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Research on Optimization of Air Equipment Transportation Mode Based on Logistics Mode

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ABSTRACT. *Air equipment transportation is an important transportation support force in our organization's future wars. Its transportation efficiency and transportation capacity directly affect the process of operations. Aviation equipment transportation is to make aviation equipment flow effectively between the production place and the use place or between storage places by selecting reasonable transportation means and modes according to the characteristics and transportation requirements of aviation equipment. In order to ensure the timely arrival of spare parts and minimize the storage cost of spare parts warehouse, equipment support units need to scientifically formulate transportation plans. In order to solve the problem of restricting the air mobility of civil equipment from the source, and provide theoretical and technical support for the air transportability verification of civil equipment in the future, it is necessary to strengthen the research of air transportation of civil equipment. Based on the analysis of logistics mode, this paper discusses the method of air equipment transportation planning from the main content of spare parts transportation plan and the main transportation mode of spare parts.*

KEYWORDS: *Air equipment transportation, Logistics mode, Mode of transport*

1. Introduction

Transportation of spare parts for aviation equipment is an important link to ensure the supply of spare parts, which is related to the continuity and turnover speed of spare parts supply [1]. In the production process of the factory, in order to ensure the smooth production, every other year, and the equipment spare parts support unit needs to sign a contract with the factory to ensure the supply of spare parts in the next stage. Transportation creates the utility of logistics space. Rationalization of logistics transportation is the key to improve logistics efficiency and reduce logistics cost, so it is particularly important to choose the mode of logistics transportation [2]. Aviation equipment transportation is to make aviation

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equipment flow effectively between the production place and the use place or between the storage places by selecting reasonable transportation means and modes according to the characteristics and transportation requirements of aviation equipment [3]. Air equipment transportation is mainly used to transport personnel, materials and equipment for carrying out emergency tasks such as operations, drills, handling of emergencies, emergency rescue and disaster relief, etc. It is also used for air mobility, transportation of airborne organization, logistics supply, transportation of the wounded and transportation of aviation [4]. At present, different transportation methods have different characteristics in terms of transportation speed, transportation capacity, reliability, etc. Once the logistics transportation method is not selected properly, it will produce different additional costs and customer service levels.

In order to ensure the timely arrival of spare parts and minimize the storage cost of the spare parts warehouse, the equipment support unit needs to scientifically formulate a transportation plan, that is, based on actual needs, reasonably determine the transportation time of various spare parts and the number of spare parts to arrange the unit's transportation strength or logistics The company carries out the implementation [5]. Aviation equipment transportation is becoming more and more important in civil operations. Reasonable aviation equipment transportation will play an important role in the victory of the civil [6]. In the process of equipment development, transformation and procurement, our organization considers more modes of transportation, mainly roads and railways, and pays less attention to air transportation conditions and the environment. As a result, some equipment cannot be quickly maneuvered by air transportation, which has become an impact and the bottleneck restricting the rapid mobility and deployment of civil equipment during wartime [7]. With the continuous development and equipment of domestic large and medium-sized civil transport aircraft, our civil's air strategic delivery capability is entering a period of rapid development. In emergency operations support, aviation equipment transportation capabilities have become a major factor restricting the operations of rapid reaction forces. Based on the logistics model, this paper analyzes the methods of aviation equipment transportation planning from the main content of the transportation plan of the spare parts and the main transportation methods of the spare parts.

2. Failure of Air Equipment Transportation System

Monitoring faults with early warning circuit method may occur a little earlier. The advance period is usually used to receive the alarm signal so that it can make a quick response within the first time. The reliability of an early warning circuit is not different from that of a normal circuit at the beginning, but increases the use burden during design, so that it will fail before the normal circuit. For example, the current density of the warning circuit can be increased by reducing the line diameter of the warning circuit. Fault diagnosis refers to the use of sensors to detect system state characteristic parameters and to evaluate the current health status of the system in combination with other data information, so as to achieve the purpose of diagnosis

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and monitoring. According to the analysis of current prediction algorithms, this technology mainly uses parameter model method and cost parameter model method. The first type is mainly to study the change law of historical data, and then data model based on the law [8]. Compared with the previous aviation equipment transportation fault diagnosis technology, the fault prediction and health management technology is a more advanced and efficient technology. It has gradually become the mainstream fault diagnosis technology in aviation equipment transportation system. Failure of comprehensive aviation equipment transportation system means that the design function of the system cannot be correctly executed under the constraint conditions. The degradation process and physical failure model of electronic products are established by mathematical methods. The damage degree and residual life of products are evaluated by analyzing the life cycle load of the system. According to the different granularity of the model, it can be divided into system model and failure physical model. The deviation curve of PCA extracted features is shown in the Figure 1.

