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Study on the Method of Test and Evaluation Measure Construction Based on Operational Desired Effect of Equipment

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ABSTRACT: For the basic input of weapons test, the author absorbed the advanced ideas of military equipment test and put forward the construction of three-level measures system of operational test evaluation, namely the combat mission, the combat equipment system task measures and weapon system/concept elaborated, the weapons and equipment operational mission description, the expected results, characteristics and operational missions. This paper is not only for the mission of measures, the mission decomposition process, solutions for the subsequent task decomposition and weapon system/equipment system decomposition, but also for the construction of similar measures system provides a useful reference.

Keywords: measure construction; operational test and evaluation; operational desired effect

1 INTRODUCTION

Weapons test as a necessary stage in the development of new weapons and equipment construction is a trend of current military equipment development and management system in a short term. It is one of direct factors of equipment quality and operational efficiency, and it is also the key problem of our army weapon equipment that stands on its way of development must be solved. At present, our army weapons equipment test is a vigorously combat test. Among them, the weapons and equipment operational test is a comprehensive test system, and a weapon combat which is the key point and the difficulty of test. In the construction of evaluation measures system, a clear test of reasonable structure is the foundation to ensure the orderly conduct of the activities of the test organization which is the basis for the operational test evaluation plan, design, implementation and evaluation. It is also with far-reaching significance to establish evaluation measures system for the test of our army to carry out effective operational test evaluation work. In this paper, the application of military measures design standards in the development process of mission decomposition method based on a certain type of surface to air missile weapon system as an example introduces the mission which is based on the measures of mission decomposition process construction method and tries to solve the problem of our army test and evaluation of basic input. Also,it provides reference for construction in similar measures system [1-5].

2 PROBLEMS

The operational test and evaluation is to determine the weapons in combat, equipment or military ammunition from the typical user performance and applicability in real combat arbitrary conditions of weapon systems, equipment and ammunition (or key components) field trial; and the test results of identification. Research on the problem of weapon equipment operational test and evaluation measures system of the basic input is carried out the operational test evaluation. The process of building measures system of weapon equipment is the typical combat mission decomposition and functional attributes of the required level of weapon system. These functions of attribute recognition are for the technical performance measures of weapon system of tactic. Then based on the statistical theory for design and analysis of experiments, they will finally establish the mapping relationship between the specific performance measures of combat mission and weapon system [6-9].

The mission of the task is the basic equipment of equipment requirement demonstration; the mission analysis is a part of the initial requirement demonstration of equipment. The weapons and equipment of the typical combat mission analysis must be the first to capture the operational evaluation measures system in the process of constructing the test. Through the analysis of the combat mission and combat mission layers of decomposition, we can gradually clear operation to perform the specific combat mission commander of weapons and equipment function, performance re-

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quirements in detail, then the weapon equipment operational test and evaluation of indicators are at all levels--combat mission, mission, equipment measures system, weapon system identification selection and design. The analysis and design of weapons and equipment operational measures (also known as the combat capability measures) is the design and implementation of the key elements of weaponry, combat measures analysis and design throughout the project demonstration With the development of weapon equipment and put it into use, it is of great significance to the construction of the development of weapons and equipment [10-13].

First, the basic work to build the weapons test and evaluation measures system is to decompose the weapons mission. The basic flow of combat mission decomposition is from the mission description, the expected effect analysis, the analysis of combat mission characteristics and the decomposition of a combat mission measures, which is a primary indicator of weapon equipment operational test and evaluation [14-17].

3 BASIC CONCEPTS CONNOTATION

For the accurate expression of the weapons decomposition process of mission for readers to understand and grasp the contents of the article, the basic concept of this paper is needed in the process of discussion--the mission description, the expected effect, the mission and mission characteristics measures of details.

(1) The combat mission

The basic elements of the action plan including the action of the main body, action, action time, action for action and other reasons generally do not contain specific actions.

