Frontiers in Education Technology
Vol. 3, No.4, 2020
www.scholink.org/ojs/index.php/fet
ISSN 2576-1846 (Print) ISSN 2576-1854 (Online)

Original Paper

Research on Effectiveness Evaluation Method of Weapon Equipment

Shang shanyu[1*] & Jia Man Sun[1]

[1] Logistics University of People's Armed Police Force, Dongli District, Tian Jin, China

[*] Shang shanyu, Logistics University of People's Armed Police Force, No. 1 Huizhi Ring Road, Dongli District, Tian Jin, China

Received: August 11, 2020 Accepted: August 29, 2020 Online Published: September 9, 2020

doi:10.22158/fet.v3n4p1 URL: http://dx.doi.org/10.22158/fet.v3n4p1

Abstract

Due to the wide application of high and new technology in weapons and equipment, modern weapons present the characteristics of complexity and systematization, and their effectiveness analysis and evaluation are paid more and more attention, which has become an arduous and urgent task in the research of weapon equipment system. Only by using scientific methods and technology to evaluate the effectiveness of various types of weapons and equipment, can we have a profound understanding of the characteristics and application value of weapons and equipment, ensure that the army can give full play to the operational potential of weapons and equipment, improve the operational efficiency, and explore the correct direction of the construction and development of weapons and equipment. Therefore, systematic research on weapon equipment effectiveness evaluation method is a necessary way for every military equipment effectiveness researcher to seek effective and accurate quantitative analysis of weapon equipment effectiveness method.

1. Concept and Classification of Weapon Equipment Effectiveness

Although the research on the effectiveness of weapons and equipment began as early as the Second World War, there is no complete consensus on the definition of the concept of effectiveness. In the national military standard gjb1364-92, the definition of effectiveness is "the ability to achieve the specified objectives under specified conditions"; other descriptions of effectiveness include: "effectiveness is the ability to complete the task", "effectiveness can also be understood as the probability of achieving the target" (quoted). Either definition has one thing in common, that is to say, effectiveness reflects the "degree of completion of the task" (quoted). According to the definition of effectiveness, weapon equipment effectiveness describes the degree to which weapons and equipment

complete specified tasks under specific operational conditions, and reflects the characteristics and level of weapons and equipment at a certain stage.

According to the needs of weapon equipment theoretical research, the effectiveness can be divided into four categories as follows:

(1) Single effectiveness: the degree (Citation) that can be achieved in terms of single use target when using weapons and equipment. Single effectiveness is the evaluation of the ability of weapon equipment in fire application and firepower support. The corresponding operational target is also single, such as shooting efficiency, reconnaissance efficiency, penetration efficiency, communication efficiency, operation efficiency, etc.

(2) System effectiveness: the possibility (Reference) of weapon system to complete a set of specific tasks under certain operational conditions. System effectiveness reflects the ability of a weapon system to achieve the specified targets, and is a measure of the average comprehensive capability level of the weapon system. Because the system effectiveness and the effectiveness of each element of the system constitute a nonlinear relationship, the system effectiveness can be obtained by a variety of individual effectiveness comprehensive calculation.

(3) Higher System effectiveness: the degree to which the weapon equipment System Of Systems (SOS) completes the specified tasks under the condition of SOS confrontation. System effectiveness is aimed at the combat system, and reflects the combat capability to complete the specified tasks under the background of system confrontation. Although the weapon system of systems belongs to the category of weapon system, the concept of system effectiveness is more abundant than the concept of system effectiveness for the higher level system above the level of weapon equipment system. Therefore, the system effectiveness is not included in the system effectiveness in this paper.

(4) Operational effectiveness: also known as force effectiveness, the degree of expected objectives that can be achieved by using weapons and equipment systems and their combat forces to carry out operational tasks under the specified operational environment. The operational effectiveness reflects the combat capability of weapon equipment system cooperating with strategy and tactics under the interaction of hostile parties.

According to the theory of system engineering, both system effectiveness and system effectiveness are the effectiveness of subsystems at different levels in the war system. Individual effectiveness is the basis of system effectiveness, and each single effectiveness is combined to form the overall effectiveness of the system. Each subsystem coordinates and interacts with each other to maximize the system effectiveness. Therefore, system effectiveness can be regarded as a subordinate index of system effectiveness. Operational effectiveness is closely related to the capabilities of relevant combat units, while the capabilities of combat units are affected by the system’s capabilities Therefore, combat effectiveness is the ultimate effectiveness and fundamental quality characteristic of any weapon equipment.

