International Journal of Innovation and Applied Studies
ISSN 2028-9324 Vol. 14 No. 2 Jan. 2016, pp. 265-271

http://www.ijias.issr-journals.org/

# Construction and Research of the Modern Civil Aviation CBT Comprehensive Laboratory Based on C/S Mode

***Shouxi Zhu[1-2], Wenlai Ma[1-2], and Guoqiang Mao[1-2]***

[1]Flying College,
Binzhou University,
Binzhou, Shandong, China

[2]Aviation Information Technology R&D Center,
Binzhou University,
Binzhou, Shandong, China



**ABSTRACT:** From the higher demand of civil aviation development for aviation talents, this paper analyzes the existing problems in civil aviation professional teaching such as teaching facilities and content relatively old, lack of practice time and teaching pattern is unitary. Then, we put forward the method to solve the above problems that using civil aviation CBT comprehensive laboratory. This paper analyzes the hardware composition and the optimizing scheme of civil aviation CBT system, studies the five teaching application platforms of civil aviation CBT software system. So it fully embodies the organic integration between computer aided education technology with the civil aviation professional teaching practice. At last, we discuss the significance of civil aviation CBT system for the modern civil aviation professional education.

**KEYWORDS:** Civil Aviation, CBT, C/S Mode, Web, Teaching, Training.

## 1 INTRODUCTION

In recent years, with the rapid development of aviation transportation industry and modern science and technology, the development of civil aviation faces significant changes [1]. As a result, it adopts some new technologies in many aviation fields, such as autopilot, communications, navigation, surveillance and aviation meteorological system. In recent years, some greater changes have also taken place in the type and performance of civil aircraft [2].The rapid development of civil aviation puts forward higher requirements to the level of training and talents quality and puts forward more challenges to the colleges and universities who service for modern civil aviation personnel training work. These can be found in the selection requirements and examination of aviation employers for graduates [3].

With the development of computer technology, as an emerging interdisciplinary, CBE (Computer Based Education) has been widely used in Education [4]. As a kind of teaching method, the CBT (Computer Based Training) teaching is developing rapidly in recent years, which has been widely applied in all kinds of training areas [5]. CBT teaching is mainly using multimedia means such as images, voice, text, and simulation operation to create a intuitive and real training environment for students, and to provide a interactive operation that close to the real, make the students has immersion experience in the process of training and then enhance the training effect.

Using CBT system in civil aviation professional teaching can largely improve the lack of practice teaching in the physical teaching and training, greatly shorten the learning time, and improve the learning effect. As a result, provide the basic theory and practical ability for the further practical training [6]. Based on the concept of CBT, we constructed a modern civil aviation CBT comprehensive laboratory based on C/S mode, built a modern civil aviation professional education platform which with the combination of theory and practice, classroom teaching and real training. By using virtual reality technology, this

**Corresponding Author:** Shouxi Zhu

laboratory can carry out the flight simulation training, aircraft engine simulation troubleshooting and all kinds of cognitive experiment. It also can be used as a platform for the students' autonomous learning, which can stimulate students' interest in learning, cultivate the sense of responsibility, and improve students' practical ability, independent analysis and problem solving ability, innovative thinking ability and the ability to integrate theory with practice. This can make the students to consolidate and enhance their professional knowledge in the integrated use of this laboratory, expand students' knowledge and comprehensive quality in an all-round way.

## 2 PRESENT PROBLEMS EXISTING IN THE CIVIL AVIATION PROFESSIONAL TEACHING

At present, there are only a dozen colleges in china that training civil aviation talents in higher education, which level is uneven. Practice teaching, especially the civil aviation professional teaching cannot completely meet the needs of development of civil aviation and civil aviation employers. Besides the teachers level, there are many common problems in these colleges.

