EEA – FEIS

1.A.3.a Aviation Annex 1

Release note – Edition 2023

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# Introduction

This document presents the modifications made to the file “1.A.3.a Aviation 1 Master emissions calculator” that is an annex to the EMEP/EEA air pollutant emission inventory guidebook.

The previous version of this file was produced in 2020.

# Glossary

|  |  |
| --- | --- |
| **Item/Acronym** | **Definition** |
| AEM | EUROCONTROL **Advanced Emissions Model**; The application used for calculating the amount of fuel burn and emissions. |
| ANP | EUROCONTROL **Aircraft Noise and Performance database**; Used for the calculation of aircraft performances and trajectory below 6,000 feet . |
| BADA | EUROCONTROL **BAse of Aircraft Data**; Used for the calculation of the trajectory of aircraft above 6,000 feet and the calculation of fuel consumption. |
| ECAC | **European Civil Aviation Conference** |
| EEDB | **Engine Emissions DataBank**. The public database that describes the jet engine emissions indices. |
| ICAO | **International Civil Aviation Organisation** |
| IMPACT | EUROCONTROL application for noise and emission impact assessments. It integrates an advanced trajectory calculation model based on ANP and BADA that is used in this context. |
| LTO | **Landing** **and** **Take-Off** operations:   * Taxi in and out * Take off * Climb out * Approach * Landing   By convention, LTO phases of flight concern the evolutions of the aircraft below 3000ft elevation |
| CCD | **Climb Cruise and Descent** operations:   * All flight operations above 3000ft |

# References

1. EMEP\_EEA\_air\_pollutant\_emission\_inventory\_annex1\_method\_V2.0\_24.01.2023
2. ICAO Doc 9889 – Airport Air Quality Manual Second edition - <https://www.icao.int/publications/documents/9889_cons_en.pdf>
3. Global Civil Aviation Black Carbon Emissions. ACS Publications (2016) - Stettler, Marc E. J.; Boies, Adam M.; Petzold, Andreas; R. H. Barrett, Steven - <https://doi.org/10.1021/es401356v>
4. ICAO CAEP - Committee on Aviation Environmental Protection - <https://www.icao.int/ENVIRONMENTAL-PROTECTION/Pages/CAEP.aspx>

# Purpose of the changes

This new version makes it possible to:

* take into account new aircraft that have entered into operation since then. For example, since mid-2010 a new generation of aircraft equipped with so-called "Neo" engines has been introduced;
* reflect changes observed in the route network (e.g. cruise levels);
* take into account updates of engine emission indexes data (EEDB);
* take into account updates of flight performance data (ANP and BADA);
* take into account the evolution of the modelling applications: IMPACT and AEM, including the update of the calculation method of the new non-volatile particulate matters.

# Edition 2023

## Modelling applications and data sources

### Tools and references

The method followed for the calculation of the raw data that are used in the “1.A.3.a Aviation annex 1 2023.zip” is described in details in the document “EUROCONTROL Method for estimating aviation fuel burnt and emissions in the framework of the EMEP/EEA air pollutant emission inventory guidebook 2016” available here: <https://www.eurocontrol.int/publication/eurocontrol-method-estimating-aviation-fuel-burnt-and-emissions>

For the release 2023 of the annex 1, calculations were conducted using:

* IMPACT 3.36 for defining best fuel-efficient trajectories.
* AEM 2.6.0 for calculating the amount of fuel burn and emissions.

The reference databases versions were:

* BADA 3.15, and 4.2
* ANP 2.3
* ICAO EEDB version 28b
* ICAO Doc 8643 – release 05/12/2022

The traffic references were:

* EUROCONTROL historic traffic database 2005-2022 (ECAC departures and arrivals)
* EUROCONTROL CODA taxi times 2005-2022 (ECAC area)

### Busiest airports taxi times

The busiest airports taxi time calculation corresponds to the sum of the average taxi time in and average taxi out time for the 25 ECAC airports with the greater number of movements (landing and take-off cumulated).

### Modelling method

The calculation method of the fuel and emissions calculation of the Annex 1 is described by the dedicated EMEP/EEA annex1 method description document [1]

### ICAO Aircraft types selection

The aircraft types that are available in the Annex are selected on the basis of their number of movements from and to European airports (international and domestic traffic recorded by the EUROCONTROL CFMU) with the following criteria:

* In first priority: more than 1000 movements in 2022
* Then, more than 1000 movements for one single year from 2005 to 2021 (included), with the exception of 2020.

### Airframe engine selection

The Annex provides the fuel and emissions estimations for the most representative airframe-engine set of each available ICAO type. The airframe-engine set are selected the basis of their number of movements from and to European airports (international and domestic traffic recorded by the EUROCONTROL CFMU) with the following criteria:

* In first priority, the best airframe/engine movement ratio for the ICAO type in 2022
* Then, the best airframe/engine movement ratio for the ICAO type from 2005 to 2021 (included), with the exception of 2020, all movements grouped.

### Ranges and cruise levels

For each ICAO aircraft type, the following method is applied to determine the traffic movement characteristics:

* Determine a movement within the physical limits of the aircraft type, in range and operational ceiling.
* For each stage length (125Nm, 200Nm, etc.), use of the most flown cruise level as recorded by the EUROCONTROL CFMU historical traffic database, on the basis of their number of movements from and to European airports (international and domestic traffic recorded by the EUROCONTROL CFMU) with the following criteria:
  + In first priority the maximum number of movements in 2022
  + Then, the maximum number of movements for one single year from 2005 to 2021 (included), with the exception of 2020, all movements grouped.
  + Then adjustment to respect the IMPACT (ANP/BADA) modelling constraints.

## Changes introduced from edition 2020

### Busiest airports taxi times

This version of the Annex 1 provides the following busiest taxi times:

|  |  |  |
| --- | --- | --- |
| Average taxi-out time for the 25 busiest European airports in 2022 | Average taxi-in time for the 25 busiest European airports in 2022 | Average Taxi time for the 25 busiest European airports |
| 00:06:56 | 00:13:52 | 00:20:50 |

### Particulate matters emission indices

This version of the Annex 1 uses the latest version of the calculation of the engine emission indices of the particulate matters, as defined in the latest release of the ICAO Doc 9889 [2], Attachment D to Appendix 1.

|  |  |
| --- | --- |
| Emission indices of Particulate Matters (PM) | Version 2023 (FOA4) |
| Volatile Suplhate PM | Identical to FOA3 |
| Volatile organic PM | Identical to FOA3 |
| Non-Volatile PM | Measured indices where available in the ICAO EEDB |
| Updated calculation method for smoke number deriver indices |

### Calculation of non-volatile particulate matters for CCD segments

This version of the Annex 1 uses an updated method to calculate non-volatile particulate matters (nvPM) for CCD segments. This method implements the requirements of the Global Civil Aviation Black Carbon Emissions [3].

This new method was developed during the ICAO CAEP 11 and 12 cycles [4] and was used for nvPM masses calculations for the ICAO CAEP12 Trends assessments. It is adapted to the use of the FOA4 nvPM emission indices. Although it is still under review and should be slightly updated in the ICAO CAEP 13 cycle, this method is more accurate than the BFFM2 that was used in the previous reports.

### Aircraft type updates

The following table lists the updates of the list aircraft types modelled using the description and classification of the ICAO Doc 8643 (edition 2022/4), since the release 2020 of the Annex 1.

The current version of the annex 1 provides a total number of 283 different ICAO codes that is 47 more aircraft types than for the 2020 edition.

|  |  |  |  |
| --- | --- | --- | --- |
| ICAO Code | Manufacturer | Example of model name / serie | Update |
| A748 | AVRO | 748 | NEW |
| AC50 | GULFSTREAM AEROSPACE | 695 JETPROP COMMANDER 1000 | NEW |
| AC95 | ANTONOV | AN-2 | NEW |
| AN2 | ANTONOV | AN-28 | NEW |
| AN28 | ATR | ATR-42-400 | NEW |
| AT44 | BOEING | 707-300 | NEW |
| B703 | BOEING | 737-200 | NEW |
| B732 | BOEING | 747-100 | NEW |
| B741 | BOEING | 777-300 | NEW |
| B773 | BRITISH AEROSPACE | BAC-111 ONE-ELEVEN | NEW |
| BA11 | BEECH | 90 (F90) KING AIR | NEW |
| BE9T | BOEING | 747-400LCF DREAMLIFTER | NEW |
| BN2T | BRITTEN-NORMAN | BN-2T DEFENDER 4000 | NEW |
| C130 | LOCKHEED | 182 HERCULES | NEW |
| C212 | AIRBUS | C-212 | NEW |
| C337 | CESSNA | 337 SUPER SKYMASTER | NEW |
| CL2T | CANADAIR | CL-215T | NEW |
| CN35 | AIRBUS | CN-235 | NEW |
| CVLT | CANADAIR | CC-109 COSMOPOLITAN | NEW |
| DC86 | DOUGLAS | DC-8-60 | NEW |
| DC93 | DOUGLAS | DC-9-30 | NEW |
| DC95 | DOUGLAS | DC-9-50 | NEW |
| DHC7 | DE HAVILLAND CANADA | DASH 7 | NEW |
| E110 | EMBRAER | BANDEIRANTE | NEW |
| E121 | EMBRAER | EC-9 XINGU | NEW |
| E35L | EMBRAER | EMB-135BJ LEGACY | NEW |
| E75L | EMBRAER | 175 (LONG WING) | NEW |
| G159 | GULFSTREAM AMERICAN | G-1159 GULFSTREAM 2 | NEW |
| GLF2 | GULFSTREAM AEROSPACE | C-20A GULFSTREAM 3 | NEW |
| GLF3 | BRITISH AEROSPACE | BAE-125-1000 | NEW |
| H25C | ILYUSHIN | IL-86 | NEW |
| IL86 | DAHER | KODIAK 100 | NEW |
| L101 | LOCKHEED | L-1011 TRISTAR | NEW |
| L188 | LOCKHEED | ELECTRA (L-188) | NEW |
| MD81 | BOEING | MD-81 | NEW |
| MD87 | BOEING | MD-87 | NEW |
| MD88 | BOEING | MD-88 | NEW |
| MD90 | BOEING | MD-90 | NEW |
| MU2 | MITSUBISHI | LR-1 | NEW |
| PA27 | MITSUBISHI | DIAMOND | NEW |
| PAY1 | PARTENAVIA | AP-68TP-300 SPARTACUS | NEW |
| PAY4 | PIPER | AZTEC | NEW |
| PC6T | PIPER | CHEYENNE 1 | NEW |
| PC9 | PIPER | CHEYENNE 400 | DELETED |
| RJ70 | AVRO | AVROLINER (RJ-70) | NEW |
| S2T | AEROSPATIALE | CORVETTE | NEW |
| S601 | SHORT | SC-7 SKYLINER | NEW |
| WW24 | BRITTEN-NORMAN | BN-2A MK3 TRISLANDER | NEW |

In particular, the PC9 is deleted from the list of ICAO types as their modelling with the EUROCONTROL IMPACT was not validated.

