Training Helicopter Selection Based on Analytic Hierarchy Process

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Abstract. Analytic Hierarchy Process (AHP) is a multi-criteria decision-making method combining qualitative analysis with quantitative analysis. This method can analyze the essence, influencing factors and inherent relations of the problem, so as to construct a hierarchical model and solve problems easily with mathematical thinking. This article first introduces the helicopter selection process, and then applies AHP in the selection and evaluation of the aircraft. Finally, it establishes a hierarchical model of helicopter selection, through which the model can be selected quickly and intuitively to suit its own model.

Introduction

From the mid-1960s to the present, the operation scope of China's civilian helicopters has been spread throughout the provinces, autonomous regions and municipalities directly under the central government except Taiwan and Tibet autonomous region [1].

Many scholars in China had carried out research on aircraft selection and selection. Chen Zhi-Huai Chen[2] put forward the main content and order of selection evaluation of civil aircraft. De-Jun Liu[3] applied data envelopment analysis to the selection and evaluation of aircraft models. Chuan-Dong Hu[4] and so on through the market research, domestic 1 to 2-ton light civilian helicopter industry to make recommendations. Zhao-Hui He [5] applied the principle of fuzzy transformation of fuzzy mathematics to the judgment of purchasing new models.

The price of modern helicopters is very high, and whether the selection is correct or not has great influence on the operation and economic benefits of the company. Therefore, helicopter planning and aircraft selection is one of the most important strategic plans for helicopter purchase units. In this paper, a hierarchical model of helicopter selection is established, and the AHP is used to provide a reference for model selection.

The content and order of helicopter selection evaluation

When selecting a general aviation enterprise, we need to consider the following three points: first, according to the development needs of our country, our region and our company, we choose the models that are suitable for our domestic and local needs. That is to say, choose the type according to the use. Secondly, the selected aircraft must have the airworthiness certificate approved by the competent airworthiness authorities of the production country and the airworthiness authorities of our country approving the type of the aircraft, or get the airworthiness certificate approved by China Civil Aviation airworthiness authorities, that is to say, the security is better. Thirdly, it is necessary to consider the economy, comfort and maintainability of the purchase and purchase models. In a word, we should choose the model which is safe, reliable, economical, easy to maintain and good service[6].

Helicopter selection generally according to the internal and external factors of airlines and to forecast the market demand of the helicopter operating range is to use, then in accordance with the

company's primary type selection, flight environment, airport conditions, the primary after the helicopter from the comprehensive analysis of two aspects of economy and technology of certain selected models. The selection process is shown in Figure 1.
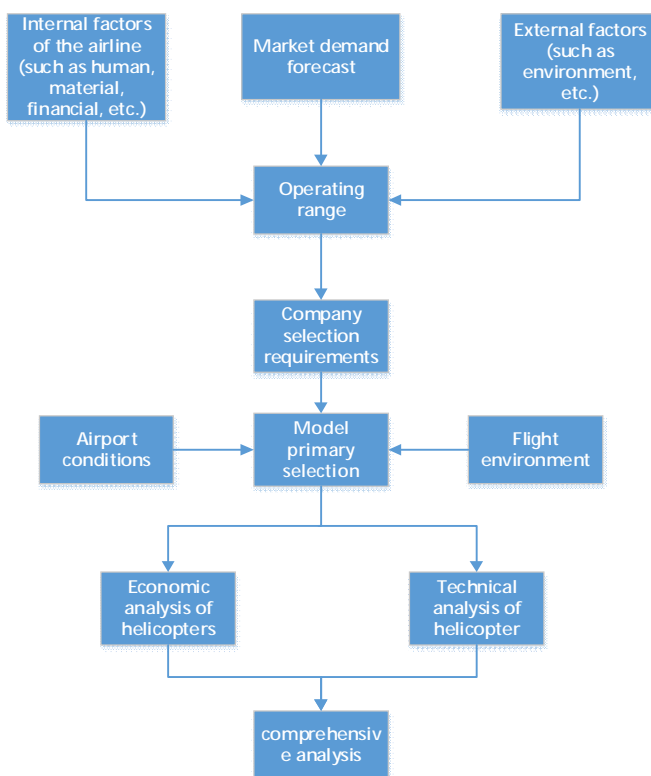