There are the following three points need to cause enough attention: The first point is that the mission objectives should be directly or indirectly associated with single goal or more goals to achieve the goal of contributing to the mission; the second point is that the meaning should be clear as much as possible and can't be ambiguous or expressed confusedly; the third point is that when dealing with mission, don't make too many guidelines of intervention and too much detailed provisions to achieve the goals and methods. In order to facilitate the concrete analysis of certain problems, we should give full play to the characteristics of field operations personnel who are familiar with the situation of battlefield, and fully motivate the initiative of the command staff [18-22].

(2) The mission expected effect

The expected effect is decided by physical or behavioral state changes. Due to changes in the physical state which is seen as we know, the physical state changes compared with the behavior changes is easier to evaluate, that is to say, the changes in physical condition are more likely to be tracked in real time to capture the state of behavior change. However, it's not like that in a timely manner, and it may be also not easy to find. Due to the behavior changes, it's more difficult to assess [23-27].

The effect of this concept is intended to clarify the mission (the target) and corresponding relationship between tasks to help combat commanders and staff agency to determine the objective conditions corresponding to reach goals that needed.

There are four requirements to grasp the key areas: The first one is the expected effect of each mission to establish direct contact with one or more targets, namely each mission expected effect should at least establish contact with a combat mission objectives. The second one is the mission of the expected effect can be quantified. The third one is the statements of effect should not be used to specify the way and the method of the effect. The only need is to give the desired effect, and that is enough. Do not implement the mission style and narrative method which are too specific. The fourth one is to distinguish the mission expected effect which should be supported by the combat mission, so that the life expectancy effect is the basis of environmental conditions for success, and it's not another one to achieve the mission objectives or a new mission [28-29].

To define the mission of the expected effect is very important, because only through effectively defining of the mission expected effect, it's easy to evaluate the function and task performance of the system to the combat mission effectiveness.

(3) The combat mission characteristics

Indicators should focus on the characteristics of development. Construction of weapon equipment operational test and evaluation measures of the process is through in-depth analysis of weapon equipment combat mission, mission and function of the system, the mission of weapon system, the characteristics of functional properties of task characteristics and system step by step.

Combat mission in the behavior level should be more focused on recognition of the characteristics of the expected effect. According to the needs of the future, we should establish contact between the key ability and the demand of the combat mission, sort according to the dependence on the focus of future capacity requirements on these ties with combat mission characteristics, and determine the degree of importance of characteristics [30-32].

(4) The combat mission measures

Describe the application of weaponry and equipment system characteristics in the process of Key Performance Parameters (KPPs), Critical Technical Parameters and Key System (CTPs) Attributes (KSAs). Weapons and equipment of the mission, task performance and effects of system function determine the completion of combat mission [33-35].

The selection of indicators should follow the following principles: The first one is that the measures should be as simple as possible through single metric measure; the second one is that the measures should

be used to reflect on the understanding of action; the third one is that the measures should be used to reflect the action to make a complete the mission; the fourth one is that the measures should be used to influence on the conditions of the sensitive; the fifth one is that the measures should be with each level of performance to distinguish; the sixth one is that the measures should reflect the output, performance, or take action process; the last one is that the measures should try to use the absolute value and relative value of their respective strengths.

4 COMBAT MISSIONS MEASURES CONSTRUCTION METHOD AND ITS APPLICATION

4.1 *Combat missions decomposition process*

The weapons mission includes the following four procedures: the mission description (including mission statement and mission goals), the construction of combat mission characteristics analysis and measures analysis, the expected effect of combat mission. These factors are determined and the final measures correlation properties are necessary. Then, we prioritize established contact; determine the key link, which will focus shifted to the key link.

The basic process of the combat mission decomposition is to describe the combat mission parameters. First of all, according to the description of the mission, we research the combat mission expected results through the A model mapping matrix decomposition; then, according to the characteristics of the combat mission, we recognize each mission with expected mission characteristics to determine the operational mission measures.

