Discussion on Supplier Selection in the Selection of Large Civil Passenger Aircraft

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Abstract: At present, the competition in the air transport industry is becoming increasingly fierce. It is increasingly being paid attention to by airlines to explore cost reduction and efficiency gains in aircraft procurement and selection. Taking the comprehensive and scientific evaluation of suppliers as the starting point, the analytic hierarchy process was used to study the choice of suppliers in aircraft selection. Taking the aero-engine as an example, the method of assigning different weights to different evaluators is used to compare the indicators with the principle of analytic hierarchy process, so as to obtain the weight distribution value of each evaluation index, that is, the complete evaluation index system. In the scoring process, in order to avoid the impact of different scoring personnel on the final scoring results due to differences in professional knowledge and work experience, the scores of different categories of personnel were weighted and averaged differently.

1. INTRODUCTION

Aircraft selection refers to the process of determining the use requirements of the aircraft purchased and reasonably selecting according to the airworthiness department or the manufacturer's technical specifications to meet the needs of the airline. Aircraft selection is a complex system engineering involving disciplines and aircraft parameters, engine performance, communication and navigation technology, flight dynamics, meteorology, art design, financial management, and corporate strategic planning. Since the price of the aircraft is as high as 100 million US dollars and the service life is about 20 years, whether the aircraft is suitable for selection, economical and reasonable choice of technical parameters will directly affect the development of the airline in the next 20 years. profit. This shows that aircraft selection is an extremely important task for airlines. Supplier selection is an important part of the aircraft selection program. This article takes the aero engine as an example to study the choice of suppliers in aircraft selection. In order to find scientific and reasonable secondary indicators, this paper uses brainstorming and causal analysis to find and analyze the supplier evaluation index system that needs to be considered in aircraft selection. In the specific implementation process, we organized the procurement department, the engineering department, and the leadership decision-making level to participate in brainstorming, and applied the causal analysis method to organize the items that everyone discussed and focused into a complete system. The steps of the analytic hierarchy process are shown in Figure 1.
2. ENGINE SUPPLIER EVALUATION INDEX WEIGHT

Analytic Hierarchy Process (AHP) is a multi-objective decision analysis method that combines elements related to task decision-making into goals, criteria, and programs. Based on this, qualitative and quantitative analysis is combined. This method is a hierarchical weight decision analysis method proposed by American operations researcher Pittsburgh University professor T. L. Satty in the early 1970s. It is characterized by the in-depth analysis of the influencing factors and intrinsic relationships of complex problems that require decision-making, using a small amount of quantitative data to mathematically make the decision-making process, thus making complex decisions with multiple criteria and no obvious structural characteristics. The problem provides an easy way to make decisions. Analytic Hierarchy Process (AHP) is an effective method for multi-objective decision-making. The basic operation steps are as follows: firstly establish a hierarchical target and sub-objective system framework, then the experts will compare the objectives to form a comparison matrix, and finally conduct a consistency test on the comparison matrix. The weight vector is obtained, and the final decision value is calculated from the product of the weight vector and the target assignment vector.

The decision-making problem of civil engine optimization selection can be attributed to the scope of operations research. At present, fuzzy judgment method, cluster analysis method and analytic hierarchy process are used at home and abroad for calculation decision. Among them, the analytic hierarchy process has the smallest error, and it is the most widely used in large-scale decision-making problems because of its practicability and effectiveness in dealing with complex decision-making problems. The biggest advantage is that it can deal with the combination of qualitative and quantitative problems, and can introduce the decision maker's subjective judgment and policy experience into the model and quantify it. AHP is used to comprehensively evaluate candidate civil aircraft engine suppliers[1].

The noise and emissions of the engine directly affect the airworthiness and comfort of the passenger aircraft. The fuel consumption and reliability of the engine greatly affect the economy and safety of the aircraft. In the early stage of civil passenger aircraft design, the evaluation of the candidate civil passenger aircraft engine must be based on a set of scientific and credible evaluation selection methods. The technical selection of civil passenger aircraft engines is a complex system engineering involving disciplines and contents such as aircraft performance, engine performance, aerodynamic drag, quality dimensions, safety, environmental protection, and supplier capability experience. And because the price of civilian passenger aircraft is as high as 100 million US dollars, the service life is about 20 a. Therefore, whether the selection of civil engine technical parameters is reasonable and whether the selection is appropriate will directly affect the development and profitability of the airline in the next 20 years. This paper makes use of the combination of qualitative
and quantitative methods of analytic hierarchy process to conduct comprehensive and objective evaluation and technical selection of candidate aviation civil engines, and considers that the engine needs to meet various requirements of aircraft requirements, and establishes a set of technical evaluation index system. The weighting factors of various influencing factors are obtained. Through the evaluation and analysis of the various indicators affecting the civil engine, the candidate engine is evaluated comprehensively, and the most suitable engine that meets the requirements of the civil passenger aircraft is selected. It is of great practical significance to provide a practical and feasible quantitative comprehensive evaluation method for the overall comprehensive evaluation of candidate civil engines.\[2\]

