Developing an Ecolabel for Aircraft

Bachelor Thesis

Hochschule für Angewandte Wissenschaften Hamburg
Hamburg University of Applied Sciences

Tim Haß

Background

The airline "flybe" introduced an ecolabel for their aircraft in 2007 and had hoped other airlines would follow. This was apparently not the case. The labeling scheme rates emissions such as of NOx, CO2 and noise of an aircraft in the style of ecolabels for fridges, microwaves and washing machines.

The result is then presented on a label, which the airline uses for advertising and displaying on board. The methodology used has potential shortcomings, which may have inhibited further adaptation. Therefore, a more reliable and meaningful solution was investigated on a generally accepted and comprehensible basis.

Research Questions

Objective of this thesis was to develop an aircraft-related labeling methodology based on environmental impact. Existing emission determination methods and previous approaches such as flybe's were taken into account. Detailed tasks were:

- Describe the purpose of ecolabeling and how it is done
- Determine major environmental impacts of aviation
- How are emissions determined in aviation?
- Analyze existing labels or rating schemes and their potential shortcomings
- How could an ecolabel for aircraft best be defined?

Environmental Factors & Aircraft Emissions

- Identification of key environmental factors based on LCIA (*ReCiPe*) methodology
- Selection of relevant factors, metrics and their quantification method
- Analysis of determination methods

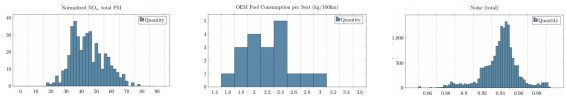
Env. Impact	Scale unit	Indicator	Determination Method
Resource Depletion	Fuel Consumption Rate	Fuel	SAR Measure Points (Specific Air Range)
Climate	GWP	CO2	SAR
		NOx	LTO / Particle Filter
		Contrails/Clouds	Travel Distance
Air Quality	PM resp. PM eq	NOx, CO, HC, Smoke	LTO / Particle Filter
Noise	EPNL	Noise	Noise Measurement

Evaluation of a Rating Scheme

A metric was developed in order to gain comparability of different aircraft classes and sizes. This also allows the rating of relative aircraft performance. These metrics include the following parameters:

- Aircraft Productivity (e.g. Number of Passengers, Seating Area)
- Fuel Efficiency
- Total Emissions of Pollutants (Engine Performance)
- Noise Performance

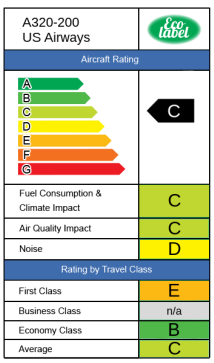
The metric yields index values, which are then evaluated based on a defined rating table. The rating scale was determined by assessing a wide range of performance data of conventional aircraft from ICAO and EASA databases.



Application

Example: A320-200
PAX: 150 (12FC + 138EC)
Seat Area: 36 in * 21 in (FC); 32 in * 18 in (EC)
MTOW: 73500 kg
Engine: CFM56
Travel Class Weighting Factors:
K (FC) = 1.2805
K (EC) = 0.9756
Fuel Consumption Index:
FCI (OEM) = 1.979 kg/100 km
FCI (Ave) = 1.979 kg/100 km
FCI (FC) = 2.535 kg/100 km
FCI (EC) = 1.931 kg/100 km
Air Quality Index = 46.97 g/KN
Noise Index = 0.9380
Overall Rating Index = 0.3564

Result



Results and Discussion

- The final label features an A-G rating for key environmental impact categories as well as a combined total aircraft rating
- The metric is kept simple in its application, but is based on life cycle considerations and takes the severity of environmental implications into account
- In order to decouple influences of airline-specific cabin configurations from the OEM aircraft, travel classes are considered individually
- For each travel class, a weighting factor and individual rating can be calculated based on efficiency of space utilization
- Future adjustments are possible while retaining the basic design concept and methodology, e.g. by changing weighting factors of the impact assessment model

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