.6
Sum Lto CO [g]	816.3	817.6	820.1	822.6	825.1
CO Taxi Out [g]	333.1	334.3	336.5	338.8	341.1
CO Take Off [g]	4.8	4.9	5.1	5.3	5.5
CO Climb Out [g]	14.5	14.6	14.6	14.7	14.7
CO Climb Cruise Descent 3000 ft [g]	1417.4	2198.2	3759.3	5320.1	6880.5
CO Approach Landing [g]	131.8	131.8	131.8	131.8	131.8
CO Taxi In [g]	332	332	332	332	332

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	BAe Jetstream 31
Hurdy_Gurdy Key	BAe Jetstream 31, Cabin Factor 65%
Emission_key	TPE331-10UG
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**
Flight Altitude [ft]	20000	20000	20000	20000	20000
Flight Altitude [m]	6096	6096	6096	6096	6096
Takeoff Mass [kg]	5987	6103	6335	6567	6800
Landing Mass [kg]	5854	5854	5854	5854	5854
Sum Total Time [min]	52.15	83.44	146.02	208.63	271.27
Sum Lto Time [min]	16.26	16.26	16.28	16.29	16.3
Time Taxi Out [min]	5	5	5	5	5
Time Take Off [min]	0.35	0.36	0.38	0.39	0.41
Time Climb Out [min]	1.21	1.21	1.21	1.21	1.21
Time Climb Cruise Descent 3000 ft [min]	35.9	67.17	129.74	192.34	254.96
Time Approach Landing [min]	4.69	4.69	4.69	4.69	4.69
Time Taxi In [min]	5	5	5	5	5
Sum Total Fuel [kg]	174.5	290.3	522	754.1	986.5
Sum Lto Fuel [kg]	45.1	45.2	45.4	45.6	45.8
Fuel Taxi Out [kg]	9.1	9.1	9.2	9.3	9.4
Fuel Take Off [kg]	2.5	2.6	2.7	2.8	2.9
Fuel Climb Out [kg]	6.6	6.6	6.6	6.6	6.6
Fuel Climb Cruise Descent 3000 ft [kg]	129.3	245	476.6	708.5	940.7
Fuel Approach Landing [kg]	18	18	18	18	18
Fuel Taxi In [kg]	9	9	9	9	9
Sum Total NOx [kg]	1.655	2.902	5.397	7.895	10.398
Sum Lto NOx [kg]	0.371	0.372	0.374	0.375	0.377
NOx Taxi Out [kg]	0.043	0.043	0.043	0.044	0.044
NOx Take Off [kg]	0.028	0.029	0.03	0.031	0.032
NOx Climb Out [kg]	0.073	0.073	0.073	0.073	0.073
NOx Climb Cruise Descent 3000 ft [kg]	1.284	2.53	5.023	7.52	10.021
NOx Approach Landing [kg]	0.185	0.185	0.185	0.185	0.185
NOx Taxi In [kg]	0.042	0.042	0.042	0.042	0.042
Sum Total HC [g]	122.1	168.3	260.8	353.2	445.7
Sum Lto HC [g]	44.6	44.7	44.8	45	45.2
HC Taxi Out [g]	18.1	18.2	18.4	18.6	18.7
HC Take Off [g]	0.2	0.3	0.3	0.3	0.3
HC Climb Out [g]	0.7	0.7	0.7	0.7	0.7
HC Climb Cruise Descent 3000 ft [g]	77.5	123.6	215.9	308.2	400.5
HC Approach Landing [g]	7.4	7.4	7.4	7.4	7.4
HC Taxi In [g]	18	18	18	18	18
Sum Total CO [g]	1510.3	2211.4	3613.6	5016	6418.5
Sum Lto CO [g]	511.1	512.2	514.3	516.3	518.4
CO Taxi Out [g]	194.8	195.7	197.6	199.5	201.4
CO Take Off [g]	5.4	5.5	5.7	5.9	6.2
CO Climb Out [g]	15.8	15.8	15.8	15.8	15.7
CO Climb Cruise Descent 3000 ft [g]	999.1	1699.2	3099.4	4499.7	5900
CO Approach Landing [g]	101.4	101.4	101.4	101.4	101.4
CO Taxi In [g]	193.7	193.7	193.7	193.7	193.7

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	ATR 72-200
Hurdy_Gurdy Key	ATR 72-200, Cabin Factor 65%
Emission_key	PW124B
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**	**2000**	**2500**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**	**3704**	**4630**