### Proxy aircraft types – Fuel burn in CCD sections

The current annex results of the CCD sections are based on a fuel burn modelling of the proposed ICAO aircraft types by using the most appropriate BADA fuel model.

Upon the total available number of 282 different aircraft types, 190 ICAO codes were assigned with the same exact BADA database model. Nevertheless, the following list of the remaining 92 ICAO codes were modelled by a proxy aircraft type.

| ICAO Code | Manufacturer | Type | BADA Proxy for CCD fuel calculation in AEM |
| --- | --- | --- | --- |
| A19N | AIRBUS | A-319NEO | A20N |
| A338 | AIRBUS | A-330-800 | A339 |
| A748 | AIL | 748 | F27 |
| AC50 | AERO (1) | COMMANDER 500 | C414 |
| AC90 | GULFSTREAM AEROSPACE | 690 JETPROP COMMANDER 840 | PAY3 |
| AC95 | GULFSTREAM AEROSPACE | 695 JETPROP COMMANDER 980 | PAY3 |
| AEST | AEROSTAR (1) | 600 | B58T |
| AN2 | AICSA | AN-2 | C188 |
| AN26 | ANTONOV | AN-26 | AN30 |
| AN28 | ANTONOV | AN-28 | AN28 |
| AN72 | ANTONOV | AN-72 | F100 |
| ASTR | IAI | 1125 ASTRA | G150 |
| AT44 | ATR | ATR-42-400 | AT45 |
| AT46 | ATR | ATR-42-600 | AT45 |
| B461 | BRITISH AEROSPACE | BAE-146-100 | B462 |
| B703 | BOEING | 707-300 | B703 |
| B721 | BOEING | 727-100 | B722 |
| B732 | BOEING | 737-200 | B732 |
| B741 | BOEING | 747-100 | B743 |
| B74S | BOEING | 747SP | B742 |
| B773 | BOEING | 777-300 | B773 |
| BA11 | BAC | 111 ONE-ELEVEN | BA11 |
| BCS1 | BOMBARDIER | BD-500 CSERIES CS100 | B736 |
| BCS3 | BOMBARDIER | BD-500 CSERIES CS300 | B737 |
| BE10 | BEECH | 100 KING AIR | F406 |
| BE18 | BEECH | 18 (PISTON) | C421 |
| BE50 | BEECH | 50 TWIN BONANZA | C402 |
| BE55 | BEECH | 55 BARON | PA27 |
| BE60 | BEECH | 60 DUKE | C414 |
| BE9T | BEECH | 90 (F90) KING AIR | BE9L |
| BN2P | AVIONS FAIREY | BN-2A DEFENDER | C414 |
| BN2T | BRITTEN-NORMAN | BN-2T TURBINE DEFENDER | F406 |
| C130 | LOCKHEED | AC-130 SPECTRE | C130 |
| C212 | AIRBUS | C-212 | JS32 |
| C25M | CESSNA | 525 CITATION M2 | C525 |
| C303 | AVIONES COLOMBIA | T303 | PA31 |
| C335 | CESSNA | 335 | C402 |
| C337 | AVIONES COLOMBIA | 337 | DA42 |
| C404 | CESSNA | 404 TITAN | PA31 |
| C425 | CESSNA | 425 CONQUEST 1 | F406 |
| C441 | CESSNA | 441 CONQUEST | PAY3 |
| C500 | CESSNA | 500 CITATION | C551 |
| C501 | CESSNA | 501 CITATION 1SP | C551 |
| C68A | CESSNA | 680A CITATION LATITUDE | C680 |
| C700 | CESSNA | 700 CITATION LONGITUDE | C700 |
| CL2T | CANADAIR | CL-215T | F27 |
| CN35 | AIRTECH (2) | CN-235 | AT43 |
| CRJ7 | CANADAIR | CHALLENGER 870 | CRJ9 |
| CVLT | CANADAIR | CC-109 COSMOPOLITAN | ATP |
| DC3 | DOUGLAS | AC-47 SKYTRAIN | F27 |
| DC6 | DOUGLAS | C-118 LIFTMASTER | AN12 |
| DC86 | DOUGLAS | DC-8-60 | DC87 |
| DC93 | DOUGLAS | DC-9-30 | DC93 |
| DC95 | DOUGLAS | DC-9-50 | DC94 |
| DH8B | DE HAVILLAND CANADA | DASH 8 (200) | DH8C |
| DHC6 | DE HAVILLAND CANADA | CC-138 TWIN OTTER | DHC6 |
| DHC7 | DE HAVILLAND CANADA | DASH 7 | AN30 |
| E110 | EMBRAER | BANDEIRANTE | D228 |
| E121 | EMBRAER | EC-9 XINGU | MU2 |
| E295 | EMBRAER | ERJ-190-400 | B736 |
| E35L | EMBRAER | EMB-135BJ LEGACY | E35L |
| E75L | EMBRAER | 175 (LONG WING) | E75L |
| FA8X | DASSAULT | FALCON 8X | FA7X |
| G159 | GRUMMAN | ACADEME | DH8A |
| GA5C | GULFSTREAM AEROSPACE | G-7 GULFSTREAM G500 | FA7X |
| GA6C | GULFSTREAM AEROSPACE | G-7 GULFSTREAM G600 | GL5T |
| GA7 | GRUMMAN AMERICAN | COUGAR | SR22 |
| GA8 | GIPPSLAND | AIRVAN | DA50 |
| GALX | IAI | 1126 GALAXY | G280 |
| GL7T | BOMBARDIER | BD-700 GLOBAL 7000 | GLEX |
| GLF2 | GRUMMAN | C-20J GULFSTREAM 2SP | FA7X |
| GLF3 | GULFSTREAM AEROSPACE | C-20A GULFSTREAM 3 | FA7X |
| GLF4 | GULFSTREAM AEROSPACE | C-20F GULFSTREAM 4 | GLF2 |
| GLF6 | GULFSTREAM AEROSPACE | GULFSTREAM G650 | GLEX |
| H25C | BRITISH AEROSPACE | BAE-125-1000 | G150 |
| IL18 | ILYUSHIN | BIZON | C130 |
| IL62 | ILYUSHIN | IL-62 | A30B |
| IL86 | ILYUSHIN | IL-86 | IL86 |
| J328 | 328 SUPPORT SERVICES | DORNIER 328JET | E135 |
| JS31 | BRITISH AEROSPACE | BAE-3100 JETSTREAM 31 | JS32 |
| L101 | LOCKHEED | L-1011 TRISTAR | L101 |
| L188 | LOCKHEED | ELECTRA (L-188) | AN12 |
| L200 | LET | L-200 MORAVA | BE36 |
| LJ31 | GATES LEARJET | 31 | LJ45 |
| LJ40 | LEARJET | 40 | LJ45 |
| LJ55 | GATES LEARJET | 55 | LJ60 |
| LJ75 | LEARJET | 75 | C650 |
| MD81 | BOEING | MD-81 | MD82 |
| MD87 | BOEING | MD-87 | MD82 |
| MD88 | BOEING | MD-88 | MD82 |
| MD90 | BOEING | MD-90 | MD83 |
| MRJ9 | MITSUBISHI | MRJ-90 | A148 |
| MU2 | MITSUBISHI | LR-1 | MU2 |
| P212 | TECNAM | P-2012 TRAVELLER | C421 |
| P68 | PARTENAVIA | OBSERVER | BE76 |
| PA23 | MILLER (1) | JET PROFILE | C206 |
| PA27 | CHINCUL | AZTEC | PA27 |
| PA30 | AICSA | PA-30 TWIN COMANCHE | C402 |
| PAY1 | CHINCUL | CHEYENNE 1 | PAY1 |
| PAY4 | PIPER | CHEYENNE 400 | P180 |
| PC24 | PILATUS | PC-24 | C560 |
| PC6T | FAIRCHILD (1) | HELI-PORTER | C208 |
| RJ70 | AI(R) | AVROLINER (RJ-70) | RJ85 |
| S2T | CONAIR | TURBO FIRECAT | SH36 |
| S601 | AEROSPATIALE | CORVETTE | C550 |
| STAR | BEECH | 2000 STARSHIP | P180 |
| SW3 | FAIRCHILD (1) | FAIRCHILD 300 | MU2 |
| WW24 | IAI | 1124 SEA SCAN | H25A |

### Aircraft type and flight definition updates

All changes affecting the modelled aircraft types are captured hereafter:

* **Aircraft performances updates**: the aircraft trajectory definition and/or the fuel flow calculation model were updated, because of:
  + the evolution of the reference databases, and associated aircraft substitution tables.
  + the revision of previous modelling of aircraft type based on experience gained from other similar EUROCONTROL projects. This has led to the definition of more accurate ANP/BADA models for calculating aircraft trajectories.

|  |  |  |
| --- | --- | --- |
| Performances databases | 2020 version | 2023 version |
| ANP | 2.1 | 2.3 |
| BADA 3 | 3.15 | 3.15 |
| BADA 4 | 4.2 | 4.2 |

* **Engine type model**: the aircraft emission model has changed due to the evolution of the ICAO jet engine reference database.

|  |  |  |
| --- | --- | --- |
| Engine emissions database | 2020 version | 2023 version |
| ICAO Engine Emissions DataBank – jet engines | 25 | 28c |

* **Aircraft flight definition**: the definition of the trajectory has been modified to reflect the characteristics of the most frequent flights of each aircraft type in the ECAC area in 2022:
  + **Distance band update**: additional stage lengths have been added to comply with the maximum range of the aircraft (according to the manufacturer)
  + **Cruise level update**: At least one cruise level has changed for a given flight distance for the concerned aircraft type.

