DEPARTMENT OF AUTOMOTIVE AND AERONAUTICAL ENGINEERING

Environmental Labels in Aviation – Aircraft Label, Airline Label, Flight Label

Task for a *Master Thesis*

Background

New commercial aircraft are often advertised with many claims about their environmental advantages over reference and competitor models. These advertisement claims are often not verifiable, not based on any reporting standards (often due to a lack of such standards), and generally not backed up by reviewed scientific publications. This published PR information does not help the traveling public to choose the least environmentally damaging aircraft among those offered for a passenger flight. Therefore, an **Ecolabel for Aircraft** (aircraft label) was introduced and applied to many aircraft as part of previous theses. It was found that aviation affects the environment most with the impact categories resource depletion and global warming (both due to fuel consumption), local air pollution (due to the nitrogen oxides emission in the vicinity of airports), and noise pollution. A calculation method was developed for each impact category based solely on official, certified, and publicly available data. To ensure that every parameter is evaluated independently of aircraft size, which allows comparison between different aircraft, normalizing factors such as the number of seats, rated thrust, and noise level limits were used. In addition, it was already presented how airlines can be compared by combining the information of the Ecolabels for Aircraft for all aircraft in an airline fleet. The result is called the **Ecolabel for Airlines** (airline label). The best aircraft and airline evaluation does not help, if a direct flight is split into two or more legs with environmental pollution at each airport and an enormous detour. For each leg of a flight, values of parameters responsible for resource depletion, global warming, local air pollution, and noise are added up by means of derived weighting factors to form the **Ecolable for Flights** (flight label), should be displayed in an online booking engine. The flight with the lowest weighted sum of emissions could be chosen. Similarly, a *Trip Emission Ecolabel* has already been conceived and tested. It adds all environmental burden from all legs of a trip and compares it with the burden from a non-stop-2400-km flight of a Boeing 737-800. Moreover, a **Multimodal Trip Score** combines the three main evaluation criteria for a flight – or likewise for the whole *multimodal trip* from origin to destination: environmental burden, ticket price (with and without compensation) and travel time (total time, time in vehicles, usable time) based on user-adjustable

weighting factors for the three main evaluation criteria and their sub criteria. The user of the online booking engine decides, if the weighted Multimodal Trip Score or alternatively only one of the three main and weighted evaluation criteria is used to determine the sequence, in which the offered travel choices are listed.

Task

Task of this Master Thesis is to combine the main results from previous students, to close open issues, to benefit from ideas, by bringing them to light, and to present a logical trinity of the Environmental Labels in Aviation plus an outlook to the Multimodal Trip Score. The subtasks are:

- Systematic review of (emission based) airline rankings.
- Systematic review of flight booking engines and their data on environmental burden, ticket price, and travel time.
- Check of the Ecolabel Calculator – an Excel table (support is provided).
- Extension of the Ecolabel Calculator to easily accept more aircraft types (support is provided).
- Use of the Ecolabel Calculator to calculate more ecolabels of propeller-driven passenger aircraft.
- Comparison of airlines with the Ecolabel for Airlines. Release of the results.
- Definition of equations for the Ecolable for Flights. Design of the label.
- Definition of equations for the Multimodal Trip Score. Design of a possible display of the data in a (flight) booking engine.
- Proposal of means to economically safeguard the labels.
- Final discussion of the trinity of the Environmental Labels in Aviation plus the Multimodal Trip Score.

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

This is a Master Thesis at TU Berlin with Prof. Dr. Bardenhagen as examiner. It is supervised at HAW Hamburg by Prof. Dr. Scholz.