Work Load Forecast for the Overhaul Planning of
Aircraft Engine Regeneration

Masterarbeit

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1 Introduction

The aircraft industry, like any other industry, is characterized by a high degree of competition and increased global networking of the individual companies.[1] Thereby airlines, subcontractors and service companies depend on each other. Within this field the regarded case study company operates. Its core competencies are the area of maintenance, repair and overhaul of aircraft engines.

The service portfolio of this company deals with operations from smaller technical services to complete disassembly, main inspection, repair and assembly as well as testing of an aircraft engine and its parts. Furthermore, the adaptation of the performance of companies needs to be oriented towards customer wishes to sustain in the competition.[2]

1.1 Background

In the aviation industry the time that a company needs to fulfil an order, apart from the quality is the most important factor. Consequently, services of high quality that provide a low lead time and a high on time delivery are the most important goals of the regarded company. The growth accompanied by a higher volume of orders and the according work load at the case study company premises lead to new challenges referring to the accomplishment of the mentioned goals as well as create the planning more complex.

The work scope of an order in the aircraft engine regeneration sector is usually not exactly certain, when the work at the object starts. The concrete work scope cannot be stated until the main inspection is done. After that, the work scope depends on the one hand on the operating conditions of the aircraft engine like for example humidity and on the other hand on the engine type. The demand for personnel is high, since the aircraft maintenance provides a low degree of automation. This circumstance implies that small changes in the work load have a high influence on the demand of personnel as well as investment in new machinery. Therefore, the company needs to plan its capacity on a strategic level

[1] Cf. Sihn (1999), p. 1
[2] Cf. Granthien (2002), p. 1

to deal with bottlenecks proactively and recognize trends at the market early enough. A long term view on the future work load based on the expected order took place in several different Microsoft Excel files, which did not consider all relevant data to offer a comprehensive information base to support capacity planning. On that account the company could only react to capacity bottlenecks by what resources had not been utilized optimally.

1.2 Aim and Structure of work

Aim of this work is the development of an automated forecast tool, which calculates the predicted work load at the shop of the case study company to provide the Production Planning and Control department a comprehensive data base to support decision making. In addition the realization of the concept as well as the implementation of the resulting forecast tool in the planning process is part of this work.

By the means of this tool, the work load of all production areas is to be calculated, which enables the Production Planning and Control to plan more efficiently on a strategic level. Furthermore, more efficient prognosis regarding the future development is to be enabled and the effort to request that information is to be decreased. Thereby not only the work load resulting from the business with whole aircraft engines has to be considered, but also the work load caused by piece parts per cost centre is to be regarded. In order to forecast the work load of the piece part business the exposure as well as repair rates of distinct parts have to be taken into account. Furthermore, the tool that has to be created, should integrate all relevant data from the different categories automatically and also save old calculations for comparison purposes. Thus this resulting flexibility is necessary to offer a comprehensive information base to support decision making within production planning. After that, an optimised and transparent bottleneck management as well as prognosis's of the prospective capacity work load of personnel; machinery et al. should be enabled.

The procedure of the development of the model has to be adapted to the given framework conditions within the case study company. First of all, the scientific

foundation of this work will be presented, followed by the analysis of the given situation at the company, before the developed model is illustrated.

Goal of the display of the scientific background is to explain the frame in which the forecast model is classified. After that the production planning as well as the key performance indicators against its performance is measured, are indicated. Concluding challenges that lead to a list of measures are stated afterwards. Based on that chapter five deals with the developed forecast tool that is classified in the production planning of the company at first. Secondly, the determination of the various influence factors of the model is carried out, before the mathematical modelling is displayed. A view of the implementation of the tool is given in the second part of that chapter, before this work is finished with a summary of the main results.

6 Conclusion

Aim of this work is the development of a forecast tool, that supports the production planning of the case study company in the mid and long term horizon. The provision of information is to be guaranteed by using the forecasted order situation of both Sales departments. A flexible structure of the tool, which builds the framework conditions, is supposed to enable the creation of a comprehensive basis of decision-making. Furthermore, the decrease of work effort to prepare and assess the calculated prospective work load of the different business categories in one tool is part of this work.

In respect of the range of application of the developed tool the theoretical background of the PPC is acquired. In this context the process of the PPC is explained firstly and afterwards the planning level of capacity planning and scheduling is considered more closely. Within the scope of this study, the focus lied on the functions continuous scheduling, determination for and coordination of capacity as well as sequence planning.

In the further process the production planning of the case study was presented. The Production Planning and Control department is thereby the central organisation unit within the PPC process of the regarded company. It could be stated that the field of creating future scenarios was insufficiently covered, by what the Production Planning and Control department was missing an information basis in order to operate within production planning. The scope of action is thereby mostly limited to the reaction to occurring situations. Reasons for that insufficient information base considering the forecast of prospective developments lies especially in the manual development of work load forecasts that cause a big amount of effort, which is why these are only carried out on an irregular basis. Apart from that, taking various influence factors into account leads to a high susceptibility to errors.

For a realistic calculation of the forecasted work load the continuous year planning for whole aircraft engines as well as the forecast of prospective orders by the SR Sales department were identified as the two most important systems. These are the central elements of the production planning at the regarded company and represent

correspondingly the data foundation of the forecast model. The provision of information by the tool concerns thereby the key performance indicators against which the Production Planning and Control department is measured. As the key performance indicators the lead time (TAT), the on time delivery (OTD) and the work load at the shop (WLU) had been identified and presented. These measure the performance of the whole company and orientate on the logistical target values.

By means of the theoretical study as well as the analysis of the current situation at the regarded company, specific requirements for the forecast model could be formulated. Thereby three goals for the tool could be identified. These concern the calculation per cost centre on a strategic level, consideration of data resulting from the SR Sales department as well as taking into account exposure and repair rates for the piece part business. Consequently, the consideration and implementation of these aims build the foundation of the demand profile for the model. Moreover, the requirement of visualizing and reducing the effort belong to the demand profile.

Based on this, a model is developed that forecast the work load from the engine and piece part business on the strategic or rather tactical level. Thereby all relevant data from both Sales department at the company has been included. In order to offer user friendliness the system of the tool is completely dynamic. Moreover, current data can be imported automatically and old calculations can be stored for comparison purposes. Due to its flexible structure the tool is independent of changes in the data base, as for instance turns of year, increased number of cost centres or component groups, etc. The model that has been created within this work was implemented in a Microsoft Access® data base by using input data from Microsoft Excel®. Within this forecast tool all requirements of the demand profile could be implemented and the work load forecast calculation automated. As a result prospective developments can be analysed and critical situations recognized at an early stage.

Altogether this master thesis offers the case study company a forecast tool, which enables an automated and flexible work load forecast at the shop as well as a comprehensive information basis referring to prospective developments. With this forecast tool the Production Planning and Control department is able to deal proactively with prospective bottlenecks rather than just react to them.