FEDERAL AVIATION ADMINISTRATION SITE

ADMINISTRATORS' PERCEPTIONS

OF A DISTANCE LEARNING

RECORD TRACKING

SYSTEM

By

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TABLE OF CONTENTS

TABLES

FIGURES

Figure Page

CHAPTER I

INTRODUCTION

Technology allows us to use computers to train individuals. Because computer-based instruction (CBI) is efficient and economical, many organizations have adopted it for the training of their personnel. As more organizations, including those in aviation, turn to CBI it becomes more important to develop methods of recording and maintaining training records. These methods must include the performance of administrative duties such as creating student rosters, the addition of local courses, assessment testing, and the maintenance of archiving of student records.

In an Federal Aviation Administration (FAA) aviation CBI system, all courses are delivered via Compact Disc Read Only Memory (CD-ROM), Digital Versatile/Video Disc Read Only Memory (DVD ROM), or the Internet. Courses are created either by "in-house developers" or by outside development companies that operate across the country. Since there is a variety of sources for course material, there is a need to keep courses as uniform as possible to minimize confusion. This creates a requirement for a standard interface for both students and administrators.

The CBI system must also interface with the students' personnel files. This interface is required to complete the training loop and ensure students receive credit for all training. In the case of the FAA, the personnel files are stored in the Consolidated

Personnel Management Information System (CPMIS). CPMIS is a national Department of Transportation (DOT) database used by all administrations in the DOT. This database has been in use within the FAA since 1975. It is divided into several subsystems, such as personnel, budget, and training, that operate independently. Within CPMIS, each administration has access to its own records and retrieve information, on a "need to know basis," from other subsystems by the use of specially written programs. This protects the privacy of information in each subsystem.

Problem Statement

Because courses are not centrally developed and administered, the FAA requires a record keeping system that integrates the course results with centralized and local student records. At present it is not known how effective this system is because of differential levels of training of administrators and administrative turn over. It is also not known whether local systems have Internet capabilities to consistently connect with the central system for distance learning record verifying. Perceptions of the training administrators toward use and effectiveness of the system are integrated and these perceptions will affect system usage. Also unknown are the students perception of the system, students being one of the ultimate stakeholders. This study will examine these unknowns to determine if the system of overall distance learning record keeping for the FAA is appropriate and adequately serves the functions for which it was designed.

Purpose of the Study

This study describes FAA training systems and attempts to gather information about site administrators' perceptions of the distance learning record tracking system.

Research Questions

To achieve the purpose of this study, the following research questions were presented:

1. What is the local training administrator's perception of the current FAA Computer Managed Instruction/Distance Learning Administrative Tracking System (DLATS) administrative capabilities?
2. What is the student's perception provided to training administrators of the current FAA Computer Managed Instruction (DLATS) student capabilities?
3. Have training administrators received training on the DLATS?
4. What type of Internet connectivity is available at local training facilities?
5. What do training administrators believe to be the most important features of the DLATS?
6. What do training administrators think their management believe to be the most important features of the DLATS?

Instrumentation

A survey was the source of data for this study. A panel of experts, including an Education Specialist at the FAA Academy, and professors and classmates at Oklahoma State University, reviewed the survey to determine validity. Revisions were made based on recommendations and suggestions from the panel.

The survey was designed to determine perceptions of the present DLATS system in the FAA. The survey contained items pertaining to administration and record tracking in that system.

Procedures for Gathering Data

The gathering of data was made as convenient as possible for survey respondents. A cover letter was included with the survey (see Appendix A), explaining the purpose of the study and providing instructions for completion. A self-addressed stamped envelope was enclosed to let the respondent return the survey once it was completed.

Significance of the Study

The aviation industry has performed extensive research as part of its efforts to develop the ideal learning environment, but has invested little effort in recording the findings. This study will document the site administrators' perceptions of the FAA DLATS administration system.

Assumptions

The following assumptions were made during this effort:

1. Record keeping is a necessary part of training, since proof is required that personnel are qualified and are making use of continuous training.
2. The responses from participants were honest expressions of their opinions.

Limitations of the Study

Since many organizations use computer-based training with different requirements, this study has been limited to the aviation industry with a focus on the FAA. Data that may be considered classified or sensitive is not included.

Definition of Terms

For the purpose of this study the following definitions are used:

Computer-Based Training (CBT) – Course or educational material presented on a computer, primarily by way of CDROM, DVD, or floppy disk. Unlike web-based training, computer-based training does not require a connection to a network and does not typically provide links to learning resources outside of the course.

Compact Disk - Read Only Memory (CDROM) – A CDROM is simply a compact disk (CD) that you can use in your computer. Like audio CDs, CDROMs are read-only; you can access the information on the CDROM, but you cannot record new information on it.

Consolidated Personnel Management Information System (CPMIS) – A national Department of Transportation (DOT) database used by all administrations in the DOT. Each administration's access is limited to its own records. This database has been in use within the FAA since 1975. It is divided into several subsystems, each operating independently. Some of the various subsystems include personnel, budget, and training. Within CPMIS, each administration has access to its own records and retrieves information, on a "need to know basis," from other subsystems through the use of specially written programs. This protects the privacy of information in each subsystem.

