ISSN 2706-655X Vol.3, Issue 10: 59-67, DOI: 10.25236/IJFET.2021.031007

Research on the construction of integrated equipment support system based on combat cloud

Guiming Chen, Zengji Wei[a,*], Chengqiang Gao, Lingliang Xu

Xi'an High Tech Research Institute, Xi'an, China
[a]2637147609@qq.com
**Corresponding author*

Abstract: *In order to adapt to the change of our army's future combat command system, deal with the rapidly changing battlefield in the future and meet the development requirements of weapons and equipment, an integrated equipment support concept based on combat cloud, namely ""Equipment Cloud Support"", is proposed. The operation process of ""Equipment Cloud Support"" is conceived; The construction requirements of ""Equipment Cloud Support"" system are analyzed; Put forward the construction objectives and principles of ""Equipment Cloud Support"" system; The construction emphases of ""Equipment Cloud Support"" system are analyzed in detail; This paper puts forward management measures from four aspects: strengthening the infrastructure construction of ""Equipment Cloud Support"" data information, the development and application of technical support means, the optimal allocation of support resources and the construction and application of support forces.*

Keywords: *"Operational cloud"; Integrated equipment support; Joint operations; Cloud support; Equipment support effectiveness*

1. Introduction

Integrated equipment support is to integrate and reconstruct various elements of the equipment support system through the comprehensive use of professional military and civil resources to meet the equipment support requirements of the joint operation system. The purpose is to break the boundaries of military civilian and military arms equipment support system, integrate strategy, campaign, tactics and support forces of various services and arms, and form an equipment support system with interconnection, interoperability, interaction and doubled efficiency among support forces [1]. Support data information is the basis for the effective operation of integrated equipment support system.

At present, integrated equipment support is still in the stage of theoretical research and practical exploration. Mainly based on the existing information system, there are prominent contradictions such as imperfect military and civil information mechanism, "bottleneck" of data fusion and difficult realization of resource sharing, which seriously restrict the effectiveness of equipment support and affect the combat capability of the force [2]. The operational cloud theory is the inheritance and development of operations based on information system system, combines operational cloud with integrated equipment support, constructs an equipment support system with organic connection between support requirements and support resources, and uses information technologies such as digital twins, big data, cloud computing and cloud services to realize in-depth resource mining and accurate equipment support, So as to achieve the effect of doubling the overall support efficiency.

2. Concept and conception of integrated equipment support based on combat cloud

2.1 "Operational cloud" and "Cloud support"

In 2013, General Mike Horstich of the air combat command of the US Air Force put forward the concept of "Combat Cloud"for the first time [2-4]. Upload the combat data of various services and arms and military and civilian technical resources to the cloud, share real-time data, and change from "Equipment looking for people" to "People looking for equipment", so as to make the highly interconnected Distributed Combat Operations feasible, so as to effectively improve the combat command and control capability of the US air force.

ISSN 2706-655X Vol.3, Issue 10: 59-67, DOI: 10.25236/IJFET.2021.031007

Operational cloud usually includes “Combat Cloud” (C-K), control “Decision Cloud” (C-CACAD and “Support Cloud” (C-ISR) [4]. Relying on cloud computing, resource virtualization, intelligent decision-making and other technologies, the three types of clouds realize interconnection, aggregation and collaboration within different terms of reference, so as to integrate and share data and information among various elements, provide technical support for battlefield decision-making and realize cloud operations. The integrated equipment support based on combat cloud is to apply the support cloud in the combat cloud to the equipment support under the background of joint operations in order to adapt to the command and control mode and combat style of cloud operations. Support cloud includes "Support Resource Cloud"," (C-ISR-R), “"Support Technology Cloud"," (C-ISR-A) and “Support Decision Cloud (C-ISR-P). In this paper, the integrated equipment support based on “Combat Cloud” is referred to as “"""Equipment Cloud Support"""”.

