Supporting European Aviation

EUROCONTROL

TFEIP 2023

Update to Aviation Guidance document and annexes 1 & 2

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CONSORTIUM COORDINATOR sesar DEPLOYMENT MANAGER

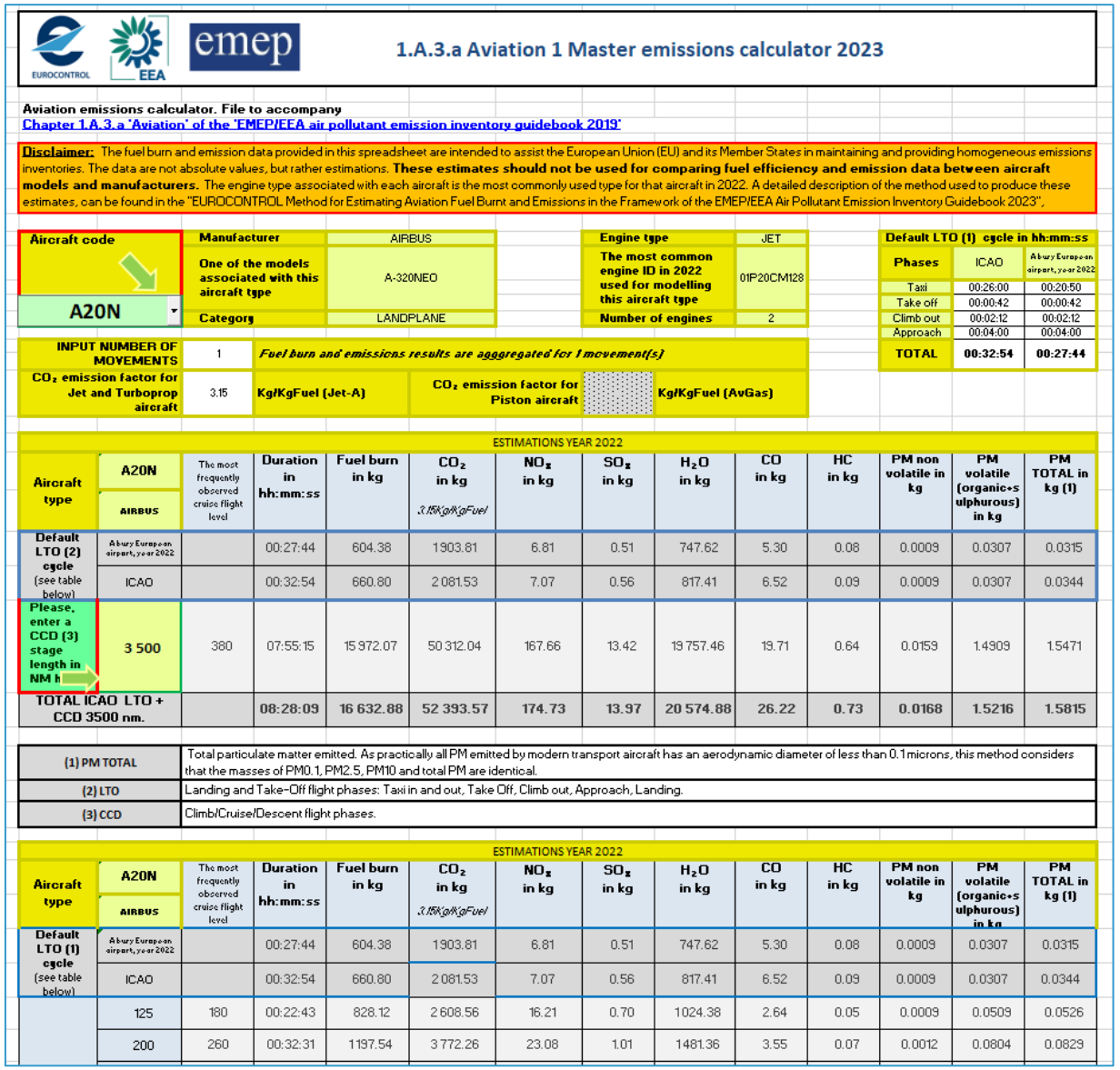
FOUNDING MEMBER sesar JOINT UNDERTAKING

NETWORK MANAGER

Update to the Aviation Guidance document

- Overview minor updates (clarification)
- Updates of table 2.1 – from 2015 to 2022 data
- Update 2.3 Activities related to flight movements (clarification)
- Update 2.4 Categories of flights (clarification)
- Update 2.6 Controls – New ICAO standards – CO2 , nvPM; “Note Frame” deleted
- Update 2.7 Contribution of air traffic to total emissions
- Table 2.3 to be updated
- References to EEA, 2016 guidance document to be replaced by 2023 edition
- Update of Table 3.7 Annex 1
- Some References updated (some links were directing to wrong URL)
- Annex 1 – Updated Figures from EAER 2022; Text to be reviewed
- Table A1.2 – to be updated
- Annex 2 – to be updated
- Annex 3 – to be updated
- Annex 4 – Updated (clarification)

Annex 1 – Master calculator Updated



1.A.3.a Aviation 1 Master emissions calculator 2023

Aviation emissions calculator. File to accompany
Chapter 1.A.3.a 'Aviation' of the 'EMEP/EEA air pollutant emission inventory guidebook 2019'

Disclaimer: The fuel burn and emission data provided in this spreadsheet are intended to assist the European Union (EU) and its Member States in maintaining and providing homogeneous emissions inventories. The data are not absolute values, but rather estimations. **These estimates should not be used for comparing fuel efficiency and emission data between aircraft models and manufacturers.