Department of Transportation (DOT) – Leadership of the DOT is provided by the Secretary of Transportation, who is the principal adviser to the President in all matters relating to federal transportation programs. The Secretary is assisted by the Deputy Secretary in this role. The Office of the Secretary (OST) oversees the formulation of national transportation policy and promotes intermodal transportation. Other responsibilities include negotiation and implementation of international transportation agreements, assuring the fitness of US airlines, enforcing airline consumer-protection regulations, issuance of regulations to prevent alcohol and illegal drug misuse in the transportation sector, and preparing transportation legislation.

Digital Versatile/Video Disk (DVD) – A DVD is similar to a CDROM; it can be used in a computer but has a larger capacity. A DVD can store two or more hours of video on one disk. The use of DVD is growing faster than the use of TV or video.

Federal Aviation Administration (FAA) – The FAA oversees the safety of civil aviation. The safety mission of the FAA is first and foremost, and includes the issuance and enforcement of regulations and standards related to the manufacture, operation, certification and maintenance of aircraft. The agency is responsible for the rating and certification of airmen and for certification of airports serving air carriers. The FAA also regulates a program to protect the security of civil aviation, and enforces regulations under the Hazardous Materials Transportation Act for shipments by air. The FAA, which operates a network of airport towers, air route traffic control centers, and flight service stations, develops air traffic rules, allocates the use of airspace, and provides for the security control of air traffic to meet national defense requirements. Other responsibilities include the construction or installation of visual and electronic aids to air navigation and promotion of aviation safety internationally. The FAA, which regulates and encourages the U.S. commercial space transportation industry, also licenses commercial space launch facilities and private sector launches.

Summary and Organization of the Study

Chapter I provides an introduction and describes the problem, purpose, significance, methodology, assumptions, limitations of the study, and the definition of terms. Chapter II presents an in-depth review of relevant literature on training systems. Chapter III describes the methodology in detail, and Chapter IV introduces the findings. Chapter V combines the information to create a detailed summary and conclusion for the study.

CHAPTER II

REVIEW OF LITERATURE

This chapter contains a review of the literature that addresses the following issues:

- History of Federal Aviation Administration Distance Learning
- Structure of the Federal Aviation Administration
- The National Computer Based Instruction Program Office
- The Purpose of Computer Managed Instruction and Administration
- Student's Role in a Computer Managed Instruction Administration System
- Administrator's Role in a Distance Learning Record Tracking System.
- Summary

History of Federal Aviation Administration Distance Learning

The history of the use of computers to facilitate distance learning parallels the history of the modern computer itself. To fully appreciate the state of the art system currently in place, it is necessary to understand the history of the computer as a teaching tool and of its integration into the FAA's library of training methods.

In 1945 the ENIAC computer was activated as a unit at the Moore School of Electrical Engineering at the University of Pennsylvania (Weik, 1961). Rapid advancement in computer technology and capability, combined with visionary foresight by the early industry pioneers, led to investigation into the feasibility of using computers as a teaching tool by the late 1950s. A significant effort began at the University of Illinois' Coordinated Science Library, evolving into a system known as Programmed Logic for Automatic Teaching Operations (PLATO). (ParallaX, 2001).

Initially the project was implemented on an ILLIAC I computer with vacuum tube memory and two terminals. Control Data Corporation (CDC) provided a CDC 1604 computer and a 20-terminal classroom was created. Initially, an authoring tool known as the Compiler for Automatic Teaching Operations (CATO) was used to create courseware, and the only student records were the standard terminal-use records generated at each terminal. The capability to store individual student-performance records within the mainframe computer itself was added once large disk drives became available. Over time, the CATO authoring system was replaced with TUTOR (see below). Initial research started at the University of Illinois under the direction of Donald Bitzer in 1959 with funding from the National Science Foundation, and the PLATO technology was patented in 1960 (Foshay).

The authoring language of the PLATO mainframe system was TUTOR, written by Paul Tenczar in 1967. TUTOR was designed to have the power of a general-purpose language such as BASIC or PASCAL, but it had additional capabilities to support instructionally important features such as interactive vector graphics and real-time online transaction processing capabilities such as free-response answer analysis and feedback.

The majority of subsequent computer-based instruction authoring systems show the influence of TUTOR, such as today's AUTHORWARE system by MacroMedia. "Similarly, the functions of computer-managed instruction were developed in PLATO's CMI system. Its influence is still felt in today's specifications and in management systems such as IMS." (Foshay).

Just as the history of computer-facilitated distributed learning is tied closely to the history of the electronic digital computer itself, so is the funding for such research and development tied to the efforts of government and other large organizations to implement that distributed learning. The early days of computer-based distributed learning involved large-scale development efforts, the use of expensive mainframe computers and leading-edge research capabilities that only governments and large institutions could afford. Funding for the development of PLATO and TUTOR was provided by several sources, including the CDC, the Advanced Research Projects Agency of the Department of Defense (ARPA), the National Science Foundation, the U.S. Department of Education, the Office of Naval Research, the University of Illinois, and the State of Illinois.