These changed are captured in the table below.

| ICAO CODE | New | Aircraft performances updates | Engine type update | Cruise FL update | Distance bands update |
| --- | --- | --- | --- | --- | --- |
| A124 |  |  | ü | ü |  |
| A140 |  | ü |  | ü | ü |
| A148 |  | ü | ü | ü |  |
| A19N |  | ü | ü | ü |  |
| A20N |  | ü | ü | ü |  |
| A21N |  | ü | ü | ü | ü |
| A306 |  | ü | ü | ü | ü |
| A30B |  | ü | ü | ü |  |
| A310 |  | ü | ü | ü |  |
| A318 |  | ü | ü | ü | ü |
| A319 |  | ü | ü | ü | ü |
| A320 |  | ü | ü | ü |  |
| A321 |  | ü | ü | ü | ü |
| A332 |  | ü | ü | ü |  |
| A333 |  | ü | ü | ü |  |
| A338 |  | ü | ü | ü |  |
| A339 |  | ü | ü | ü |  |
| A342 |  | ü | ü | ü |  |
| A343 |  | ü | ü | ü |  |
| A345 |  | ü | ü | ü | ü |
| A346 |  | ü | ü | ü |  |
| A359 |  | ü | ü | ü | ü |
| A35K |  | ü | ü | ü | ü |
| A388 |  | ü | ü | ü | ü |
| A3ST |  | ü | ü | ü |  |
| A748 | ü |  |  |  |  |
| AC50 | ü |  |  |  |  |
| AC90 |  | ü | ü | ü | ü |
| AC95 | ü |  |  |  |  |
| AEST |  | ü | ü | ü |  |
| AN12 |  | ü | ü | ü | ü |
| AN2 | ü |  |  |  |  |
| AN24 |  | ü |  | ü |  |
| AN26 |  | ü | ü | ü |  |
| AN28 | ü |  |  |  |  |
| AN30 |  | ü | ü | ü |  |
| AN32 |  | ü | ü | ü | ü |
| AN72 |  | ü | ü | ü |  |
| ASTR |  | ü | ü | ü | ü |
| AT43 |  | ü | ü |  |  |
| AT44 | ü |  |  |  |  |
| AT45 |  | ü | ü | ü |  |
| AT46 |  | ü | ü | ü |  |
| AT72 |  | ü | ü | ü |  |
| AT73 |  | ü | ü | ü |  |
| AT75 |  | ü | ü | ü |  |
| AT76 |  | ü | ü | ü |  |
| ATP |  | ü | ü | ü | ü |
| B190 |  | ü | ü | ü |  |
| B350 |  | ü | ü | ü |  |
| B38M |  | ü | ü | ü |  |
| B39M |  | ü | ü | ü | ü |
| B461 |  | ü | ü | ü | ü |
| B462 |  | ü | ü | ü |  |
| B463 |  | ü | ü | ü |  |
| B703 | ü |  |  |  |  |
| B712 |  | ü | ü | ü |  |
| B721 |  | ü | ü | ü | ü |
| B722 |  | ü | ü | ü |  |
| B732 | ü |  |  |  |  |
| B733 |  | ü | ü | ü |  |
| B734 |  | ü | ü | ü |  |
| B735 |  | ü | ü | ü |  |
| B736 |  | ü | ü | ü |  |
| B737 |  | ü | ü | ü |  |
| B738 |  | ü | ü | ü |  |
| B739 |  | ü | ü | ü |  |
| B741 | ü |  |  |  |  |
| B742 |  | ü | ü | ü | ü |
| B743 |  | ü | ü | ü |  |
| B744 |  | ü | ü | ü | ü |
| B748 |  | ü | ü | ü |  |
| B74S |  | ü | ü | ü |  |
| B752 |  | ü | ü | ü | ü |
| B753 |  | ü | ü | ü |  |
| B762 |  | ü | ü | ü |  |
| B763 |  | ü | ü | ü |  |
| B764 |  | ü | ü | ü | ü |
| B772 |  | ü | ü | ü | ü |
| B773 | ü |  |  |  |  |
| B77L |  | ü | ü | ü | ü |
| B77W |  | ü | ü | ü | ü |
| B788 |  | ü | ü | ü |  |
| B789 |  | ü | ü | ü |  |
| B78X |  | ü | ü | ü | ü |
| BA11 | ü |  |  |  |  |
| BCS1 |  | ü | ü | ü |  |
| BCS3 |  | ü | ü | ü |  |
| BE10 |  | ü | ü | ü |  |
| BE18 |  | ü | ü | ü | ü |
| BE20 |  | ü | ü | ü | ü |
| BE30 |  | ü | ü | ü |  |
| BE40 |  | ü | ü | ü |  |
| BE50 |  | ü | ü | ü | ü |
| BE55 |  | ü | ü |  |  |
| BE58 |  | ü | ü | ü | ü |
| BE60 |  | ü | ü | ü | ü |
| BE76 |  | ü | ü | ü | ü |
| BE99 |  | ü | ü | ü |  |
| BE9L |  | ü | ü | ü |  |
| BE9T | ü |  |  |  |  |
| BN2P |  | ü | ü | ü | ü |
| BN2T | ü |  |  |  |  |
| C130 | ü |  |  |  |  |
| C208 |  | ü | ü | ü | ü |
| C212 | ü |  |  |  |  |
| C25A |  | ü | ü | ü |  |
| C25B |  | ü | ü | ü |  |
| C25C |  | ü | ü | ü | ü |
| C25M |  | ü | ü | ü |  |
| C303 |  | ü | ü | ü | ü |
| C310 |  | ü | ü | ü |  |
| C335 |  | ü | ü | ü | ü |
| C337 | ü |  |  |  |  |
| C340 |  | ü | ü | ü | ü |
| C402 |  | ü | ü | ü |  |
| C404 |  | ü | ü | ü | ü |
| C414 |  | ü | ü | ü | ü |
| C421 |  | ü | ü | ü | ü |
| C425 |  | ü | ü | ü | ü |
| C441 |  | ü | ü | ü | ü |
| C500 |  | ü | ü | ü | ü |
| C501 |  | ü | ü | ü |  |
| C510 |  | ü | ü | ü |  |
| C525 |  | ü | ü | ü |  |
| C550 |  | ü | ü | ü |  |
| C551 |  | ü | ü | ü |  |
| C560 |  | ü | ü | ü |  |
| C56X |  | ü | ü | ü |  |
| C650 |  | ü | ü | ü |  |
| C680 |  | ü | ü | ü | ü |
| C68A |  | ü | ü | ü |  |
| C700 |  | ü | ü | ü | ü |
| C750 |  | ü | ü | ü |  |
| CL2T | ü |  |  |  |  |
| CL30 |  | ü | ü | ü |  |
| CL60 |  | ü | ü | ü | ü |
| CN35 | ü |  |  |  |  |
| CRJ1 |  | ü | ü | ü |  |
| CRJ2 |  | ü | ü | ü |  |
| CRJ7 |  | ü | ü | ü |  |
| CRJ9 |  | ü | ü | ü |  |
| CRJX |  | ü | ü | ü |  |
| CVLT | ü |  |  |  |  |
| D228 |  | ü | ü |  |  |
| D328 |  | ü | ü | ü |  |
| DA42 |  | ü | ü | ü |  |
| DC10 |  | ü | ü | ü | ü |
| DC3 |  | ü | ü | ü | ü |
| DC6 |  | ü | ü | ü | ü |
| DC86 | ü |  |  |  |  |
| DC87 |  | ü | ü | ü | ü |
| DC93 | ü |  |  |  |  |
| DC95 | ü |  |  |  |  |
| DH8A |  | ü | ü | ü |  |
| DH8B |  | ü | ü | ü |  |
| DH8C |  | ü | ü |  |  |
| DH8D |  | ü | ü | ü |  |
| DHC6 |  | ü | ü | ü |  |
| DHC7 | ü |  |  |  |  |
| E110 | ü |  |  |  |  |
| E120 |  | ü | ü | ü |  |
| E121 | ü |  |  |  |  |
| E135 |  | ü | ü | ü |  |
| E145 |  | ü | ü | ü | ü |
| E170 |  | ü | ü | ü |  |
| E190 |  | ü | ü | ü |  |
| E195 |  | ü | ü | ü | ü |
| E290 |  | ü | ü | ü |  |
| E295 |  | ü | ü | ü |  |
| E35L | ü |  |  |  |  |
| E50P |  | ü | ü | ü |  |
| E545 |  | ü | ü | ü |  |
| E550 |  | ü | ü | ü |  |
| E55P |  | ü | ü | ü | ü |
| E75L | ü |  |  |  |  |
| E75S |  | ü | ü | ü | ü |
| EA50 |  | ü | ü | ü |  |
| F100 |  | ü | ü | ü |  |
| F27 |  | ü | ü | ü |  |
| F28 |  | ü | ü | ü |  |
| F2TH |  | ü | ü | ü | ü |
| F406 |  | ü | ü |  |  |
| F50 |  | ü | ü | ü |  |
| F70 |  | ü | ü | ü |  |
| F900 |  | ü | ü | ü | ü |
| FA10 |  | ü | ü | ü |  |
| FA20 |  | ü | ü | ü |  |
| FA50 |  | ü | ü | ü |  |
| FA7X |  | ü | ü | ü | ü |
| FA8X |  | ü | ü | ü | ü |
| G150 |  | ü | ü | ü |  |
| G159 | ü |  |  |  |  |
| G280 |  | ü | ü | ü |  |
| GA5C |  | ü | ü | ü | ü |
| GA6C |  | ü | ü | ü | ü |
| GA7 |  | ü | ü | ü | ü |
| GA8 |  | ü | ü | ü |  |
| GALX |  | ü | ü | ü |  |
| GL5T |  | ü | ü | ü |  |
| GL7T |  | ü | ü | ü | ü |
| GLEX |  | ü | ü | ü | ü |
| GLF2 | ü |  |  |  |  |
| GLF3 | ü |  |  |  |  |
| GLF4 |  | ü | ü | ü |  |
| GLF5 |  | ü | ü | ü | ü |
| GLF6 |  | ü | ü | ü | ü |
| H25B |  | ü | ü | ü |  |
| H25C | ü |  |  |  |  |
| HA4T |  | ü | ü | ü |  |
| HDJT |  | ü | ü | ü |  |
| IL18 |  | ü | ü | ü |  |
| IL62 |  | ü | ü | ü | ü |
| IL76 |  | ü | ü | ü |  |
| IL86 | ü |  |  |  |  |
| IL96 |  | ü | ü | ü |  |
| J328 |  | ü | ü | ü |  |
| JS31 |  | ü | ü | ü |  |
| JS32 |  | ü | ü | ü |  |
| JS41 |  | ü | ü | ü | ü |
| L101 | ü |  |  |  |  |
| L188 | ü |  |  |  |  |
| L200 |  | ü | ü |  |  |
| L410 |  | ü | ü | ü |  |
| LJ25 |  | ü | ü | ü | ü |
| LJ31 |  | ü | ü | ü | ü |
| LJ35 |  | ü | ü | ü | ü |
| LJ40 |  | ü | ü | ü |  |
| LJ45 |  | ü | ü | ü |  |
| LJ55 |  | ü | ü | ü |  |
| LJ60 |  | ü | ü | ü |  |
| LJ75 |  | ü | ü | ü | ü |
| MD11 |  | ü | ü | ü |  |
| MD81 | ü |  |  |  |  |
| MD82 |  | ü | ü | ü |  |
| MD83 |  | ü | ü | ü |  |
| MD87 | ü |  |  |  |  |
| MD88 | ü |  |  |  |  |
| MD90 | ü |  |  |  |  |
| MRJ9 |  | ü | ü | ü | ü |
| MU2 | ü |  |  |  |  |
| P06T |  | ü | ü |  |  |
| P180 |  | ü | ü | ü |  |
| P212 |  | ü | ü | ü |  |
| P46T |  | ü | ü |  |  |
| P68 |  | ü | ü | ü | ü |
| PA23 |  | ü | ü | ü | ü |
| PA27 | ü |  |  |  |  |
| PA30 |  | ü | ü |  |  |
| PA31 |  | ü | ü | ü | ü |
| PA34 |  | ü | ü | ü |  |
| PA44 |  | ü | ü | ü |  |
| PA46 |  | ü | ü | ü |  |
| PAY1 | ü |  |  |  |  |
| PAY2 |  | ü | ü | ü |  |
| PAY3 |  | ü | ü | ü |  |
| PAY4 | ü |  |  |  |  |
| PC12 |  | ü | ü | ü |  |
| PC24 |  | ü | ü | ü |  |
| PC6T | ü |  |  |  |  |
| PRM1 |  | ü | ü | ü |  |
| RJ1H |  | ü | ü | ü |  |
| RJ70 | ü |  |  |  |  |
| RJ85 |  | ü | ü | ü |  |
| S2T | ü |  |  |  |  |
| S601 | ü |  |  |  |  |
| SB20 |  | ü | ü | ü | ü |
| SBR1 |  | ü | ü | ü | ü |
| SF34 |  | ü | ü | ü |  |
| SF50 |  | ü | ü |  |  |
| SH36 |  | ü | ü | ü |  |
| STAR |  | ü | ü | ü | ü |
| SU95 |  | ü | ü | ü |  |
| SW3 |  | ü | ü | ü |  |
| SW4 |  | ü | ü | ü | ü |
| T134 |  | ü | ü | ü | ü |
| T154 |  | ü | ü | ü | ü |
| T204 |  | ü | ü | ü | ü |
| TBM7 |  | ü | ü | ü |  |
| TBM8 |  | ü | ü | ü |  |
| TBM9 |  | ü | ü | ü | ü |
| WW24 | ü |  |  |  |  |
| YK42 |  | ü | ü | ü | ü |
| YK42 |  |  | ü | ü | ü |

