SWISS FOCA National Greenhouse Gas Inventory (IPCC)

Year 1990

To	**BAFU/ P. Filliger, A. Liechti, B.C. Müller**
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0. Results

[in Metric Tonnes]	FUEL	CO2	H2O	SO2	Pb	NOx	VOC	CO
CH Total International	974211	3068765	1198367	975	1	11724	875	4036
CH Total Domestic	80237	252747	99244	80	4	826	116	3147
CH Total	1054448	3321512	1297611	1054	5	12549	991	7183

1. Method

Swiss FOCA has used Tier 3a Method for scheduled and charter traffic of passengers and freight in order to estimate both LTO and Cruise emissions for domestic and international flights. The effort for a Tier 3a calculation had to be made because it was the only way to separate domestic and international flights as accurately as possible. Further motivation also for future Tier 3a application is the monitoring of individual technology developments and changes in fleet composition during time and the assessment of NOx, VOC and CO emissions in a more accurate manner.

2. Movement Statistics (Input Data)

Table 1: Aircraft Movement Data 1990. One observation for each single movement for charter- and scheduled flights:

Airline	***Seats***	CH_Airp	A_D	Ori_Dest	Move	PAX	DIST
AAL	144	LSZH	A	KJFK	1	137	6315.92304
AAL	170	LSZH	A	KORD	1	44	7136.65444
AAL	175	LSGG	A	PAR	1	64	395.165155
AAL	175	LSZH	A	KJFK	1	175	6315.92304
AAL	217	LSZH	A	EDDM	1	40	261.165593
AAL	217	LSZH	A	KORD	1	163	7136.65444
AAL	235	LSZH	A	EDDM	1	159	261.165593
AAL	277	LSZH	A	EDDM	1	136	261.165593

(a total of 340'000 records)

Table 2: Emission and fuel consumption data per aircraft type for LTO and cruise

Inputfile For Calculation

arp	Aircraft _icao	Mouve-ments	Distance	dom_int	ICAO Size	Code	Engine	Rated_Output	Test_year	Bypass	Takeoff	Climb
LSZH	A300	144	793743.1577	aus	5	J143	CF6-50C2	230.4	1979	4.3	2.487	1.975
LSGG	A306	24	69170.25303	aus	6	J159	CF6-80C2A5	267.34	1995	5.1	2.58	2.096
LSZM	A30B	489	8571.720257	inl	5	J143	CF6-50C2	230.4	1979	4.3	2.487	1.975
LSGG	A310	2029	11119526.9	aus	5	J361	JT9D-7R4D	213.5	1981	5	2.055	1.678
LSZH	A310	7431	38602702.06	aus	5	J361	JT9D-7R4D	213.5	1981	5	2.055	1.678
LSZM	A310	719	232295.8488	aus	5	J361	JT9D-7R4D	213.5	1981	5	2.055	1.678
LSGG	A320	12	2752.956775	inl	3	J030	CFM56-5-A1	111.2	1986	6	1.051	0.862

arp	NOx_Cl	Appr	Taxi	NOx_To	NOx_Ap	NOx_Ta	VOC_To	VOC_Cl	VOC_Ap	VOC_Ta	CO_To	CO_Cl
LSZH	29.7	0.66	0.215	36.3	9.5	3.6	1	1	1	22	0	0
LSGG	21.69	0.672	0.205	28.57	12.53	4.76	0	0	0	1	0	0
LSZM	29.7	0.66	0.215	36.3	9.5	3.6	1	1	1	22	0	0
LSGG	30	0.7593	0.2054	38.5	9.8	4.1	0	0	0	1	1	0
LSZH	30	0.7593	0.2054	38.5	9.8	4.1	0	0	0	1	1	0
LSZM	30	0.7593	0.2054	38.5	9.8	4.1	0	0	0	1	1	0
LSGG	19.6	0.291	0.1011	24.6	8	4	0	0	0	1	1	1