2.2 Concept of “"""Equipment Cloud Support"""”

“"""Equipment Cloud Support"""” is inseparable from military actors, command and control center, “"Support Resource Cloud",”, “"Support Technology Cloud"," and “Support Decision Cloud” Military actors include operational entities responsible for operational operations and support entities involved in equipment support. The "Support Resource Cloud", includes equipment data resource cloud and equipment entity resource cloud, in which the support entity in the military actor exists in the "Support Resource Cloud",. The command and control center commands and controls the overall combat situation, supervises and commands all operations and related support actions. This paper only discusses the equipment support command and control in combat operations. Under the unified and coordinated control of the command and control center, the cloud support process usually plays a corresponding role through data information flow, technical support flow, command and control flow and support action flow, and finally completes the equipment support of combat entities in military actors. Data information flow mainly refers to the direction of equipment support data information collection, processing, distribution and transmission among various elements in the process of cloud support; Technology support flow refers to the direction in which the technology cloud plays a technical support role for various elements in the process of cloud support; Support action flow refers to the direction in which the support entities of military actors implement equipment support actions against combat entities in the process of cloud support; Command and control flow refers to the direction in which the command and control center commands and controls the processing and flow of data and information of various elements, technical support, operation and support action implementation, etc. in the process of cloud support.

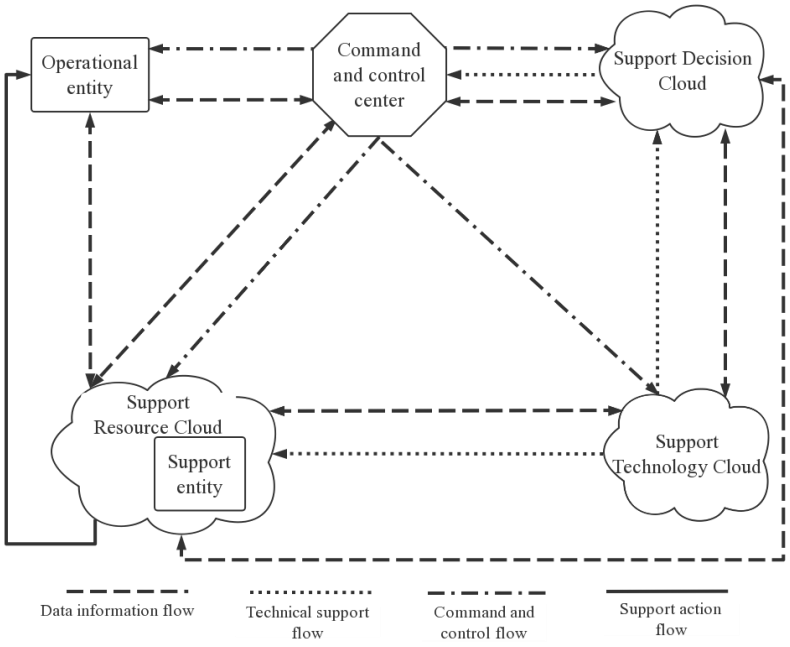

Figure 1 “"""Equipment Cloud Support"""” concept.

The concept of “"""Equipment Cloud Support"""” is shown in Figure 1. The data information flow

ISSN 2706-655X Vol.3, Issue 10: 59-67, DOI: 10.25236/IJFET.2021.031007

from combat entity to "Support Resource Cloud", refers to the acquisition and collection process of equipment support information data. It includes that the combat entity transmits its own equipment data information and support demand information to the "Support Resource Cloud",. At the same time, it also includes that the "Support Resource Cloud", obtains equipment support related information from the combat entity through situational awareness, such as equipment fault information. The data information flow from "Support Resource Cloud", to "Support Technology Cloud", and support decision cloud and from "Support Technology Cloud", to support decision cloud is essentially the processing process of equipment support data information. After the original support data information and demand information are integrated in the "Support Resource Cloud", they are transferred to the "Support Technology Cloud", and support decision cloud. The data information is processed through big data, data mining and cloud computing, and the equipment support decision information is formed according to the support requirements. The data information flow from the support decision cloud to the "Support Technology Cloud", and "Support Resource Cloud", and from the "Support Resource Cloud", to the combat entity indicates that the processed equipment support information and the formed equipment support decision information are distributed for use by the combat entity and support entity. The data information flow formed between the "Support Resource Cloud", support decision cloud and the command and control center indicates that the equipment support data information and equipment support decision information are transferred to the command and control center and applied to command and control and feedback. The technical support flow from "Support Technology Cloud", to "Support Resource Cloud", and support decision cloud refers to that "Support Technology Cloud", provides corresponding technical support to resource cloud and decision cloud, such as distributed computing, data mining, artificial intelligence, network storage, virtualization and other information technologies.