During the 1970s, CDC and the University of Illinois continued development of PLATO and TUTOR. CDC offered the combination as a commercial product in the early 1970s. In 1972 the United States Air Force Schools of Health Care Sciences began a PLATO project and implemented classes that were taught entirely through the system using the mainframe at the University of Illinois. Initial cost for this service was $1,130 per month per terminal.

On July 1, 1973 the FAA Aeronautical Center at Oklahoma City, Oklahoma published "An Air Traffic Instructional Systems Study," Computer-Assisted Instruction

Systems. There were six members on the report preparation team, including the study's Project Manager, Roy W. Klotz. The purpose of the study was to provide a concise report of the findings of the Air Traffic Instructional Systems Study (ATISS) group with regard to the feasibility of Computer Assisted Instruction (CAI) in the FAA's training programs.

Information available to the ATISS indicated that agencies such as the United States Air Force, United States Navy and the IBM Corporation had all experienced savings in student training time of 37% to 50% through CAI implementation. The courses being taught by those agencies were of a type that closely resembled the types of instruction that the FAA provided, especially in the early stages of an individual's specialty training.

In making a recommendation to pursue a test program to determine the effectiveness of CAI in FAA training, the group recognized the importance of a system that could provide stimulation of as many human senses as possible, most importantly sight, hearing and touch. The value of multi-media presentation and the effective use of color graphics, both static and animated, were also recognized.

At this point in the history of CAI, and in the history of CAI within the FAA specifically, it is important to understand the limitations of the systems available at the time. Displays were monochromatic and many did not have the ability to provide even crude vector graphics. The computers themselves did not have integrated audio circuitry, and file formats for graphic and audio information were non-standard. CAI systems were the electronic equivalent of a book, and usually a book without diagrams, charts or pictures. CAI systems were also limited in their availability: in order to use the CAI the student had to present himself to a "classroom" where a dedicated terminal was available to connect to the central mainframe computer. The landline capabilities of the time limited data transfer rates (bandwidth) to a maximum of 56 kbit/s to terminals not directly connected to the mainframe computer. This bandwidth allowed approximately 7,000 alphanumeric characters per second under optimum conditions using specially conditioned, dedicated transmission lines. A more typical data transfer rate was 9,600 bit/s, or some 1,200 alphanumeric characters per second.

The group determined that any system chosen for evaluation as a candidate for adoption by the FAA should have the following minimum capabilities (FAA Aeronautical Center, 1973):

- Teach many different lessons simultaneously.
- Teach many students simultaneously.
- Provide an "author oriented" development language or tool.
- Provide multiple methods of student input.
- Provide audio capability.
- Provide visuals on the display under computer control.
- Provide computer-generated graphics.
- Provide animation.
- Provide a fast terminal response time.
- Provide statistical information through computer data collection.

Ten existing CAI systems were analyzed to determine their ability to meet these minimum requirements. The candidate systems included products from such notable sources as Honeywell, Texas Instruments and Vought Aeronautics. Table I, extracted from the FAA study, shows the systems considered and their ability to provide the necessary features.

TABLE I

FAA FIRST COMPUTER ASSISTED INSTRUCTION
SYSTEM CANDIDATES

Category	1	2	3	4	5	6	7	8	9	10
Plasma display	X			#						
Touch-panel input	X			#						
Multicolor visuals	X		X	X						
Random access visuals	X	X	X	X						
Visuals/display superimposed	X			X						
Computer-generated graphics	X	X								
Computer-generated animation	X									
Display refresh not required	X			#						
Computer-generated alphanumerics	X	X		X	X	X	X	X	X	X
Response time of 3 seconds or less	X	X	X	X	X		X	X	X	X
Videotape	X	X								
Hardcopy of display	#			X	X	X	X		X	X
Online authoring	X			X	X	X	X		X	X
Online modification	X			X	X	X	X		X	X
Online performance monitoring	X	X		X					X	X
Calculation mode	X	X		X	X	X	X		X	X
Random access audio	X	X	X							

Note: 1=Plato; 2=Ticcit; 3=LTS; 4=Cybernet; 5=IDF; 6=Mark III; 7=Honeywell; 8=Texas Instruments; 9=Vought Aeronautics; 10=ITS; #=under development.

Candidate systems included:

- PLATO – A dedicated CAI system developed by the University of Illinois, based on the CDC's 6500 mainframe computer and able to connect to a maximum of 4,000 terminals. Authoring was performed using the TUTOR language.
- TICCIT – (Time-shared, Interactive, Computer-Controlled Information Television) Designed by the MITRE Corporation using a pair of Data General mini-computers with a maximum capacity of 128 terminals per pair. Still under development at the time of the FAA study.
- LTS – (Lincoln Training System) A computer-supported microfiche system from the Massachusetts Institute of Technology, Lincoln Laboratory that used a Digital Equipment Corporation (DEC) PDP-8 computer.
- CYBERNET – A CDC product using the CDC 7000 series computers with an authoring language (PLANIT) and connected to various terminal types through telephone couplers (Modulator-Demodulator, or MODEM).
- IDF – (Instructional Dialog Facility) developed by Hewlett-Packard (HP) with one of three HP time-sharing computers acting as the server system, allowing up to 32 users to access the system simultaneously via a CRT or teletype terminal.
- MARK III – A General Electric (GE) system based on the GE 635 mainframe computer, with course development accomplished using either the FORTRAN or BASIC programming languages.