4.2 *Mapping matrix model A: combat mission objectives to mission expected effect*

Difficulties in establishing the mapping matrix model of the A is to get to the right information, of course, it depends on the quality of access to data. Once the mission description (including mission statement and mission operations) and the expected effect are determined, the mapping relationship between the mapping matrix models of A is built up. There is a need to answer the question of constructing the mapping relationship: If a desired effect can be reached the final, will its corresponding mission be implemented? If the answer is yes, then the mapping relationship between the mission and the expected effect exists.

Check the A model mapping matrix. If it's not the expected effect of corresponding mission objectives, then it should return to the literature search to meet the principles of constructing the mapping matrix model of A. Finally, construct the hierarchical mapping mission expected effect characteristics and the mission system.

4.3 *Mapping matrix model B: combat expected results to combat mission characteristics*

According to the effect of the definition and the expected results of combat classification, the following context shows different classifications and related characteristics of the expected effects of the combat mission.

To determine the characteristics of combat mission is one of the most difficult tasks of the mission decomposition process. Because the effect is the mission of the output, when the effect was assessed, the evaluation result is the final effect, and this effect must be measured. The importance of this concept will be very apparent in the following cases:

(1) The expected effect 1: manned and ready.

For each of the desired effect, the types of effect are classified physically and behavior is very helpful. The expected results 1 into the physical state of the weapon system change. The weapon system selection in this case is the missile weapon system of missile weapon system, the change of state from "into the firing position" state to "launch ready".

In the expected effect 1 in this example, "availability" was chosen as the most appropriate characteristic because of the need for "system maintenance" and "the test launch of the missile weapon system" is in order to ensure its entry for launch condition is available. Definition of "availability" includes "system maintenance" and "launch" these two words, it is in order to reduce the construction of measures mapping matrix model in C problem.

Availability of equipment refers to equipment located at the start of a mission when the state works normally, which influence (by equipment reliability, maintainability, testability, human factors and the protection of resources, 11). In this paper, the "availability" refers to the system of missile weapon system maintenance and testing after launch to play a normal function and launch ready state degree.

(2) The expected effect 2: keep the will to fight

The expected results 2 is classified as weapon system behavior change or changes in behavior. Because there is no indication of the need to support what the will to fight, the expected effect may also need further confirmation. If you motivate the weapons operator's will to fight, then the weapon system behavior will be affected by the change; if it is related to all personnel involved in the mission operations or other person's will to fight, this will involves changes in behavior, because of the effect of the pre period which will affect the combat mission characteristics selection. Notice the following two points which are very important: One is the verb "keep" which implies behavior change over a period of time (or the whole mission execution; another one is the expected effect which is to change the war fighter's will to fight in a more positive direction.

The movement coordination between weapon-controlled personnel should be established, maintained and improved the positive cooperation between

each other's attitude as the starting point. The ability to focus a high fighting spirit can enhance the weapons operator, the focusing ability can make their rational use of knowledge and technology have its own controlled factors which affect weapon systems, combat worthiness of weapons people. Therefore, the personnel of supporting arms control will fight are to effectively deal with the hostile situation. Therefore, "the key indicators of response" was chosen as the expected effect 2. The meaning of "reactive" is defined as the situation of reaction speed of weapon control personnel on the battlefield, it is helpful to build to measure the mapping matrix model C.

(3) The expected effect 3: to improve operational performance

The expected result 3 is classified as a behavioral effect. To enhance the combat mission from the aspect of performance, how to enhance the interaction between operational and performance is a usual consideration. Coordination is the key operational performance. In order to take appropriate action, we must maintain the warning on the height of the battlefield situation.

"Harmony" refers to the missile weapon system implementation of continuous action in the battle between the nodes and the degree of integration, the implementation of the action by reducing redundant program creates a coordinated mechanism to improve operational performance. Operational node is an important method to describe the combat mission, task, content of a series of operations, and operational organization functions merged into the abstract description. "Early warning" refers to the operational node missile weapon system capacity and the maintenance process relevant information and takes appropriate action. Through understanding of the definition of the "harmony" and "early warning", the construction will help measure the mapping matrix model C.