### 2.1 PRACTICE TEACHING FACILITIES AND TEACHING CONTENT IS RELATIVELY OLD

The investment of civil aviation experimental training equipments is huge. Under the condition of limited fund resources, generally, the colleges and universities can only buy a few relatively classic experiment equipments, the update speed of the equipments is slow which can't keep up with the civil aviation development [7]. The problems of single equipment function and poor quantity, on one hand, cannot guarantee the actual operation for many students at the same time, there is no enough training time for the students; On the other hand, in order to guarantee the teaching schedule, there are almost observe and verification experiments, the contents are relatively old, the comprehensive and design experiments cannot effectively carried out.

### 2.2 CLASS TIME CANNOT FULLY MEET THE NEEDS OF PRACTICE TEACHINGTO COMPLETE

Although the civil aviation experimental practice occupies a larger proportion in the professional talent cultivation plan in many colleges, but within the limited class time, the time that the students can operate independently is still less. As a result, for many students, a lot of practice can only from the textbook on abstract understanding, In case of insufficient practice time, the practical teaching effect cannot be guaranteed.

### 2.3 TRADITIONAL PRACTICE TEACHING MODE CANNOT GET GOOD TEACHING EFFECT

Due to the lack of experimental equipment and the level of teachers, the practice teaching generally take the method that the teacher adopt simple explanation and operation on equipment then the students independent grouping experiment after observational learning. In many experiments, the students can only take part of the operation and unable to understand the whole experiment. In addition, some experiment equipments and operation have certain risk, so the students cannot preview before class and review after class on the experimental equipment independently. This single teaching mode makes the students lack of interest in practice and the effect is unsatisfactory.

Remote laboratory and virtual laboratory is a hot spot in the development of modern education technology [8], the civil aviation CBT comprehensive laboratory is the organic combination of remote virtual laboratory and real laboratory, so it is an effective way to solve the above problems.

## 3 HARDWARE OF CIVIL AVIATION CBT SYSTEM

### 3.1 WHOLE STRUCTURE OF HARDWARE SYSTEM

CBT system uses the C/S mode, through the LAN facilities, we built a network, digital experiment teaching system. The whole hardware system consists of a server (instructor side) and multiple customer terminals (students side). They work together to accomplish the work of local experiment. At the same time, the system can also be formed a distance learning and training platform through internet technology [9], the model of CBT system is shown in figure 1.

