Research on equipment life cycle information management

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Abstract. At the beginning of this century, with the rapid development of information technology and the high technology of weapons and equipment, the traditional management model can no longer meet the current and future development needs of equipment construction. It is urgent to establish an information management system to improve the life cycle of equipment. This paper explores the life cycle information management model of equipment from many perspectives and levels, such as equipment management at home and abroad, equipment information management analysis, basic principles of equipment information management construction, system technology platform, system development and so on.

1. Introduction
The traditional management of weapons and equipment (hereinafter referred to as equipment) is the management to make the equipment timely supplemented, rationally used and maintained in good condition. Modern weapons and equipment have developed into a huge system of high-tech equipment clusters. The traditional equipment management model can no longer meet the needs of rapid development of equipment construction. In order to realize the efficient management and precision guarantee of the whole life cycle of equipment, and integrate the information management of the life cycle of the equipment, the western countries in the 1980s gradually explored the information management of the military equipment in the whole life, the whole cycle and the whole process. The concept of information technology construction and management of the whole life cycle has become a priority strategy for the development of equipment informationization in various countries.

2. Concept analysis
2.1. Life cycle management
The original concept of the whole life cycle originates from the manufacturing industry, which refers to the whole process of products from processing to disposal, and essentially refers to the entire life cycle of material transformation in the whole process of production activities. The West began research on the relevant life cycle design and its feasibility for weapon systems as early as 1986, and gradually formed a life cycle management model for equipment. The life cycle of equipment can usually be divided into stages of demonstration, development, production, procurement, guarantee, use, maintenance, and decommissioning. According to the law of equipment construction management, the equipment life-cycle management will decompose the various stages of the equipment life-time into specific standard management to achieve higher quality, faster efficiency, better protection and better benefits. Finally, improve the comprehensive operational capabilities [1].
2.2. CALS
CALS (Continuous Acquisition and Life Cycle Support) originated in the 1980s. The US defense department did not standardize, incompatible, insecure, uncontrolled, etc. information between the equipment demand side and the large number of weapons and equipment technical service units. The problem is to realize the standardization and digitization of data docking between many technology platforms, realize the synchronization and integration of information, and integrate and unify, to meet the smooth connection between the design, test, manufacturing and maintenance of complex equipment systems, and the first proposed in the acquisition of weapon systems. The Computer Aided Logistic Support strategy was implemented during the security process. The goal of CALS is to manage life and life. information Exchange, in the life-cycle management process of equipment or engineering projects, the demand side and the design unit, manufacturing unit, and service unit comprehensively utilize advanced information technologies such as digital communication networks, databases, and computer-aided design to design, produce, manage, and maintain equipment. Information and data Digitizing Standardization, synergy, and sharing, strive to achieve information integration within the scope of industry standards, reduce data exchange costs, improve work efficiency, effectively shorten development time and labor costs, improve quality efficiency and maintenance support level (Figure 1). For example, the maintenance manual for a type of destroyer in the West weighs 23.5 tons. Carrying paper materials increases the ship's draught by nearly 9 centimeters and prints up to hundreds of thousands of dollars. If it is digitized, only a few digital storage discs or 1 hard disk are needed. Information storage can be achieved. In the 1990s, CALS evolved into "Continuous Acquisition and Lifetime Support" and was used in Commerce (Commerce At Light Speed).

Figure 1. The main goals of cal: information integration, collaboration, sharing.

3. Equipment life cycle information management
Equipment information management, from the perspective of historical development, managers from the traditional paper document management, to the stand-alone version of digital information management, to the current development of equipment life cycle information management three development stages. The degree of informationization of modern weapons and equipment is constantly improving. The information management of equipment life cycle will play a supporting role in the construction, management and operation of the equipment system [2].