- HONEYWELL – No specific CAI system was available as a pre-configured package. Specific components from off-the-shelf products could be combined to provide a system tailored to the customer.
- TEXAS INSTRUMENTS – An experimental system built upon the Texas Instruments 980A computer with the goal of providing a low-cost, in-the-home CAI system.
- VOUGHT AERONAUTICS – Based on a DEC PDP-11 minicomputer, with a maximum capacity of 16 terminals per computer.
- ITS – (Interactive Training System) Developed by IBM based on their IBM 360/370 mainframe systems, with the ability to use a wide range of computer terminals.

It is easy to understand why the PLATO system was selected to become the test bed for the feasibility of CAI implementation within the FAA. This was the only system of the candidate group that truly represented "state of the art" at that time.

PLATO proved satisfactory to the needs and requirements of the FAA and other organizations, and would remain the benchmark system for at least the next sixteen years. During this period PLATO was adopted by several federal agencies, and several installations were built across the United States. Another large user of the PLATO system was the United States Army.

In 1975, the FAA's Office of Management Systems published the Feasibility Study of Computer-Based Instruction. The study noted that, during the previous five years, training costs had risen to the point where they were stretching available resources to the breaking point. The classic live classroom with a lecturing instructor was still the rule of the day for teaching and training. The drawbacks to this approach in an organization that is as geographically widespread as the FAA are numerous:

- Lost time on the job for students attending classes
- Additional expenditures associated with travel, lodging and meals for students attending classes
- Increased workload for staff members at facilities that have temporarily lost personnel to training commitments
- Facility maintenance costs for the training facility itself.

Five options were considered in the feasibility study. Based on a cost/benefit study performed as part of the study, a recommendation was made to proceed with the installation and activation of a system centrally located at the FAA Academy in Oklahoma City. Initially, the system would provide computer-based instruction to students attending classes at the academy. As the system proved itself to be reliable, additional components were added to the system and installed at remote locations so that the central system could deliver instructional material to remote sites.

> In April 1980, the Information Systems Review Committee (ISRC) approved the Computer-Based Instruction Interim System Proposal. The adoption of the Interim System Proposal directed the agency towards a program whose ultimate goal is the conversion of academic training materials to a format suitable for delivery on an Academy/remote CBI system. (FAA Academy)

In 1981 the United States General Services Administration (GSA) estimated that total government spending for PLATO systems and support would exceed $10 million per year by 1984, based on use and anticipated development in 1981. The GSA called a meeting of government PLATO users in March 1981. The eventual outcome of this initial meeting was that the planning and implementation of CAI systems within the government would become centrally managed and funded. Instead of each organization acquiring or developing systems individually, an orchestrated approach to acquisition would be implemented to provide internal consistency in training capabilities, reduce duplication of effort in developing courseware, reduce operating costs through shared system components such as communications networks, and improve contracting strategies.

In 1982 the Joint Committee on Computer Based Instruction (JCCBI) was designated as the agency responsible for management and administration of the government owned and networked CBI systems. The JCCBI was chaired by a representative from the U.S. Army's Office of Deputy Chief of Staff for Training, Army Training and Doctrine Command (TRADOC). The committee had members from that same office and from the U.S. Army Forces Command (FORSCOM), U.S. Army Material Command (AMC), the Defense Information Office (DINSFO), the Academy of Health Sciences, The U.S. Air Force, the Internal Revenue Service (IRS) and the FAA. The committee began efforts to fund a government-owned PLATO network. In 1984 some $14.3 million was approved for expenditure between 1984 and 1989 for the project. By 1989, the network was established with government-owned and operated computer systems connected with contracted communications, with the notable exception that the FAA provided their own communications system. By 1989 there were five CDC PLATO systems online and networked:

- Ft. Leavenworth, KS
- Ft. Belvoir, VA
- Ft. Huachuca, AZ

- Redstone Arsenal, Huntsville, AL
- Federal Aviation Administration Academy, Oklahoma City, OK

The system as a whole was known as the Joint Computer Based Instructional System (JCBIS). The operating costs, recovered as charge-back fees to the organizations using the system, were reduced from the original $1,130.00 per terminal per month, to $450 per terminal per month by 1985, and then to $385 per terminal per month by 1991.

In June 1982, a CBI planning group made up of FAA representatives from 45 facilities met for five days at the FAA Academy in Oklahoma City, Oklahoma to act on the recommendations made by the Information Systems Review Committee (ISRC) in 1980. There was no doubt in the minds of this planning group that an improved and more widely implemented CBI system was needed to meet both their short and long-term training requirements. By September 1982, 37 interim field terminals had been installed. The project would continue for another three years. The system was PLATO based.

The Aviation Industry CBT Committee (AICC) was founded in 1988 (AICC FAQ). The FAA is a member of this organization. Today the AICC is the recognized industry leader in establishing standards for CBT courseware at an international level.

In 1989, CDC sold the rights to the PLATO name for the standalone and Local Area Network (LAN) versions of the system. The rights were acquired by TLO Learning, Incorporated, which later became PLATO Learning, Incorporated. PLATO Learning is still in business at this time. CDC retained rights to the networked version, renaming it CYBIS.