Flight Altitude [ft]	25000	25000	25000	25000	25000	25000	25000	25000
Flight Altitude [m]	7620	7620	7620	7620	7620	7620	7620	7620
Takeoff Mass [kg]	17075	17291	17722	18153	18585	19446	20306	21163
Landing Mass [kg]	16812	16812	16812	16812	16812	16812	16812	16812
Sum Total Time [min]	50.26	82.24	146.18	210.09	273.94	401.48	528.7	655.39
Sum Lto Time [min]	17.29	17.37	17.53	17.69	17.85	18.17	18.5	18.82
Time Taxi Out [min]	5	5	5	5	5	5	5	5
Time Take Off [min]	0.42	0.42	0.43	0.44	0.45	0.47	0.49	0.51
Time Climb Out [min]	2.37	2.44	2.59	2.74	2.9	3.2	3.5	3.8
Time Climb Cruise Descent 3000 ft [min]	32.97	64.87	128.66	192.4	256.09	383.31	510.2	636.57
Time Approach Landing [min]	4.51	4.51	4.51	4.51	4.51	4.51	4.51	4.51
Time Taxi In [min]	5	5	5	5	5	5	5	5
Sum Total Fuel [kg]	351.6	567.3	998.6	1429.7	1860.7	2721.8	3581.3	4438.2
Sum Lto Fuel [kg]	137	138.1	140.2	142.4	144.6	149	153.3	157.7
Fuel Taxi Out [kg]	30.1	30.2	30.3	30.4	30.5	30.7	30.9	31.1
Fuel Take Off [kg]	7.4	7.5	7.7	7.9	8.1	8.4	8.8	9.1
Fuel Climb Out [kg]	29.7	30.7	32.6	34.5	36.4	40.2	44	47.8
Fuel Climb Cruise Descent 3000 ft [kg]	214.6	429.2	858.3	1287.3	1716.1	2572.8	3428	4280.5
Fuel Approach Landing [kg]	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6
Fuel Taxi In [kg]	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1
Sum Total NOx [kg]	3.888	5.916	9.971	14.026	18.081	26.187	34.285	42.367
Sum Lto NOx [kg]	1.452	1.469	1.503	1.537	1.571	1.64	1.708	1.776
NOx Taxi Out [kg]	0.226	0.226	0.227	0.228	0.229	0.23	0.232	0.233
NOx Take Off [kg]	0.132	0.134	0.137	0.14	0.144	0.15	0.156	0.163
NOx Climb Out [kg]	0.473	0.488	0.518	0.548	0.579	0.639	0.7	0.76
NOx Climb Cruise Descent 3000 ft [kg]	2.436	4.447	8.468	12.489	16.509	24.547	32.577	40.591
NOx Approach Landing [kg]	0.395	0.395	0.395	0.395	0.395	0.395	0.395	0.395
NOx Taxi In [kg]	0.226	0.226	0.226	0.226	0.226	0.226	0.226	0.226
Sum Total HC [g]	0	0	0	0	0	0	0	0
Sum Lto HC [g]	0	0	0	0	0	0	0	0
HC Taxi Out [g]	0	0	0	0	0	0	0	0
HC Take Off [g]	0	0	0	0	0	0	0	0
HC Climb Out [g]	0	0	0	0	0	0	0	0
HC Climb Cruise Descent 3000 ft [g]	0	0	0	0	0	0	0	0
HC Approach Landing [g]	0	0	0	0	0	0	0	0
HC Taxi In [g]	0	0	0	0	0	0	0	0
Sum Total CO [g]	2145	3283.7	5560.1	7835	10108.3	14648.5	19176.9	23686.4
Sum Lto CO [g]	722.6	725	729.8	734.6	739.4	748.9	758.5	768
CO Taxi Out [g]	250.2	250.6	251.5	252.3	253.1	254.7	256.4	258
CO Take Off [g]	14.9	15.1	15.4	15.8	16.1	16.8	17.6	18.3
CO Climb Out [g]	56.5	58.3	61.9	65.5	69.2	76.4	83.6	90.8
CO Climb Cruise Descent 3000 ft [g]	1422.5	2558.7	4830.3	7100.5	9368.9	13899.6	18418.4	22918.4
CO Approach Landing [g]	151.2	151.2	151.2	151.2	151.2	151.2	151.2	151.2
CO Taxi In [g]	249.7	249.7	249.7	249.7	249.7	249.7	249.7	249.7

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK. Copyright 2001 FOI, Sweden.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	ATR 42-320
Hurdy_Gurdy Key	ATR 42-320, Cabin Factor 65%