3.1. Equipment Information Management Analysis
Equipment information management is essentially the process of collecting, processing and exchanging equipment information. With the new information technology, a new mode of equipment information management can be established, which can ensure the effective protection, deep development and efficient organization and utilization of equipment information resources, and realize the planning, organization, command, coordination and control of information resources. The most important feature of life-cycle information management is that the information element module is
integrated into the unified standard information resource module during the equipment life cycle, and the resource management is coordinated on the unified platform. It is a standardized and digital integrated information management mode.

3.2. Equipment Information Resource Classification
There are many kinds of equipment related information. From the perspectives of equipment business, equipment category and equipment information nature, it mainly includes the following contents:

3.2.1. Equipment business information
Equipment construction requires the cooperation of different equipment departments, and each equipment management unit has different information needs. According to the business classification, the equipment management business organization mainly includes: planning, scientific research, finance, ordering, maintenance and other departments. The required information is mainly comprehensive and comprehensive information of equipment, including basic information and special information of equipment, for all levels of equipment management departments. Decision making use. Military equipment related units such as R&D, manufacturing, assembly, integration, and service, the required equipment information is usually concentrated on detailed technical information such as technical parameters, technical and tactical requirements, maintenance and upgrades of a certain type of equipment[3].

3.2.2. Equipment category information
It is usually divided according to the function, use, performance, arms, and use environment of the equipment. The specific classification is omitted.

3.2.3. Multiple nature of equipment information

- Basic information: It mainly includes basic information such as basic data indicators, parameters, standards, management regulations, and technical support units of equipment.
- Real-time information: It mainly includes information on the current production, inventory, use, maintenance, and scrapped quality status information of each type of equipment, as well as the status of current equipment management.
- Direct data: mainly refers to the technical value of a certain performance of the equipment, the fault information of a certain type of equipment, maintenance data, and the like.
- Processed information: mainly includes various classification information obtained after the equipment information is processed through aggregation, analysis, statistics, classification, etc. of the information system.

3.3. Information Delivery Process

3.3.1. Equipment classification of each cycle
In different periods of equipment management, managers have very different needs for information. A large amount of information needs to be collected and processed, and this information is effectively integrated and integrated, making it an indispensable information resource for equipment development and construction. An important part of the work. One of the main tasks of daily information management is to ensure accurate and timely entry, generation, migration, storage and retrieval of these information. According to the main cycle of equipment construction, the most frequently used information is generated in the following five stages.

- Equipment demonstration stage. This stage produces a large amount of equipment demonstration information and communication information between the military and the military, including: demand plan, mission objectives, system design, function indicators, research and development cycle, fund calculation, feasibility study and other information.
• Equipment development stage. This stage generates a large amount of scientific research technology and communication information, including a large amount of information such as research and development programs, technical parameters, cost of financing, and management communication.
• Equipment production stage. This stage mainly produces a large amount of manufacturing and production information, including: material specifications, parts, order contracts, test and test information.
• Use the guarantee phase. This stage includes major activities such as equipment distribution, use, storage, and maintenance, and generates a large amount of statistical and communication information, including information on equipment quantity, technical status, maintenance plan, and security funds.
• Equipment decommissioning and scrapping stage. This stage is the last cycle of equipment life, and produces less information. It is the stage of equipment information archiving, which mainly includes data such as total equipment cost and equipment recovery.

3.3.2. Equipment information transmission in each cycle
In traditional equipment management, the information transmission process is basically transmitted in the order of non-existence and interlocking equipment, reflecting the upstream and downstream relationship and leadership decision-making sequence of traditional equipment management work (as shown in Figure 2).

![Figure 2. Information transfer process of traditional equipment management.](image)

In a large number of practical work processes, the internal stages of the equipment life cycle not only generate a large amount of information, but also a large amount of information exchange between the cycles. The traditional equipment management work mode needs to be broken. With the rapid increase of information volume, the information transmitted between the various periods of equipment management has both the information accumulated in the forward direction and the information in the reverse feedback. There are both superimposed information and gradually integrated information. Information, also has independently generated information. It reflects the complexity of equipment management work information and the universality of information exchange. It is necessary to establish a new efficient and flexible equipment information management system to realize the high-efficiency utilization of information resources [4].