(4) The expected effect 4: get the enemy's intelligence

The expected result 4 is classified as physical effects, the requirement is that this situation is removed from the battle space; the intention is to prevent the enemy military strategy and the ability to influence the state of will, or to take action against the enemy. Characteristics of "readiness" of the planning and training and the characteristics of "harmony" are characteristics of a concerted effort. "Readiness" refers to the missile weapon system combat nodes that meet the missile weapon system combat mission readiness. The measure to be trained with regularity and competent personnel, equipment status ensures supply, storage system, ammunition and equipment based on the number of available.

A mapping matrix model B to the combat mission characteristics were defined, but the defined properties of mission are very important in the construction of the mapping matrix model C design process for combat mission characteristics measures definition.

4.4 *Mapping matrix model C: combat mission characteristics to mission measures matrix*

Characteristics of combat mission indicators point to the expected effect. The measures must be able to influence the assessment mission to the desired effect. Remember the desired effect is to end the presentation objective or state of completion, so the measures must be applied to the goal or end state. Property is defined as the decomposition process in the mission of the last step to determine, it is helpful to implement the mission decomposition process. Every final indicator is included on the interpretation of the meaning and a description of its scope of application. Support for multiple common benefit measures, there are some situations can occur, such as the limited resource makes the assessment of some difficult mission level indicator. A mapping matrix model C will be devoted to the design mission level indicators; however, as a replacement of quantitative indicators, the key problems should be offered to qualitative.

(1) Availability

There is an availability to build the expected effect 1 (launch ready) and all three missions contact. Definition of "availability" in the mapping matrix model for the design process of B showed that the weapon which quickly returned to the evaluation and used state immediately is very necessary. According to regulations, the key is the availability characteristics of test launch. Therefore, whether the test launch becomes the most can show the availability characteristics. Give a consideration to the measures which include a large number of combat missions. As an example, the most appropriate indicator is "weapon system through probability test launch in the normal state". However, the precondition of weapon equipment system overhaul is usual, so it is worth considering the second indicator is "weapon system through the system after repair in normal state probability". The key problem of the characteristics is that the corresponding "evaluation of weapon equipment quickly returned to the ability to use immediately".

(2) Reaction

The reaction of structures and the expected effect 2 (keep fighting spirit) and two three (mission of defending our goals to fulfill the mission of the military) is contact. Definition of "reactive" in the mapping matrix model B design process involves a weapon control personnel to make quick response to a battlefield situation. "Fast" is also meant to be on time for reservation, it is used to know how soon. In this way, we can construct a measure, namely "need a weapon control personnel according to the changing conditions of reaction time to respond". In order to make the change of type, weapons and equipment with the change of the reaction conditions described in further detail, we propose a better explanation of the indicators, namely "weapon control personnel to respond to threats and reaction time changing environmental conditions". The second measure which is more direct is the will to fight in the reaction of side effect. If the

mission is successful, we should find the cause of what factor is unsuccessful, the definition of indicators for the "will to fight the survival effect on the weapon operator probability". The key issue of the corresponding characteristics is "evaluation of weapon control personnel to make the rapid reaction ability of battlefield situation". It is worth noting. It is not in the process of acquiring or in a training program that can measure. It may be just an accident in the process of military action to combat or after the analysis of the field.