Support action flow refers to the flow from support entities in the "Support Resource Cloud", to combat entities. It refers to the point-to-point equipment support services implemented in the cloud support process. The support entities implement corresponding support services such as technical support, equipment supply, equipment use support and equipment maintenance to combat entities according to the command and control information of the command and control center and the equipment support demand information of combat entities.

Command and control flow refers to the flow from the command and control center to other elements. It refers to the command, control, coordination and unified deployment of various support elements and activities by the command and control center in the process of ""Equipment Cloud Support"".

2.3 Meaning of “""Equipment Cloud Support""”

“""Equipment Cloud Support""” can be understood as an integrated, modular and information-based equipment support mode based on combat cloud theory.Through the establishment of support information network, the combat command organs and support command organs of various services and arms are connected with combat forces, technical reconnaissance forces, equipment rescue and evacuation forces, equipment maintenance forces and equipment and material support forces, with combat and equipment data information as the basic support;Take "cloud" gathering and "cloud" dispersion as the realization way;Take accurate equipment support as the ultimate goal[5-7].

2.3.1 Equipment data information is the basic support

“""Equipment Cloud Support""” is a multidimensional integrated support implemented by the equipment support forces of various services and arms and the military and civilian support forces.The core concept of ""Equipment Cloud Support"" is to improve equipment support efficiency through smooth flow and efficient use of data information, organically connect all support nodes in each operational domain, share information and resources, and realize real-time data information processing and flow.Cloud support uses data resources as a "neural network" to connect all military entities and elements of the support cloud.Realize the real-time seamless connection between guarantee subjects, subjects and objects, superiors and subordinates.

2.3.2 Gathering and dispersing clouds is the basic way

Cloud aggregation refers to each "cloud" in ""Equipment Cloud Support"", which relies on terminal equipment to monitor the real-time status of physical equipment, equipment use and the specific needs of support personnel in various military actors, process the obtained information and transmit it to the support resource cloud and command and control center.Cloud dispersion refers to the process of task

ISSN 2706-655X Vol.3, Issue 10: 59-67, DOI: 10.25236/IJFET.2021.031007

deployment of various elements after gathering all kinds of data and information, and finally implementing equipment support for various military actors.For example, in the process of spare parts support, the support resource cloud carries out situational awareness on the combat equipment in the combat unit to obtain the spare parts demand data information;The support technology cloud uses data mining and other technologies to cluster and correlate equipment data, so as to obtain equipment fault information, predict the variety and quantity of spare parts required for equipment maintenance, and assist the support decision cloud in making decisions.For example, in the grass-roots maintenance, if the combat unit lacks maintenance personnel or spare parts for damaged equipment, the optimal maintenance scheme can be determined through ""Equipment Cloud Support"" to decide whether to transfer to support level maintenance or transfer corresponding resources for maintenance support.Thus, ""Equipment Cloud Support"" is realized by gathering data and resources into the cloud and dispersing schemes and resources out of the cloud.

2.3.3 Accurate equipment support is the ultimate goal

“""Equipment Cloud Support"""” enables direct communication between combat and support entities in different regions to realize the real-time flow of support information.All military actors put forward equipment support requests at any time, anywhere and on demand through cloud support;The command and control center shall timely respond and deploy corresponding "cloud" service resources according to equipment support requirements;Using cloud technology, pervasive portal technology, cloud service integrated management technology, etc., timely formulate scientific and reasonable support schemes, respond, match and manage equipment support needs and resources, and finally achieve accurate support as needed.

3. Demand analysis of ""Equipment Cloud Support"" system construction

“""Equipment Cloud Support"""” is the inheritance and innovation of equipment support networking, which is in line with the theme of promoting combat effectiveness construction with innovative development.The construction of ""Equipment Cloud Support"" system should comply with the development of the times and the requirements of new military reform, focus on meeting the needs of future battlefield, take accurate support as the goal, and make cloud support based on modern information technology become a catalyst and multiplier to improve equipment support efficiency[8].

3.1 Adapt to the reform of joint battle command system

At present, the joint operation command system of our army is from the Military Commission to the theater, and then to the troops.With the development of science and technology and the continuous change of war mode, it is urgent to build and form a highly integrated command system with many military actors.The traditional equipment support system will also be transformed into a fusion of equipment support resources and forces covering many military actors.The construction of ""Equipment Cloud Support"" system can organically reorganize the equipment support resources and forces of various military actors, and make the equipment support orderly and efficient at different levels, so as to adapt to the reform of joint battle command system.