** The engine type associated with each aircraft is the most commonly used type for that aircraft in 2022. A detailed description of the method used to produce these estimates, can be found in the "EUROCONTROL Method for Estimating Aviation Fuel Burnt and Emissions in the Framework of the EMEP/EEA Air Pollutant Emission Inventory Guidebook 2023".

Aircraft code		Manufacturer	AIRBUS	Engine type	JET
A20N		One of the models associated with this aircraft type	A-320NEO	The most common engine ID in 2022 used for modelling this aircraft type	01P20CM128
		Category	LANDPLANE	Number of engines	2

Default LTO (1) cycle in hh:mm:ss		
Phases	ICAO	Albury European airport, year 2022
Taxi	00:26:00	00:20:50
Take off	00:00:42	00:00:42
Climb out	00:02:12	00:02:12
Approach	00:04:00	00:04:00
TOTAL	00:32:54	00:27:44

INPUT NUMBER OF MOVEMENTS	1	*Fuel burn and emissions results are aggregated for 1 movement(s)*			
CO_2 emission factor for Jet and Turboprop aircraft	3.15	Kg/KgFuel (Jet-A)	CO_2 emission factor for Piston aircraft		Kg/KgFuel (AvGas)

ESTIMATIONS YEAR 2022

Aircraft type	A20N / AIRBUS	The most frequently observed cruise flight level	Duration in hh:mm:ss	Fuel burn in kg	CO_2 in kg (3.15Kg/KgFuel)	NO_x in kg	SO_x in kg	H_2O in kg	CO in kg	HC in kg	PM non volatile in kg	PM volatile (organic+sulphurous) in kg	PM TOTAL in kg (1)
Default LTO (2) cycle (see table below)	Albury European airport, year 2022		00:27:44	604.38	1903.81	6.81	0.51	747.62	5.30	0.08	0.0009	0.0307	0.0315
	ICAO		00:32:54	660.80	2 081.53	7.07	0.56	817.41	6.52	0.09	0.0009	0.0307	0.0344
Please, enter a CCD (3) stage length in NM h	3 500	380	07:55:15	15 972.07	50 312.04	167.66	13.42	19 757.46	19.71	0.64	0.0159	1.4909	1.5471
TOTAL ICAO LTO + CCD 3500 nm.			08:28:09	16 632.88	52 393.57	174.73	13.97	20 574.88	26.22	0.73	0.0168	1.5216	1.5815

