

## Research of Ship Mission Profile Model

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### ABSTRACT

In view of the shipborne equipment carries out the need of mission under the condition of high and new technology, in order to clarify the relationship between the factors influencing the equipment operational effectiveness, depict the whole operational process in detail, established the general 3D model of ship mission profile. From time dimension, equipment dimension and criterion dimension, the mission process is fully described and has universality.

**Keywords:** mission profile, shipborne equipment, three-dimensional model.

### 1 INTRODUCTION

The future sea mission is a comprehensive counterbalance between the high-tech equipment system. The mission district, mission time domain, mission styles, operational principles, operational methods, and operational environments will be highly uncertain. In order to improve the shipborne equipment mission success and operational effectiveness, tasks details must be accurate and complete depiction, and detailed description from receive tasks to post-war evaluation summary of the whole process of environmental impact, equipment reliability, equipment operation, operational principle, operational method and assessment criteria, and other factors, and to clarify the links between various influencing factors. The mission profile of shipborne equipment is an integral part of the equipment mission section.

The mission profile is defined as: "the sequence of events and circumstances experienced by the product during the completion of the specified tasks" [1]. The equipment mission profile refers to the general term for events and circumstances that have been experienced during the period from task readiness to the completion of a typical mission. The mission profile of the equipment covers every task that it can perform. Its rules on the task from beginning to end have been through a series of events and environmental conditions on time sequence was described, and each task is determined with temporal phase duration of weapons and equipment tasks, events, and conditions of use.

## **2 MISSION PROFILE DESCRIPTION**

Mission profile is usually used to define the main tasks of the equipment, working status, operating time, working order, maintenance plan, and environment[2]. From the definition of the task section, it is necessary to define four aspects, such as the specified time, the specified environment, the specified product and the specified event. According to the mission undertaken by the weapon equipment, the elements of the mission section are mainly described from the time, region, environment, compilation and planning of the mission[3] [4].

### **2.1 MISSION TIME**

Mission time contains the start and end times of the task. The tasks can be divided into several sub-phases according to the task time period. For example, the ship mission profile can be reduced to four stages of voyage, attack, evacuation and return. This paper will only consider the mission profile of the ship mission phase.

### **2.2 MISSION AREA**

The mission area refers to the geographical location and geographical range of the ship's operations. Latitude and longitude are used to describe the mission area. When the task time and the task area are identified, the task environment is determined.

### **2.3 MISSION ENVIRONMENT**

In surface ships against air defense, mission environment is a description of the external environmental factors that affect the operational effectiveness. It mainly includes the sea mission environment such as electromagnetism, meteorology, water sound, day and night and sea condition.

## 2.4 MISSION STRUCTURE

Mission structure requires a description of the equipment unit and command relationship, which can be described by the tree structure. The surface ship equipment system participates in the equipment units with the detection system, the accusation system and the weapon system. The corresponding command relation of each task unit constitutes the mission structure.

## 2.5 MISSION PLANNING

Mission planning refers to the planning of completing the action of each task unit within the task time period. Ships carry equipment against air and sea object, each unit of the equipment system has different specific tasks. In the specified time, it is necessary to optimize the profile of fixed tasks efficiently.

## 3 SHIP MISSION PROFILE DESIGN

### 3.1 ANALYSIS OF TYPICAL MISSION PROCESS

Before the ship carries out the mission, there is usually a mission preparation and task observation. A series of preparations for the operation is called task readiness. This time period usually refers to the first equipment launch from receiving task missions. Such as research and analysis, to formulate operational plans, organizing exercises, preparation and inspection of equipment, instruments and ammunition, preparation of weather conditions, etc. But from the point of view of task, the center of the task preparation is to calculate the data of the mission.

After the preparation is completed, when encountering an sea object, first determine the location of the target or the side angle, the distance between the opposing sides and the side angle of the ship. Rapidly occupying the position, the ship is able to gain advantageous position through observation and maneuver, is an important condition to defeat the target. Both sides are based on task performance and visibility, other object, etc. Occupation of the other party is difficult to play all the shipborne equipment angle. The ship's side angle requires the use of the entire ship or fleet of shipborne equipment in the course of the mission and reduces the impact of the wave on the target.

After occupying the advantageous position of attack, the shipborne equipment system began to instruct the target and organize the attack. And then the target will be tracked. Search, capture, and track targets. After determining the position, start the attack control solution, control the artillery attack, conduct attack correction, and complete the attack. Here, in order to quantize the attack preparation and attack observation, the mission effectiveness of the shipborne equipment was quantified by combining the accuracy and level of the task preparation and the amount of attack deviation.