The first FAA CYBIS mainframe was brought online as part of a contract awarded to the SMS Data Products group in 1989. In the first year of operation, some

300,000 hours of instruction was delivered by the FAA at a cost of $6.00 per hour. The amount of training delivered would increase slightly over the next three years and by 1992, the per-hour cost was determined to be $4.70 per student hour, based on the combined use of all JCBIS systems.

CDC began updating and enhancing the PLATO courseware in 1992 with the assistance and cooperation of the University of Maryland. Standards were developed for color use, display composition and sequencing. A LAN-based system was developed to reduce telecommunication and mainframe requirements. Centralizing the system allowed greater version control of the master copy of courseware, produce a consistent delivery format and quality, and providing a central repository for student records. Additional enhancements included email service tailored to the needs of students, instructors and administrators. The system was beginning to take on a configuration designed to provide optimum training to the student, while yielding cost savings and providing better management capabilities for system administrators.

By 1991 the equipment that had been acquired in 1983 was considered either obsolete or no longer cost effective. Not only was the hardware out of date, the courseware was deemed inadequate by the standards of the day. The course development tools were cumbersome and the courses themselves did not meet the perceived requirements of a system that was intended to achieve maximum training efficiency. Once again, cost/benefit studies of the proposed system showed that the replacement of the existing system would provide significant long-term financial gain, increase the training capability, and maximize the quality of training.

The current system became operational during the 1990s. Rather than a system centered on specific computer hardware, the new approach involved following the standards put forth by the Aviation Industry CBI Committee (AICC). This CMI System, located at the Federal Aviation Administration's Academy, uses an Oracle database to provide central storage and maintenance of student records. The system exchanges information with the FAA's Consolidated Personnel Management Information System (CPMIS) to provide a record of certifications attained by students. Courseware is used by students on any system that is AICC compliant and running AICC-compliant courseware. Courseware sources include commercially developed training courses, and specialized training courses developed under the direction and control of various divisions of the FAA. Courseware developed under the direction and control of the FAA is developed using an interface tool known as Designer. This interface tool took its present form in 1995, and provides student routing, with the ability to reuse component modules to create different course options and meet the requirements of FAA directives for CBT material (FAA, 1995).

Structure of the Federal Aviation Administration

Today's FAA began as the Aeronautics Branch, Department of Commerce on August 11, 1926 under the leadership of the Assistant Secretary of Commerce for Aeronautics. On July 1, 1934 the organization became known as the Bureau of Air Commerce, Department of Commerce. From August 22, 1938 until June 30, 1940 the organization was known as the Civil Aeronautics Authority and had two Chairmen and a single Administrator. In July of 1940 the Civil Aeronautics Authority became the Civil

Aeronautics Administration, Department of Commerce and kept that name until December 30, 1958 with nine individuals serving as Administrator of Civil Aeronautics during the period. On December 31, 1958 the office of Administrator of the FAA superseded the Administrator of Civil Aeronautics. On April 1, 1967, FAA's name changed from Federal Aviation Agency to Federal Aviation Administration.

The FAA is known to the public primarily as the agency responsible for "all things aviation." From issuing their first pilot's license to today's roll as the central agency responsible for virtually every aspect of the aviation industry, the FAA has been a leader in organization, safety and training.

Three months after issuing the first pilot's license, the Branch issued the first Federal aircraft mechanic's license and on March 29, 1927, issued the first airworthiness-type certificate to the Buhl Airster CA-3, a three-place open biplane.

Today the Administration's major functions include:

- Regulating civil aviation to promote safety and fulfill the requirements of national defense
- Encouraging and developing civil aeronautics, including new aviation technologies
- Developing and operating a common system of air traffic control and navigation for both civil and military aircraft
- Research and development with respect to the National Airspace System and civil aeronautics
- Developing and implementing programs to control aircraft noise and other environmental effects of civil aviation

- Regulating U.S. commercial space transportation.

The FAA is headed by an Administrator who is assisted by a Deputy Administrator. Reporting to the Administrator are five Associate Administrators who direct the line-of-business organizations that carry out the agency's principal functions. Also, reporting to the Administrator are the Chief Counsel and nine Assistant Administrators responsible for other key programs. The FAA's field organization includes nine geographical regions and two major centers, the Mike Monroney Aeronautical Center and the William J. Hughes Technical Center. (FAA, An Overview)

Figure 1 (see following page) illustrates the current organization of the Administration.