## CCD Fuel burn comparison between 2020 and 2023 editions - Examples

Due to the changes listed in Section 5.2.6, and the updates of the IMPACT model calculations, the following CCD flight fuel burn relative differences can be observed from 2020 to 2023 releases. The tables of the sections hereafter show some example of differences.

### A320

|  |  |  |  |
| --- | --- | --- | --- |
| Distance Band (Nm) | Most frequent cruise level (FL) | | % difference fuel burn (2023-2020) |
| 2020 | 2023 |
| 125 | 180 | 180 | -0.05% |
| 200 | 240 | 240 | -3.91% |
| 250 | 300 | 320 | -2.91% |
| 500 | 360 | 360 | -0.35% |
| 750 | 360 | 360 | -0.14% |
| 1000 | 360 | 360 | -0.07% |
| 1500 | 360 | 360 | 0.04% |
| 2000 | 360 | 360 | 0.10% |
| 2500 | 380 | 360 | 1.78% |

### B733

|  |  |  |  |
| --- | --- | --- | --- |
| Distance Band (Nm) | Most frequent cruise level (FL) | | % difference fuel burn (2023-2020) |
| 2020 | 2023 |
| 125 | 200 | 220 | 0.79% |
| 200 | 280 | 260 | -2.72% |
| 250 | 300 | 300 | -0.85% |
| 500 | 340 | 340 | 0.01% |
| 750 | 360 | 340 | 1.11% |
| 1000 | 340 | 340 | 0.17% |
| 1500 | 340 | 340 | 0.26% |
| 2000 | 360 | 340 | 1.13% |

### B789

|  |  |  |  |
| --- | --- | --- | --- |
| Distance Band (Nm) | Most frequent cruise level (FL) | | % difference fuel burn (2023-2020) |
| 2020 | 2023 |
| 125 | 120 | 200 | 11.62% |
| 200 | 300 | 220 | 2.85% |
| 250 | 300 | 300 | 1.59% |
| 500 | 340 | 380 | -2.82% |
| 750 | 400 | 400 | 1.56% |
| 1000 | 400 | 400 | 1.28% |
| 1500 | 400 | 400 | 1.04% |
| 2000 | 400 | 400 | 0.92% |
| 2500 | 400 | 400 | 0.79% |
| 3000 | 400 | 400 | 0.86% |
| 3500 | 380 | 400 | -1.75% |
| 4000 | 380 | 400 | -0.73% |
| 4500 | 380 | 400 | -0.80% |
| 5000 | 380 | 400 | -0.11% |
| 5500 | 380 | 400 | -0.22% |
| 6000 | 380 | 400 | 0.36% |
| 6500 | 380 | 400 | 0.98% |
| 7000 | 420 | 400 | 3.31% |
| 7500 | 420 | 400 | 3.24% |
| 8000 | 380 | 400 | 0.32% |

### AT45

For this aircraft, the distance band 750Nm was removed from the list of the available values because the the ATR 45 usual range for a full payload is 700Nm.

|  |  |  |  |
| --- | --- | --- | --- |
| Distance Band (Nm) | Most frequent cruise level (FL) | | % difference fuel burn (2023-2020) |
| 2020 | 2023 |
| 125 | 160 | 160 | -7.05% |
| 200 | 180 | 200 | -10.59% |
| 250 | 200 | 230 | -14.80% |
| 500 | 200 | 220 | -6.06% |
| 750 | 230 |  |  |

### DC3

The selected DC3 proxy of the version 2023 is the S2P, instead of the Cessna 421 for the release 2020, which is a more realistic choice. Therefore, this modelling change has a major impact for the CCD fuel calculation.

|  |  |  |  |
| --- | --- | --- | --- |
| Distance Band (Nm) | Most frequent cruise level (FL) | | % difference fuel burn (2023-2020) |
| 2020 | 2023 |
| 125 | 160 | 160 | 174.04% |
| 200 | 160 | 160 | 161.20% |
| 250 | 120 | 120 | 142.52% |
| 500 | 120 | 120 | 148.14% |
| 750 | 180 | 180 | 151.55% |
| 1 000 |  | 180 |  |

# Edition 2020

## Changes introduced from edition 2016

### Aircraft types

The following table lists the aircraft types modelled using the description and classification of the ICAO Doc 8643 (edition 2019/4).