### 3.2 MISSION PROFILE ESTABLISHMENT PROCESS

The process of determining the operational use profile is a precise definition of the mission task of the equipment. Or the process of specifying the specific operational conditions required by the objectives of the equipment. Determine the mission profile, the tasks that define the equipment stage, operation mode, operation function, success criteria and task time, environmental stress, and under the environmental stress time, the limits on maintenance, etc.

Step 1, the first step is to convert the use requirements of the equipment into a series of events, which are arranged in a number of stages according to the sequence of events. The multi-tasking capability of complex equipment needs to be combined with multiple profiles to illustrate mission capability and requirements. When various tasks are possible, each task is considered as a separate sequence of events. Form the first dimension of the mission profile: time dimension. The time dimension is staged.

Step 2, when various task phases are identified, task analysis should be performed for each task phase. Lists the various operating modes of each major equipment in each task phase and various execution functions in each operation mode, and relates to the related task requirements. Form the second dimension of the mission profile: equipment dimension.

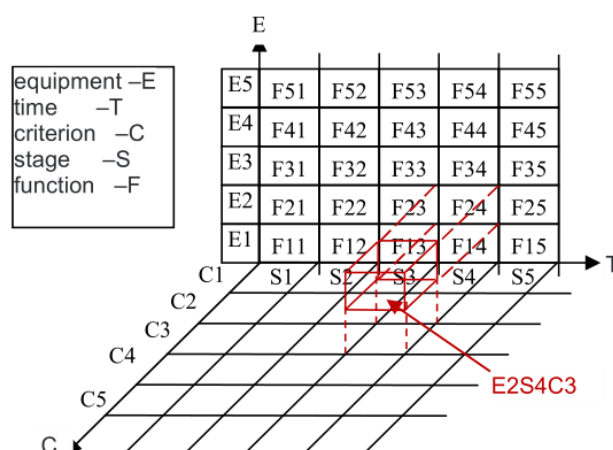
Step 3, can use task analysis information subsystem of each equipment listed in each stage and what we need in each operation mode of executive function, hardware and software, the execution time and success criteria, under environmental stress, task cycle time, maintenance restrictions, etc.

Step 4, The operational requirements, security requirements and environmental conditions of the identified equipment subsystem are further refined to the equipment level. As the specific operation of equipment and equipment, the basic requirements of operational effectiveness should be given. Form the third dimension of the mission profile: criterion dimension.

### 3.3 THE MODEL OF SHIP MISSION PROFILE

According to the working principle and working procedure of the shipborne equipment system, typical mission profile can be established for typical missions. As shown in Fig. 1.

Fig.1 Mission profile 3D model



The 3D mission profile model is composed of time dimension, equipment and standard dimension. The mission section is divided into several independent sub-task stages according to the process of the mission, and the detailed degree of the task phase can be determined according to the actual demand. Equipment dimension refers to the functions and functions of various subsystems or devices that are composed of different tasks and sub-tasks. The criterion dimension is to show the operation steps and related requirements for the corresponding tasks in different task stages and sub-tasks.

For example, the E2S4C3 part in figure 1 refers to the operation and use method of equipment 2 under the constraint of rule 3 in stage 4.

According to the detailed requirements of task segmentation and operational process details, it can be further established according to the general model to establish level 2, 3 or even more detailed multi-level mission profile.

#### 4 CONCLUSION

The 3D mission model of ship has changed the description of environmental stress and equipment reliability in the past, which is detailed in three aspects from mission, environment and equipment operation. Moreover, through the establishment of 3D model, the limitation of 2D profile display is changed, and the influence of each factor is more directly reflected. The 3D mission profile model of the ship is universal and can be applied to the mission profile analysis of all shipborne equipment systems. It can be applied to the mission profile analysis of any granularity requirement. The 3D mission profile model of shipborne equipment system has the characteristics of comprehensive, practical, strong and easy to use.

## REFERENCES

- [1] Yiqun Zhi,ZhangJilei. A study on typical combat mission profile of a self-propelled gun-howitzer system [J]. Journal of artillery launch and control, 1998(1).
- [2] Shi Jianrong, Wang Xiaoxia. Equipment life environment profile and mission profile [J].Equipment environment engineering, vol 7, 2010.4: 18-20.
- [3] Tan Qi, Jiang Yongguang, mo xian. Research on reliability test mission of military communication network [J]. Information security and communication confidentiality, 2010.4: 53-55.
- [4] Yu Jianjian, Zeng Benyin. Method of using mission profile for helicopter flight [J]. Helicopter technology, vol 138, 2004(2)