3.2 Meet the needs of future battlefield

With the in-depth development of joint operations and the wide application of big data, cloud computing and artificial intelligence in the military field, great changes will be brought to the future war form and battlefield environment.For example, in the cloud combat mode based on the combat cloud theory, through the organic integration of multi domains such as information domain, cognitive domain, physical domain and action domain, and the high aggregation and real-time sharing of combat resources, we can realize efficient cross domain operations, minimize the constraints of space-time and battlefield changes on future operations, and then promote the improvement of combat effectiveness.The innovation of future combat mode also puts forward new requirements for equipment support. In the traditional equipment support, the links between various services and arms and other military actors are weak, and there is a lack of unified Department planning and deployment. There are problems such as unreasonable equipment support system structure and unimpeded equipment support information, which are difficult to meet the rapidly changing needs of the future battlefield.Therefore, it is urgent to build an equipment support system based on advanced science and technology such as cloud computing, big data and artificial intelligence, provide an interconnection, interoperability and

ISSN 2706-655X Vol.3, Issue 10: 59-67, DOI: 10.25236/IJFET.2021.031007

interoperability platform for combat entity equipment support, and improve battlefield situation awareness and sharing of equipment data information, so as to adapt to the future battlefield with emphasis on agility, timeliness and high requirements.The integrated equipment support based on combat cloud is based on data information, supported by advanced technology and aimed at accurate support. Through cloud gathering and dispersion, the support information and resources are organically integrated and efficiently shared among military actors to meet the needs of future battlefield changes.

3.3 Comply with the requirements of weapon equipment development

New weapons and equipment continue to be installed in the army, and information technology accounts for an increasing proportion of new weapons and equipment.Weapons and equipment are interconnected through information technology, which puts forward new and higher requirements for equipment management and support.With the in-depth development of military civilian integration, more and more equipment manufacturing units participate in equipment support. Equipment support needs more military civilian cooperation, and the traditional self closed support can not meet the requirements.Integrated equipment support based on combat cloud can not only adapt to the information development of information weapons and equipment, but also break the barriers between military actors and support elements, promote cooperation among actors, and realize accurate and efficient equipment support.In the process of military operation and application of new weapons and equipment, corresponding technical support forces are required. The allocation of support personnel has become an important factor restricting the support of new equipment. It is particularly important to realize remote support and ""Equipment Cloud Support"".""Equipment Cloud Support"" can store the corresponding technical information in the cloud for real-time call by equipment users and support personnel. At the same time, it can monitor the equipment status in real time through situation awareness and remote monitoring, and timely carry out online diagnosis and collaborative maintenance for faulty equipment to realize remote support.

4. Objectives and principles of "Equipment Cloud Support" system construction

4.1 Construction objectives

The construction of "Equipment Cloud Support" system should be based on the overall deployment and unified leadership of the CMC organs from the perspective of the whole army, focus on improving the combat equipment support capability of the army under the background of joint operations, take data fusion, real-time information processing and transmission, optimal allocation of resources among military actors as the core, and take equipment support efficiency as the measurement standard to realize accurate equipment support,Improve the sustained combat capability of the troops[9].

4.2 Construction principle

The construction of "Equipment Cloud Support" system shall follow the following basic principles:

4.2.1 Task traction and unified leadership

The construction of "Equipment Cloud Support" system serves military tasks and is an overall and systematic work. Under the unified leadership of the Military Commission, decision-making and planning must be carried out according to the requirements of future combat missions, tasks, environment and military operations. The organs shall organize and implement it according to the division of functions and on the basis of careful planning and close coordination, so as to strive to form a joint force of equipment support,Meet the needs of future combat equipment support.

4.2.2 Overall consideration and efficiency

The construction of "Equipment Cloud Support" system is an integrated and comprehensive work, with many points and a wide range, heavy tasks and high requirements.We should not only coordinate the overall situation and give full consideration to all aspects, but also grasp the key points.This requires that all equipment support forces should not only divide and cooperate, but also highly aggregate, stress the economic and social benefits of military integrated equipment support, make scientific calculation and accurate prediction with the least human, material and financial resources, and make decisions by combining qualitative and quantitative methods, so as to provide timely, appropriate and appropriate accurate support for the troops and obtain the best support effect.