| **ICAO**  **Code** | Manufacturer | **Serie / Model** | **Engine Tye** | **Nb Engines** | **WTC** |
| --- | --- | --- | --- | --- | --- |
| A124 | ANTONOV | An-124 Ruslan | Jet | 4 | H |
| ANTONOV | Ruslan | Jet | 4 | H |
| A19N | AIRBUS | A-319neo | Jet | 2 | M |
| A20N | AIRBUS | A-320neo | Jet | 2 | M |
| A21N | AIRBUS | A-321neo | Jet | 2 | M |
| A338 | AIRBUS | A-330-800 | Jet | 2 | H |
| A339 | AIRBUS | A-330-900 | Jet | 2 | H |
| A35K | AIRBUS | A-350-1000 XWB | Jet | 2 | H |
| AIRBUS | A-350-1000 XWB Prestige | Jet | 2 | H |
| AIRBUS | Prestige (A-350-1000) | Jet | 2 | H |
| A3ST | AIRBUS | A-300ST Beluga | Jet | 2 | H |
| AIRBUS | A-300ST Super Transporter | Jet | 2 | H |
| AIRBUS | Beluga | Jet | 2 | H |
| AIRBUS | Super Transporter | Jet | 2 | H |
| SATIC | A-300ST Beluga | Jet | 2 | H |
| SATIC | A-300ST Super Transporter | Jet | 2 | H |
| SATIC | Beluga | Jet | 2 | H |
| SATIC | Super Transporter | Jet | 2 | H |
| AT45 | ATR | ATR-42-500 | Turboprop/Turboshaft | 2 | M |
| ATR | ATR-42-500 Surveyor | Turboprop/Turboshaft | 2 | M |
| ATR | Surveyor (ATR-42-500) | Turboprop/Turboshaft | 2 | M |
| AT46 | ATR | ATR-42-600 | Turboprop/Turboshaft | 2 | M |
| AT73 | ATR | ATR-72-211 | Turboprop/Turboshaft | 2 | M |
| ATR | ATR-72-212 | Turboprop/Turboshaft | 2 | M |
| AT75 | ATR | ATR-72-212A (500) | Turboprop/Turboshaft | 2 | M |
| ATR | ATR-72-500 | Turboprop/Turboshaft | 2 | M |
| AT76 | ATR | ATR-72-212A (600) | Turboprop/Turboshaft | 2 | M |
| ATR | ATR-72-600 | Turboprop/Turboshaft | 2 | M |
| B350 | BEECH | 300 (B300) Super King Air 350 | Turboprop/Turboshaft | 2 | L/M |
| BEECH | Super King Air 350 | Turboprop/Turboshaft | 2 | L/M |
| BEECHCRAFT | 300 (B300) King Air 350 | Turboprop/Turboshaft | 2 | L/M |
| BEECHCRAFT | King Air 350 | Turboprop/Turboshaft | 2 | L/M |
| HAWKER BEECHCRAFT | 300 (B300) King Air 350 | Turboprop/Turboshaft | 2 | L/M |
| HAWKER BEECHCRAFT | 300 (B300) Shadow | Turboprop/Turboshaft | 2 | L/M |
| HAWKER BEECHCRAFT | King Air 350 | Turboprop/Turboshaft | 2 | L/M |
| HAWKER BEECHCRAFT | MC-12 | Turboprop/Turboshaft | 2 | L/M |
| HAWKER BEECHCRAFT | Shadow | Turboprop/Turboshaft | 2 | L/M |
| RAYTHEON | 300 (B300) Super King Air 350 | Turboprop/Turboshaft | 2 | L/M |
| RAYTHEON | LR-2 Super King Air 350 | Turboprop/Turboshaft | 2 | L/M |
| RAYTHEON | Super King Air 350 | Turboprop/Turboshaft | 2 | L/M |
| B38M | BOEING | 737 MAX 8 | Jet | 2 | M |
| BOEING | 737 MAX 8 BBJ | Jet | 2 | M |
| BOEING | BBJ (737 MAx 8) | Jet | 2 | M |
| B39M | BOEING | 737 MAx 9 | Jet | 2 | M |
| BOEING | 737 MAx 9 BBJ | Jet | 2 | M |
| BOEING | BBJ (737 MAX 9) | Jet | 2 | M |
| B77W | BOEING | 777-300ER | Jet | 2 | H |
| BOEING | 777-300ER BBJ | Jet | 2 | H |
| BOEING | BBJ (777-300ER) | Jet | 2 | H |
| B78x | BOEING | 787-10 Dreamliner | Jet | 2 | H |
| BOEING | Dreamliner (Srs.10) | Jet | 2 | H |
| BCS1 | AIRBUS | A-220-100 | Jet | 2 | M |
| BOMBARDIER | BD-500 CSeries CS100 | Jet | 2 | M |
| BOMBARDIER | CS100 | Jet | 2 | M |
| BOMBARDIER | CSeries CS100 | Jet | 2 | M |
| BCS3 | AIRBUS | A-220-300 | Jet | 2 | M |
| BOMBARDIER | BD-500 CSeries CS300 | Jet | 2 | M |
| BOMBARDIER | CS300 | Jet | 2 | M |
| BOMBARDIER | CSeries CS300 | Jet | 2 | M |
| BE76 | BEECH | 76 Duchess | Piston | 2 | L |
| BEECH | Duchess | Piston | 2 | L |
| C25A | CESSNA | 525A Citation CJ2 | Jet | 2 | L |
| CESSNA | Citation CJ2 | Jet | 2 | L |
| C25B | CESSNA | 525B Citation CJ3 | Jet | 2 | L |
| CESSNA | Citation CJ3 | Jet | 2 | L |
| C25C | CESSNA | 525C Citation CJ4 | Jet | 2 | M |
| CESSNA | Citation CJ4 | Jet | 2 | M |
| C25M | CESSNA | 525 Citation M2 | Jet | 2 | L |
| CESSNA | Citation M2 | Jet | 2 | L |
| C310 | AVIONES COLOMBIA | 310 | Piston | 2 | L |
| CESSNA | 310 | Piston | 2 | L |
| CESSNA | L-27 | Piston | 2 | L |
| CESSNA | T310 | Piston | 2 | L |
| CESSNA | U-3 | Piston | 2 | L |
| COLEMILL | Bearcat | Piston | 2 | L |
| COLEMILL | Executive 600 | Piston | 2 | L |
| RILEY | 65 | Piston | 2 | L |
| RILEY | Rocket | Piston | 2 | L |
| RILEY | Super 310 | Piston | 2 | L |
| RILEY | Turbo-Rocket | Piston | 2 | L |
| RILEY | Turbostream | Piston | 2 | L |
| C68A | CESSNA | 680A Citation Latitude | Jet | 2 | M |
| CESSNA | Citation Latitude | Jet | 2 | M |
| C700 | CESSNA | 700 Citation Longitude | Jet | 2 | M |
| CESSNA | Citation Longitude | Jet | 2 | M |
| CRJ1 | CANADAIR | CL-600 Regional Jet CRJ-100 | Jet | 2 | M |
| CANADAIR | CL-600 Regional Jet RJ-100 | Jet | 2 | M |
| CANADAIR | Regional Jet CRJ-100 | Jet | 2 | M |
| CANADAIR | Regional Jet RJ-100 | Jet | 2 | M |
| CRJ2 | CANADAIR | Challenger 800 | Jet | 2 | M |
| CANADAIR | Challenger 850 | Jet | 2 | M |
| CANADAIR | CL-600 Challenger 800 | Jet | 2 | M |
| CANADAIR | CL-600 Challenger 850 | Jet | 2 | M |
| CANADAIR | CL-600 Corporate Jetliner | Jet | 2 | M |
| CANADAIR | CL-600 Regional Jet CRJ-200 | Jet | 2 | M |
| CANADAIR | CL-600 Regional Jet CRJ-440 | Jet | 2 | M |
| CANADAIR | CL-600 Regional Jet RJ-200 | Jet | 2 | M |
| CANADAIR | CL-600 Special Edition | Jet | 2 | M |
| CANADAIR | Corporate Jetliner | Jet | 2 | M |
| CANADAIR | Regional Jet CRJ-200 | Jet | 2 | M |
| CANADAIR | Regional Jet CRJ-440 | Jet | 2 | M |
| CANADAIR | Regional Jet RJ-200 | Jet | 2 | M |
| CANADAIR | Special Edition | Jet | 2 | M |
| CRJx | BOMBARDIER | CL-600 Regional Jet CRJ-1000 | Jet | 2 | M |
| BOMBARDIER | Regional Jet CRJ-1000 | Jet | 2 | M |
| D228 | DORNIER | 228 | Turboprop/Turboshaft | 2 | L |
| FAIRCHILD DORNIER | 228 | Turboprop/Turboshaft | 2 | L |
| HINDUSTAN | 228 | Turboprop/Turboshaft | 2 | L |
| RUAG | Dornier 228 | Turboprop/Turboshaft | 2 | L |
| D328 | DORNIER | 328 | Turboprop/Turboshaft | 2 | M |
| DORNIER | C-146 | Turboprop/Turboshaft | 2 | M |
| FAIRCHILD DORNIER | 328 | Turboprop/Turboshaft | 2 | M |
| DA42 | DIAMOND | DA-42 Guardian | Piston | 2 | L |
| DIAMOND | DA-42 Twin Star | Piston | 2 | L |
| DIAMOND | DA-42 Twin Turbo | Piston | 2 | L |
| DIAMOND | Guardian | Piston | 2 | L |
| DIAMOND | Twin Star | Piston | 2 | L |
| DIAMOND | Twin Turbo | Piston | 2 | L |
| DH8A | DE HAVILLAND CANADA | CC-142 Dash 8 | Turboprop/Turboshaft | 2 | M |
| DE HAVILLAND CANADA | CT-142 Dash 8 | Turboprop/Turboshaft | 2 | M |
| DE HAVILLAND CANADA | Dash 8 (100) | Turboprop/Turboshaft | 2 | M |
| DE HAVILLAND CANADA | DHC-8-100 Dash 8 | Turboprop/Turboshaft | 2 | M |
| DE HAVILLAND CANADA | E-9 Dash 8 | Turboprop/Turboshaft | 2 | M |
| DH8B | DE HAVILLAND CANADA | Dash 8 (200) | Turboprop/Turboshaft | 2 | M |
| DE HAVILLAND CANADA | DHC-8-200 Dash 8 | Turboprop/Turboshaft | 2 | M |
| DH8D | DE HAVILLAND CANADA | Dash 8 (400) | Turboprop/Turboshaft | 2 | M |
| DE HAVILLAND CANADA | DHC-8-400 Dash 8 | Turboprop/Turboshaft | 2 | M |
| E195 | EMBRAER | 195 | Jet | 2 | M |
| EMBRAER | ERJ-190-200 | Jet | 2 | M |
| E290 | EMBRAER | E190-E2 | Jet | 2 | M |
| EMBRAER | ERJ-190-300 | Jet | 2 | M |
| E295 | EMBRAER | E195-E2 | Jet | 2 | M |
| EMBRAER | ERJ-190-400 | Jet | 2 | M |
| E50P | EMBRAER | EMB-500 Phenom 100 | Jet | 2 | L |
| EMBRAER | Phenom 100 | Jet | 2 | L |
| E545 | EMBRAER | EMB-545 Legacy 450 | Jet | 2 | M |
| E550 | EMBRAER | EMB-550 Legacy 500 | Jet | 2 | M |
| E75S | EMBRAER | 175 (short wing) | Jet | 2 | M |
| EMBRAER | ERJ-170-200 (short wing) | Jet | 2 | M |
| FA8x | DASSAULT | Falcon 8x | Jet | 3 | M |
| GA5C | GULFSTREAM AEROSPACE | G-7 Gulfstream G500 | Jet | 2 | M |
| GULFSTREAM AEROSPACE | Gulfstream G500 (G-7) | Jet | 2 | M |
| GA6C | GULFSTREAM AEROSPACE | G-7 Gulfstream G600 | Jet | 2 | M |
| GULFSTREAM AEROSPACE | Gulfstream G600 | Jet | 2 | M |
| GL5T | BOMBARDIER | BD-700 Global 5000 | Jet | 2 | M |
| BOMBARDIER | Global 5000 | Jet | 2 | M |
| GL7T | BOMBARDIER | BD-700 Global 7000 | Jet | 2 | M |
| BOMBARDIER | Global 7000 | Jet | 2 | M |
| HA4T | HAWKER BEECHCRAFT | 4000 Hawker 4000 | Jet | 2 | M |
| HAWKER BEECHCRAFT | Hawker 4000 | Jet | 2 | M |
| RAYTHEON | 4000 Hawker 4000 | Jet | 2 | M |
| RAYTHEON | 4000 Hawker Horizon | Jet | 2 | M |
| RAYTHEON | Hawker 4000 | Jet | 2 | M |
| RAYTHEON | Hawker Horizon | Jet | 2 | M |
| HDJT | HONDA | HA-420 HondaJet | Jet | 2 | L |
| HONDA | HondaJet | Jet | 2 | L |
| J328 | 328 SUPPORT SERVICES | Dornier 328JET | Jet | 2 | M |
| AVCRAFT | Dornier 328JET | Jet | 2 | M |
| FAIRCHILD DORNIER | 328JET | Jet | 2 | M |
| FAIRCHILD DORNIER | 328JET Envoy 3 | Jet | 2 | M |
| FAIRCHILD DORNIER | Envoy 3 | Jet | 2 | M |
| RUAG | Dornier 328 JET Envoy | Jet | 2 | M |
| JS32 | BRITISH AEROSPACE | BAe-3200 Jetstream Super 31 | Turboprop/Turboshaft | 2 | M |
| BRITISH AEROSPACE | Jetstream Super 31 | Turboprop/Turboshaft | 2 | M |
| JETSTREAM | BAe-3200 Jetstream Super 31 | Turboprop/Turboshaft | 2 | M |
| JETSTREAM | Jetstream Super 31 | Turboprop/Turboshaft | 2 | M |
| MD83 | BOEING | MD-83 | Jet | 2 | M |
| MCDONNELL DOUGLAS | MD-83 | Jet | 2 | M |
| SHANGHAI | MD-83 | Jet | 2 | M |
| MRJ9 | MITSUBISHI | MRJ-90 | Jet | 2 | M |
| P06T | TECNAM | P-2006T | Piston | 2 | L |
| P180 | PIAGGIO | Avanti | Turboprop/Turboshaft | 2 | L |
| PIAGGIO | P-180 Avanti | Turboprop/Turboshaft | 2 | L |
| P212 | TECNAM | P-2012 Traveller | Piston | 2 | L |
| TECNAM | Traveller | Piston | 2 | L |
| P46T | JETPROP | DLx | Turboprop/Turboshaft | 1 | L |
| PIPER | M500 | Turboprop/Turboshaft | 1 | L |
| PIPER | Malibu Meridian | Turboprop/Turboshaft | 1 | L |
| PIPER | Meridian M500 | Turboprop/Turboshaft | 1 | L |
| PIPER | PA-46-500TP Malibu Meridian | Turboprop/Turboshaft | 1 | L |
| PIPER | PA-46-500TP Meridian M500 | Turboprop/Turboshaft | 1 | L |
| PA44 | AICSA | PA-44 Seminole | Piston | 2 | L |
| AICSA | Seminole | Piston | 2 | L |
| PIPER | PA-44 Seminole | Piston | 2 | L |
| PIPER | PA-44 Turbo Seminole | Piston | 2 | L |
| PIPER | Seminole | Piston | 2 | L |
| PIPER | Turbo Seminole | Piston | 2 | L |
| PA46 | PIPER | M350 | Piston | 1 | L |
| PIPER | Malibu | Piston | 1 | L |
| PIPER | Malibu Matrix | Piston | 1 | L |
| PIPER | Malibu Mirage | Piston | 1 | L |
| PIPER | PA-46-310P Malibu | Piston | 1 | L |
| PIPER | PA-46-350P M350 | Piston | 1 | L |
| PIPER | PA-46-350P Malibu Mirage | Piston | 1 | L |
| PIPER | PA-46R-350T Malibu Matrix | Piston | 1 | L |
| PC24 | PILATUS | PC-24 | Jet | 2 | M |
| RJ1H | AI(R) | Avroliner (RJ-100) | Jet | 4 | M |
| AI(R) | RJ-100 Avroliner | Jet | 4 | M |
| AVRO | Avroliner (RJ-100) | Jet | 4 | M |
| AVRO | RJ-100 Avroliner | Jet | 4 | M |
| BAE SYSTEMS | Avro RJ-100 | Jet | 4 | M |
| BRITISH AEROSPACE | RJ-100 | Jet | 4 | M |
| RJ85 | AI(R) | Avroliner (RJ-85) | Jet | 4 | M |
| AI(R) | RJ-85 Avroliner | Jet | 4 | M |
| AVRO | Avroliner (RJ-85) | Jet | 4 | M |
| AVRO | RJ-85 Avroliner | Jet | 4 | M |
| BAE SYSTEMS | Avro RJ-85 | Jet | 4 | M |
| BRITISH AEROSPACE | RJ-85 | Jet | 4 | M |
| SF50 | CIRRUS | SF-50 Vision | Jet | 1 | L |
| CIRRUS | SJ-x Vision | Jet | 1 | L |
| CIRRUS | Vision | Jet | 1 | L |
| SU95 | SUKHOI | Superjet 100-95 | Jet | 2 | M |
| TBM9 | DAHER | TBM-700N (TBM-910) | Turboprop/Turboshaft | 1 | L |
| DAHER | TBM-700N (TBM-930) | Turboprop/Turboshaft | 1 | L |
| DAHER | TBM-910 | Turboprop/Turboshaft | 1 | L |
| DAHER | TBM-930 | Turboprop/Turboshaft | 1 | L |
| SOCATA | TBM-700N (TBM-900) | Turboprop/Turboshaft | 1 | L |
| SOCATA | TBM-700N (TBM-910) | Turboprop/Turboshaft | 1 | L |
| SOCATA | TBM-700N (TBM-930) | Turboprop/Turboshaft | 1 | L |
| SOCATA | TBM-900 | Turboprop/Turboshaft | 1 | L |
| SOCATA | TBM-910 | Turboprop/Turboshaft | 1 | L |
| SOCATA | TBM-930 | Turboprop/Turboshaft | 1 | L |