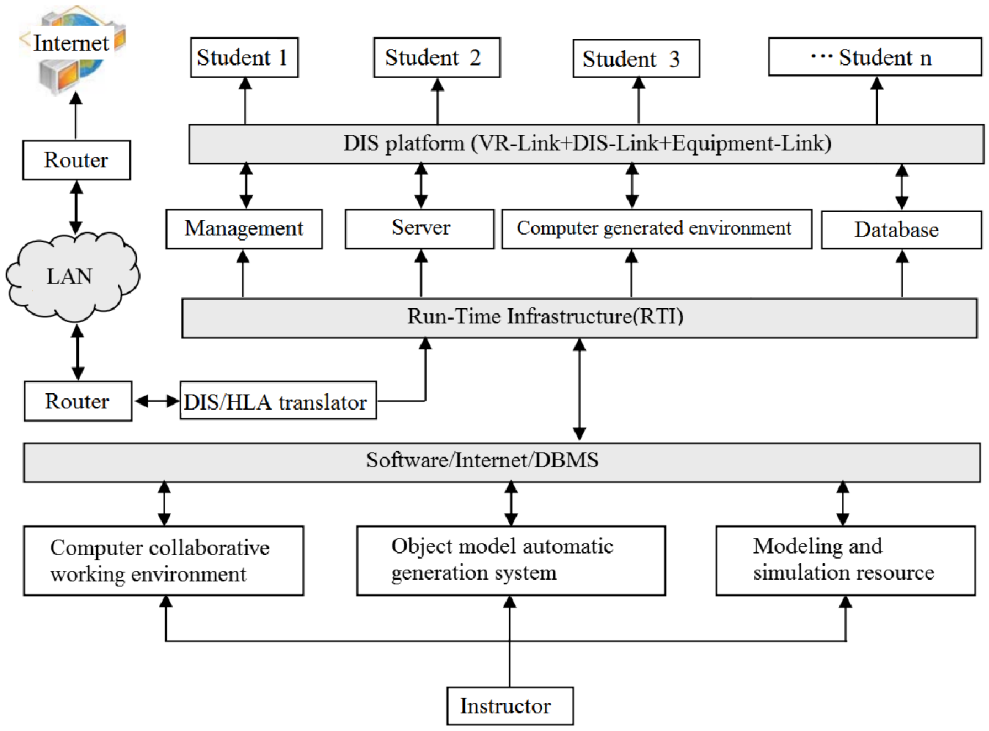


***Fig. 1. Model of The Modern Civil Aviation CBT Integrated System***

### 3.2 HARDWARE CHOICES

If we want to construct a civil aviation CBT comprehensive laboratory, we need at least the following hardware devices.

- A high performance server, which based on the large capacity disk array storage technology and high-speed performance optimization system.
- A set of network components system, which based on high-speed data transmission and global load balance optimization.
- One master control computer (for teachers) and some terminal computer (for students), the exact amount depends on the lab area. The computer that used in CBT system should choose the computer with great graphics image processing function, in order to meet the requirements of all kinds of virtual experiment.
- A set of multimedia teaching system (including projectors, multimedia console, electric curtain, sound system, etc.).

### 3.3 HARDWARE SYSTEM OPTIMIZATION

In order to adapt the characteristics of CBT system, such as large data storage capacity, high-speed transmission of real-time, security and strong anti-catastrophic requirements, in the system development process, many aspects, including data storage, data communication, data exchange and other hardware performance have been optimized .

- Large-capacity high speed disk array storage technology and performance optimization

The large number of multimedia files interactive and powerful scalability of the CBT system puts forward high demands on disk capacity and performance. The CBT system uses a RAID 0+1 standard, by continuously segmentation data in bits or bytes, concurrent read/write multiple disks to achieve high data transfer rate. At the same time, through disk mirroring technology to increase system data reliability, through network-attached storage support to further improve the efficiency and stability of data exchange.

- High-speed data transmission based on wire-speed switching technology,

We use wire-speed switching technology to achieve high-speed data transmission, complete protocol analysis and packet forwarding through a dedicated hardware, which makes the data streams of multiple switch ports can be processed simultaneously. That can improve the data transmission efficiency significantly.

- Streaming technology and global data transmission load balance optimization

Using streaming technology, we can achieve the media files online access. In order to deal with the network congestion caused by multiple users access the same media files at the same time, the system uses a global load balancing technology [10], combined with a network-attached storage, we can minimize I/O channel throughput due to server limit caused by network congestion.

- Information security management and network optimization

The system combines hardware development of router and specialized network management software to achieve the management of all computers internet applications in the system, including restricting access network time, type and so on. Through a combination of hardware and software disk encryption, disk file virus monitoring and scanning, message encryption technology and firewall technology to maximize the system security.

## 4 TEACHING APPLICATION PLATFORM OF CIVIL AVIATION CBT SYSTEM

Civil aviation CBT system is the organic integration of modern computer aided education thoughts and technology with the civil aviation professional teaching practice, the software system including five teaching application platform, respectively are professional education platform, simulation training platform, quality expand platform, teaching management platform and system management platform, as shown in figure 2.

