Research on Key Techniques of the Warship Equipment Support Capability Design for the People’s Armed Police Coast Guard

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Abstract. According to the actual requirement and the existing situation of the warship equipment support, the article makes its main research on the People’s Armed Police Coast Guard, and describes the concept and connotation of the warship equipment support design. Finally, it summarizes the project and technological approaches which can realize the support target from the project demonstration phase to the using support phase. The warship equipment support capacity design aims at solving the generated problem of the system of systems support capability, and can improve the logistical support system, innovative the support model, enhanced the logistical support capability.

1. Introduction
The Chinese People’s Armed Police Coast Guard has undertaken a number of major missions, including the maintenance of national maritime security and public order, the responsibility of security guards for important targets at sea, and the handling of emergencies at sea. As we all know, as long as any equipment is used for combat and training, it needs a certain form and scale of maintenance and support capabilities. Without these maintenance and support capabilities, the equipment will not be able to perform its tasks well, nor will it be able to form combat capabilities. Equipment maintenance and equipment support both serve combat missions. The inherent support characteristics and degree of support of the equipment itself ultimately determine its ability to complete combat missions. Therefore, when we need perform combat missions, we should use equipment to achieve its mission requirements, and it is necessary to provide equipment and support capabilities which can meet with the mission.

2. Requirement Analysis
For a long time, the main realization of warship design is functional performance design. Tactical and technical indicators are the first important indicators that need to be considered for realization. The warship equipment is usually poorly supported which is designed in that mode. Although the equipment is delivered, it will take a long time to form a combat capability that matches the formation. According to the characteristics of the development of the warship itself, it is determined that the number of ship development is small and the technical status is variable. The applicability index of the warship's good usage and good support cannot be fully evaluated. In order to solve this problem, a lot of research and application work has been carried out in China, and some research work has
been carried out on how ships are maintained and staffed. However, in general, how to carry out support design for warships has not yet become an essential part of model work.

The notable characteristics of the development of the new generation of ships are informatization, networking, and intelligence, which eventually form a system. The support work must also adapt to these characteristics, and improve the support capability of the ship. At present, there are many mature technologies at home and abroad. If these technologies are not fully utilized in the design of the People’s Armed Police Coast Guard warship, the level of support informatization in the future will be very low, and the efficiency and effectiveness of the support will not meet the needs of enhancing the overall operational effectiveness of the People's Armed Police Coast Guard system. In other words, although the performance of the newly delivered ships is very advanced, the level of support performance is very backward, finally the equipment has no combat power.

3. The Support Capability Design for the Warship

3.1. Combat Design Requirements

The actual combat is the fundamental requirement for the quality of warships. Meeting the needs of actual combat is the fundamental goal and ultimate goal of the warship design. Once the focus deviates from the battlefield and we are only content to get the equipment out, not paying enough attention to the equipment’s easy, practical and durable usage, the equipment must not be suitable for the complex geographical environments, complex meteorological and hydrological environments, complex electromagnetic environments, and high-intensity confrontation environments. Finally, it will not be suitable for system integration requirements. These inadequacies are reflected on the battlefield, that is, they cannot fight or fight against strong opponents.

The actual combat requirements for ships must be run through the entire system and life cycle management process of ship development. Firstly, carry out the demonstration of warship needs according to the actual combat requirements, clarify the opponent, and determine the performance index of the newly-developed equipment by referring to the performance index and quality standards of the opponent's equipment, and solve the actual combat-oriented problem from the source. According to the perspective of warship design, the actual combat requirements should be specific to the design. It is necessary to change the design thinking and design capabilities into equipment. This capability includes combat capabilities and support capabilities. Combat capabilities can be measured using tactical technical performance indicators, and support capabilities can be measured using support performance indicators.

3.2. Supportability Requirements

The support serves for the combat mission. The inherent support characteristics and support degree of the equipment itself ultimately determine its ability to complete combat missions. The equipment ability is composed of two parts, equipment combat capability and equipment support capability. When we carry out combat missions and use equipment to achieve the mission requirements, it is necessary to provide equipment and support capabilities suitable for the mission.

![Figure 1. The equipment combat capability and support capability](image)

The meaning of supportability has the following points:
(1) The support must be based on the requirements of combat missions and the support is generated in the process of performing missions and is implemented according to the content of the missions. Therefore, the support must serve for the combat missions, and its ultimate goal is to meet the needs of combat missions.

(2) The support must have specified conditions. From the perspective of forming capabilities, the prescribed conditions are the environmental and support conditions for the use of equipment by the army, including a certain number of supportable equipment (allocation plan) designed to be easily supported and meet the mission requirements, and trained support personnel (staffing) Plan, supporting sufficient supporting resources (according to the task duration or number of times), applicable supporting facilities, necessary supporting procedures and methods, fast supporting command system, and necessary supporting information, etc.

(3) The support serves for the equipment. Its purpose is to enable equipment to perform tasks, and its essential content is to maintain and restore the combat effectiveness. Therefore, the support capability must match the combat capability and provide assurance for the combat capability of the equipment.

(4) The main body of support capability should be the personnel who perform equipment support work (usually including the use and support personnel), which usually refers to the capability of a combat unit or a combat unit or group, or it can be the capability of an independent combat system including main equipment and support systems.

(5) The support capability is dynamic and fluctuates with changes in mission requirements and support conditions, which also means that troops should have different support capabilities for different tasks. Therefore, the implementation of different tasks requires different support conditions and adaptation.

