Summary

The transport sector was one of the first industries to be affected by the consequences of the economic crisis in 2008. Not only did the passenger and freight transport volumes drop, the consequences of the economic crisis also lasted longer when compared to the impact of 9/11 or the war in Iraq. Although it seems as if the revenues are back on their old level, the forecasts for 2011 indicate that the growth will decline when compared to 2010.

Like the majority of airlines, Air France - KLM has been struggling to return a profit over the past couple of years. Last year, large losses were incurred despite the fact that the company managed to cut back their annual operating expenses by 700 million Euro. It has become evident that, in an industry where profit margins are becoming smaller, cost reduction is essential to realize sustainable growth.

This research is based on the trade-off between cost reduction and desired service level. As the fleet development department is responsible for the composition of the fleet, it is their task to realize the required service level, while keeping in mind the importance of cost reduction. For this purpose, comparative analyses are conducted to assess the performance and operational costs of different aircraft types.

The research goal is to develop a new maintenance cost estimation model for this comparative aircraft evaluation. As a part of the operational cost, maintenance cost is currently estimated by an in-house developed model. However, it has appeared that maintenance cost, which account for 10% of the operational cost, are hard to accurately predict. A well-funded estimate of maintenance cost is required as it provides the airline with, among other things, a bargaining means for guarantee negotiations and reliable projections about the maintenance cost of future generation aircraft.

It is found through a literature review that a gap is present between the demand for an adequate maintenance cost estimation model by KLM, and the supply of knowledge on this subject by scientific literature, which provides a valid motive for this research.

To present a baseline for the research, the current situation is first critically assessed. It is found that there is no method or performance indicator to evaluate the estimates which are produced by the model. Instead, the coefficient of determination, R^2, is used to evaluate the quality of the fit of the regression. A review of scientific literature has led to the decision to use the residual and relative error as main performance indicators. In order to compare the results of the model performance evaluations, box plots are found to be a suitable tool to visualize the distributions of the PI's. Evaluation of the current model by means of the new method has shown that the model produces estimates which deviate substantially from the actual maintenance cost.

A literature review has demonstrated that three common cost estimation techniques are eligible for this research, being Activity Based Costing, Parametric Estimation and Analytical Modelling.

Through a weigh-off in which several quantitative- and qualitative criteria are ranked by an ordinal scale, it is decided that, for this research, parametric estimation will be used.

By means of data collection and –analysis, two new cost estimation models are developed which represent the maintenance cost on two different levels of detail. The first is based on the current cost breakdown structure, but is dependent of more input parameters. The second is based on a deeper level of cost detail, which allows for again more input parameters to be included in the model. Both models are verified, validated and checked for robustness by a sensitivity analysis before their performance is assessed. Apart from these two models, four hybrid versions of the two models have been created to see if they represent the best of both models.

The new models' performances are assessed through a comparison on the basis of both quantitative- and qualitative criteria. A score is allocated to each model for the different criteria after which each score is multiplied by weight factor which is determined by end-user enquiring. The results are aggregated and the models are compared to the current model. It is found that the first alternative model possesses the most added value for KLM's fleet development department.

Through comparison of data from Original Aircraft Manufacturers and KLM, analogies are sought which can aid the cost estimation for future aircraft. For this purpose, three case studies are executed on aircraft which have been introduced into the KLM fleet in the past decade. Unfortunately, it is found that the cost-breakdown structures of the OAM and KLM are incomparable and therefore no analogies are found.

It is concluded that the first two research objectives have been reached. The current situation has been critically assessed, after which new models were developed which possess added value. A method has been described in which a high-level maintenance cost estimation model is developed, which acts from the perspective of KLM as a client. This method fits in the gap in scientific literature which was mentioned in the introduction. However, the third objective remains unfulfilled, as the model can't be adjusted by analogous factors.

Next, it is concluded that the developed model is unfit for KLM to present a well-funded cost estimate for the Airbus A350 and Boeing 787. In order for these goals to be reached, a more detailed cost breakdown of maintenance cost needs to be quantified. It is therefore recommended to perform further studies into the quantification of the direct maintenance cost for KLM.

It was introduced that the cost estimates can prove to be valuable as bargaining means in the process of cost guarantee negotiations. It is concluded that the new model provides a solid base for these negotiations, when it comes to past- and current generation aircraft. However, for future generation aircraft, a more in-depth study is recommended to produce a reliable projection.

Altogether, it is concluded that by means of the model developed in this research, aircraft operating cost estimates are more reliable. Therefore the choice for cost-efficient aircraft can be made with more confidence which can help in the process of operating cost reductions.