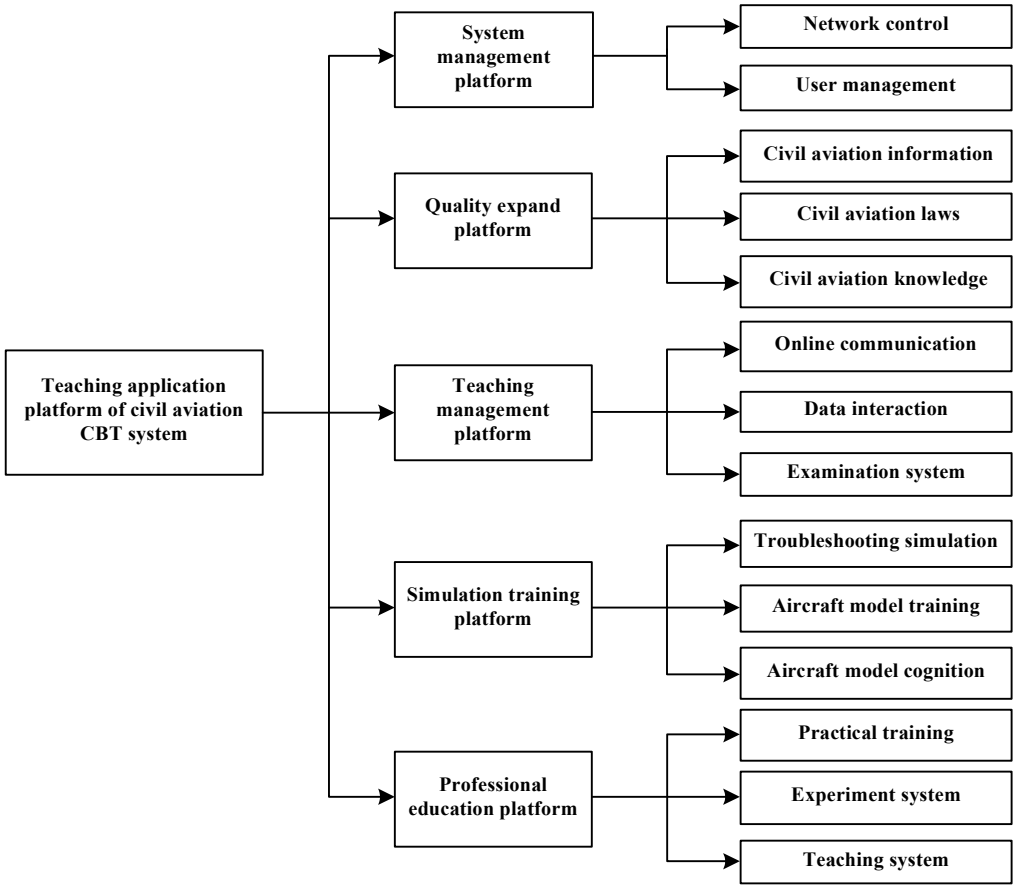


*Fig. 2. Teaching Application Platform of Civil Aviation CBT System*

### 4.1 PROFESSIONAL EDUCATION PLATFORM

Professional education platform including two forms of Chinese teaching and bilingual teaching, including three big modules, respectively are practical training system, experiment system and teaching system. Professional education platform collection of all the theory courses that the aviation professional education needs, including electronic teaching materials, courseware, teaching plan and teaching programme. Based on the professional talent cultivation plan and the industry standard, the platform integrates all kinds of practice teaching resources, including the various experiments, training schemes, experiment teaching syllabus and so on. Three big modules jointly build a modern civil aviation professional education platform with the combination of theory and practice, classroom teaching and training. This platform fully embodies the characteristics of civil aviation professional educational system and ideas that can help students build a scientific and complete professional knowledge structure.

### 4.2 SIMULATION TRAINING PLATFORM

Simulation training platform includes aircraft model cognition, aircraft model training and troubleshooting simulation three modules. The module of aircraft model cognition and aircraft model training provides almost all details of the mainstream aircraft models in the world today, can make students form system and perfect models knowledge. Powerful and perfect computer assisted training is the essence and core of the modern civil aviation CBT software system [11], through computer simulation and virtual reality technology, the system developed the virtual prototype of B-737 and A320 two mainstream models and PW4000 aeroengine. Through fault modeling and simulation on the highly realistic panel, the students can independently do troubleshooting operations training that can solve the problems of practical maintenance training models, such as large investment and fewer sets. In addition, the system also makes full use of the aviation training resources on the network (AVSOFT), integrated the Boeing MPT and Airbus AIRMAN software into the system [12], make troubleshooting training more conform to the industry demand. The content of simulation training platform is step by step and the virtual troubleshooting training more close to reality, so as to get the best training effect as much as possible.

