Appendix K: Emissions Indices[1]

Section 1 – Boeing Method Two Indices

This section contains global emission indices from "Scheduled Civil Aircraft Emission Inventories for 1992: Database Development and Analysis", Appendix M (NASA Contractor Report 4700). These were calculated by integrating the fuel burned and emissions over the 0-9 kilometer altitude band and over the 9-13 kilometer band.

Section 2 – ICAO Indices

This section contains emission indices from "ICAO Engine Exhaust Emissions Data Bank", (Doc 9646-AN/943).

[1] This appendix was developed by Donna Middleton (FAA/SETA).

Appendix K, Section 1: Boeing Method Two Indices

	0-9 km Altitude Band (lbs/1000)			9-13 km Altitude Band (lbs/1000)		
Engine	NOx	CO	HC	NOx	CO	HC
146-200/ALF502R-5	8.8	7.9	0.8	7.7	0.2	0
727-100/JT8D-7B	10.8	7.4	2.2	7.8	3.8	1.1
72S-200/JT8D-15	11.7	4.9	0.7	8.7	2.3	0.5
737-200/JT8D-15	10.8	5.4	0.8	7.7	3.3	0.7
73L-500/CFM56-3C	11.4	12.9	0.8	9.4	3.8	0.2
73Y-300/CFM56-3B	12.2	15.6	1.3	9.6	2.9	0.2
73Z-400/CFM56-3B	12.2	15	1.1	9.6	3.5	0.2
747-100/JT9D-7A	24	21.4	11.2	13.9	0.4	0.6
747-200B/JT9D-7Q	20	21.1	7.5	12.5	0.8	0.7
74I-400/PW4056	21.2	3.6	0.3	14.2	0.3	0.3
757-200/RB211-535E4	20.7	11.5	1.1	10.3	2.9	0.1
767-200/CF6-80A	18.8	6.9	1.5	12.5	2.9	0.6
A30B2-100/CF6-50C2R	21.2	17.7	7.1	15.2	1.1	0.9
A31-200/CF6-80A3	17.6	7.4	1.7	13	2.4	0.6
A32-200/CFM56-5A1	14.9	7.1	0.7	11.1	2.2	0.5
AT4/LGTURB	13.1	4.3	0			
B3C-320CH/JT3D-3B	15.1	38.8	44.3	5.9	7.7	7.7
BAC-500/RR_SPEY-512	11.4	12.7	1.6	9.3	2.6	0.5
BE1/SMTURB	8.2	4	0.2			
BEK/SMTURB	8.2	3.9	0.2			
CNJ/	10.5	5.9	0.5	9.9	2.1	0.4
Concorde	10.4	27.9	5.4	10	26	1.8
D10-10/CF6-6D	20.6	18.3	6.8	12.6	2.2	1.4
D8C-33F/JT4A-11	7.3	44.9	38.4	5.4	7.4	2
D8S-63H/JT3D-7	8.1	32.4	26.6	6.1	4.2	1.3
D9S-30/JT8D-7B	9.4	9.5	3	8.1	2.1	0.5
D9X-50/JT8D-17	10.7	6.1	0.8	9.4	2.3	0.5
D9Z-82/JT8D-217	14.7	5.6	1.6	10.7	3.8	1.3
DH3/MDTURB	11.8	5	0.6			
DH8/MDTURB	11.8	5.1	0.6			

Appendix K, Section 1: Boeing Method Two Indices

	0-9 km Altitude Band (lbs/1000)			9-13 km Altitude Band (lbs/1000)		
Engine	NOx	CO	HC	NOx	CO	HC
DLR-30/CF6-50C2	21.3	18	6.7	12.6	2.1	1.3
EMB/SMTURB	8.1	4	0.2			
F10-100/TAY620-15	11.4	15.5	2.1	8	3.2	1.1
F28-4000/RR_SPEY-MK555	10.5	6	0.5	8.5	1.5	0.4
F50/LGTURB	13	4.3	0			
I62/SOL	14.6	34.2	39.5	5.9	5.9	6
I72/	15.1	38.7	44.5	5.8	8	7.9
I86/KUZ	15.1	38.8	44.7	5.8	8.1	8
L10-1/RB211-22B	18.2	25.4	18.8	14.7	3.1	1
L4T/SMTURB	8.2	3.8	0.2			
LRJ/	10.7	5.6	0.5	8.7	1.3	0.4
MDL-11P/PW4460	19.6	7.5	0.6	13	1.5	0.2
MU2/SMTURB	8.4	3.7	0.2			
PA6/SMTURB	8.4	3.6	0.2			
SF3/MDTURB	11.7	5.1	0.6			
SH6/MDTURB	12.3	5.1	0.6			
T34/SOL	9.4	9.3	2.9	8	2.1	0.5