Figure 1 flow chart of helicopter selection

Evaluation of helicopter selection by analytic hierarchy process

First, we consider the various factors involved in the selection and evaluation of the helicopter, they should be: engine performance, noise characteristics, electronic equipment, airport routes adaptability, adaptability, cabin comfort, fuel utilization, helicopter life and convenient disassembly, purchase cost. We will be involved in the helicopter selection evaluation factors are divided into two categories, namely the related technique of the engine performance and noise characteristics, electronic equipment, airport routes adaptability, adaptability, cabin comfort for a class; related to the economy of the fuel utilization rate, purchase cost, helicopter life, become a kind of convenient disassembly. A hierarchical structure of AHP for helicopter selection is established to solve this problem, as shown in Figure 2.
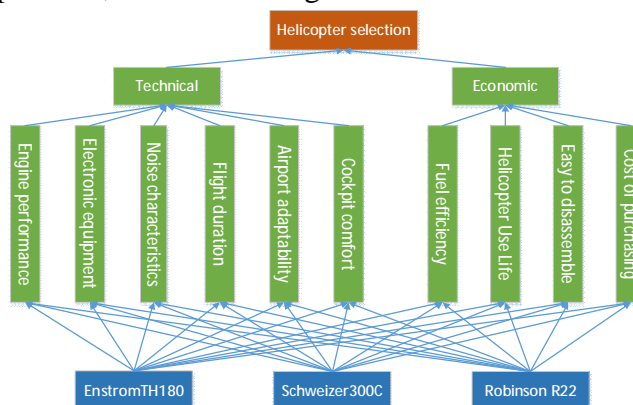

Figure 2 helicopter selection evaluation hierarchy structure

Numerical Example

We choose 3 commonly used training helicopters.

EnstromTH180   Schweizer300C
Robinson R22

selection evaluation matrix and calculation of importance

We give a hierarchical figure of helicopter selection evaluation, and we evaluate each level according to the benchmarks and principles of analytic hierarchy process.

First of all, the total target of helicopter selection is to compare the factors of the second layers. The results of the second - layer pairwise comparison matrix and the weight calculation are shown in Table 1.

Table 1: Pairwise comparison of elements of Level 2

Helicopter selection	Technical	Economic	Importance
Technical	1	0.5	0.3333
Economic	2	1	0.6667

And then compare the elements under the second stratum

Table 2 Comparison between subprojects under technical subprojects

Technical	Engine performance	Noise characteristics	Electronic equipment	Flight duration	Airport adaptability	Cockpit comfort	Importance
Engine performance	1	1	2	2	2	2	0.2499
Noise characteristics	1	1	0.3333	0.5	1	1	0.1168
Electronic equipment	0.5	3	1	1	2	2	0.2122
Flight duration	0.5	2	1	1	2	2	0.1984
Airport adaptability	0.5	1	0.5	0.5	1	0.5	0.1113
Cockpit comfort	0.5	1	0.5	0.5	1	1	0.1113

Table 3 paired comparison between subitems in economic performance

Economic	Fuel efficiency	Helicopter Use Life	Easy to disassemble	Cost of purchasing	Importance
Fuel efficiency	1	1	2	1	0.2857
Helicopter Use Life	1	1	2	1	0.2857
Easy to disassemble	0.5	0.5	1	0.5	0.1429
Cost of purchasing	1	1	2	1	0.2857

Table 4 comprehensive weight of each subproject

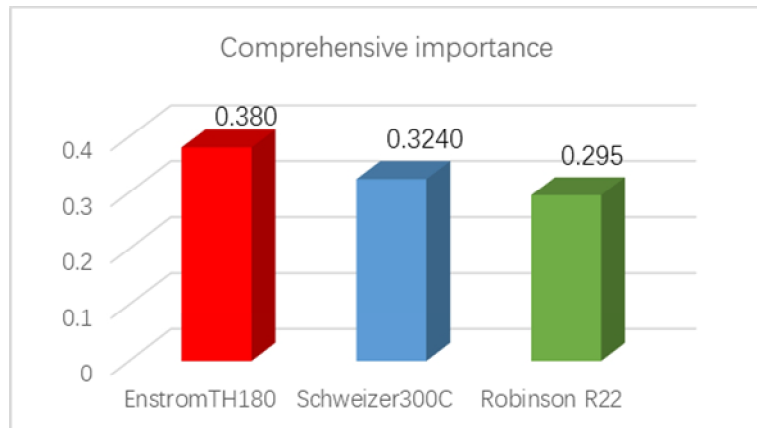|	Comprehensive importance
Engine performance	0.0833
Noise characteristics	0.0389
Electronic equipment	0.0707
Flight duration	0.0661
Airport adaptability	0.0371
Cockpit comfort	0.0371
Fuel efficiency	0.1905
Helicopter Use Life	0.1905
Easy to disassemble	0.0952
Cost of purchasing	0.1905

Figure 3 comprehensive weight diagram

According to the comprehensive importance Figure 3, it is clear that the EnstromTH180 model is suitable for the three types of helicopters, so the type selection process is over.

Conclusions

Entering the 21st century, China's macro economic and social development environment is conducive to the development of general aviation. Higher requirements for helicopter training and teaching are provided, and reasonable helicopter selection is more and more important. Based on AHP, a helicopter selection model is built, which makes the selection work simpler and more intuitive. At the same time, the feasibility of the model is proved by an example, which provides a reference for future helicopter selection.

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