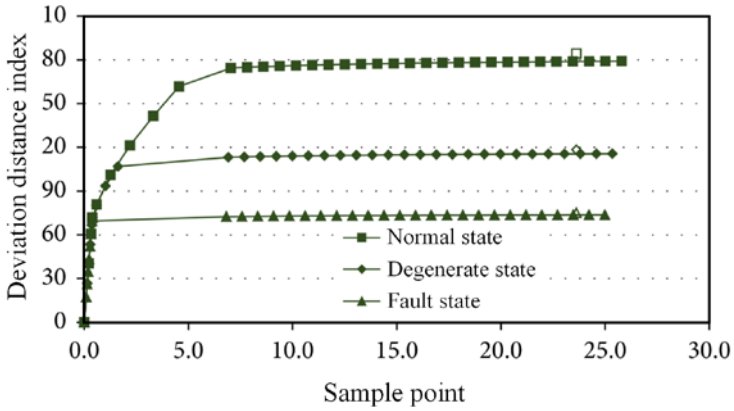

Figure. 1 PCA extraction feature deviation curve

For the data set composed of fault information extracted from multiple test points and historical degraded fault information, maximum likelihood method is used to estimate the dimension of fault features to be extracted. The high-dimensional original data is reduced to a low-dimensional nested structure with a specified dimension by a noise reduction self-coding neural network method, so that key and important fault characteristics are extracted, and redundant fault information is removed. Although the failure may be caused by environmental factors, the internal reason is mainly the design defects of the equipment. Or internal hardware damage or firmware amnesia due to the inability of the electronic device to withstand external stress during operation. The monitoring characteristic parameter method can process the obtained information through a certain program, and then carry out effective analysis on the processed data so as to predict various faults of the electronic system. The fault diagnosis of the aviation point in the system needs

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to be carried out through a series of programs, and the detected data must be analyzed under certain circumstances.

3. Evaluation of Air Equipment Transportation Efficiency

Air transportability test is an important link in the equipment development process. Through the test, the development unit can be helped to correct the defects in air transportability design. During air transportation, the volume of spare parts transported is limited. Therefore, it should only be used when transporting small spare parts in urgent need under special circumstances. For the initially determined air transportability test contents of civil equipment, the main test items can be scientifically and reasonably selected and determined according to the actual situation of our civil equipment and the actual construction of air transportability engineering system. The time limit of the cargo receiving and dispatching agreement must be bound with the time when the cargo arrives at the terminal to ensure the timely and punctual transportation of the cargo. According to various regulations and standards issued by our organization, the civil equipment management department should track and monitor the development of equipment at all stages, and review the progress and quality of scientific research. The air transportation review should be carried out simultaneously with the above-mentioned civil equipment development review. In order to facilitate the organization and implementation of the test, the composition of the specific test items shall be determined in accordance with the requirements of various test contents on test instruments and equipment and test technical methods, and in accordance with the method of merging similar items.

In the actual logistics distribution problem, we will also encounter the problem of transportation route optimization. Suppose a distribution center wants to supply d demand points, and the routes that can be traveled are known. It is required that the transportation route to be established should make the total mileage the shortest, i.e. return after delivery from the distribution center through various demand points to find the shortest distance:

$$f_1(x)=\sum_{i=1}^{D-1}\left[100\left(x_{i+1}-x_i^2\right)^2+\left(x_i-1\right)^2\right] \tag{1}$$

The objective function is:

$$o_j(t)=f\left(\left[\sum_{i=1}^{n}w_{ij}x_i\left(t-\tau_{ij}\right)\right]-T_{ij}\right) \tag{2}$$

The constraints are:

$$Y_j(t)=\varphi\left(\sum_{i=1}^{n}w_{ji}x_i-\theta_j\right) \tag{3}$$

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When equipment is transported by air, civil planes are mainly used. When necessary, the spare parts department shall submit an application to the chief for the superior to send special planes to transport spare parts, or use transit planes and transport planes to carry out training missions. In the station spare parts department that connects civil aviation flights or the spare parts department that is close to civil aviation airports, regular civil aviation flights can also be used to airlift a small amount of urgently needed spare parts. For all goods transportation vehicles, the sum of the shortest operation time and the time required for goods to be delivered at the terminal can be arranged according to the effective speed of the vehicle, and the normal operation time of the goods can be obtained [9]. At present, due to the lack of relevant testing equipment and testing institutions, most air transportation reviews can only be conducted by means of data review, calculation verification, etc., which is difficult to ensure the scientific nature of the review results. The reliability and scientificity of technical requirements for air transportability can be tested through carrying out engineering tests for air transportability, which can provide scientific basis for formulating standards for air transportability. Civil equipment may be affected by mechanical environmental conditions during air transportation. Therefore, a cargo compartment mechanical environmental simulation system for the whole flight process of transport aircraft can be established, and civil equipment can be put into the simulation environment for testing to judge its climate and environmental adaptability.

4. Summary

The research on air transportation of civil equipment is a new research field for our organization, and it is also an important problem to be solved urgently for air delivery support. For the data set composed of fault information extracted from multiple test points and historical degraded fault information, maximum likelihood method is used to estimate the dimension of fault features to be extracted. In order to ensure the timely arrival of spare parts and minimize the storage cost of the spare parts warehouse, the equipment support unit needs to scientifically formulate the transportation plan, i.e. reasonably determine the transportation time and quantity of various spare parts according to the actual demand, so as to arrange the transportation force of the unit or determine the logistics company to implement. When transporting spare parts, the transportation of spare parts to be transported must be reasonably organized according to the actual situation of spare parts to be transported and the existing transportation means. For all goods transportation vehicles, the sum of the shortest operation time and the time required for goods to be delivered at the terminal can be arranged according to the effective speed of the vehicle, and the normal operation time of the goods can be obtained. Civil equipment may be affected by mechanical environmental conditions during air transportation. Therefore, a cargo compartment mechanical environment simulation system for the whole flight process of transport aircraft can be established, and civil equipment can be put into the simulation environment for testing.

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