arp	Smoke_Nbr	CO_Ap	CO_Ta	Pressure_Ratio	Eng_Nbr_CO	Eng_Nbr_VOC	Eng_Nbr_NOx	Eng_Nbr_SN	Number_of_Engines	Typ	Zeit_Take_Off	Zeit_Climbout
LSZH	4	4	62	30	6	6	6	6	2	JET2	0.7	2.2
LSGG	7	2	19	32	2	2	2	2	2	JET2	0.7	2.2
LSZM	4	4	62	30	6	6	6	6	2	JET2	0.7	2.2
LSGG	5	1	9	23	6	6	5	4	2	JET2	0.7	2.2
LSZH	5	1	9	23	6	6	5	4	2	JET2	0.7	2.2
LSZM	5	1	9	23	6	6	5	4	2	JET2	0.7	2.2
LSGG	16	2	18	27	1	1	1	1	2	JET2	0.7	2.2

arp	kg_NOx_NM	Zeit_Approach	Zeit_Taxi	kg_fuel_NM	g_VOC_NM	g_CO_NM
LSZH	0.31	4	20	11.1	1.11	12.2
LSGG	0.31	4	20	11.1	1.11	12.2
LSZM	0.31	4	20	11.1	1.11	12.2
LSGG	0.11	4	20	8.6	1.3	6
LSZH	0.11	4	20	8.6	1.3	6
LSZM	0.11	4	20	8.6	1.3	6
LSGG	0.075	4	20	5.2	0.91	4.7

The key-variable between airport- and aircraft-data is usually the aircraft registration number. This key-variable is missing in the 1990-airport-data. Therefore we merged the two files with the variables Airline and Seats. We had to use four different merge procedures for connecting both files together because of differences in the numbers of seats and missing of Airlines in the aircraft file. Since 1990 many airlines do not exist any more. We managed this problem in defining new key - variables with +-5 seats and seat - categories according to ICAO. Missing airlines where replaced with airlines of the same nationality operating on the same flight stage.

Table 3: Aircraft Data, selected by airplanes built before 1990

Aircraft Register AIRSTAT (Selection of variables)

Airline	*Seats*	ICAO	Year	ATBMC	ATBMN	MTOFW_kg
AAA	40	DH8A	1986	PWC PW120A	PWC PW120A	15649
AAA	73	B462	1985	LY ALF502R	LY ALF502R-5	40597
AAA	73	B462	1989	LY ALF502R	LY ALF502R-5	42184
AAA	78	B462	1988	ALF-502R-3	ALF-502R-3	42184
AAA	78	B462	1988	LY ALF502R	LY ALF502R-5	42184
AAA	144	A320	1989	CFM 56-5A1	CFM 56-5A1	73500
AAA	211	B762	1983	CF6-80	CF6-80	140613
AAF	129	B732	1974	JT8D-15A	JT8D-15A	54204

(a total of 22'000 records)

.

3. Calculation Basics

3.1 Scheduled and Charter traffic

a) Definition used for Domestic Flights:

All flights between A and B in Switzerland

b) Definition used for International Flights:

For LTO: All flights which take place between Switzerland and another country. Arriving traffic from abroad is also counted in the LTO.
For Cruise: All flights which start in Switzerland and end in another country.

c) Assignment of Emission Factors:

The 1990 fleet that was operated in and from Switzerland has been analyzed. The corresponding most frequent engines within an aircraft category (ICAO Code) have been assigned to every aircraft type (see Appendix).

d) LTO-Emission Factors:

The Swiss FOCA engine emissions database consists of more than 450 individual engine data sets. Jet engine factors for engines above 26.7 kN thrust (emission certificated) are identical to the ICAO engine emissions databank. Emission factors for lower thrust engines, piston engines and helicopters were taken from manufacturers or from own measurements. Emission factors for turboprops could be obtained in collaboration with the Swedish Defence Research Agency (FOI)