The FAA's activities cover a broad spectrum of aviation-related areas. The primary activities associated with the FAA's services to the aviation industry and flying public are:

Safety Regulation. The FAA issues and enforces regulations and minimum standards relating to the manufacture, operation, and maintenance of aircraft. The agency is responsible for the rating and certification of airmen and for certification of airports serving air carriers.
Airspace and Air Traffic Management. The safe and efficient utilization of the navigable airspace is a primary objective of the FAA. The agency operates a network of airport towers, air route traffic control centers, and flight service stations. It develops air traffic rules, allocates the use of airspace, and provides for the security control of air traffic to meet national defense requirements.
Air Navigation Facilities. The FAA is responsible for the construction or installation of visual and electronic aids to air navigation, and for the maintenance, operation and quality assurance of these facilities. Other systems maintained in support of air navigation and air traffic control include voice/data communications equipment, radar facilities, computer systems, and visual display equipment at flight service stations.
Civil Aviation Abroad. As mandated by legislation, the FAA promotes aviation safety and encourages civil aviation abroad. Activities include: exchanging aeronautical information with foreign authorities; certifying foreign repair shops, airmen, and mechanics; providing technical assistance and training; negotiating bilateral airworthiness agreements; and providing technical representation at international conferences.
Commercial Space Transportation. The agency regulates and encourages the U.S. commercial space transportation industry. It licenses commercial

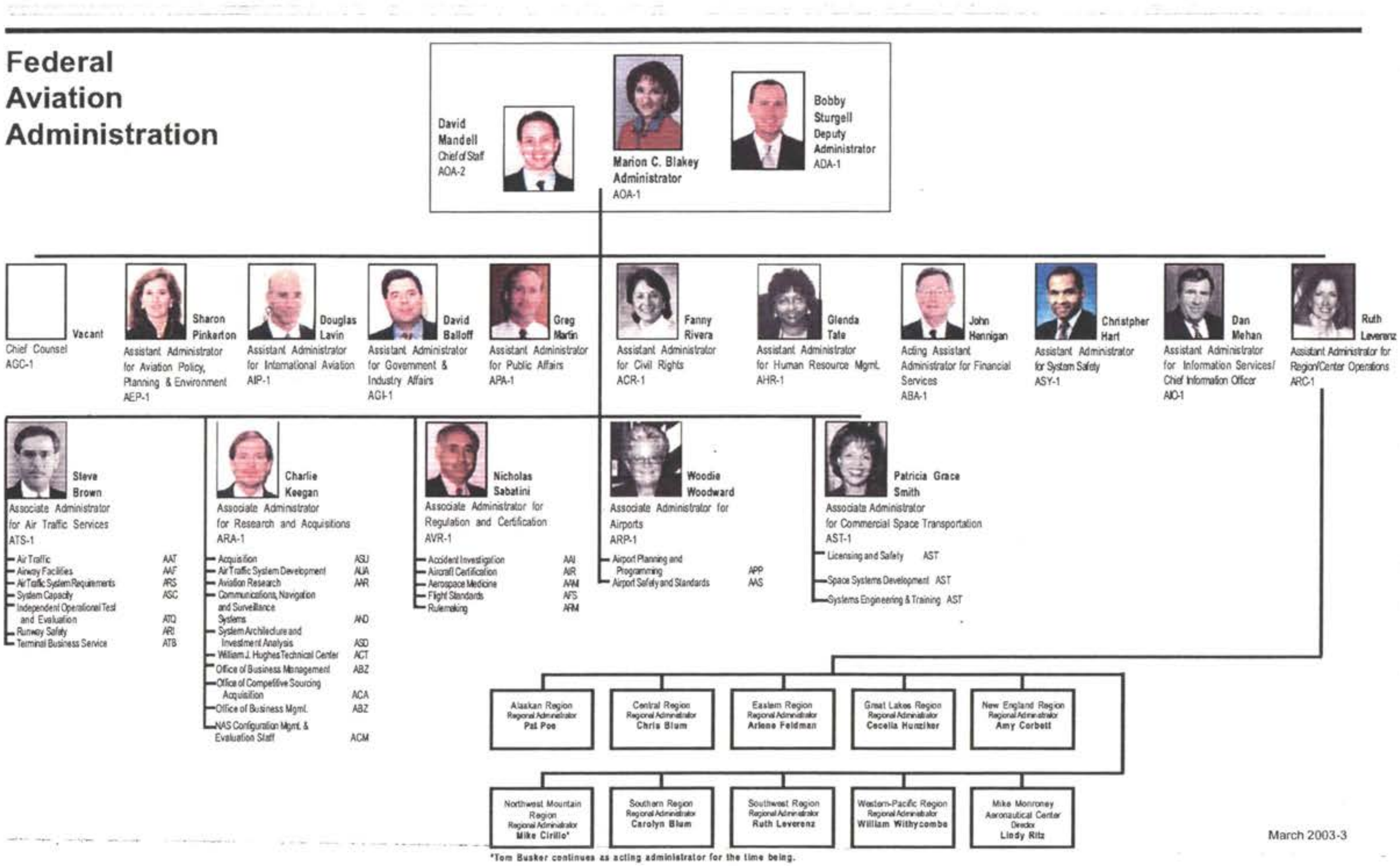

Figure 1. Federal Aviation Administration Organizational Chart (FAA, Organization)

space launch facilities and private sector launching of space payloads on expendable launch vehicles.

Research, Engineering, and Development. The FAA engages in research, engineering, and development aimed at providing the systems and procedures needed for a safe and efficient system of air navigation and air traffic control. The agency performs an aeromedical research function and supports development of improved aircraft, engines, and equipment. It also conducts tests and evaluations of specified items such as aviation systems, devices, materials, and procedures.

