

# Study of a certain type of missile maintenance training system

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**Keywords:** Missile maintenance; information integration; training system

**Abstract.** In this paper, the maintenance training characteristics and rules of a certain type of missile equipment is researched, and a framework for integrated maintenance training system for enhancing maintenance training effectiveness is constructed. The system can be equipped for teaching, information querying, system simulation, maintenance training etc. and it can be realized the individual training and military cooperation training.

## Introduction

Because of missile equipment is a complex electronic equipment which has a broader professional field, higher system integration and more complex working relationship, there is a higher requirement for maintenance support of Missile equipment. Therefore, how to use information technology to improve the practice skills of equipment maintenance person and to upgrade efficiency of equipment maintenance training, how to explore the new equipment maintenance training mode which can adapt to the development equipment, have been a hot topic in which equipment maintenance field made great efforts to research. With the development of computer technology and virtual reality technology, the traditional method of maintenance training is replaced by the virtual maintenance technology. And now the virtual maintenance technology has become the main maintenance training method [1]. But at present maintenance training system is still in its infancy, the common problem is including:

*A. The research object is very simple*

The system is aimed at operation training for combination of machinery and equipment such as composition and decomposition etc, and is lack of maintenance training on the electrical electric performance of electronic equipment.

*B. The function of maintenance system is simple*

Its function is concentrated on the introduction, teaching, practice and soon on, and the system is not reflected the process of maintenance training.

*C. The training effect is not ideal*

Restricted by hardware development, there has a larger difference between the actual maintenance process and virtual maintenance training, so the maintenance person has a poor sense of training when using maintenance training system.

*D. The utility is not enough*

At present maintenance training system is mostly at the stage of laboratory, owing to the disadvantages such as higher costs of interactive device (helmet, sensors) and more complicate structure of the system, there is a lack of mature technology support for the practical application.

*E. The systemic research on maintenance theory and training mode is lack*

Nowadays, the research mainly focuses on solving material technical problem. Instead, the training pattern and system frame which is in order to improve the training effect are not much involved.

In this paper, the maintenance training characteristics and rules of a certain type of missile equipment is researched, and a framework for integrated maintenance training system for enhancing

maintenance training effectiveness is constructed. On this condition, a missile equipment maintenance training system used for army, maintenance agencies and colleges is developed.

### Structure of system

Figure 1 is the whole structure of missile equipment maintenance training system. In the system, all the equipment resource data are stored in the data base server; the system is implemented by a combination of B/S and C/S soft patterns.

Using B/S structure, the server port of the equipment information resource management platform is set on intelligent substation, in which all the teachers and students can connect equipment information resource management platform through a personal computer or maintenance guidance training unit to upload or download all kinds of equipment resource, courseware, test etc.

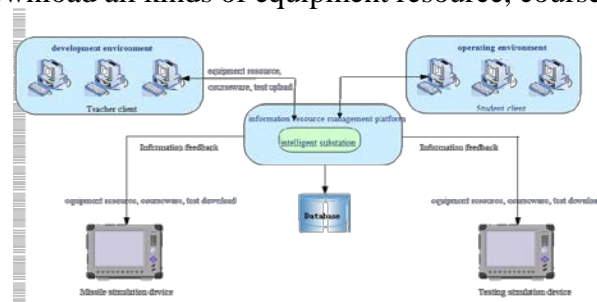


Figure 1. Topology structure of general equipment maintenance training system

Using C/S structure, the interactive development platform environment is mainly operated in the teacher's personal computer.

Through which teacher can generate various kinds of courseware or tests and upload these data to the equipment information resource management platform.

Similarly, using C/S structure, the teaching training platform environment is mainly operated in the maintenance instructions and maintenance training unit, by downloading different courseware or simulation training model to implement maintenance training and other functions. At the same time, it can be run on the personal computer to help students complete the self-learning function [2].

Finally, the maintenance training intelligent terminal guidance and training platform can cooperate to complete the function of maintenance process visualization instruction, fault injection, analog signal output.

### F. Organization, development of equipment maintenance information resource

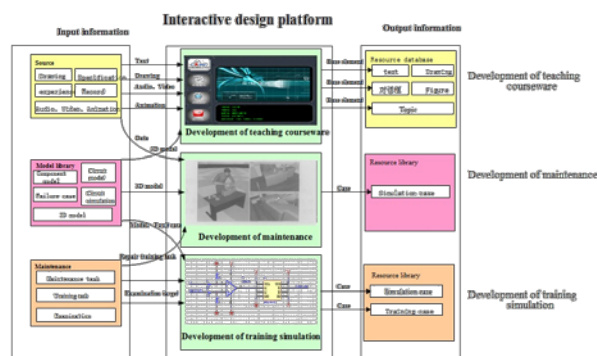


Figure 2. Structure diagram of interactive design platform

Using C/S structure, Interactive design platform is mainly operated in the teacher's office client. The platform is designed for teacher to achieve the development and management function, in which teacher can describe and demonstrate the process information on the equipment structure, principle, equipment disassembly, interactive diagnosis, maintenance guide training by using some means such as text, graphics, tables, multimedia(video, audio, flash), 3Dmodel etc. On this condition, a set of simulation training platform including the mechanical fault analysis, electric fault analysis,

interactive maintenance guide is provided for the troops. The structure of simulation training platform is shown in figure 2.

