

Fuel Consumption of the 50 Most Used Passenger Aircraft as Function of Flight Distance

Task for a *Bachelor Thesis*

Background

Aircraft fuel consumption depends strongly on stage length, as a considerable amount of fuel is required for take-off and climb. This fuel expenditure is not fully recuperated during descent and landing. Moreover, flying extremely long-range routes necessitates a reduced payload to accommodate the additional fuel required. This relationship between fuel consumption and stage length is visualized with the bathtub curve and can be approximated using a simple equation. As an example, the bathtub curve is applied to fuel calculations in Intermediate Stop Operation (ISO). ISO has the potential to reduce per-passenger fuel consumption. Instead of conducting an ultra-long-haul flight in one leg, the journey is divided into two flight legs, each covering approximately half the full flight distance. On the two shorter flights, the aircraft can avoid high per-passenger fuel consumption at reduced payload. It is also possible to select a more efficient aircraft with shorter range. However, the approach faces practical difficulties such as increased operational complexity, additional airport fees and emissions, as well as extended overall travel time.

Task

The task of this Bachelor Thesis is to analyze aircraft fuel consumption using the bathtub curve and to apply it to ISO as an example. The subtasks are:

- Present the state of the art with a small literature review (bathtub curve, analytical equation, ISO).
- Calculate the bathtub curve using our [Excel Table](#) with data from our [Aircraft Database](#) among input data also from other sources.
- Extend the calculation to find the analytical (approximate) [simple equation](#).
- Apply the above calculations to the 50 most used passenger aircraft.
- Analyze the parameters of the approximate version of the bathtub curve.
- Extend the calculation to obtain the absolute fuel consumption for a given range.
- Assess the potential for ISO with the bathtub curve using the same long-range aircraft and alternatively using an aircraft better suited for the shorter ISO legs.
- Evaluate the practical implications of ISO.

The report has to be written in English based on international standards on report writing.