2. Overview of Weapon Equipment Effectiveness Evaluation Methods

The effectiveness evaluation method is a means or tool for quantitative evaluation of the military usefulness of weapons and equipment. With the deepening of effectiveness evaluation research, the combination of evaluation method and high-tech shows more and more complex, quantitative and systematic characteristics. There are a lot of methods to evaluate the effectiveness of each scheme. However, there are not many methods to evaluate the effectiveness of each scheme. According to the classification of weapon equipment effectiveness, this paper divides the methods suitable for weapon equipment effectiveness evaluation into single effectiveness evaluation method, multi index effectiveness evaluation method, system effectiveness evaluation method and combat effectiveness evaluation method.

(1) Individual effectiveness evaluation method

Since the single effectiveness correspondence is a single target combat action, on the basis of selecting appropriate indicators, the focus of single effectiveness evaluation is to model the capability of weapon equipment in each basic link of combat action (such as reconnaissance, communication, protection, shooting, etc.). Typical single effectiveness evaluation models are: shooting effectiveness index evaluation model, communication and command effectiveness index evaluation model, search efficiency index evaluation model, maneuvering effectiveness index evaluation model, protection effectiveness index evaluation model, survival effectiveness index evaluation model, availability index evaluation model, and credibility index evaluation model.

(2) Multi index effectiveness evaluation method

The multi index effectiveness evaluation is applicable to the weapon equipment which is more complex and difficult to measure by a single index. It mainly integrates multiple index information of weapon equipment, evaluates its effectiveness comprehensively, and obtains the overall situation reflecting its effectiveness. Compared with single effectiveness evaluation, multi index effectiveness evaluation is a more comprehensive evaluation method. The methods suitable for multi index effectiveness evaluation include generalized index method, probability synthesis method, multi-attribute utility analysis method, distance evaluation method based on positive and negative ideal points, principal component analysis method, grey theory related method, set pair analysis method, nonlinear dynamic system theory method, etc.

(3) System effectiveness evaluation method

Because the weapon system is composed of weapons and related equipment, the weapon system can be regarded as a complex with a set of operational functions. Therefore, the system effectiveness depends on a group of functions that the system completes the specified tasks under certain conditions, and the evaluation of system effectiveness can be completed through the comprehensive description of these functions. There are five kinds of system effectiveness evaluation methods: test statistical method, analytic method, comprehensive evaluation method, simulation based evaluation method and neural network based evaluation method.

(4) Higher System effectiveness evaluation method

Weapon system effectiveness evaluation method weapon equipment system is a kind of combat that implements system of systems confrontation in modern information warfare. Compared with general weapon system, its structure is more complex, its tasks are more diverse, and its functions are more comprehensive. The uncertainty of the combat process and the complex correlation of different levels of systems put forward higher requirements for the evaluation of its comprehensive "effectiveness contribution", The system effectiveness evaluation method should not only follow the layered principle and aggregation and equivalence principle, but also combine with the simulation modeling method to realize the accurate and efficient evaluation of system effectiveness. The evaluation methods of system effectiveness include index method, equivalent analysis method, architecture optimization method and system simulation method. No matter which method is used, the equipment system of systems must be modeled, and the effectiveness data must be processed comprehensively.

(5) Operational effectiveness evaluation method

The operational effectiveness of this paper refers to the effectiveness of the combat unit to complete the expected combat tasks with weapons and equipment. The effectiveness degree here is the coincidence degree of action effect and mission requirements. Therefore, the evaluation of weapon equipment operational effectiveness can be quantified by establishing effect and demand function. The methods that are suitable for combat effectiveness evaluation include: combat simulation method, support vector machine evaluation method, data cultivation and mining method, and distributed interactive simulation method.

3. Conclusion

There are many academic papers about weapon equipment effectiveness evaluation. Although this paper only selects some representative papers to review, it can grasp the research direction of system effectiveness evaluation. Improper, welcome criticism and correction!

Reference

Jin, C. Z. (2017). *Research on evaluation method of navy equipment system contribution based on mmf-ooda*. Nanjing: Nanjing University of technology.

Ding, H. B. (2014). *Effectiveness evaluation of missile weapon system based on system confrontation*. Shenyang: Northeast University.

Dong, L. D. et al. (2008). Research on effectiveness evaluation method of weapon equipment system. *Weapon Equipment Automation, 2008*(3).

Guo, Q. S. et al. (2003). *Introduction to equipment effectiveness evaluation*. Beijing: National Defense Industry Press.