DEPARTMENT OF AUTOMOTIVE AND AERONAUTICAL ENGINEERING

Aircraft Fuel Consumption – Estimation and Visualization

Task for a *Project* according to university regulations.

Background

"3.85 liters per 100 passenger kilometers" – this was Lufthansa Group's specific fuel consumption in 2016, averaged over short-haul and long-haul flights. The statement was taken from Lufthansa Group's Sustainability Report 2017. The amount of consumed fuel depends on different factors: aircraft type, distance, payload, cruise Mach number, and more. It is evident: a) The longer the distance flown, the more fuel will be consumed. b) Is fuel consumption sufficiently constant versus range, if the fuel consumption is calculated per range? c) How does the picture change if we consider fuel consumption per range and per number of seats? Consider: Payload (and hence number of passengers) has to be reduced for flights at very long range. A nonlinear behavior is found for specific fuel consumption plotted versus range in all the cases mentioned. The problem: Publicly available aircraft data is always limited.

Task

Task of this project is to extract the aircraft's efficiency (aerodynamics and engines) from given payload-range diagrams. Here, help is available from previous project work. Based on this data the fuel consumption of an aircraft can be plotted, analyzed, and discussed. Following subtasks have to be considered:

- Analyzing payload-range diagrams with basic flight mechanics.
- Plotting and investigating fuel consumption versus range
  (Breguet Factor, "bath tub curve").
- Writing an Excel tool to support such fuel calculations and its visualization.
- Applying gained insight in a critical investigation of current long range aircraft operation.

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