Appendix K, Section 2: ICAO Indices

	TAKE OFF					CLIMB OUT				
ENGINE	TIME (mins)	FUEL (kg/sec)	HC (lbs/1000)	CO (lbs/1000)	NOx (lbs/1000)	TIME (mins)	FUEL (kg/sec)	HC (lbs/1000)	CO (lbs/1000)	NOx (lbs/1000)
501D22A	0.7	0.299	0.28	2.00	8.88	2.2	0.277	0.89	2.10	9.22
ALF 502R-5	0.7	0.358	0.06	0.30	13.53	2.2	0.296	0.05	0.25	10.56
CF34-3A	0.7	0.407	0.06	0.00	11.61	2.2	0.334	0.06	0.00	10.14
CF6-50C2	0.7	2.487	0.60	0.50	36.30	2.2	1.975	0.70	0.50	29.70
CF6-6D	0.7	1.736	0.30	0.50	40.00	2.2	1.431	0.30	0.50	32.60
CF6-80A	0.7	2.145	0.29	1.00	29.80	2.2	1.795	0.29	1.10	25.60
CF6-80A3	0.7	2.254	0.30	1.00	29.60	2.2	1.885	0.37	1.10	26.60
CF6-80C2A5	0.7	2.580	0.04	0.06	28.57	2.2	2.096	0.05	0.04	21.69
CF6-80C2D1F	0.7	2.629	0.04	0.05	28.12	2.2	2.126	0.05	0.04	21.30
CF6-80E1A2	0.7	2.767	0.04	0.05	28.72	2.2	2.245	0.04	0.04	22.01
CFM56-3-B1	0.7	0.946	0.04	0.90	17.70	2.2	0.792	0.05	0.95	15.50
CFM56-3C-1	0.7	1.154	0.03	0.90	20.70	2.2	0.954	0.04	0.90	17.80
CFM56-5-A1	0.7	1.051	0.23	0.90	24.60	2.2	0.862	0.23	0.90	19.60
CFM56-5C2	0.7	1.308	0.01	0.93	32.60	2.2	1.076	0.01	0.80	25.80
CJ610-2C	0.7	0.350	0.10	27.00	4.20	2.2	0.306	0.20	27.00	3.70
CJ610-6	0.7	0.350	0.10	27.00	4.20	2.2	0.288	0.20	28.00	3.50
CT7-5	0.5	0.101	1.00	2.50	13.80	2.5	0.094	1.00	2.70	13.20
D-36	0.7	0.634	0.00	0.50	26.00	2.2	0.533	0.00	0.40	22.00
F100-PW-100	0.7	5.569	0.10	55.10	16.50	2.2	1.310	0.05	1.80	44.00
IO-360-B	0.7	0.013	10.00	199.00	1.99	2.2	0.009	8.16	983.30	4.59
JT3D-3B	0.7	1.174	4.00	1.50	12.10	2.2	0.932	2.00	2.80	9.90
JT3D-7 (SERIES)	0.7	1.254	0.50	0.89	12.69	2.2	1.032	0.40	1.90	9.59
JT8D-15(REC)	0.7	1.178	0.24	0.03	19.40	2.2	0.945	0.28	1.15	15.10
JT8D-17	0.7	1.245	0.22	0.90	20.60	2.2	0.997	0.27	1.10	15.70
JT8D-217	0.7	1.320	0.28	0.80	25.70	2.2	1.078	0.43	1.20	20.60
JT8D-7 SERIES (REC)	0.7	0.989	0.25	0.90	17.20	2.2	0.811	0.25	1.10	14.00
JT9D-7A	0.7	2.099	0.10		38.70	2.2	1.789	0.10		28.50
JT9D-7Q	0.7	2.442	0.20	0.20	31.60	2.2	2.000	0.20	0.20	25.60
O-200	0.7	0.006	20.81	974.10	4.87	2.2	0.006	20.81	974.10	4.87