e) Cruise Emission Factors

Most of the cruise emission factors could be taken from CORINAIR Version 2.3. To compute the aircraft cruise factors, representative flight distances per aircraft type and a load factor of 65% had to be assumed, because the factors are dependent on those. Part of the cruise factors have been taken from former CROSSAIR (1991) and SWISSAIR (1996) confidential operational data. From FOCA statistics, the great circle distance for every flight (scheduled, charter, freight) is known (In the inventory, the great circle distance was multiplied by a factor of 1.1 to estimate the effective flight distance for 1990 [Polyméris, SWISS operations, October 2005]). The table below gives emission factors per nautical mile. Multiplication with flight distance per aircraft directly produces cruise emissions per aircraft.
Some of the old or missing aircraft cruise factors had to be modeled on the basis of the ICAO engine emissions databank. Vast knowledge of aircraft types and engine technology was necessary to perform this task. For 300HP piston engine aircraft, Swiss FOCA has produced its own data, which were taken under real flight conditions (2005 data, also valid for 1990, because of no technology change). (see Appendix)

f) LTO-Times in Mode

Swiss FOCA does not use all ICAO standard cycle times for all aircraft categories. For jets, the mean time for taxi-in and taxi-out at Swiss airports has been determined 20 minutes instead of the standard 26 minutes. For jets, business jets, turboprops, piston engines and helicopters, the following times in mode were used, based on ICAO, US EPA and Swiss FOCA data (see Appendix).

g) Emission factors for CO2, H2O, SO2 and Pb

3.15 kg CO_2 / kg fuel
1.23 kg H_2O / kg fuel
0.001 kg SO_2 / kg fuel (JET-A1 only)
0.794 g Pb / kg fuel (AVGAS only)

3.2 Non-scheduled, non-charter, General Aviation (including Helicopters)

a) General remark

Within the scope of this present inventory, the emissions data for non-scheduled, non-charter, GA (helicopters etc.) could not be calculated with a Tier 3 method. The portion of fuel consumption of this kind of traffic is around 10%. Data were taken from the following study

Schadstoffemissionen und Treibstoff-Verbrauch des Zivilluftverkehrs in der Schweiz 1990[1]

and the published FOCA statistics from 1990.

Jahresstatistik BAZL 1990

b) Basic methods

For the small aircraft there was no information available about actual aircraft that have been flying and no information was recorded about their destination, however, from the fleet register, the most frequent (generic small) aircraft have been derived. The Swiss FOCA statistical database 1990 contains records of the number of all movements per airport, including all movements from airfields. Movements from airfields are dominated by small piston engine aircraft. The track distances have been estimated by mean flight times. In Switzerland, the mean cruising time for small aircraft has been estimated 20 minutes, corresponding to a mean total flight time of 30 to 40 minutes (LTO included). With this information and the FOCA emissions data base (1990), cruise emissions of small aircraft have been calculated.

For the IPCC inventory, small aircraft cruise emissions from airfields are considered 95% domestic and 5% international.

Non-charter and non-scheduled aircraft, operating from major airports have been modeled on the basis of the *BAZL Jahresstatistik 1990*, where flight movements for this kind of traffic have been recorded. Emission factors were taken from *EWI 1990*, by calculating mean values for Turboprops, Piston and Helicopter aircraft.

Helicopters can contribute quite significantly to domestic emissions. For the inventory, the number of helicopter flight segments was taken from *"Unternehmensstatistik der Schweizer Helikopterunternehmen."* The number of flight segments has been converted to movements by multiplying with a factor of two. Further corrections have been made in order to avoid double counting with LTO at airports. From fleet composition, a split between 87% single engine helicopters and 13% twin engine helicopter has been made, applying two corresponding FOCA emission factor data sets for the actual emission calculation.

For the IPCC inventory, Helicopter rotations emissions are considered 100% domestic.

4. Completeness

The methods should account for all fuel used for aviation in the country. General aviation emissions, like helicopters emissions, have been added because they are considered significant. Any other aviation related activities that generate emissions are not included within the scope of the IPCC methodology.
No Swiss fuel has been sold to Euro Airport Bâle, therefore this airport is excluded from the bottom up calculation.
With the 1990 statistical database, the determination of GA emissions is rather difficult. Apart from this, the bottom-up approach in this inventory is considered complete and therefore the

[1] *EWI, Elektrowatt Ingenieurunternehmung AG, 8034 Zürich, Bundesamt für Zivilluftfahrt (BAZL), Sektion Umwelt, 3003 Bern*

result for the calculated fuel consumption should be not more than a few percent below the effective tanked fuel quantity. The calculated domestic fuel consumption is considered complete. In order to match the reported sold fuel quantity with the bottom up calculation, any occurring difference between total fuel sold and total fuel calculated is attributed to “International” (bunker). The factor between calculated international fuel and adjusted international fuel is used to linearly scale the bunker emissions.