### 4.3 QUALITY EXPAND PLATFORM

The development of modern civil aviation tends to have more diversified demand for talent, so the civil aviation personnel should have a broad knowledge and a good comprehensive quality. In addition, the comprehensive understanding of industry knowledge is a key way to stimulate students' interest in learning, cultivate the sense of responsibility, consolidate and improve the professional knowledge. According to the needs of teaching and quality requirements for civil aviation talents, the system built the modern civil aviation quality expand platform. The content covers aircraft models knowledge, civil aviation knowledge, civil aviation laws and regulations, civil aviation books and materials, and other function modules. In file storage, information retrieval, multimedia reading and other aspects, the system also does some development work, makes the reading and use more convenient, fast and practical, and has formed a small and online browsing "library" of civil aviation.

### 4.4 TEACHING MANAGEMENT PLATFORM

Teaching management platform contains examination system, data interaction and online communication three big modules. Including the following function modules: course management, courseware management, pre-course reading/review after class, experimental teaching management, teaching files management, item bank management, automatic examination paper generating, examination paper management, results management, online communication and data interaction. Those function modules are rich in content and have full function which can effectively improve the efficiency and quality of teaching, management and service work.

### 4.5 SYSTEM MANAGEMENT PLATFORM

As an open and networked computer assisted education system, system security and efficient operation is the necessary premise. Therefore, the system developed system management platform which including user management, network settings, database maintenance and other function modules. It can help the administrator to complete the effective management of all teachers and students users, ensure the data security and reliable operation of the system.

## 5 MEANING OF CIVIL AVIATION CBT SYSTEM FOR CIVIL AVIATION PROFESSIONAL TEACHING

Civil aviation CBT system is not only a open experimental comprehensive teaching system based on network, but also a complete civil aviation professional teaching and management system for colleges and universities. It integrates computer aided teaching and engineering simulation training into a system and makes almost all teaching activities can be conducted on this system.

### 5.1 IMPLEMENTATION OF MOBILE LEARNING ANYTIME AND ANYWHERE

Almost all electronic teaching materials of civil aviation professional courses are integrated into the CBT system, these electronic teaching materials are connected through headings, navigation, and indexing query. Students can achieve mobile learning anytime and anywhere through the network, so it can facilitate the implementation of preview and review of the theory courses and experiment, and greatly expand the learning space and time of students.

### 5.2 EFFECTIVELY IMPROVE THE PRACTICE TEACHING EFFECT

Compared to the actual aircraft troubleshooting laboratory which less models and relatively backward functions, the aircraft troubleshooting simulation training platform can reproduce almost all mainstream common fault of the aircraft, it integrated with plenty of practical experience in troubleshooting, and can be convenient to upgrade and update. Therefore, it can follow the development of civil aviation. Students can practice under the guidance of "virtual instructor", so as to stimulate the students' interest in learning, enhance the students' learning autonomy. Troubleshooting simulation can be an effective supplement to actual aircraft troubleshooting training and can greatly improve the effect of practice teaching.

### 5.3 TEACHING MANAGEMENT REFLECTS THE PEOPLE-ORIENTED

The system provides an advanced examination management system and platform, greatly reduced the workload of class management, prepare a lesson, formulate an examination paper, results analysis and so on. Also, it can make the student self-test become more convenient and independent. Teaching interactive and communication online features provide an open and advanced platform of remote communication for teachers and students, students and students, school and out-school. So the teaching management is more people-oriented and more in line with the teaching rule.

