Fuel Consumption of the 50 Most Used Passenger Aircraft

How to overcome industry’s secrecy towards passenger aircraft’s fuel consumption?

Get fuel consumption from 4 calculation schemes or extracted from 2 databases or from a literature review. The trick to get it from the ICAO/EASA "metric value" that tries to hide fuel consumption numbers. Applied to 50 aircraft. Results evaluated. But: Precise numbers are difficult to get.

PURPOSE
Fuel consumption of passenger aircraft is certainly known, but towards the public it is considered an industry secret. This project defines fuel consumption for passenger aircraft, shows and evaluates methods and databases for its calculation, and lists the fuel consumption of the 50 most-used passenger aircraft. Input data is only from publicly available documents.

METHODOLOGY

FINDINGS
Fuel consumption should be defined as kilogram of fuel per kilometer flown, per seat. Each aircraft type has many variants. Different sources give different values for the parameters. This can lead to undetected errors and deviations among the results from different methods beyond their fundamental differences. Method 1 underpredicts, Method 2 overpredicts. Method 4 is a reliable source with apparently good results, but new aircraft types (like A320neo) are presently not in the database. For Method 8, EASA so far publishes only MVs from flight tests with the A330neo. More data will come with new aircraft being certified. With 7 input parameters, an average value can be calculated from Methods 1, 2, and 3. The results give a good first indication of aircraft’s fuel consumption. Fuel consumption depends on range. For an economic range (range at maximum payload, harmonic range) modern aircraft consume between 0.02 kg/km/seat and 0.025 kg/km/seat of kerosine.

CO2 emissions evaluation metric value (MV) = \( \frac{1}{SAR} \cdot GF^2 \cdot \frac{1}{2} \)

- SAR: For aeroplanes with a single deck determine the area of a surface (expressed in m²) bounded by the maximum width of the fuselage outer mould line (OML) projected to a flat plane parallel with the main deck floor divided by 1 m² (ICAO Annex 16 2017)
- GF: The fuel consumption of the aircraft in kg of fuel per kg of CO2.

RESEARCH LIMITATIONS
The accuracy of the methods is limited. For this reason, the aircraft with the lowest fuel consumption cannot be named. CO2 emissions can be calculated directly from fuel consumption (3.15 kg CO2 / kg fuel). Otherwise, this project does not go further into emission calculations.

PRACTICAL IMPLICATIONS
Simple methods to determine the fuel consumption of passenger aircraft are presented.

SOCIAL IMPLICATIONS
Fuel consumption of passenger aircraft can be investigated and can be discussed openly independent of (missing) manufacturer's data.

ORIGINALITY
So far, no report discusses so many ways to determine fuel consumption of passenger aircraft in such a simple and practical way.

All details in the Bachelor Project of Kühn (2023):
https://nbn-resolving.org/urn:nbn:de:gbv:18302-aero2023-09-11_011

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