Table 4: Calculated totals (upper table) and adjusted international fuel and emissions (lower table):

Metric Tonnes	FUEL	CO2	H2O	SO2	Pb	NOx	VOC	CO
CH Total International	931822	2935242	1146226	932	1	11214	837	3861
CH Total Domestic	80237	252747	99244	80	4	826	116	3147
CH Total	1012060	3187989	1245470	1012	5	12039	953	7008

CH Total Fuel Sold (BFE)	1054448

CH Total International	974211	3068765	1198367	975	1	11724	875	4036
CH Total Domestic	80237	252747	99244	80	4	826	116	3147
CH Total	1054448	3321512	1297611	1054	5	12549	991	7183

5. Quality Assurance / Quality Control

5.1 Comparison of fuel burn, using alternative approaches

a) Comparison with total aviation fuel sold in Switzerland in 1990

Bottom-up calculated total fuel for charter/scheduled traffic: 980’320 Tons
Rest of Traffic, GA (EWI[1]) : 31’740 Tons
Calculated total fuel : **1’012’060 Tons**

Total aviation fuel sold: **1’054’395 Tons**

The result was obtained by direct application of activity data and predefined emission factors. The difference of 4% between bottom up calculation and reported fuel sold is considered to be acceptable. Even in the case, where actual flight paths together with sophisticated fuel flow modeling are used, differences of 10% can easily result from fuelling strategies of airlines and other operational effects.[2]

b) Comparison with EWI LTO fuel calculation for main and regional airports:

EWI[1] study, main and regional airports without Bâle total LTO fue (GA incl.): **123’527 Tons**
This calculation, main and regional airports without Bâle total LTO fuel (GA excl.):**118’914 Tons**

c) Comparison between calculated domestic total fuel and taxed aviation fuel

In 1990, the taxation of aviation fuel was not always directly linked to domestic flights. The exact mechanisms are not known anymore [Rawyler, Eidg. Zollverwaltung, 2005]. That is one of the

[2] Information obtained from former SWISSAIR fuel expert. “Tankering” can be done excessively by some airlines due to small differences of fuel prices between different countries.

reasons, why the inventory had to be calculated bottom-up. A comparison can only be used as a rough check of magnitude.

Bottom-up calculated total domestic fuel (LTO and Cruise, without GA):	57’703 Tons
Taxed aviation fuel:	24’027 Tons

Remark: The higher calculated value is in line with the finding that international flights departing from Switzerland and making an intermediate landing in Switzerland (domestic leg) were usually not taxed.

d) Consistency of total emission results with other years

Total calculated emissions for domestic and international flights have been compared between different years. The development of total emissions with time is consistent with a fleet renewal of former Swissair in the early nineties, the technological improvements and changes in fleet composition.

5.2 Review of Emission Factors

- From total fuel burn, total distance, number of pax (without freight) per aircraft type, the fuel consumption per 100 pax km has been calculated (backward calculation). The result of 2 to 10 kg fuel/100pkm is in line with expectations for 1990 passenger fleets. For freighters the calculated numbers are not representative, because they carry only a few pax besides their freight.

- The cruise emission factors have been compared to operational data from former Crossair (1991) and Swissair technical services (1996). For SWISSAIR and CROSSAIR fleets, fuel consumption has been calculated based on these (confidential) data. These data generated higher fuel consumption than the CORINAIR calculation.