Emission_key	PW121
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**	**2000**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**	**3704**
Flight Altitude [ft]	25000	25000	25000	25000	25000	25000	25000
Flight Altitude [m]	7620	7620	7620	7620	7620	7620	7620
Takeoff Mass [kg]	13657	13853	14243	14634	15024	15805	16584
Landing Mass [kg]	13400	13400	13400	13400	13400	13400	13400
Sum Total Time [min]	53.08	83.53	144.41	205.27	266.08	387.58	508.81
Sum Lto Time [min]	16.67	16.69	16.74	16.78	16.82	16.9	16.98
Time Taxi Out [min]	5	5	5	5	5	5	5
Time Take Off [min]	0.34	0.35	0.36	0.37	0.38	0.4	0.42
Time Climb Out [min]	1.54	1.55	1.58	1.61	1.64	1.7	1.77
Time Climb Cruise Descent 3000 ft [min]	36.4	66.84	127.68	188.49	249.27	370.68	491.83
Time Approach Landing [min]	4.79	4.79	4.79	4.79	4.79	4.79	4.79
Time Taxi In [min]	5	5	5	5	5	5	5
Sum Total Fuel [kg]	333.6	528.9	919.3	1309.6	1699.8	2479.6	3258.1
Sum Lto Fuel [kg]	115.2	115.5	116.2	116.8	117.4	118.7	120
Fuel Taxi Out [kg]	26.1	26.2	26.3	26.4	26.5	26.7	26.9
Fuel Take Off [kg]	5.6	5.7	5.8	6	6.2	6.5	6.8
Fuel Climb Out [kg]	18.7	18.8	19.2	19.6	19.9	20.7	21.4
Fuel Climb Cruise Descent 3000 ft [kg]	218.4	413.3	803.1	1192.8	1582.4	2360.9	3138.1
Fuel Approach Landing [kg]	38.8	38.8	38.8	38.8	38.8	38.8	38.8
Fuel Taxi In [kg]	26	26	26	26	26	26	26
Sum Total NOx [kg]	2.926	4.477	7.577	10.678	13.777	19.975	26.166
Sum Lto NOx [kg]	1.017	1.021	1.029	1.037	1.045	1.061	1.077
NOx Taxi Out [kg]	0.172	0.173	0.173	0.174	0.175	0.176	0.177
NOx Take Off [kg]	0.081	0.082	0.085	0.087	0.089	0.094	0.099
NOx Climb Out [kg]	0.246	0.249	0.254	0.258	0.263	0.273	0.283
NOx Climb Cruise Descent 3000 ft [kg]	1.909	3.456	6.548	9.641	12.733	18.914	25.089
NOx Approach Landing [kg]	0.346	0.346	0.346	0.346	0.346	0.346	0.346
NOx Taxi In [kg]	0.172	0.172	0.172	0.172	0.172	0.172	0.172
Sum Total HC [g]	0	0	0	0	0	0	0
Sum Lto HC [g]	0	0	0	0	0	0	0
HC Taxi Out [g]	0	0	0	0	0	0	0
HC Take Off [g]	0	0	0	0	0	0	0
HC Climb Out [g]	0	0	0	0	0	0	0
HC Climb Cruise Descent 3000 ft [g]	0	0	0	0	0	0	0
HC Approach Landing [g]	0	0	0	0	0	0	0
HC Taxi In [g]	0	0	0	0	0	0	0
Sum Total CO [g]	3035.4	4823.3	8397.7	11970.1	15540	22670.4	29783.7
Sum Lto CO [g]	863.3	864.5	866.8	869.1	871.4	875.9	880.5
CO Taxi Out [g]	308.1	308.7	309.8	311	312.2	314.6	316.9
CO Take Off [g]	11.2	11.3	11.7	12	12.3	13	13.7
CO Climb Out [g]	39.2	39.6	40.3	41.1	41.9	43.4	45
CO Climb Cruise Descent 3000 ft [g]	2172	3958.8	7531	11101	14668.6	21794.5	28903.1
CO Approach Landing [g]	197.6	197.6	197.6	197.6	197.6	197.6	197.6
CO Taxi In [g]	307.3	307.3	307.3	307.3	307.3	307.3	307.3

Method	Master using Hurdy-Gurdy 1.2
Method Explation	Hurdy-Gurdy manages Flight Cases, where performance, fuel comsumption and emissions are based on modelling of results according to PIANO (above Lto altitude) and HARP (Lto) methods. PIANO is a trademark of Lissys Ltd, UK.