### 5.4 QUALITY EXPAND IS MORE ADAPT TO THE DEVELOPMENT OF CIVIL AVIATION

The powerful database supports of system can convenient provide civil aviation professional information in vast amounts. The broad and rich industry knowledge can stimulate students' interest in learning, cultivate their sense of responsibility. Students can continuously consolidate and improve in the integrated use of professional knowledge. The knowledge base and comprehensive quality of the students can get a comprehensive development and can greatly enhance the value of civil aviation talents cultivation.

## 6 CONCLUSION

In Flying college of Binzhou University, the civil aviation CBT comprehensive laboratory has been built and run for nearly six years. Through constantly upgrade and modification of CBT system, its function is constantly improving, and playing an increasingly important role in talent training of our college. However, it is important to note that the civil aviation CBT system is an autonomous learning, simulation practice and comprehensive diathesis developing platform, the virtual experiment and practical application is feasible in all kinds of cognitive experiment or initial training, but it cannot fully replace the actual experiment or training operation. If we just want to reduce teachers' workload or enhance the utilization ratio of the CBT lab and arrange many practical experimental in CBT laboratory, the experimental results cannot be guaranteed. CBT system is an integrated learning platform. Only the correct use of civil aviation CBT system, can it play a greater role in the cultivation of civil aviation talents.

## ACKNOWLEDGMENT

This research was financially supported by key experimental technology research project of Binzhou University (Grant NO.BZXYSYXM201401, BZXYSYXM201302).

**REFERENCES**


[1] Kearns Suzanne, "Online Single-Pilot Resource Management: Assessing the Feasibility of Computer-Based Safety Training," *International Journal of Aviation Psychology*, vol. 21, no. 2, pp. 175-190, 2011.

[2] H. M. Cuevas, "Fiore SM.Enhancing learning outcomes in computer-based training via self-generated elaboration," *Instructional Science*, vol. 42, no. 6, pp. 839-859, 2014.

[3] Y. Wang, "Type training innovation caused by Maintenance Training Device," *Aviation Maintenance & Engineering*, no, 4, pp. 28-293, 2010.

[4] A. Bolstad Cheryl, R. Endsley Mica and M. Costello Anthony et al, "Evaluation of Computer-Based Situation Awareness Training for General Aviation Pilots," *International Journal of Aviation Psychology*, vol. 20, no. 3, pp. 269-294, 2010.

[5] D. C. Kraus and A. K. Gramopadhye, "Effect of team training on aircraft maintenance technicians: computer-based training versus instructor-based training," *International Journal of Industrial Ergonomics*, vol. 27, no. 3, pp. 141-157, 2001.

[6] S. Guan, "Development of the CBT Courseware for the Maintenance of the Boeing 757 Aircraft," *Journal of Civil Aviation University of China*, vol, 19, no. 2, pp. 48-51, 2001.

[7] Y. Yao, GH. Su and LP. Feng, "Construction of Network Virtual Laboratories for Engineering Majors," *Research and Exploration in Laboratory*, vol. 32, no. 5, pp. 212-215, 2013.

[8] H. Zhao and ZC. Li, "Construction and implementation of network virtual laboratory system based on B/S," *Experimental Technology and Management*, vol. 32, no. 5, pp. 212-215, 2013.

[9] Y. Wang, GL. Li and YJ. Ying etal, "Constructing virtual laboratory based on network and deepening reform of modern experiment teaching," *Experimental Technology and Management*, vol. 27, no. 9, pp. 85-88, 2010.

[10] J. Yang, M. Qi and WJ. Yang, "Construction and Teaching of Aviation Maintenance Practice Platform Based on Network," *Experimental Technology and Management*, vol. 33, no. 8, pp. 282-286, 2014.

[11] JW. Xu and M. Zhao, "Boeing's Maintenance Performance Toolbox," *International Aviation*, no. 9, pp. 68-69, 2010.

[12] Z. Gu, "Airbus Digital Troubleshooting and Maintenance Management Software AIRMAN," *Aviation Maintenance & Engineering*, no. 6, pp. 39-41, 2005.