Taking the first-level indicator in the indicator system as an example, the weight values of the six first-level evaluation indicators such as cost C1, quality C2, use characteristic C3, after-sales service C4, supply capacity C5, and market share C6 are analyzed. When comparing the weights of these six primary evaluation indicators in decision-making, we use the 1-9 score scale method. “9” means very important, and “1” means equal importance. In order to judge the importance of the first-level indicators, we invited the purchasing manager P1, the engineer P2 and the company management personnel P3 to evaluate the above indicators, and assign different weights to the evaluation results according to different division of labor. The purchasing manager P1 gives 0.3, the engineer P2 gives 0.2, and the company manager P3 gives 0.5. After the expert evaluation, the final first-level indicator weight vector can be obtained by using the corresponding weight weighting\[3\]. The weight of each relevant factor is shown in Table 1.

| Index | Purchasing Manager | Engineer | Company Manager |
|-------|--------------------|----------|-----------------|
| Weight| 0.3                | 0.2      | 0.5             |

For the optimization model of civil passenger aircraft engine, the civil engine selection and evaluation problem should be organized and hierarchical, and a structural model of hierarchical analysis should be constructed. In the analysis model, the complex problem of the selection is decomposed into various components (called elements), and then the elements are divided into groups according to the attributes. Using the same group of elements as a criterion, the elements within the group are dominant, and at the same time they are dominated by the target layer of the same level. The highest level is the target layer, which is the predetermined goal that needs to solve the problem. The middle layer groups are the criteria involved in and the objectives to be achieved. The bottom layer is the various measures and technical indicators that may be adopted to achieve the goal. The analytic hierarchy process is used to establish an engine selection model consisting of four levels: the first level target layer is the final preferred civil passenger engine; the second level criterion layer is the evaluation aspect of the engine selection (criteria); the third layer is under each criterion layer. Corresponding specific engine index parameters; the fourth floor plan layer is an alternative civil engine. The judgment matrix structure, the weight coefficient calculation, the judgment matrix consistency test, the weight calculation of the target layer, and the like are conventional methods, and are not described in detail herein\[4\].

3. ENGINE SUPPLIER EVALUATION
When evaluating quantitative indicators, it is only necessary to standardize the corresponding assignments. However, when evaluating qualitative indicators, these qualitative indicators are somewhat biased towards engineering services, and some are more focused on procurement. Therefore, in the actual score, it is necessary to evaluate the evaluation according to different evaluators. The indicator types are given different weights. The civil passenger engine is an extremely complicated
system, which has many influencing factors on the passenger aircraft. Therefore, the objective technical evaluation of the candidate civil engine is a difficult and complicated task, and the selection of the passenger aircraft engine directly affects the operation of the civil passenger aircraft. Performance and R&D costs. This paper introduces the analytic hierarchy process into the technical evaluation and selection of candidate engines for civil passenger aircraft, establishes its comprehensive evaluation index system and selection evaluation method, and establishes a selection evaluation model to realize an effective, scientific and objective comprehensive evaluation of candidate engines. select. From the analysis and evaluation results of the above application examples, the method is feasible and in line with objective reality. The various influencing factors of the candidate engine are expressed in numerical form, and the contrast effect is intuitive, which helps to select a suitable civil passenger engine, improve the competitiveness of the passenger aircraft in the future market, and provides a certain theory for the comprehensive evaluation of civil engines. Basis has very important practical significance[5].

4. CONCLUSION
In summary, the analytic hierarchy process used in this study can make the supplier selection in aircraft selection more economical, comprehensive and rapid. The specific results have the following two points: comprehensive consideration of various departments' evaluation of different aspects of suppliers, optimization of supplier selection results, making the final selection results more scientific, comprehensive and accurate; shortening the choice of suppliers in aircraft selection the cycle ensures the progress of the project.

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