Other Programs. The FAA provides a system for registering aircraft and recording documents affecting title or interest in aircraft and their components. Among other activities, the agency: administers an aviation insurance program; develops specifications for aeronautical charts; and publishes information on airways and airport services as well as on technical subjects relating to aeronautics. (FAA, An Overview)

The FAA is not only the licensing authority for Air Traffic Controllers, both civilian and military, who control air traffic at FAA facilities within United States airspace, it is the organization that provides training to those controllers and other personnel who work at FAA facilities across the nation. To develop and retain a cadre of qualified personnel, Human Resources Management (FAA/AHR) is tasked as the central focal point for training. The primary instructional facility is the Federal Aviation Academy located at the Mike Monroney Aeronautical Center in Oklahoma City, Oklahoma.

National Computer Based Instruction Program Office

The FAA's National Computer Based Instruction (CBI) Program Office is located in the Academy Building at the Mike Monroney Aeronautical Center, Oklahoma City, Oklahoma. This office is tasked with the development and delivery of CBI courseware on CD, DVD and through web-based technology.

The FAA uses a spectrum of technologies to provide distance learning. The Distance Learning Branch (AMA-310) is divided into three offices, Computer Based Instruction (CBI), Aviation Training Network (ATN), and correspondence study, to facilitate the management of courseware used to deliver training under various technologies. When all courseware available through all channels of the FAA's distance learning offices are viewed collectively, there are over 2,000 titles available.

Federal Aviation Administration Correspondence Study (AMA-310C) is the support office for all "traditional" correspondence courses available. At present there are just over 100 courses available in this format. Student registration and testing may be accomplished online where Internet access is available; otherwise, traditional correspondence is used to provide these management activities. All course material is provided in hardcopy form, with the course study materials being mailed to the student. When final testing is performed using online facilities, the test results are placed automatically into the student's record and provided to the student with minimal delay. Safeguards are in place to reduce the risk of compromising test material: each course has multiple final exams prepared, and the tests must be taken while a test proctor is present.

The Aviation Training Network, managed by AMA-310B, provides live or videotaped lectures and seminar-type material via satellite downlinks to 65 locations in the contiguous 48 states, Hawaii, Alaska and Puerto Rico. This process permits rapid, widespread dissemination of the information to the students with a minimum requirement for travel. This in turn reduces expenses that would be incurred if the lectures or seminars were only available to students who were physically present at the time of delivery.

AMA-310A, Distance Learning (CBI) is the office managing courseware available on CD, DVD and through Internet facilities. As of April, 2003 there were some 337 CBI course titles available, along with eight web-based Computer Managed Instruction (CMI) courses awarding credit for completion (FAA, National Program Office).

The FAA has contracted the SkillSoft Corporation to develop over 500 courses covering Information Technology (computers), Office Administration (OA) and business skills improvement (FAA Academy). The only equipment required to access these courses is a computer with an Internet connection. The course content is delivered over the Internet with no special requirements beyond those needed to access any website, although the FAA has added provisions to restrict access to authorized students and administrators. The student needs only a computer with an Internet connection, an account with the system, and certain off-the-shelf software packages to provide proper display of animation videos included in the courseware. Specialized software needed to interface with the Computer Managed Instruction System is provided to capture completion information required for certification.

Courseware development is not centrally controlled. Each of the offices managing a functional area, such as Air Traffic (AAT), Airways Facilities (AAF) or Aircraft Certification (AIR) may develop courseware in-house or contract out for its development. Regardless of the method of development, each course's design process is governed by directives. Typical of such direction and guidance is FAA Order 3120.4J, Air Traffic Technical Training (July 30, 1998). Chapter 4, COMPUTER-BASED INSTRUCTION (CBI) is quoted, in part, as an example of the level of detail this direction and guidance (FAA Order 3120.4J) as follows:

SECTION 3. CBI COURSEWARE AND LESSON DEVELOPMENT
4-4. NATIONAL LESSON DEVELOPMENT.
The National lesson development process shall include the following steps:
(1) Initial Design.
(a) During the initial design, the developer shall define the target audience for the lesson, objectives and skills to be trained, the content to be presented, and the methods (e.g., tutorials, simulations, questions, games, etc.) and media (e.g., video, audio, graphic, etc.) to be used.
(b) Lesson design shall emphasize student control of movement through the lesson, interactivity, and immediate feedback.
(c) The design documents shall be approved by ATX-100 prior to lesson development.
(2) Lesson Development.
(a) During this step, the developer shall outline the content to be presented, create the lesson storyboards, and write the test questions.
(b) Lesson storyboards shall include a written description of CBI lesson screens, animation's and sound
(c) Storyboards shall be approved by ATX-100 prior to programming.
(3) Programming
(a) CBI lessons shall include save-place capability, page numbering or screen referencing, a help/reference menu, and a glossary of terms.
(b) Courseware shall be CMI compliant.
(c) CBI lessons shall be developed using Authorware. The version of Authorware shall be specified by ATX-100.
(d) All CBI lessons shall utilize the standard Air Traffic navigation template.
(e) Requests to deviate from CBI programming requirements shall be submitted in writing to ATX-100 for approval.
(4) Courseware Validation.
(a) The developer shall review and correct all known errors in the CBI lesson before delivery to the FAA.
(b) ATX-100 shall validate the course to ensure that the CBI lesson is technically accurate, meets training requirements, and the lesson works as intended.
(c) Following courseware validation, ATX-100 may conduct a field test with a representative sample of employees (See Figure 4-1 for a optional checklist for reviewing draft CBI lessons).
(5) Finalizing.
(a) Lessons will be finalized upon completion of courseware validation corrections.