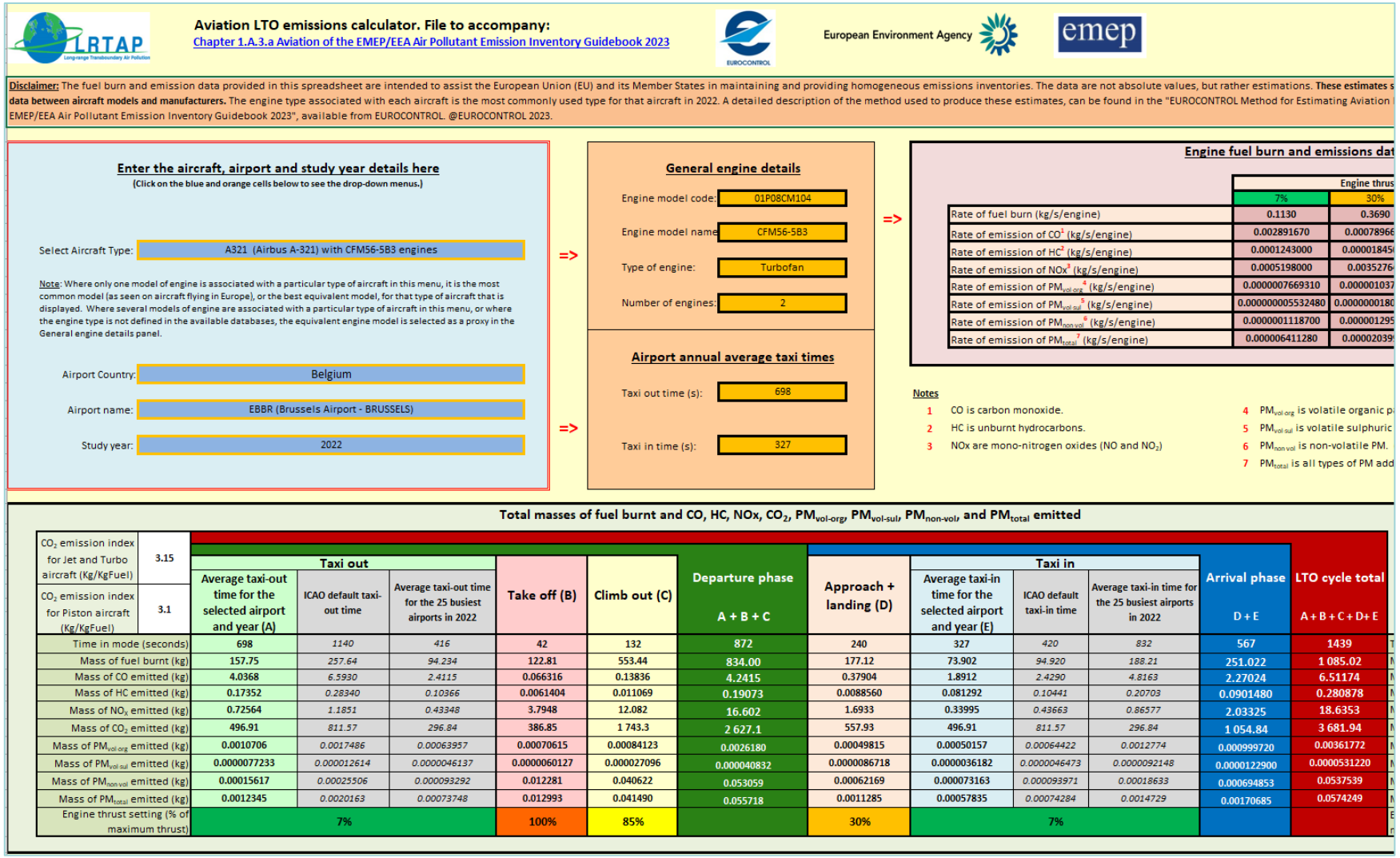
(1) PM TOTAL	Total particulate matter emitted. As practically all PM emitted by modern transport aircraft has an aerodynamic diameter of less than 0.1 microns, this method considers that the masses of PM0.1, PM2.5, PM10 and total PM are identical.
(2) LTO	Landing and Take-Off flight phases: Taxi in and out, Take Off, Climb out, Approach, Landing.
(3) CCD	Climb/Cruise/Descent flight phases.

