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Study on the Optimal Problem of the Maintenance Resources Allocation

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Abstract. Aiming at the problems of lacking of system engineering method for the equipment maintenance support resource allocation problem, the problem to be solved for resource allocation is proposed from the three hierarchical perspective which is "what to allocate , how to allocate, and how much to allocate"; from the three aspects of the demand analysis, allocation method, optimizing allocation, the connotation of the problem is described, and for the each problem the essence of the problem solving method is studied systematically; the proposed method can provide science and technology support for the equipment maintenance support resources allocation scheme in the design phase.

Keywords: maintenance support, resource allocation, demand analysis, allocation method, optimizing allocation

1 Introduction

The maintenance support resources are the important part of the maintenance support system. Whether the demand of the maintenance support resources is scientifically predicted not only affects the life cycle cost of the equipment, but also directly affects the integrity of the equipment and the army combat effectiveness. However, in the process of the maintenance support resources allocation, some unreasonable problems often occur. On the one hand, whether in peacetime or wartime repair training, it will seriously affects the completion of the forces training and task when lacking maintenance support resources or the support is inadequate, resulting in the difficulty of forming efficient support force and combat effectiveness rapidly; on the other hand, if the maintenance support resources reserve or backlog is excessive, it will inevitably lead to a tremendous waste of resources as well as the trouble in increasing storage.

Therefore, solving the allocation problem of the equipment maintenance support resources is the material basis and significant assurance of carrying out the comprehensive support of the equipment. The ability to allocate the maintenance support resources scientifically and rationally, not only affects the life cycle cost of the equipment, but also has direct impact on the equipment readiness and combat effectiveness. That is to say, the allocation problem of maintenance support resources covers both economic issues and combat effectiveness recovery issues, while the

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purpose of maintenance support resources allocation is to control the maintenance cost and also meet the demand.

The paper has systematically analyzed the current domestic primary literature about the equipment maintenance support resources allocation problem, and elaborating its own viewpoints in the aspects of "what to allocate, how and how much to allocate those resources".

2 The maintenance support resources allocation process

The maintenance support resources allocation process was shown in Figure 1.

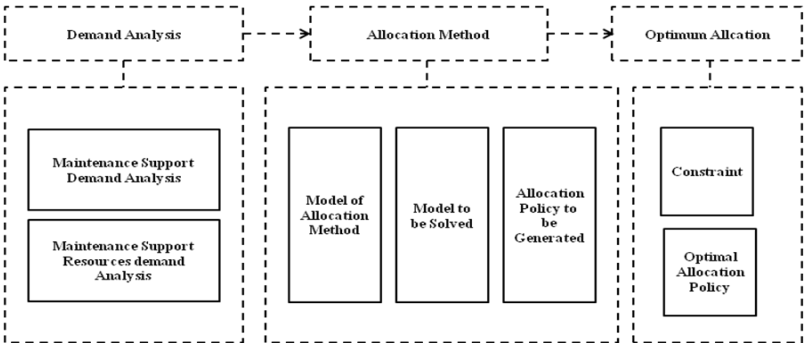

Fig. 1. Maintenance support resources allocation process

The demand analysis means "what kinds of resources to allocate", through which we could gradually get the requirements of the maintenance support resources.

2.1 Maintenance Support Demand Analysis

Equipment maintenance support demand analysis simply means: what kind of maintenance support resources to be used when the equipment are in the failure? The final aim is to determine the requirements of various kinds of resources through the analysis of equipment maintenance support, for that maintenance support resources are the material basis for the implementation of maintenance support, and only if equipped with the imperative resources various can those reparation and support work be complete.