Creator	FOI Aviation and Environment
Date	2001-12-17
Aircraft ID	Antonov 26
Hurdy_Gurdy Key	Antonov 26, Cabin Factor 65%
Emission_key	AI-24VT
No of Engines	2
Engine Category	**Turboprop**
Cabin Factor	65%
CO2 Fuel Factor	3.16

Flight_Distance [nm]	**125**	**250**	**500**	**750**	**1000**	**1500**	**2000**
Flight_Distance [km]	**232**	**463**	**926**	**1389**	**1852**	**2778**	**3704**
Flight Altitude [ft]	25000	25000	25000	25000	25000	25000	25000
Flight Altitude [m]	7620	7620	7620	7620	7620	7620	7620
Takeoff Mass [kg]	18942	19272	19934	20597	21260	22590	23924
Landing Mass [kg]	18583	18583	18583	18583	18583	18583	18583
Sum Total Time [min]	54.13	88.97	158.62	228.27	297.89	437.01	575.62
Sum Lto Time [min]	15.74	15.73	15.71	15.69	15.67	15.64	15.6
Time Taxi Out [min]	5	5	5	5	5	5	5
Time Take Off [min]	0.6	0.61	0.63	0.66	0.68	0.72	0.77
Time Climb Out [min]	1.94	1.92	1.88	1.83	1.79	1.71	1.63
Time Climb Cruise Descent 3000 ft [min]	38.4	73.24	142.91	212.57	282.22	421.38	560.02
Time Approach Landing [min]	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Time Taxi In [min]	5	5	5	5	5	5	5
Sum Total Fuel [kg]	488.1	818.4	1479.3	2140.8	2803	4130.2	5461.9
Sum Lto Fuel [kg]	136.9	137	137.4	137.7	138.1	138.8	139.5
Fuel Taxi Out [kg]	31.6	31.7	32	32.3	32.7	33.3	33.9
Fuel Take Off [kg]	12.9	13.2	13.7	14.2	14.7	15.7	16.7
Fuel Climb Out [kg]	21.2	21	20.6	20.1	19.6	18.7	17.8
Fuel Climb Cruise Descent 3000 ft [kg]	351.3	681.3	1341.9	2003	2664.9	3991.5	5322.4
Fuel Approach Landing [kg]	39.7	39.7	39.7	39.7	39.7	39.7	39.7
Fuel Taxi In [kg]	31.4	31.4	31.4	31.4	31.4	31.4	31.4
Sum Total NOx [kg]	0.841	1.148	1.764	2.383	3.006	4.268	5.566
Sum Lto NOx [kg]	0.196	0.196	0.196	0.197	0.197	0.198	0.199
NOx Taxi Out [kg]	0.032	0.032	0.032	0.032	0.033	0.033	0.034
NOx Take Off [kg]	0.035	0.036	0.037	0.039	0.04	0.043	0.045
NOx Climb Out [kg]	0.058	0.057	0.056	0.055	0.053	0.051	0.048
NOx Climb Cruise Descent 3000 ft [kg]	0.646	0.953	1.568	2.187	2.809	4.07	5.367
NOx Approach Landing [kg]	0.04	0.04	0.04	0.04	0.04	0.04	0.04
NOx Taxi In [kg]	0.031	0.031	0.031	0.031	0.031	0.031	0.031
Sum Total HC [g]	19962.4	27581.4	42802	57994.8	73151.9	103304.7	133029.3
Sum Lto HC [g]	6900.4	6915.8	6946.5	6977.3	7008.1	7069.8	7131.7
HC Taxi Out [g]	3215	3230.4	3261.1	3291.8	3322.6	3384.3	3446.2
HC Take Off [g]	4.2	4.3	4.5	4.6	4.8	5.1	5.4
HC Climb Out [g]	6.9	6.9	6.7	6.6	6.4	6.1	5.8
HC Climb Cruise Descent 3000 ft [g]	13062	20665.6	35855.5	51017.6	66143.9	96234.9	125897.6
HC Approach Landing [g]	475.9	475.9	475.9	475.9	475.9	475.9	475.9
HC Taxi In [g]	3198.3	3198.3	3198.3	3198.3	3198.3	3198.3	3198.3
Sum Total CO [g]	31794.4	53590.7	97153.5	140667.2	184117	270718.2	356479.9
Sum Lto CO [g]	10066.4	10086.2	10125.7	10165.3	10205	10284.5	10364.2
CO Taxi Out [g]	4107.2	4126.8	4166.1	4205.3	4244.7	4323.5	4402.5
CO Take Off [g]	94.9	96.7	100.4	104.1	107.8	115.2	122.6
CO Climb Out [g]	156.2	154.6	151.2	147.9	144.5	137.8	131
CO Climb Cruise Descent 3000 ft [g]	21728	43504.6	87027.8	130501.9	173912	260433.8	346115.7
CO Approach Landing [g]	1622.1	1622.1	1622.1	1622.1	1622.1	1622.1	1622.1
CO Taxi In [g]	4085.9	4085.9	4085.9	4085.9	4085.9	4085.9	4085.9