(3) Coordination

Coordination is built and the expected effect 4, the expected effect 3 (to enhance operational performance, get the enemy intelligence) and the last two mission goals (performance of military mission and defeating enemy attempts to link). "The definition of harmony" in the mapping matrix model B design process for weapons in combat mission in the process of implementation across the vertical and horizontal coordinates of all combat node connection. This coordination needs to be continued and it cannot be interrupted. To reduce the redundancy, collaborative innovation is used to enhance operational performance. "Redundant" through the measurement redundancy actions is to assess the situation; the corresponding measures are "according to the probability of action plan redundancy". "Collaboration" for the measures is more difficult. If there is coordination which is collaborated with the hypothesis, then, it may be the best. However, most of condition is not like that, so it is more difficult for the coordination measures. Coordination measures which are corresponding to horizontal and vertical direction are "across the operational node for the coordination ratio" and "across the operational node continuous vertical coordination rate". The ability to stop the enemy meets our need of position which is coordinated in the planning and preparation. Therefore, the measure is "in the weapons mission execution, planning and operational node oriented across the smooth coordination of probability". The most important feature is that the "evaluation on operational node of weapon equipment is in order to coordinate across the combat mission, and the ability is to reduce the redundancy program and create a coordination mechanism".

(4) Early warning

Early warning and the expected results 3 (built to enhance the combat performance) and 2 (military mission to fulfill the mission) is contact. The definition of "early warning" in the mapping matrix model B design process is in order to deal with related information and take timely and appropriate action for operational node, acquisition and maintenance of the battlefield situation which vary from minute to minute warning is necessary. Then, evaluate the weapon equipment information and take appropriate action to correct the measures can also be written. The first measure for early warning is "according to battlefield situation, operational node decision accuracy". The second indicators for early warning are "according to battlefield situation, the correct rate of weapon control". The third indicators for early warning are "according to battlefield situation, the correct rate of operational node action". The key issue of the corresponding characteristics is "ability to assess the operational nodes across all battlefield situations to make early warning".

(5) Readiness

Readiness to build and the expected effect of 4 (to get the enemy intelligence mission) and 3 (defeating enemy attempts) contact. Definition of "readiness" in the mapping matrix model B design process is the "ready state". Most of the early warning measures represent the planning stage implementation stage effect on combat mission. A measure of "by the lack of training in combat mission execution trapped rate". Another indicator is "by the lack of equipment, security and capital leads to combat mission execution trapped rate". The key issue of the characteristics of the corresponding evaluation ability is "in ready state to perform combat missions".

It should be noted that, although the discussion in this part of the key issues is raised, the mapping matrix model C on the combat mission characteristics and mission parameters which are shown is not reflected in the Table 1 and the key issues is on mapping relationship between indicators and characteristics.

Table 1. Combat mission critical ability

Combat mission characteristics	The key ability
Characteristics of #1: Usability	Evaluation of weapon equipment quickly returned to the ability to use immediately
Characteristics of #2: Reactivity	Evaluation of weapon control personnel to make the rapid reaction ability of battlefield situation
Characteristics of #3: Coordination	Evaluation of weapon equipment operational node in order to coordinate across the combat mission, the ability to reduce the redundancy program and create a coordination mechanism
Characteristics of #4: Early warning	Evaluation of operational nodes across all battlefield situation to make early warning
Characteristics of 5: Readiness	Assessment of ability to perform in readiness for combat mission

5 CONCLUSIONS

This paper attempts to solve the basic input problem of weapon equipment operational test evaluation. The author does research on the operational test and evaluation measures system construction method through absorbing the advanced theory and the test with our practice and putting forward three-level indicators which are the combat mission, the combat task measures system of equipment and weapons systems, the weapons of the mission description of the desired effect, the connotation of the concept of combat, the combat mission characteristics and mission operations. This paper also introduces the construction of combat mission target mission decomposition method. By analyzing the operational mission objectives and expected results, the author determines the characteristics of the combat mission, and obtains the final combat mission measures. The construction of combat mission is used to assess whether the measures has reached the expected effect of weapon equipment operational capabilities, operational effectiveness and operational adaptability by weapons combat mission to assess the weapons and equipment. This paper introduces the mission decomposition method to carry out according to the mission and weapon equipment system which provides the subsequent decomposition, and it also has guiding significance to other similar measures system construction.

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