So far the maintenance support requirements analysis is fragmented, lacking standardized method. One practical and common analysis method is based on RCM (Reliability Centered Maintenance analysis) ,the principle of which is organizing the reliability analysis of important items of the equipment.RCM method, considering adaption and economics as its decision criteria, is based on the analysis of equipment failure modes and consequences, and determining the method of maintenance and testing, cycle, the level (who did) and activities (how to complement)by using the logical determination method .In addition, RCM method gets its maintenance

program constantly improved according to the equipment's data and experience .The basic steps of RCM method include:1) identify important functional items;2)determine the maintenance ways;3)determine the contents of the maintenance work; 4)determine the level of maintenance work.

The literature on Ref 1 studies the equipment maintenance support demand analysis in the following aspects: object-oriented level analysis, tasks-oriented failure mode analysis, program-oriented maintenance strategy analysis and resources-oriented maintenance process analysis. The method has certain reference significance in providing specific process and principles for the equipment maintenance support demand analysis.

2.2 Maintenance Support Resources demand Analysis

Maintenance support resources demand analysis is to determine the type and quantities of the resources needed in the maintenance support activities, such as devices type, fuel type, human resources and so on, it is the premises of the allocation of the equipment maintenance support resources.

Maintenance support resources are mainly divided into three parts, that is, material resources, human resources and information resources. When talking about the resources allocation studies, it is mainly about the allocation of material resources and human resources. Material resources mainly refer to the necessary equipment, spare parts, tools, instruments and technical materials in maintenance. Human resources include the maintenance staff dealt with technical work and the management staff from all levels engaged in maintenance management and program organization.

Thus, the main task of the resources demand analysis is to determine the type and the quantity of maintenance devices, spare parts, maintenance and human resources. The general process of the maintenance support resources demand analysis is shown in Figure 2. This process is similar with the maintenance support allocation process, but they have different emphasis.

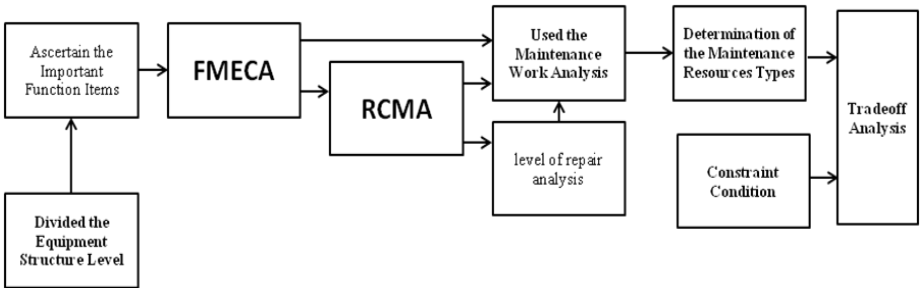

Fig. 2. General process of maintenance support resources demand analysis

Figure 2 shows that this process is in a accordance with the maintenance support demand analysis, which eventually aims to determine the requirements of the maintenance support resources.

This process can initially identify a detailed list of maintenance equipment, spare parts, personnel and other resources. In determining this list and carrying out

resources plan further, a variety of methods as well constraints might be taken into consideration.

3 Optimum of the resources allocation

The output of maintenance support resources allocation method is “how much to allocate”. The direct result of algorithm can meet the basic requirements of maintenance support, but may be “unreasonable”, such as resources squandered or free. Therefore, it demands to combine repair mission requirements. The output which makes the maintenance support resources allocation methods and maintenance demand balanced is the number that actual maintenance support resources need to be equipped, which means “reasonable allocation ”realizes ”match”.

The optimal allocation of equipment maintenance support resources can effectively avoid the waste of individual maintenance resources, short supply, maximize utilization of maintenance resources and ensure the need of weapons and equipment maintenance, reduce the equipment cycle cost.

4 Conclusion

The allocation of maintenance support resources is a complex issue with intricate realization process, it requires a comprehensive application of various methods to optimize all the aspects of resources allocation, so as to improve the intelligent allocation of maintenance support resources as a whole .Consequently, in the study of maintenance support resources allocation ,how to select the appropriate method in each allocation step, making best use of its advantages and avoiding its disadvantages, has become the key issue.

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