4. Equipment information management system
From a macro perspective, in the life cycle management of equipment, equipment information leads and integrates management elements such as capital, technology, talents, and logistics, and becomes the first driving force for driving equipment construction and development. Establishing a real-time
and efficient equipment information management system will lay a technical foundation for the improvement of military economic benefits of equipment management.

4.1. system technology platform
The equipment information management system established in the early days, due to technical limitations, mostly used in a single machine or in a small-area LAN environment, and many equipment management units usually establish their own information systems, although these stand-alone versions are security and confidentiality. It is higher, but it is essentially a multitude of information islands. The complete information chain of equipment is scattered in many different units. The information exchange efficiency is low, and the information resource sharing benefit cannot be formed, which can not meet the war preparation requirements under the high-tech conditions of our military. With the maturity and soundness of the military integrated information network, the traditional equipment information management system has been gradually upgraded to a new platform based on the military Internet, using high-speed data networks to integrate information resources such as hardware, software, and data distributed in different locations. Integration, realize the integration and integration of information flow, capital flow, talents, technology and logistics, open up multiple information channels, realize resource sharing, and provide different types of equipment information services for many end users. The equipment information management platform integrates the equipment management objectives, management system and management methods, and is an important starting point for equipment management informationization.

4.2. system function architecture
As a typical information system, the equipment information management system has basic information input and output functions, and has the functions of planning, control, statistics and analysis required for equipment management. It is a comprehensive information system for comprehensive management of equipment. From a technical perspective, the structure of the equipment information management system can be divided into software structure and hardware structure. The software structure refers to the operating system, database and management application software; the hardware structure refers to the computer hardware system and network equipment facilities.

4.2.1. From the structure of the information system
The equipment information management system can be divided into the following five functional modules: 1. Information collection module. It is mainly used to input equipment information to ensure the authenticity, standardization, accuracy, completeness, uniformity and timeliness of information collection.2. Information storage module. It mainly reviews, verifies, classifies, summarizes, stores and updates the entered data to ensure the timeliness of information access.3. Information processing module. It is mainly used to identify, calculate, retrieve, and manage equipment information to achieve decision support.4. Client module. The main implementation system provides convenient and flexible information services for various users.5. Data transmission module. It mainly realizes the functions of receiving, publishing, and managing messages through the network.

4.2.2. From the perspective of equipment business
The equipment information management system can be divided into three functional categories and 21 information management business function modules to realize the specific functional tasks of the equipment business, the information processing of the system and the network information exchange function.
4.3. System Development

The establishment of the equipment information management system can completely solve the problems of information integration difficulties and information sharing difficulties in the traditional management methods, and provide interest resource services for all stages of equipment life cycle management. We must stand at the height of long-term development of equipment construction, fully consider the current and future characteristics of equipment construction management, and strictly implement the implementation of industry standards for information system development. The development and construction of information systems is usually divided into five stages: overall planning, requirements analysis, software design, deployment and implementation, and operation and maintenance.

5. Conclusion

With the rapid development and popularization of new high-tech equipment, the equipment model is updated fast, the technical content is high, and the guarantee mode is complex, which brings severe challenges to the equipment work. It is unable to meet the equipment support requirements simply by relying on the strength of the troops. Since 2015, the integration of military and civilian development has risen to a national strategy, which has pointed out the direction for the integration of military and civilian equipment under high-tech conditions. Under the background of the popularization and application of advanced technologies such as big data and artificial intelligence, the whole life cycle management of equipment will be developed in the direction of standard unification, intelligent
decision-making, military-civilian integration and talents generalization, and research and application of equipment life-long information management system. It will gradually establish and improve a new information ecological environment integrating peace and war, military-civilian integration, resource sharing and integration guarantee, and provide a new information driving force for the future development of equipment construction.

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