### Aircraft type updates

All changes affecting the modelled aircraft types are captured hereafter:

* **Aircraft performances model**: the aircraft trajectory definition and/or the fuel flow calculation model were updated, because of:
  + the evolution of the reference databases, and associated aircraft substitution tables.
  + the revision of previous modelling of aircraft type based on experience gained from other similar EUROCONTROL projects. This has led to the definition of more accurate ANP/BADA models for calculating aircraft trajectories.

|  |  |  |
| --- | --- | --- |
| Performances databases | 2016 version | 2020 version |
| ANP | 2.1 | 2.2 |
| BADA 3 | 3.12 | 3.15 |
| BADA 4 | 4.1 | 4.2 |

* **Engine emissions model**: the aircraft emission model has changed due to the evolution of the ICAO jet engine reference database.

|  |  |  |
| --- | --- | --- |
| **Engine emissions database** | **2016 version** | **2020 version** |
| ICAO Engine Emissions DataBank – jet engines | 2.1 | 2.2 |

* **At least one cruise level update and new distances**: the definition of the trajectory has been modified to reflect the characteristics of the most frequent flights of each aircraft type in the ECAC area in 2019:
  + **Flown distance**: additional stage lengths have been added to comply with the maximum range of the aircraft (according to the manufacturer)
  + **Cruise level update**: At least one cruise level has changed for a given flight distance for the aircraft type concerned. In particular, for piston and turboprop aircraft, in some specific cases, the cruise altitude has changed by 10 000 feet or more between the 2 releases, which induces significant changes in fuel consumption and emissions.

These changed are captured in the table below.