5.3 Activity Data Check

a) Relation of total movements and total distances

- Result: Mean value of 867 km direct flight distance per movement.

b) Comparison between total movement numbers in this calculation and in 1990 published statistics

- In this calculation we considered all flights for which there was a form ‘Traffic Report to the airport authorities’ filled in (total heavy aircraft). The total number of movements is 266’487 (without Bâle)
- The published number of movements for scheduled and charter flights in 1990 is: 263’952 (without Bâle). The difference is due to pure cargo, post and rerouted flights, which are not considered as scheduled or charter movements.

c) Plausibility Checks

- SAS-Compiler: We used the SAS-Software (Statistical Analysis System) for programming. This software has a compiler system that controls the program flow and indicates all number of records who are read and written.
- All class variables where checked with the FREQ procedures for controlling the frequencies and the content of each variable. So we could handle the missing values.
- The totals of all calculated variables in input-work-files where listed out and the results checked.
- Domestic charter flights with DC3: The aircraft DC3 (which is in fact a pre-WW II design) was appearing in the activity data, with 101 movements at Zurich airport and other Swiss airports. Investigation showed that DC3s were actually still operated in Switzerland in 1990, with one company based in Zurich.

APPENDIX

Table 5: LTO-Cycle times

LTO_CYCLE				
Typ	Zeit_Take_Off	Zeit_Climbout	Zeit_Approach	Zeit_Taxi
BJET2	0.4	0.5	1.6	13
BJET3	0.4	0.5	1.6	13
BJET4	0.4	0.5	1.6	13
SJET4	1.2	2	2.3	20
JET3	0.7	2.2	4	20
JET1	0.7	2.2	4	20
JET2	0.7	2.2	4	20
JET4	0.7	2.2	4	20
P2	0.3	2.5	3	12
P3	0.3	2.5	3	12
TP2	0.5	2.5	4.5	13
P4	0.3	2.5	3	12
P1	0.3	2.5	3	12
TP1	0.5	2.5	4.5	13
TP4	0.5	2.5	4.5	13
HE2	0	6.5	6.5	7
HE1	0	6.5	6.5	7

Table 6: Aircraft-Engine Combinations and associated codes for SWISS FOCA emissions database.

AIRCRAFT_ENGINE_COMBINATIONS				
Aircraft_ICAO	Engine_Name	Code	Number_of_Engines	Typ
A300	CF6-50 C2	J143	2	JET2
A306	GE CF6-80C2A5	J159	2	JET2
A30B	GE CF6-50C2	J143	2	JET2
A310	JT9D-7R4D1	J361	2	JET2
A320	CFMI CFM56-5A1	J030	2	JET2
AC50		P003	2	P2
AEST		P003	2	P2
ALO2		H001	1	HE1
AN12	AL 501	T600	4	TP4
AN2		P004	1	P1
AN24	IV AI-24	T600	2	TP2
AN26	IV AI-24VT	T600	2	TP2
AT43	PWC PW120	T031	2	TP2
AT72	PW-125B	T033	2	TP2
ATP	PWC PW126	T788	2	TP2
B06	DDA 250-C20	H001	1	HE1
B190	PWC PT6A-65B	T749	2	TP2
B463	LY ALF502R-5	J690	4	JET4

AIRCRAFT_ENGINE_COMBINATIONS				
Aircraft_ICAO	Engine_Name	Code	Number_of_Engines	Typ
B703	PW JT3D-3B (HK2/COM	J300	4	JET4
B721	PW JT8D-7B (HK3/FDX	J312	3	JET3
B722	PW JT8D-15 (HK3/FDX	J341	3	JET3
B727	JT8D-15	J316	3	JET3
B732	PW JT8D-9A	J314	2	JET2
B733	CFMI CFM56-3B1	J020	2	JET2
B734	CFMI CFM56-3C1	J022	2	JET2
B73A	JT8D-15	J316	2	JET2
B73B	CFM 56-3C-1	J022	2	JET2
B741	CF6-45A	J129	4	JET4
B742	PW JT9D-7	J350	4	JET4
B743	PW JT9D-7R4G2	J366	4	JET4
B744	GE CF6-80C2B1F	J164	4	JET4
B74A	GE CF6-80C2B1F	J164	4	JET4
B74R	GE CF6-80C2B1F	J164	4	JET4
B74S	PW JT9D-7F	J352	4	JET4
B752	RR RB211-535E4	J507	2	JET2
B762	PW JT9D-7R4D	J361	2	JET2
B763	GE CF6-80C2B6	J109	2	JET2
BA11	Spey Mk511	J550	2	JET2
BA46	LY ALF502R-5	J690	4	JET4
BE10	PT6A-41	T726	2	TP2
BE20	PT6A-41	T726	2	TP2
BE55	CO IO-520-C	P121	2	P2
BE58		P003	2	P2
BE80		P003	2	P2
BN2P		P003	2	P2
C130		T201	4	TP4
C208	PWC PT6A-114	T704	1	TP1
C310		P003	2	P2
C402	CO TSIO-520-E	P121	2	P2
C425		T703	2	TP2
C500		B071	2	BJET2
C550		B072	2	BJET2
C551		B072	2	BJET2
CARJ		P002	1	P1
CL60	CF34-3A	J090	2	JET2
CONC	RR Olympus 593-610	B011	4	SJET4
CVLT		T140	2	TP2
DC10	GE CF6-50C2	J143	3	JET3
DC3		P004	2	P2
DC8	JT3D-3B	J300	4	JET4