#### G. Application and interaction of equipment maintenance training system

The operating platform is included all kinds of resources generated by development platform. In this platform, students can obtain the corresponding access through the portal system of management, accordingly, they can obtain and organize the corresponding data resources to implement the simulation and test specific tasks.

- Courseware learning Platform. The platform has courseware resources, in which students can browse relevant information and data resources to realize self-learning. In order to ensure the full utilization of the learning resource, a variety of formats and types of files can be displayed in the courseware learning platform, namely, the platform has good compatibility to many kinds of file format [3].
- Simulation training platform. Simulation training platform can provide a virtual training environment simulation training platform for students. By using this platform, students can complete the maintenance auxiliary, equipment operation training, simulation, fault injection and other functions. Based on the task configuration files and related resources, using PMA, oscilloscope, signal generator and other equipment as the hardware environment, the simulation training platform can be simulated and trained various tasks. At the same time, it can displayed corresponding output through the interactive devices and virtual equipment model [4]. Figure 3 is shown the main function that the platform can be completed.

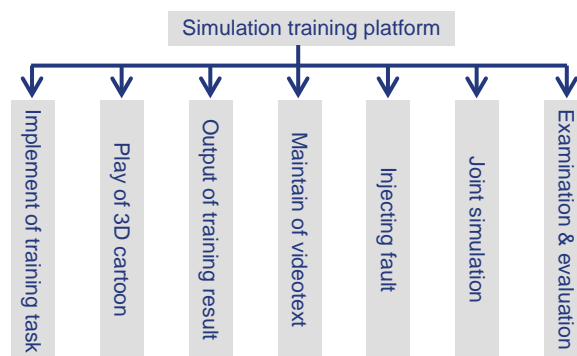


Figure 3. Structure diagram of the simulation training function

- Implement of training task. The system execution engine can call the related resource file to response students' operation of training task, and the response process is mainly implemented in the form of three-dimensional visualization. Namely, the system can complete variety of simulation tasks such as assembly, disassembly, maintenance etc according to the instructions of moving, rotating and detecting.

### Analysis of key technology

#### H. Relational data structure technology

Unlikely some general simple electrical documents or multimedia databases, the equipment information resource database divide the data into different objects and store them as a basic unit in the database. These data is associated with each other and is stored in a general standard. In addition, the data can be updated by a granular form.

In the form of information structure, the information data is classified three levels-the application information layer, topic information layer and basic information layer. The information structure is shown in figure 4. According to the above idea, multimedia database is designed to facilitate organization and management of information resources [5].

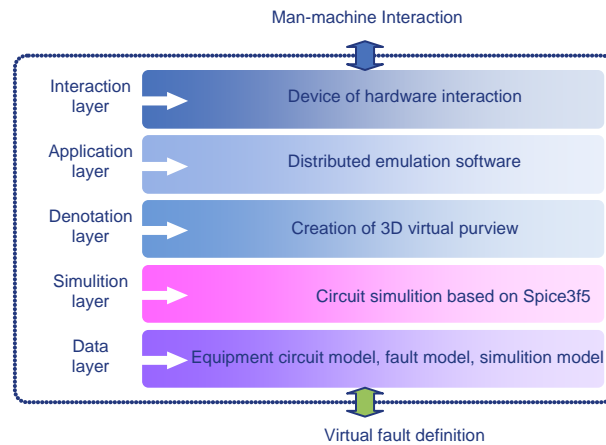


Figure 4. Hierarchy diagram of information structure

### I. Intelligent search engine technology

With the development of weapon equipment, the scale of relevant information will be increasing constantly. For instance, there are hundreds of millions data in the database of a tactical missile. So an intelligent search engine technology must be adopted by quickly searching related content on the huge data. According to the data organization form, in the practical application, an index can quickly locate relevant content by using database segmentation and indexing technology. At the same time, the primary search engine is extended to inquire out the outside information resources data and submit to the user. The search engine technology can remarkably improve the search speed and efficiency of the system.

### J. 3D visualization technology

This technology is mainly divided into three parts--model import and reduction, scene rendering and 3D animation. The technology of model import and reduction is imported the model resources into virtual environment, the information is including: geometry information, material, texture files, model component dependency, skeletal animation files etc; Scene rendering is mainly draw a virtual scene, where the open-source rendering engine OGRE is used to draw the scene through calling to DirectX; Shown in the platform, the model can be controlled to complete the installation disassembly of equipment through operating the mouse.

## Acknowledgment

Maintenance person training is very important for the missile equipment maintenance training mission. The missile equipment maintenance training system has the advantages such as powerful function, rich resources and convenient to use etc. Using the system, the training process of equipment maintenance person can be accelerated and the equipment maintenance ability can be improved. The system has an important significance for the army construction.

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