According to the requirements of combat missions, it is necessary to put forward target requirements for the support capability, and give the conditions, standards and guidelines for completing the capability. The support capabilities can be proposed according to pre-operation, during and after operations, and life cycle for the equipment. The aspects of these support capabilities are common to most equipment and the requirements for support capabilities can be proposed from the following aspects:

(1) Before the combat mission: the warship can maintain its ability to perform the mission quickly and at any time when they receive the mission.

(2) During a combat mission: the warship should owe the ability to continuously perform missions without failure or support requirements.

(3) During a combat mission: the warship should owe the ability to quickly recover and continue the mission, once a failure occurs or a support requirement is raised.

(4) During the combat mission: the warship support system has the ability to quickly redeploy when the combat changes.

(5) After the combat mission: the warship should owe the ability to collect support information and safely withdraw to the designated area in time.

(6) The entire task period or life cycle: the warship should owe the ability to complete the above tasks in an economically affordable manner.

These abilities are different for different equipment and different tasks for the same equipment. Different equipment has different processes for performing tasks, different task requirements, and different parameters and indicators for measuring the effect of tasks. It is usually necessary to convert capabilities into performance and performance into features, and implement capabilities, performance and features into various product levels and support system designs. The equipment mission capability is conditional on its performance, and performance is measured on its characteristics, as shown in Figure 2.
At present, the main difficulty lies in the lack of actual combat experience. Only through actual combat can we sum up the requirements for the troop's ability to perform missions. This capability requires the organic combination of equipment and human beings and eliminate the enemy's forces to the limit. We can summarize useful "required abilities" from the exercise. These capabilities will ultimately need to be implemented into actual planning work, and designed into equipment, support programs, and support resource design, and should have support plans corresponding to combat missions, so that they can be deployed at any time when needed.

3.3. Support design requirements
The warship support design starts from the support capability and then reaches to the support capability. This is very different from the traditional ship design. From the perspective of capability, it is necessary to design the conditions for the formation of support capabilities, which means the support conditions are formed with the ability according to the support conditions. This support design model cannot only start from a single ship, but must be considered as a whole. The cooperation of other systems is needed to achieve greater efficiency.

The warship support design refers to the development of various supportability design features, including the support resource design, the support system design, the initial support plan, the support target, as well as verification of the realization of the support target in order to achieve the ship support capability target. From the perspective of single warship design, the warship support performance design mainly includes support design characteristics and support resource characteristics, as well as the comprehensive characteristics of the two parts of the characteristics, which can also be referred to as support comprehensive characteristics or support performance. As shown in Figure 3.
The support performance can also be called the supportability in a broad sense, which is different from the "assurance" traditionally understood from the product design itself, that is, the narrow supportability. Narrow supportability is equivalent to design characteristics such as reliability and maintainability, and is sometimes referred to as "resource supportability".

The support design features involve various features that are easy to support, including the reliability, maintainability, testability, environmental adaptability, safety, transportation, survivability, accessibility, durability, standardization, and so on. The resource supportability refers to a set of characteristics that the planned support resources (including support equipment, spare parts, technical data, support facilities, training and training support, manpower and personnel, packaging, transportation, loading and unloading, software support, etc.) meet the ability of equipment to perform tasks. It is mainly related to the implementation of various resources for supportability, which is an important condition necessary for equipment to perform its tasks.

4. Supporting capacity design engineering approach

The engineering approach to achieve the goal of warship support is the warship support system engineering. The basic process of the guarantee system engineering is shown in Figure 4. The definition of warship support system engineering is a series of technical and management activities carried out to achieve the goal of support at affordable cost during the life cycle of the ship. The Warship support system engineering implements the capability-based equipment development idea. This idea must always insist that the two main lines have been working in parallel.
Figure 4. The equipment supportability system engineering

The first one is the main line of main ship development. This main line is what we pay more attention to now. It mainly includes scheme design, in-depth scheme design, technical design, construction design, test and use stage.

The second main line is the main line for the generation, control and evaluation of the demand for support capabilities. This main line starts with the establishment of a model project, starting from the analysis of operational mission requirements, and finally reaching supportability in actual use. It mainly experiences the determination of supportability goals, supportability tradeoffs, supportability design realization, supportability verification, supportability evaluation, etc.
These two main lines are interrelated and restrictive. The ultimate goal is to ensure the synchronization and coordinated development of the main equipment design and the support system design, as shown in Figure 5. From the perspective of army users, the most important thing is whether the goal of support capability can be achieved. At present, the comprehensive demonstration report on equipment project establishment and the general requirements for development are comprehensively demonstrated. From the perspective of forming capabilities, no requirements for capabilities, especially requirements for guaranteeing capabilities, are put forward.

Figure 5. Overall coordination of support system engineering and traditional design engineering

5. Conclusion
In the future, as the country's "second navy," the People’s Armed Police Coast Guard is an important force for realizing the dream of a strong country and a strong military, and a force that requires key development. How to realize the transformation of the People’s Armed Police Coast Guard warship equipment from scale and quantity to quality and efficiency, and to improve the support efficiency of ship equipment is the key to solving the successful transformation. It is necessary to update traditional concepts and establish the concept of large support to improve the support efficiency of ship equipment. Establish the concept of support design, take support capability as the starting point and end point of warship development, innovate in management mechanism, organization, design concept, design means, test methods, support methods. Break through a batch of key technologies and fully implement ship support system engineering.

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