AIRCRAFT_ENGINE_COMBINATIONS				
Aircraft_ICAO	Engine_Name	Code	Number_of_Engines	Typ
DC86	JT3D-3B	J300	4	JET4
DC9	JT8D	J315	2	JET2
DC91	PW JT8D-7B	J312	2	JET2
DC92	PW JT8D-9	J313	2	JET2
DC93	PW JT8D-9	J313	2	JET2
DC94	PW JT8D-11 (HK3/ABS	J315	2	JET2
DC95	PW JT8D-17 (HK3/ABS	J318	2	JET2
DH8A	PW-120A	T132	2	TP2
DHC6	PWC PT6A-27	T011	2	TP2
DHC7	PWC PT6A-50	T735	2	TP2
E120	PWC PW118	T765	2	TP2
F100	RR Tay 620-15	J651	2	JET2
F27	RR Dart 532-7	T114	2	TP2
F28	RR Spey 555-15P	J552	2	JET2
F50	PWC PW125B	T033	2	TP2
F900	GA TFE731-5BR-1C	B052	2	BJET2
FA20	TFE731-2-2B	B051	2	BJET2
FA50	TFE731-3	B052	3	BJET3
G159	RR Dart Mk 529-8X	T113	2	TP2
GLF2	SPEY Mk511	J554	2	JET2
GLF3	SPEY Mk511	J554	2	JET2
GLF4	TAY Mk611-8	J650	2	JET2
IL18	IV AI-20M	T999	2	TP2
IL62	KU NK-8-4	J713	4	JET4
IL76	SOL D-30KP	J751	4	JET4
IL86	KU NK-86	J710	4	JET4
L101	RR RB211-524B4	J513	3	JET3
L29A		B001	4	BJET4
L382	AL 501	T201	4	TP4
LJ35	TFE 731	B051	2	BJET2
MD80	JT8D-219	J334	2	JET2
MD82	PW JT8D-217C	J333	2	JET2
MD83	PW JT8D-219	J334	2	JET2
MD87	PW JT8D-219	J334	2	JET2
MU2	GA TPE331-10-501M	T301	2	TP2
P68		P112	2	P2
PA31		P003	2	P2
PA34		P131	2	P2
PAY3	PWC PT6A-41	T726	2	TP2
PRCE		P003	2	P2
PUMA		H002	2	HE2
S210	JT8D-9 series	J348	2	JET2
SF34	GE CT7-5A2	T051	2	TP2

AIRCRAFT_ENGINE_COMBINATIONS				
Aircraft_ICAO	**Engine_Name**	**Code**	**Number_of_Engines**	**Typ**
SH36	PWC PT6A-65AR	T748	2	TP2
SW3	RR Dart MK732-7L	T111	2	TP2
SW4	RR Dart MK732-7L	T111	2	TP2
T134	SO D-30-III	J753	2	JET2
T154	KUS-N-8-211	J714	3	JET3

Table 7: Aircraft cruise factors, used for cruise emission calculation (1990 technology)