ESTIMATIONS YEAR 2022

Aircraft type	A20N / AIRBUS	The most frequently observed cruise flight level	Duration in hh:mm:ss	Fuel burn in kg	CO_2 in kg (3.15Kg/KgFuel)	NO_x in kg	SO_x in kg	H_2O in kg	CO in kg	HC in kg	PM non volatile in kg	PM volatile (organic+sulphurous) in kg	PM TOTAL in kg (1)
Default LTO (1) cycle (see table below)	Albury European airport, year 2022		00:27:44	604.38	1903.81	6.81	0.51	747.62	5.30	0.08	0.0009	0.0307	0.0315
	ICAO		00:32:54	660.80	2 081.53	7.07	0.56	817.41	6.52	0.09	0.0009	0.0307	0.0344
	125	180	00:22:43	828.12	2 608.56	16.21	0.70	1024.38	2.64	0.05	0.0009	0.0509	0.0526
	200	260	00:32:31	1197.54	3 772.26	23.08	1.01	1481.36	3.55	0.07	0.0012	0.0804	0.0829

- Updated aircraft types list 2022
- 2 CO2 emissions factor (Jet fuel & Avgas)
- Updated average taxi / out times
- New ICAO nvPM method

Annex 2 – LTO calculator Updated



Aviation LTO emissions calculator. File to accompany:
Chapter 1.A.3.a Aviation of the EMEP/EEA Air Pollutant Emission Inventory Guidebook 2023

European Environment Agency

Disclaimer: The fuel burn and emission data provided in this spreadsheet are intended to assist the European Union (EU) and its Member States in maintaining and providing homogeneous emissions inventories. The data are not absolute values, but rather estimations. **These estimates s data between aircraft models and manufacturers.** The engine type associated with each aircraft is the most commonly used type for that aircraft in 2022. A detailed description of the method used to produce these estimates, can be found in the "EUROCONTROL Method for Estimating Aviation EMEP/EEA Air Pollutant Emission Inventory Guidebook 2023", available from EUROCONTROL. @EUROCONTROL 2023.

Enter the aircraft, airport and study year details here
(Click on the blue and orange cells below to see the drop-down menus.)

Select Aircraft Type: A321 (Airbus A-321) with CFM56-5B3 engines

Note: Where only one model of engine is associated with a particular type of aircraft in this menu, it is the most common model (as seen on aircraft flying in Europe), or the best equivalent model, for that type of aircraft that is displayed. Where several models of engine are associated with a particular type of aircraft in this menu, or where the engine type is not defined in the available databases, the equivalent engine model is selected as a proxy in the General engine details panel.

Airport Country: Belgium
Airport name: EBBR (Brussels Airport - BRUSSELS)
Study year: 2022

General engine details
Engine model code: 01P08CM104
Engine model name: CFM56-5B3
Type of engine: Turbofan
Number of engines: 2