Appendix K, Section 2: ICAO Indices

	TAKE OFF					CLIMB OUT				
ENGINE	TIME (mins)	FUEL (kg/sec)	HC (lbs/1000)	CO (lbs/1000)	NOx (lbs/1000)	TIME (mins)	FUEL (kg/sec)	HC (lbs/1000)	CO (lbs/1000)	NOx (lbs/1000)
OLYMPUS 593 MK610	1.2	6.365	2.90	29.00	9.50	2	2.329	1.70	19.90	9.30
PT6A-45	0.7	0.080	0.00	0.71	9.70	2.2	0.070	0.00	0.94	9.00
PT6A-65B	0.7	0.080	0.00	4.70	7.00	2.2	0.070	0.00	6.40	6.60
PW118	0.7	0.120	0.00	2.20	12.70	2.2	0.110	0.00	2.40	12.00
PW120	0.7	0.130	0.00	2.00	13.80	2.2	0.110	0.00	2.30	12.30
PW125B	0.7	0.150	0.00	2.10	18.10	2.2	0.140	0.00	2.10	16.30
PW4056	0.7	2.342	0.06	0.44	28.10	2.2	1.930	0.01	0.57	22.90
PW4084	0.7	3.411	0.10	0.10	45.00	2.2	2.689	0.10	0.10	35.50
PW4460	0.7	2.647	0.10	0.37	32.80	2.2	2.085	0.03	0.51	24.70
RB211-22B (REV.)	0.7	1.877	0.15	0.78	37.33	2.2	1.546	0.25	1.68	26.89
RB211-535E4	0.7	1.860	0.04	1.01	52.70	2.2	1.510	0.01	1.23	36.20
SPEY MK511	0.7	0.889	0.98	1.81	23.27	2.2	0.726	1.32	2.06	19.18
SPEY MK555	0.7	0.720	0.88	0.44	18.92	2.2	0.589	0.16	0.00	14.64
T53-L-11D	0.7	0.086	0.29	3.00	7.36	2.2	0.086	0.29	3.00	7.36
TAY MK620-15	0.7	0.760	0.80	0.70	21.10	2.2	0.630	0.30	0.80	16.80
TF30-P-412A(JFT 10A)	0.7	5.040	1.00	15.00	6.75	2.2	0.932	0.09	2.10	16.66
TF33-P-3	0.7	1.257	0.30	1.30	11.00	2.2	0.923	0.40	1.80	9.00
TFE731-2-2B	0.7	0.205	0.11	1.39	15.25	2.2	0.173	0.13	2.03	13.08
TPE 331-3	0.7	0.058	0.11	0.80	12.36	2.2	0.052	0.15	1.00	11.86
V2525-D5	0.7	1.053	0.04	0.53	26.50	2.2	0.880	0.04	0.62	22.30