AIRCRAFT_CRUISE_FACTORS					
Aircraft_ICAO	**Cruise_D_Source**	**kg_fuel_NM**	**kg_NOx_NM**	**g_VOC_NM**	**g_CO_NM**
A300	FOCA/91/DC10	11.1	0.31	1.11	12.2
A306	FOCA/91/DC10	11.1	0.31	1.11	12.2
A30B	FOCA/91/DC10	11.1	0.31	1.11	12.2
A310	Swissair techn services 1996	9.7	0.13	1.5	7.7
A320	250	6.8	0.11	1.1	6.9
A330	2000	12	0.16	11	17
A340	5000	13.1	0.22	9.4	12.9
AC50	FOCAP001	0.844444444	0.008208	5.792888889	636.5591111
AEST	FOCAP001	0.844444444	0.008208	5.792888889	636.5591111
ALO2	FOCAHeli	1.91	0.024	0.42	2.1
AN12	AN26*2	5.36	0.0062	143	348
AN2	FOCA/91/DC3	0.82	0.0002	13.7	1000
AN24	AN26	2.68	0.0031	71.7	174
AN26	500	2.68	0.0031	71.7	174
AT43	500	1.6	0.013	0	15
AT72	500	1.72	0.0169	0	9.66
ATP	AT72	1.72	0.0169	0	9.66
B06	FOCAHeli	1.91	0.024	0.42	2.1
B190	250	0.945	0.004	9.23	39.9
B350	250	0.844	0.0033	4.17	34.6
B463	FOCA UW 6.3.91	7	0.0739	0.4	1.7
B703	FOCAEDB	12	0.1	35	156
B721	FOCAEDB	7.6	0.07	4.1	43
B722	FOCAEDB	8.8	0.09	8	47
B727	750	8.33	0.077	4.1	16
B731	250	6.3	0.053	4.6	11
B732	B731	6.3	0.053	4.6	11
B733	B731	6.3	0.053	4.6	11
B734	250	5.8	0.057	0.66	11
B73A	B734	5.8	0.057	0.66	11
B73B	B734	5.8	0.057	0.66	11
B741	3500	21.3	0.37	5.9	18.4
B742	3500	21.3	0.37	5.9	18.4
B743	Swissair techn services 1996	26.63	0.37	5.9	18.4
B744	B742	21.3	0.37	5.9	18.4

AIRCRAFT_CRUISE_FACTORS					
Aircraft_ICAO	Cruise_D_Source	kg_fuel_NM	kg_NOx_NM	g_VOC_NM	g_CO_NM
B74A	B742	21.3	0.37	5.9	18.4
B74R	B742	21.3	0.37	5.9	18.4
B74S	B742	21.3	0.37	5.9	18.4
B752	FOCAEDB	9.4	0.114	7.3	11.7
B757	750	7.3	0.114	7.3	11.7
B762	B763	9.2	0.124	4.3	11.4
B763	2000	9.2	0.124	4.3	11.4
B777	3500	13.6	0.21	12.4	16.3
BA11	500	4.91	0.055	1.1	7.8
BA46	500	5.21	0.039	1.9	6.9
BE10	BE20	0.756	0.0032	3.2	18.2
BE20	250	0.756	0.0032	3.2	18.2
BE55	FOCAP001	0.844444444	0.008208	5.792888889	636.5591111
BE58	FOCAP001	0.844444444	0.008208	5.792888889	636.5591111
BE80	FOCAP001	0.844444444	0.008208	5.792888889	636.5591111
BN2P	FOCAP001	0.844444444	0.008208	5.792888889	636.5591111
C130	1000	6.84	0.071	1.99	12.04
C208	250	0.54	0.0031	0.126	2.01
C310	FOCAP001	0.844444444	0.008208	5.792888889	636.5591111
C402	FOCAP001	0.844444444	0.008208	5.792888889	636.5591111
C425	DHC3*2	1.14	0.0058	0.958	14.1
C500	FOCABJ	3.016	0.046	0.3	2.8
C550	FOCABJ	3.016	0.046	0.3	2.8
C551	FOCABJ	3.016	0.046	0.3	2.8
CARJ	FOCAP	0.24	0.01	1.1	71
CL60	FOCABJ	3.016	0.046	0.3	2.8
CONC	FAAEEDB1985	33.27142857	0.00002329	56.56142857	662.1014286
CVLT	F27*2	3.54	0.0046	40	214
D328	500	1.4	0.012	0	11.2
DC10	2500	15.6	0.27	14.2	17.3
DC3	FOCA/91/DC3	1.64	0.0004	27.4	2000
DC8	FOCAB703	12	0.1	35	156
DC86	FOCAB703	12	0.1	35	156
DC9	500	6.1	0.057	3.7	11
DC91	DC9	6.1	0.057	3.7	11
DC92	DC9	6.1	0.057	3.7	11
DC93	DC9	6.1	0.057	3.7	11
DC94	DC9	6.1	0.057	3.7	11
DC95	DC9	6.1	0.057	3.7	11
DH8A	DH8D	3.12	0.042	0	14.1
DH8D	500	3.12	0.042	0	14.1
DHC3	250	0.57	0.0029	0.479	7.05
DHC6	DHC3*2	1.14	0.0058	0.958	14.1
DHC7	500	1.95	0.0099	0.975	16.8