Airport annual average taxi times
Taxi out time (s): 698
Taxi in time (s): 327

Engine fuel burn and emissions dat

	Engine thrus 7%	30%
Rate of fuel burn (kg/s/engine)	0.1130	0.3690
Rate of emission of CO[1] (kg/s/engine)	0.002891670	0.00078966
Rate of emission of HC[2] (kg/s/engine)	0.0001243000	0.00001845
Rate of emission of NOx[3] (kg/s/engine)	0.0005198000	0.0035276
Rate of emission of $PM_{vol\,org}$[4] (kg/s/engine)	0.000007669310	0.000001037
Rate of emission of $PM_{vol\,sul}$[5] (kg/s/engine)	0.000000005532480	0.0000000180
Rate of emission of $PM_{non\,vol}$[6] (kg/s/engine)	0.0000001118700	0.000001295
Rate of emission of PM_{total}[7] (kg/s/engine)	0.000006411280	0.00002039

Notes
1 CO is carbon monoxide.
2 HC is unburnt hydrocarbons.
3 NOx are mono-nitrogen oxides (NO and NO_2)
4 $PM_{vol\,org}$ is volatile organic p
5 $PM_{vol\,sul}$ is volatile sulphuric
6 $PM_{non\,vol}$ is non-volatile PM.
7 PM_{total} is all types of PM add

Total masses of fuel burnt and CO, HC, NOx, CO_2, $PM_{vol\text{-}org}$, $PM_{vol\text{-}sul}$, $PM_{non\text{-}vol}$, and PM_{total} emitted

		Taxi out					Departure phase		Taxi in			Arrival phase	LTO cycle total
CO_2 emission index for Jet and Turbo aircraft (Kg/KgFuel)	3.15	Average taxi-out time for the selected airport and year (A)	ICAO default taxi-out time	Average taxi-out time for the 25 busiest airports in 2022	Take off (B)	Climb out (C)	A + B + C	Approach + landing (D)	Average taxi-in time for the selected airport and year (E)	ICAO default taxi-in time	Average taxi-in time for the 25 busiest airports in 2022	D + E	A + B + C + D + E
CO_2 emission index for Piston aircraft (Kg/KgFuel)	3.1												
Time in mode (seconds)		698	1140	416	42	132	872	240	327	420	832	567	1439
Mass of fuel burnt (kg)		157.75	257.64	94.234	122.81	553.44	834.00	177.12	73.902	94.920	188.21	251.022	1 085.02
Mass of CO emitted (kg)		4.0368	6.5930	2.4115	0.066316	0.13836	4.2415	0.37904	1.8912	2.4290	4.8163	2.27024	6.51174
Mass of HC emitted (kg)		0.17352	0.28340	0.10366	0.0061404	0.011069	0.19073	0.0088560	0.081292	0.10441	0.20703	0.0901480	0.280878
Mass of NO_x emitted (kg)		0.72564	1.1851	0.43348	3.7948	12.082	16.602	1.6933	0.33995	0.43663	0.86577	2.03325	18.6353
Mass of CO_2 emitted (kg)		496.91	811.57	296.84	386.85	1 743.3	2 627.1	557.93	496.91	811.57	296.84	1 054.84	3 681.94
Mass of $PM_{vol\,org}$ emitted (kg)		0.0010706	0.0017486	0.00063957	0.00070615	0.00084123	0.0026180	0.00049815	0.00050157	0.00064422	0.0012774	0.000999720	0.00361772
Mass of $PM_{vol\,sul}$ emitted (kg)		0.0000077233	0.000012614	0.0000046137	0.0000060127	0.000027096	0.000040832	0.0000086718	0.0000036182	0.0000046473	0.0000092148	0.0000122900	0.0000531220
Mass of $PM_{non\,vol}$ emitted (kg)		0.00015617	0.00025506	0.000093292	0.012281	0.040622	0.053059	0.00062169	0.000073163	0.000093971	0.00018633	0.000694853	0.0537539
Mass of PM_{total} emitted (kg)		0.0012345	0.0020163	0.00073748	0.012993	0.041490	0.055718	0.0011285	0.00057835	0.00074284	0.0014729	0.00170685	0.0574249
Engine thrust setting (% of maximum thrust)		7%			100%	85%		30%	7%				

- Updated aircraft types list 2022
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- Updated average taxi / out times
- New ICAO nvPM method

Thank you for your attention!

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