ISSN 2706-655X Vol.3, Issue 10: 59-67, DOI: 10.25236/IJFET.2021.031007

4.2.3 Integrated guarantee and resource sharing

The construction of "Equipment Cloud Support" system needs to proceed from the overall situation of national comprehensive strength and military system capability, fully tap the potential of local equipment support, integrate the support resources and forces of many services and arms, and establish the organic connection of strategy, campaign, tactics and all levels on the basis of comprehensive utilization of the equipment support forces of the whole army and efficient sharing of the support resources of the whole army,It is an integrated equipment support system in which all services and arms are closely combined and coordinated, and the military and civilian are integrated. The whole and part, system and branch forces are interconnected, interconnected and interoperable."Equipment Cloud Support" has broken through the separation of military and civilian, service boundaries, professional division of labor and platform isolation, completely changed the traditional equipment support mode, and realized the cross domain on-demand support of "cloud" gathering and "cloud" dispersion through the deep integration of equipment data and information.

5. Key points and management measures of "Equipment Cloud Support" system construction

5.1 Construction focus

According to the construction objectives and principles and the operation concept of "Equipment Cloud Support", the construction focus of integrated equipment support system based on combat cloud is determined, as shown in Figure 2.

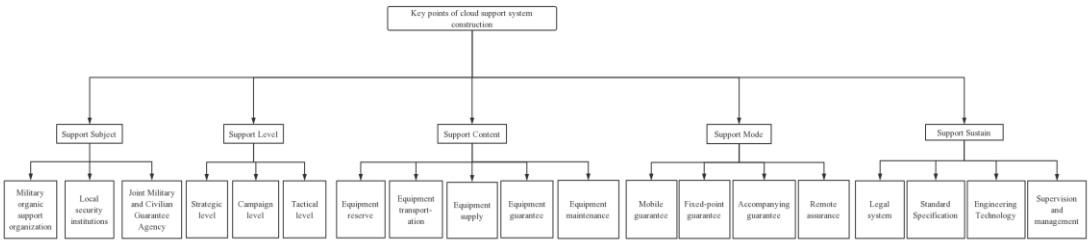

Figure 2 Key points of “"Equipment Cloud Support"” system construction

This paper discusses the key points of "Equipment Cloud Support" system construction from five aspects: support subject, support level, support content, support mode and support supporting[11].

5.1.1 Equipment support subject

The main body of equipment support is mainly composed of military organic equipment support institutions such as relevant units of various services and arms and military scientific research units, as well as local support institutions with equipment manufacturing units as the main body. In wartime, it is also possible to establish military civilian joint emergency support institutions.All support entities participating in cloud support must enter the support entity resource cloud.That is, through virtualization technology, the support resources are abstracted into data information and transmitted to the support resource cloud, which connects and interacts with other elements to implement equipment support for combat entities.

5.1.2 Equipment support level

The level of equipment support mainly includes strategic level, campaign level and tactical level.Strategic level equipment support is the highest level, which refers to equipment support that plays a decisive role in the overall situation of the war and major strategic actions according to the national security strategy and key operational directions;Campaign level equipment support refers to the equipment support for the theater performing operational tasks and the basic campaign Corps under the unified command of theater joint operations;Tactical level equipment support refers to the equipment support implemented for specific combat units or specific combat equipment."Equipment Cloud Support" should be implemented in an orderly manner at all levels.At the same time, "Equipment Cloud Support" connects all levels of equipment support and support resource cloud, and applies the situation awareness information of combat entities to support decision-making and control.