| **ICAO Code** | **Aircraft model updates** | **Flight definition update** |
| --- | --- | --- |
| A140 | Aircraft performances model | At least one cruise level update |
| A148 | Aircraft performances model | At least one cruise level update |
| A306 | Engine emissions model | At least one cruise level update |
| A30B | Engine emissions model | At least one cruise level update |
| A310 | Aircraft performances model and engine emissions model | At least one cruise level update |
| A318 | Aircraft performances model | At least one cruise level update |
| A319 | Engine emissions model | At least one cruise level update |
| A320 | Aircraft performances model and engine emissions model | At least one cruise level update |
| A321 | Aircraft performances model and engine emissions model | At least one cruise level update |
| A332 | Aircraft performances model and engine emissions model | At least one cruise level update |
| A333 | Aircraft performances model and engine emissions model | At least one cruise level update |
| A342 |  | At least one cruise level update |
| A343 | Engine emissions model | At least one cruise level update |
| A345 | Engine emissions model | At least one cruise level update |
| A346 | Engine emissions model | At least one cruise level update |
| A359 | Aircraft performances model and engine emissions model | At least one cruise level update |
| A388 | Aircraft performances model | At least one cruise level update |
| AC90 | Aircraft performances model | At least one cruise level update |
| AEST | Aircraft performances model and engine emissions model | At least one cruise level update |
| AN12 | Aircraft performances model | At least one cruise level update |
| AN24 |  | At least one cruise level update |
| AN26 |  | At least one cruise level update |
| AN30 | Aircraft performances model | At least one cruise level update |
| AN32 |  | At least one cruise level update |
| AN72 | Aircraft performances model | At least one cruise level update |
| ASTR | Aircraft performances model | At least one cruise level update |
| AT43 | Aircraft performances model | At least one cruise level update |
| AT72 | Engine emissions model | At least one cruise level update |
| ATP | Aircraft performances model | At least one cruise level update |
| B190 | Aircraft performances model and engine emissions model | At least one cruise level update |
| B461 |  | At least one cruise level update |
| B462 |  | At least one cruise level update |
| B463 |  | At least one cruise level update |
| B712 |  | At least one cruise level update |
| B721 | Aircraft performances model and engine emissions model | At least one cruise level update |
| B722 | Aircraft performances model and engine emissions model | At least one cruise level update |
| B733 | Aircraft performances model and engine emissions model | At least one cruise level update |
| B734 | Engine emissions model | At least one cruise level update |
| B735 | Engine emissions model | At least one cruise level update |
| B736 |  | At least one cruise level update |
| B737 | Engine emissions model | At least one cruise level update |
| B738 | Engine emissions model | At least one cruise level update |
| B739 | Aircraft performances model and engine emissions model | At least one cruise level update |
| B742 | Engine emissions model | At least one cruise level update |
| B743 | Aircraft performances model and engine emissions model | At least one cruise level update |
| B744 | Aircraft performances model and engine emissions model | At least one cruise level update |
| B748 |  | At least one cruise level update |
| B74S | Engine emissions model | At least one cruise level update |
| B752 | Engine emissions model | At least one cruise level update |
| B753 | Engine emissions model | At least one cruise level update |
| B762 | Engine emissions model | At least one cruise level update |
| B763 | Aircraft performances model and engine emissions model | At least one cruise level update |
| B764 |  | At least one cruise level update |
| B772 | Aircraft performances model and engine emissions model | At least one cruise level update |
| B77L | Aircraft performances model and engine emissions model | At least one cruise level update and new distances |
| B788 | Aircraft performances model | At least one cruise level update |
| B789 | Aircraft performances model and engine emissions model | At least one cruise level update |
| BE10 | Aircraft performances model | At least one cruise level update |
| BE18 | Aircraft performances model and engine emissions model | At least one cruise level update |
| BE20 | Engine emissions model | At least one cruise level update |
| BE30 |  | At least one cruise level update |
| BE40 |  | At least one cruise level update |
| BE50 | Aircraft performances model and engine emissions model |  |
| BE55 | Engine emissions model | At least one cruise level update |
| BE58 | Aircraft performances model and engine emissions model | At least one cruise level update |
| BE60 | Aircraft performances model and engine emissions model | At least one cruise level update |
| BE99 | Aircraft performances model and engine emissions model | At least one cruise level update |
| BE9L | Aircraft performances model and engine emissions model | At least one cruise level update |
| BN2P | Aircraft performances model and engine emissions model | At least one cruise level update |
| C208 | Aircraft performances model and engine emissions model | At least one cruise level update |
| C303 | Engine emissions model | At least one cruise level update |
| C335 | Aircraft performances model and engine emissions model |  |
| C340 | Aircraft performances model and engine emissions model | At least one cruise level update |
| C402 | Aircraft performances model and engine emissions model | At least one cruise level update |
| C404 | Aircraft performances model and engine emissions model | At least one cruise level update |
| C414 | Aircraft performances model and engine emissions model | At least one cruise level update |
| C421 | Engine emissions model | At least one cruise level update |
| C425 | Aircraft performances model | At least one cruise level update |
| C441 | Engine emissions model | At least one cruise level update |
| C500 | Aircraft performances model | At least one cruise level update |
| C501 | Aircraft performances model | At least one cruise level update |
| C510 |  | At least one cruise level update |
| C525 |  | At least one cruise level update |
| C550 | Aircraft performances model | At least one cruise level update |
| C551 | Aircraft performances model | At least one cruise level update |
| C560 | Aircraft performances model | At least one cruise level update |
| C56x | Aircraft performances model | At least one cruise level update |
| C650 |  | At least one cruise level update |
| C680 | Engine emissions model | At least one cruise level update |
| C750 | Engine emissions model | At least one cruise level update |
| CL30 | Aircraft performances model | At least one cruise level update |
| CL60 | Aircraft performances model and engine emissions model | At least one cruise level update |
| CRJ7 | Aircraft performances model | At least one cruise level update |
| CRJ9 | Aircraft performances model | At least one cruise level update |
| DC10 | Aircraft performances model and engine emissions model | At least one cruise level update |
| DC3 | Engine emissions model | At least one cruise level update |
| DC6 | Aircraft performances model and engine emissions model | At least one cruise level update |
| DC87 |  | At least one cruise level update |
| DH8C | Engine emissions model | At least one cruise level update |
| DHC6 | Aircraft performances model and engine emissions model | At least one cruise level update |
| E120 |  | At least one cruise level update |
| E135 | Aircraft performances model and engine emissions model | At least one cruise level update |
| E145 | Aircraft performances model and engine emissions model | At least one cruise level update |
| E170 | Aircraft performances model | At least one cruise level update |
| E190 | Aircraft performances model and engine emissions model | At least one cruise level update |
| E55P | Aircraft performances model | At least one cruise level update |
| EA50 |  | At least one cruise level update |
| F100 | Aircraft performances model and engine emissions model | At least one cruise level update |
| F27 | Aircraft performances model | At least one cruise level update |
| F28 | Aircraft performances model | At least one cruise level update |
| F2TH | Aircraft performances model | At least one cruise level update |
| F406 | Aircraft performances model | At least one cruise level update |
| F50 |  | At least one cruise level update |
| F70 | Aircraft performances model | At least one cruise level update |
| F900 | Aircraft performances model | At least one cruise level update |
| FA10 | Aircraft performances model | At least one cruise level update |
| FA20 |  | At least one cruise level update |
| FA50 | Aircraft performances model | At least one cruise level update |
| FA7x | Aircraft performances model and engine emissions model | At least one cruise level update |
| G150 | Aircraft performances model | At least one cruise level update |
| G280 | Aircraft performances model | At least one cruise level update |
| GA7 | Engine emissions model | At least one cruise level update |
| GA8 | Aircraft performances model and engine emissions model |  |
| GALx | Aircraft performances model | At least one cruise level update |
| GLEx | Aircraft performances model | At least one cruise level update |
| GLF4 | Aircraft performances model and engine emissions model | At least one cruise level update |
| GLF5 |  | At least one cruise level update |
| GLF6 |  | At least one cruise level update |
| H25B | Aircraft performances model | At least one cruise level update |
| IL18 | Engine emissions model |  |
| IL62 | Aircraft performances model | At least one cruise level update |
| IL76 | Aircraft performances model | At least one cruise level update |
| IL96 | Aircraft performances model | At least one cruise level update |
| JS31 | Aircraft performances model | At least one cruise level update |
| JS41 | Engine emissions model | At least one cruise level update |
| L200 | Aircraft performances model and engine emissions model | At least one cruise level update |
| L410 | Aircraft performances model and engine emissions model | At least one cruise level update |
| LJ25 | Aircraft performances model | At least one cruise level update |
| LJ31 |  | At least one cruise level update |
| LJ35 |  | At least one cruise level update |
| LJ40 | Aircraft performances model | At least one cruise level update |
| LJ45 |  | At least one cruise level update |
| LJ55 | Aircraft performances model | At least one cruise level update |
| LJ60 | Aircraft performances model | At least one cruise level update |
| LJ75 | Aircraft performances model | At least one cruise level update |
| MD11 |  | At least one cruise level update |
| MD82 | Engine emissions model | At least one cruise level update |
| P68 | Aircraft performances model | At least one cruise level update |
| PA23 | Engine emissions model | At least one cruise level update |
| PA30 | Aircraft performances model and engine emissions model | At least one cruise level update |
| PA31 | Engine emissions model | At least one cruise level update |
| PA34 | Engine emissions model | At least one cruise level update |
| PAY2 | Aircraft performances model | At least one cruise level update |
| PAY3 | Aircraft performances model and engine emissions model | At least one cruise level update |
| PC12 |  | At least one cruise level update |
| PC9 | Aircraft performances model | At least one cruise level update |
| PRM1 | Engine emissions model | At least one cruise level update |
| SB20 | Aircraft performances model | At least one cruise level update |
| SBR1 | Aircraft performances model | At least one cruise level update |
| SF34 | Engine emissions model | At least one cruise level update |
| SH36 | Engine emissions model |  |
| STAR | Aircraft performances model | At least one cruise level update |
| SW3 | Aircraft performances model and engine emissions model | At least one cruise level update |
| SW4 | Engine emissions model | At least one cruise level update |
| T134 | Aircraft performances model |  |
| T154 |  | At least one cruise level update |
| T204 | Aircraft performances model | At least one cruise level update |
| TBM7 | Aircraft performances model | At least one cruise level update |
| TBM8 | Aircraft performances model and engine emissions model | At least one cruise level update |
| YK42 | Aircraft performances model | At least one cruise level update |

## Fuel burn comparison between 2016 and 2020 editions

Due to the changes listed in Section 6.1.2, differences can be observed between 2016 and 2020 releases. The following tables provide some examples of the most significant changes.

### A320 - 3CM026

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Stage length (Nm) | Release 2016 | | | Release 2020 | | | 2016 to 2020 change | |
| Most frequent cruise level 2015 (100ft) | Duration  (hh:mm:ss) | Fuel burn (kg) | Most frequent cruise level 2019 (100ft) | Duration  (hh:mm:ss) | Fuel burn (kg) | Duration | Fuel burn |
| 125 | 180 | 00:21:37 | 932 | 180 | 00:21:07 | 937 | -2.29% | 0.51% |
| 200 | 270 | 00:31:18 | 1 356 | 240 | 00:31:11 | 1 391 | -0.40% | 2.56% |
| 250 | 280 | 00:37:44 | 1 647 | 300 | 00:37:22 | 1 621 | -0.98% | -1.58% |
| 500 | 320 | 01:10:49 | 2 946 | 360 | 01:11:01 | 2 820 | 0.27% | -4.27% |
| 750 | 360 | 01:45:05 | 4 124 | 360 | 01:44:34 | 4 120 | -0.49% | -0.10% |
| 1000 | 380 | 02:18:37 | 5 273 | 360 | 02:18:05 | 5 379 | -0.38% | 2.01% |
| 1500 | 380 | 03:25:45 | 7 769 | 360 | 03:25:11 | 7 945 | -0.28% | 2.27% |
| 2000 | 380 | 04:32:47 | 10 484 | 360 | 04:32:18 | 10 561 | -0.18% | 0.74% |
| 2500 | 380 | 05:39:50 | 12 914 | 380 | 05:39:28 | 12 864 | -0.11% | -0.39% |
| 3000 | 380 | 06:46:01 | 15 847 | 380 | 06:45:57 | 15 686 | -0.01% | -1.02% |