Appendix K, Section 2: ICAO Indices

	APPROACH					IDLE				
ENGINE	TIME (mins)	FUEL (kg/sec)	HC (lbs/1000)	CO (lbs/1000)	NOx (lbs/1000)	TIME (mins)	FUEL (kg/sec)	HC (lbs/1000)	CO (lbs/1000)	NOx (lbs/1000)
501D22A	4	0.144	1.96	5.10	7.49	26	0.077	17.61	43.60	3.52
ALF 502R-5	4	0.103	0.22	7.10	6.60	26	0.041	5.39	40.93	3.78
CF34-3A	4	0.119	0.13	1.90	6.86	26	0.050	3.95	42.60	3.82
CF6-50C2	4	0.660	1.00	4.30	9.50	26	0.215	21.80	61.80	3.60
CF6-6D	4	0.484	0.70	6.50	11.40	26	0.173	21.00	54.20	4.50
CF6-80A	4	0.615	0.47	3.10	10.30	26	0.150	6.29	28.20	3.40
CF6-80A3	4	0.641	0.45	2.80	10.80	26	0.150	6.28	28.20	3.40
CF6-80C2A5	4	0.672	0.11	1.91	12.53	26	0.205	1.48	18.89	4.76
CF6-80C2D1F	4	0.688	0.11	1.90	12.66	26	0.205	1.38	18.02	4.85
CF6-80E1A2	4	0.724	0.11	1.85	12.66	26	0.228	1.25	17.37	4.88
CFM56-3-B1	4	0.290	0.08	3.80	8.30	26	0.114	2.28	34.40	3.90
CFM56-3C-1	4	0.336	0.07	3.10	9.10	26	0.124	1.42	26.80	4.30
CFM56-5-A1	4	0.291	0.40	2.50	8.00	26	0.101	1.40	17.60	4.00
CFM56-5C2	4	0.356	0.08	1.75	10.00	26	0.118	5.68	34.00	4.19
CJ610-2C	4	0.124	2.70	88.00	1.50	26	0.064	18.00	155.00	0.90
CJ610-6	4	0.129	0.00	88.00	1.50	26	0.064	18.00	155.00	0.90
CT7-5	4.5	0.045	1.50	5.30	6.90	26	0.015	4.00	35.40	2.20
D-36	4	0.211	0.00	2.70	9.00	26	0.000	5.40	20.70	5.50
F100-PW-100	4	0.378	0.60	3.00	11.00	26	0.134	2.26	19.30	3.96
IO-360-B	4	0.005	9.70	691.30	10.10	26	0.001	49.20	897.40	1.16
JT3D-3B	4	0.346	4.00	24.50	4.80	26	0.135	112.00	98.00	25.00
JT3D-7 (SERIES)	4	0.389	2.10	19.50	5.30	26	0.128	123.00	138.99	2.20
JT8D-15(REC)	4	0.340	0.55	2.77	6.90	26	0.148	1.46	11.00	3.20
JT8D-17	4	0.354	1.96	2.70	8.00	26	0.147	1.25	10.50	3.20
JT8D-217	4	0.383	1.60	4.20	9.10	26	0.137	3.33	12.30	3.70
JT8D-7 SERIES (REC)	4	0.286	0.40	2.20	6.30	6	0.129	3.80	14.30	3.15
JT9D-7A	4	0.619	1.30	7.60	7.60	26	0.211	36.10	83.60	3.10
JT9D-7Q	4	0.680	0.30	1.70	7.80	26	0.237	12.00	53.00	3.00
O-200	4	0.003	0.03	1,187.80	1.14	26	0.001	29.00	644.40	1.58

Appendix K, Section 2: ICAO Indices

	APPROACH					IDLE				
ENGINE	TIME (mins)	FUEL (kg/sec)	HC (lbs/1000)	CO (lbs/1000)	NOx (lbs/1000)	TIME (mins)	FUEL (kg/sec)	HC (lbs/1000)	CO (lbs/1000)	NOx (lbs/1000)
OLYMPUS 593 MK610	2.3	1.171	11.40	52.90	3.50	26	0.421	33.40	100.10	1.70
PT6A-45	4	0.040	0.00	4.80	6.20	26	0.021	3.40	21.00	4.00
PT6A-65B	4	0.041	3.80	21.80	4.50	26	0.022	22.00	66.00	2.90
PW118	4	0.060	0.00	6.50	7.90	26	0.040	0.00	16.30	5.50
PW120	4	0.070	0.00	6.00	8.10	26	0.040	0.00	14.90	5.70
PW125B	4	0.080	0.00	3.50	10.00	26	0.050	0.00	9.20	6.90
PW4056	4	0.658	0.13	2.00	11.60	26	0.208	1.92	21.86	4.80
PW4084	4	0.875	0.20	0.40	12.00	26	0.242	2.70	18.70	4.40
PW4460	4	0.703	0.14	1.78	12.00	26	0.213	1.66	20.32	4.90
RB211-22B (REV.)	4	0.566	5.96	20.65	8.18	26	0.225	67.75	88.99	2.86
RB211-535E4	4	0.570	0.04	1.71	7.50	26	0.190	1.00	15.44	4.30
SPEY MK511	4	0.279	7.23	20.30	7.94	26	0.119	56.73	97.96	1.48
SPEY MK555	4	0.222	6.97	22.22	5.92	26	0.115	92.74	88.23	1.83
T53-L-11D	4	0.086	0.29	3.00	7.36	26	0.018	63.38	29.60	1.41
TAY MK620-15	4	0.230	0.90	3.90	5.70	26	0.110	3.40	24.10	2.50
TF30-P-412A(JFT 10A)	4	0.327	1.12	15.20	7.08	26	0.126	38.44	68.20	2.40
TF33-P-3	4	0.478	3.79	9.00	7.30	26	0.107	91.96	88.50	1.77
TFE731-2-2B	4	0.067	4.26	22.38	5.90	26	0.024	20.04	58.60	2.82
TPE 331-3	4	0.032	0.64	7.00	9.92	26	0.014	79.11	61.50	2.86
V2525-D5	4	0.319	0.06	2.44	8.90	26	0.128	0.11	12.43	4.70