5.1.3 Equipment support content

Equipment support mainly includes equipment reserve, equipment transportation, equipment supply,

ISSN 2706-655X Vol.3, Issue 10: 59-67, DOI: 10.25236/IJFET.2021.031007

equipment use support and equipment maintenance.The system construction is mainly aimed at the equipment support requirements generated by various military actors in the implementation of tasks.Equipment reserve mainly refers to optimizing the location of equipment storage facilities based on the support cloud, carrying out peacetime and wartime storage management, calculating the reserve amount of equipment and determining the reserve layout and structure according to the demand and historical data.Equipment transportation and equipment supply refer to the transportation and supply of various equipment and its spare parts to provide the equipment required for scientific decision-making to complete the task by relying on various elements of "Equipment Cloud Support", such as scientifically classifying the transported equipment by relying on the technical support of support technology cloud and the intelligent decision of support decision cloud, selecting appropriate means of transportation and determining scientific transportation methods and transportation routes,At the same time, the whole transportation and supply process shall be dynamically monitored to ensure that the transportation and supply activities are completed as required.During equipment use support, during the use of equipment in peacetime and wartime, provide the required use support resources through the support cloud, provide technical guidance to the equipment affiliated units, and conduct real-time monitoring and situational awareness of the equipment to ensure the normal operation and operational use of the equipment.Equipment maintenance refers to the support of war damaged or faulty equipment based on the support cloud, which generally includes battlefield emergency repair, fault diagnosis and repair, spare parts management, maintenance technical support, repair personnel allocation and other activities.

5.1.4 Equipment support mode

According to the mobility of the support force, the equipment support mode is divided into mobile support and fixed-point support, and according to the spatial layout of the support force, it is divided into accompanying support and remote support.In the process of "Equipment Cloud Support", the equipment support implemented by the support subject to the combat entity needs to be determined at each support level according to the specific demand information of the combat entity and battlefield combat conditions.

5.1.5 Equipment support

Equipment support includes laws and regulations, standards and specifications, engineering technology, supervision and management, etc.The effective operation of "Equipment Cloud Support" needs strong relevant supporting support.Establish and improve the laws, regulations, systems, standards and specifications system related to "Equipment Cloud Support", and establish corresponding technical review, supervision and management institutions to provide guarantee for the operation of local support system, conduct technical review and support for the other party's support institutions, and monitor, evaluate and regulate the "Equipment Cloud Support" capability in combination with the requirements of combat entities and the actual support effect of support subjects.

5.2 Management measures

The key to whether "Equipment Cloud Support" can improve equipment support efficiency lies in the construction, management and effective operation of "Equipment Cloud Support" system.Therefore, corresponding management measures must be taken for the construction of cloud support system to ensure the efficient operation of cloud support system on the basis of adapting to the change of battle command system, meeting the needs of future battlefield changes and meeting the requirements of weapon and equipment development.

5.2.1 Strengthen the construction of "Equipment Cloud Support" data information infrastructure

First, a strategic level data and information center integrating equipment support data, mission planning and support operations is established at the state and the Military Commission to manage the data and information processing, circulation and support operations of military, civilian and military actors.Theater and other operational functional departments need to connect and coordinate the data information infrastructure between the Military Commission and various arms, connect data information and support resources at all levels through the information network established by "Equipment Cloud Support", and complete equipment support, decision-making, command and implementation through cloud data information flow.All services and arms should actively cooperate with the decision-making and deployment of the Military Commission and the theater, strengthen the construction of "Equipment Cloud Support" system, and ensure that their equipment support data information and resources can be put into the cloud in real time, used efficiently and give full play to

ISSN 2706-655X Vol.3, Issue 10: 59-67, DOI: 10.25236/IJFET.2021.031007

support efficiency.

5.2.2 Strengthen the development and application of "Equipment Cloud Support" technology support means

The effective operation of "Equipment Cloud Support" system is inseparable from the development and application of technical support means.The state and the CMC need to create a good policy environment for "Equipment Cloud Support", such as strengthening investment in the development and application of equipment support engineering technology;At the same time, we should focus on the development infrastructure of cloud support, such as providing integrated development environment, development library and operation platform for various elements of "Equipment Cloud Support", so as to realize the integration of development, testing, deployment and operation.The theater and all services and arms should enhance the development of technology application capabilities and tool development means, such as building an equipment support comprehensive information office system based on cloud computing, and providing applications such as equipment status monitoring and updating, equipment information management, equipment situation presentation, etc.

5.2.3 Strengthen the optimal allocation of "Equipment Cloud Support" resources

The implementation of "Equipment Cloud Support" takes the support resources as the material basis, and the optimal allocation of resources is particularly important.The state and the CMC need to specify the requirements for classified deployment of equipment support resources according to the functions, missions, tasks and equipment allocation of military actors, and conduct unified planning, overall construction and optimal allocation of support resources according to the "Equipment Cloud Support" requirements.The theater and all services and arms need to implement the deployment of the state and the CMC, and take corresponding measures to optimize the allocation of equipment support personnel, support equipment and support facilities.For example, strengthen the reorganization and reconstruction of support facilities, concentrate the construction of repair workshops, stations, equipment warehouses and other facilities within a certain range, form an integrated and comprehensive equipment support area, and improve the efficiency of equipment support.