### B734 - 1CM007

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Stage length (Nm)** | **Release 2016** | | | **Release 2020** | | | **2016 to 2020 change** | |
| **Most frequent cruise level 2015 (100ft)** | **Duration  (hh:mm:ss)** | **Fuel burn (kg)** | **Most frequent cruise level 2019 (100ft)** | **Duration  (hh:mm:ss)** | **Fuel burn (kg)** | **Duration** | **Fuel burn** |
| 125 | 180 | 00:23:03 | 967 | 220 | 00:22:34 | 950 | -2.12% | -1.74% |
| 200 | 270 | 00:33:04 | 1 409 | 260 | 00:33:14 | 1 415 | 0.52% | 0.39% |
| 250 | 280 | 00:39:57 | 1 711 | 280 | 00:39:55 | 1 709 | -0.06% | -0.15% |
| 500 | 320 | 01:14:18 | 3 144 | 340 | 01:14:41 | 3 101 | 0.51% | -1.35% |
| 750 | 360 | 01:50:31 | 4 588 | 340 | 01:49:45 | 4 606 | -0.69% | 0.40% |
| 1000 | 380 | 02:25:53 | 6 019 | 340 | 02:24:46 | 6 071 | -0.77% | 0.85% |
| 1500 | 380 | 03:36:33 | 8 991 | 340 | 03:34:53 | 9 050 | -0.77% | 0.66% |
| 2000 | 380 | 04:47:08 | 12 029 | 360 | 04:47:18 | 12 048 | 0.06% | 0.16% |

### B737 - 3CM032

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Stage length (Nm) | Release 2016 | | | Release 2020 | | | 2016 to 2020 change | |
| Most frequent cruise level 2015 (100ft) | Duration  (hh:mm:ss) | Fuel burn (kg) | Most frequent cruise level 2019 (100ft) | Duration  (hh:mm:ss) | Fuel burn (kg) | Duration | Fuel burn |
| 125 | 180 | 00:22:58 | 902 | 200 | 00:22:50 | 900 | -0.61% | -0.19% |
| 200 | 270 | 00:32:53 | 1320 | 320 | 00:32:09 | 1 288 | -2.25% | -2.45% |
| 250 | 280 | 00:39:44 | 1601 | 360 | 00:38:52 | 1 510 | -2.20% | -5.63% |
| 500 | 320 | 01:11:57 | 2895 | 400 | 01:12:24 | 2 643 | 0.63% | -8.72% |
| 750 | 360 | 01:45:52 | 4040 | 400 | 01:45:58 | 3 842 | 0.09% | -4.91% |
| 1000 | 380 | 02:19:27 | 5125 | 400 | 02:19:30 | 5 005 | 0.04% | -2.34% |
| 1500 | 380 | 03:26:34 | 7561 | 400 | 03:26:36 | 7 371 | 0.01% | -2.52% |
| 2000 | 380 | 04:33:47 | 10044 | 400 | 04:33:45 | 9 787 | -0.01% | -2.56% |
| 2500 | 380 | 05:40:49 | 12441 | 400 | 05:40:50 | 12 112 | 0.00% | -2.64% |
| 3000 | 380 | 06:48:04 | 14984 | 400 | 06:48:02 | 14 738 | -0.01% | -1.64% |
| 3500 | 380 | 07:55:07 | 17383 | 380 | 07:55:06 | 17 359 | 0.00% | -0.14% |
| 4000 | 380 | 09:02:10 | 19782 | 400 | 09:02:11 | 19 455 | 0.00% | -1.65% |

### B77W - 7GE099

| Stage length (Nm) | Release 2016 | | | Release 2020 | | | 2016 to 2020 change | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Most frequent cruise level 2015 (100ft) | Duration  (hh:mm:ss) | Fuel burn (kg) | Most frequent cruise level 2019 (100ft) | Duration  (hh:mm:ss) | Fuel burn (kg) | Duration | Fuel burn |
| 125 | 180 | 00:21:33 | 2 766 | 200 | 00:20:37 | 2 809 | -4.34% | 1.56% |
| 200 | 270 | 00:31:04 | 4 101 | 280 | 00:30:11 | 4 143 | -2.85% | 1.02% |
| 250 | 280 | 00:37:23 | 4 991 | 380 | 00:36:09 | 4 802 | -3.30% | -3.79% |
| 500 | 360 | 01:08:01 | 8 947 | 340 | 01:06:55 | 9 122 | -1.63% | 1.96% |
| 750 | 380 | 01:39:14 | 13 035 | 360 | 01:38:26 | 13 223 | -0.81% | 1.44% |
| 1000 | 400 | 02:10:21 | 17 039 | 380 | 02:09:35 | 17 152 | -0.59% | 0.67% |
| 1500 | 400 | 03:12:41 | 25 264 | 360 | 03:11:51 | 25 778 | -0.43% | 2.04% |
| 2000 | 400 | 04:15:06 | 33 596 | 380 | 04:14:19 | 33 782 | -0.31% | 0.55% |
| 2500 | 400 | 05:17:20 | 41 727 | 360 | 05:16:28 | 42 573 | -0.27% | 2.03% |
| 3000 | 400 | 06:19:41 | 50 246 | 360 | 06:18:52 | 51 097 | -0.22% | 1.69% |
| 3500 | 400 | 07:21:56 | 58 378 | 360 | 07:21:07 | 59 420 | -0.18% | 1.79% |
| 4000 | 400 | 08:24:11 | 67 068 | 360 | 08:23:32 | 68 010 | -0.13% | 1.40% |
| 4500 | 400 | 09:26:36 | 75 223 | 360 | 09:25:47 | 76 337 | -0.14% | 1.48% |
| 5000 | 400 | 10:47:06 | 86 374 | 360 | 10:25:31 | 85 445 | -3.33% | -1.07% |
| 5500 | 400 | 11:51:17 | 94 753 | 340 | 11:24:34 | 94 788 | -3.76% | 0.04% |

### DHC6 – Turboprop

For this type of aircraft, the performance model and the change in cruise level have a significant impact in terms of fuel flow and emissions. With a flight level of 9,000 feet below 2016 release for a stage length of 500 NM there is an increase of more than 100% in fuel consumption.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Stage length (Nm) | Release 2016 | | | Release 2020 | | | 2016 to 2020 change | |
| Most frequent cruise level 2015 (100ft) | Duration  (hh:mm:ss) | Fuel burn (kg) | Most frequent cruise level 2019 (100ft) | Duration  (hh:mm:ss) | Fuel burn (kg) | Duration | Fuel burn |
| 125 | 100 | 00:41:00 | 145 | 120 | 00:48:31 | 256 | 18.34% | 77.11% |
| 200 | 200 | 01:03:22 | 219 | 120 | 01:14:50 | 388 | 18.08% | 77.31% |
| 250 | 210 | 01:18:08 | 258 | 120 | 01:32:27 | 476 | 18.32% | 84.10% |
| 500 | 210 | 02:30:16 | 453 | 120 | 03:00:09 | 914 | 19.88% | 101.78% |
| 750 | 210 | 03:42:20 | 648 | 180 | 04:36:10 | 1 336 | 24.21% | 106.20% |

### AN24 - Turboprop

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Stage length (Nm) | Release 2016 | | | Release 2020 | | | 2016 to 2020 change | |
| Most frequent cruise level 2015 (100ft) | Duration  (hh:mm:ss) | Fuel burn (kg) | Most frequent cruise level 2019 (100ft) | Duration  (hh:mm:ss) | Fuel burn (kg) | Duration | Fuel burn |
| 125 | 160 | 00:33:00 | 499 | 160 | 00:33:10 | 503 | 0.50% | 0.64% |
| 200 | 180 | 00:50:14 | 732 | 180 | 00:50:20 | 733 | 0.19% | 0.21% |
| 250 | 230 | 01:02:58 | 848 | 180 | 01:01:25 | 890 | -2.46% | 5.05% |
| 500 | 250 | 01:59:10 | 1 516 | 190 | 01:57:04 | 1 645 | -1.76% | 8.52% |
| 750 | 260 | 02:56:12 | 2 177 | 260 | 02:56:10 | 2 191 | -0.02% | 0.65% |
| 1000 | 260 | 03:53:08 | 2 848 | 260 | 03:52:59 | 2 873 | -0.06% | 0.88% |

### BE60 - TIO-540-J2B2

For this aircraft type, the changes resulted in -37% fuel burn for the stage length 750 Nm and at despite cruising at the same flight level FL240.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Stage length (Nm) | Release 2016 | | | Release 2020 | | | 2016 to 2020 change | |
| Most frequent cruise level 2015 (100ft) | Duration  (hh:mm:ss) | Fuel burn (kg) | Most frequent cruise level 2019 (100ft) | Duration  (hh:mm:ss) | Fuel burn (kg) | Duration | Fuel burn |
| 125 | 120 | 00:42:18 | 97 | 120 | 00:45:11 | 69 | 6.83% | -29.16% |
| 200 | 240 | 01:01:34 | 131 | 140 | 01:09:08 | 101 | 12.29% | -22.95% |
| 250 | 240 | 01:14:21 | 164 | 180 | 01:21:34 | 121 | 9.69% | -26.50% |
| 500 | 240 | 02:19:04 | 332 | 180 | 02:39:12 | 222 | 14.48% | -33.31% |
| 750 | 240 | 03:23:38 | 500 | 240 | 03:44:35 | 312 | 10.29% | -37.59% |

### DC3 - Prop > 500hp

For this particular aircraft type, both the performance model and the cruise level changed resulting in a big reduction in fuel burn and emissions. For example, there is 78% less fuel burn for stage length 500NM because the cruise level was reduced by 6,000ft.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Stage length (Nm) | Release 2016 | | | Release 2020 | | | 2016 to 2020 change | |
| Most frequent cruise level 2015 (100ft) | Duration  (hh:mm:ss) | Fuel burn (kg) | Most frequent cruise level 2019 (100ft) | Duration  (hh:mm:ss) | Fuel burn (kg) | Duration | Fuel burn |
| 125 | 100 | 00:41:13 | 393 | 160 | 00:38:57 | 85 | -5.51% | -78.27% |
| 200 | 140 | 01:01:03 | 581 | 160 | 00:59:47 | 122 | -2.08% | -79.07% |
| 250 | 180 | 01:12:04 | 700 | 120 | 01:17:36 | 149 | 7.68% | -78.77% |
| 500 | 180 | 02:19:07 | 1 278 | 120 | 02:31:26 | 277 | 8.85% | -78.32% |
| 750 | 180 | 03:27:00 | 1 881 | 180 | 03:26:52 | 385 | -0.06% | -79.53% |

--- End of release note 2020 ---