AIRCRAFT_CRUISE_FACTORS					
Aircraft_ICAO	**Cruise_D_Source**	**kg_fuel_NM**	**kg_NOx_NM**	**g_VOC_NM**	**g_CO_NM**
E110	250	0.899	0.0052	0.194	3.48
E120	FOCA/87/TP Altenrhein	1.87	0.002	0.19	2.1
F100	500	5.2	0.044	2	7.5
F27	250	1.77	0.0023	20	107
F28	250	4.9	0.054	12.4	13.3
F406	250	0.583	0.0029	0.63	7.63
F50	250	2.23	0.028	0	12
F900	FOCABJ	3.016	0.046	0.3	2.8
FA20	FOCABJ	3.016	0.046	0.3	2.8
FA50	FOCABJ*1.5	4.5	0.069	0.45	4.2
G159	F27	1.77	0.0023	20	107
GLF2	FOCABJ*1.5	4.5	0.069	0.45	4.2
GLF3	FOCABJ*1.5	4.5	0.069	0.45	4.2
GLF4	DC9	5.9	0.057	3.7	11
IL18	F27	1.77	0.0023	20	107
IL62	FOCAEDB	19	0.18	58	261
IL76	FOCAEDB	16	0.16	33	147
IL86	FOCAEDB	19	0.17	19	126
JS32	250	0.98	0.01	0.494	6.8
JS41	250	1.35	0.013	0.694	8.79
L101	FOCAEDB	15.8	0.3	16	16
L29A	FA50	4.5	0.069	0.45	4.2
L382	F27*2	3.54	0.0046	40	214
LJ35	FOCABJ	3.016	0.046	0.3	2.8
MD80	MD82	7.1	0.099	3.6	10.7
MD82	500	7.1	0.099	3.6	10.7
MD83	MD82	7.1	0.099	3.6	10.7
MD87	MD82	7.1	0.099	3.6	10.7
MU2	BE20	0.756	0.0032	3.2	18.2
P3	1000	5.27	0.0479	3.68	14.9
P68	FOCAP001	0.844444444	0.008208	5.792888889	636.5591111
PA31	FOCAP001	0.844444444	0.008208	5.792888889	636.5591111
PA34	FOCAP001	0.844444444	0.008208	5.792888889	636.5591111
PAY3	BE20	0.756	0.0032	3.2	18.2
PRCE	FOCAP001	0.844444444	0.008208	5.792888889	636.5591111
PUMA	FOCAHeli*2	3.82	0.048	0.82	4.2
S210	DC9	6.1	0.057	3.7	11
SB20	250	2.67	0.029	0.156	10.5
SF34	FOCA UW 6.3.91	2.16	0.01	4.6	20
SH36	250	1.53	0.0081	6.1	37
SW3	250	0.8	0.0079	0.48	6.4
SW4	SW3	0.8	0.0079	0.48	6.4
T134	FOCAEDB	7	0.058	7	77
T154	FOCAEDB	13.8	0	34	131