5.2.4 Strengthen the construction and application of "Equipment Cloud Support" force

The construction and application of equipment support force of "Equipment Cloud Support" is the decisive factor to determine the overall efficiency of "Equipment Cloud Support".The state and the CMC need to focus on strengthening the overall construction of military and civilian equipment support forces.According to the requirements of future combat tasks, we will strive to do a good job in the overall construction, classified guidance and key breakthroughs of equipment support forces at the military and civilian levels, all services and arms and at all levels.According to the system requirements, integrate resources and concentrate efforts, so as to strengthen the synchronization and supporting construction of various internal elements of "Equipment Cloud Support".The theater and all services and arms should strengthen the combat readiness training and actual combat application ability of equipment support forces.For example, strengthen integrated training, integrate multi-level equipment support forces, take improving equipment support capability as the goal, and conduct integrated training on various support elements according to the support methods and requirements in the "Equipment Cloud Support" system, so as to form a highly integrated polymer and improve equipment support efficiency.

6. Conclusion

The integrated equipment support based on combat cloud is based on the overall situation of the country and comprehensive strength and military system capability, relying on the information technology platform, centralizing all support resources and support forces, integrating, reorganizing and optimizing the allocation of resources through the application of modern information technologies such as cloud computing and artificial intelligence based on data information and according to actual needs"Real time monitoring, on-demand deployment and accurate guarantee"This is to build an integrated, information-based and intelligent equipment support system, adapt to the continuous innovation of future combat command system and combat style, the continuous change of battlefield environment and the continuous development of weapons and equipment, enhance the agility and credibility of troops and actions, and improve the sustained combat capability of troops. While developing "Equipment Cloud Support", we should also take into account system information security and risk management. It is also one of the key topics to be explored in the future.

ISSN 2706-655X Vol.3, Issue 10: 59-67, DOI: 10.25236/IJFET.2021.031007

References

[1] Hongmin Yu. General equipment support [M]. Beijing: National Defense Industry Press, January 2014

[2] Tong Niu , Lin Zhang, Bo Zhang, Shengjun Wei, Bo Li. Military civilian integrated equipment support system and mechanism based on "combat cloud" [J]. Firepower and command and control, 2020,45 (10): 19-22 + 27

[3] Dangsheng Han. Armored equipment support from the perspective of "combat cloud" theory [J]. National defense science and technology, 2018,39 (01): 86-89 + 94

[4] Bin Jiang, Min Liang , Bei Huo. Analysis of "cloud warfare" based on "combat cloud" [J]. Firepower and command and control, 2020,45 (07): 1-5

[5] Can Ding, Guangcai Zhu, Jing Li. Analysis of military civilian integration innovation and collaborative innovation based on innovation chain [J]. Journal of Xihua University (PHILOSOPHY AND SOCIAL SCIENCES EDITION), 2018,37 (5): 49-54

[6] Tao Lin, Yuming Lin. Cloud Security -- a new service-oriented social security model [J]. Journal of University of Electronic Science and Technology (SOCIAL SCIENCE EDITION), 2014,16 (03): 6-9

[7] Guanlin Wu. Research on information resource scheduling and optimization method for combat cloud [D]. University of national defense science and technology, 2018

[8] Lei Yang,Wanguo Sun , Tieli Gong. Joint combat equipment support training system [M]. Beijing: Electronic Industry Press, March 2020

[9] Changxi Li, Jun Yu, Ying Xu, Cheng Chen. Research on the construction of battlefield situational awareness system under the condition of joint operation [J]. Journal of Chinese Academy of Electronic Sciences, 2018,13 (06): 680-684

[10] Song Yang, Qiang Yang, Zhaohui Yang, Li Zhou. Situational based battlefield situational awareness interface model [J]. Command control and simulation, 2017,39 (02): 81-84

[11] Guohong Zhao. Research on combat Cloud Architecture [J]. Journal of command and control, 2015,1 (03): 292-295