(b) Prior to lesson approval by ATX-100, the following deliverables shall be received:

1. Application or executable files.
2. Programming source code.
3. Copies of electronic clip media files used to assemble the courseware.
4. Master audio tape used to create audio files.
5. Training lesson supplements.
6. Master video tape and any digital video files.

FIGURE 4-1. CBI LESSON CHECKLIST

Instructions: You may want to use this checklist when reviewing draft CBI lessons.

1	Instructions on how to use the lesson are clear.	Yes	No
2	Opportunities are provided for reviewing completed sections of the lesson where appropriate.	Yes	No
3	Opportunities are provided to exit the lesson. When returning, individuals can begin at the exit point rather than starting over.	Yes	No
4	Lesson length does not exceed 20 to 30 minutes or the lesson is divided into separate modules.	Yes	No
5	Interactions are frequent and meaningful (i.e., require thought, not just pushing a key).	Yes	No
6	Motivation/interest is maintained throughout the lesson. When possible, the pace of the lesson is under the user's control.	Yes	No
7	Selected media support the lesson content and are not distracting.	Yes	No
8	Lesson content and references are technically correct. Lesson completion date and/or date of the last technical update is provided.	Yes	No
9	Lesson content, graphic images, video, and audio are free of racial, ethnic, gender, and other stereotypes.	Yes	No
10	Lesson content is sequenced in a logical progression.	Yes	No
11	Lesson content is at the appropriate level of depth for the objectives and for the intended users.	Yes	No
12	Lesson content is complete. No key concepts or information have been omitted.	Yes	No
13	Clear and simple sentences are used. Screen formats are attractive and uncluttered.	Yes	No
14	Test items are fair and provide all information needed to respond. Subject-matter experts have reviewed the test items.	Yes	No
15	Feedback is provided after each response. Explanations are provided on why a response is correct or incorrect.	Yes	No
16	All paths and branches have been tested to ensure that the lesson is free of bugs.	Yes	No

4-5. LESSON DISTRIBUTION

a. National distribution shall be authorized by ATX-100. Targeted facilities shall receive:

(1) CD-mastered lessons as they become available.

(2) Videodisk lessons as required.

b. Lesson distribution shall include written information on the target audience, any required prerequisite knowledge, a summary of the course content (including course length), and the type of training (e.g., mandatory, annual, currency, required, etc.).

c. Source-code versions of lessons may be requested from the CBI hotline staff, and shall be provided to site developers as instructed by ATX-100.

4-6. COURSEWARE MODIFICATION AND MAINTENANCE.

a. All national and site specific CBI development shall be logged on the Air Traffic Training WEB site.

b. Local site modifications to a national lesson shall be limited to adding or supplementing relevant site specific content without disabling functionality, impacting CMI compatibility, or removing course content.

c. Maintaining technical accuracy and currency in locally developed or modified lessons shall be the responsibility of the development site.

4-7. STUDENT INFORMATION.

a. A student's Social Security number shall be used to register for CBI lessons and to maintain student training records.

b. Student information shall be limited to those items needed for enrollment purposes and for updating training records and lesson validation.

4-8. QUALITY CONTROL. Technical accuracy and validity of site-developed courseware/software utilized locally are the responsibility of the developing site or hub. Direct distribution of site specific lessons between sites is permitted, however the receiving site is responsible for ensuring the accuracy and validity of the site specific courseware. (FAA Order 3120.4J)

Course enrollment, student progress and status and other administrative functions are controlled using the Distance Learning Administrative Tracking System (DLATS).

The Purpose of Computer Managed Instruction and Administration

The following definition of CMI is useful. "Computer managed instruction (CMI): The use of computers to register learners, schedule learning resources, control and guide the learning process, and analyze and report learner performance" (IEEE).

The National CBI Program Office is responsible for distance learning via local computer-based courses and Internet-delivered courses. The courses are developed outside this office either by the respective FAA organization or by individual contractors. These courses represent each of the major organizations, specifically Airway Facilities, Air Traffic, Regulatory Standards, Airports and Logistics. Each organization has its own distance learning representative. For example, courseware that relates to Airway Facilities will generally be courseware designed to train technicians. Courseware for the Air Traffic division will generally be courses for air traffic controllers. Courseware for Regulatory Standards will generally be courseware relating to FAA inspectors. Once courseware has been designed and developed, a prototype walkthrough is scheduled in a classroom with students from the field. After a successful prototype, the courseware is delivered to the National CBI Program Office. The CBI Program Office accepts the courseware from all of the organizations, and groups this courseware by category. The program office creates a master CD/DVD set for duplication.

Once a student has completed a course in the CMI system, the student data is stored and sent to what is called the central system. The central system is an Oracle database that captures completion information. This information is sent from the CBI training computer to the central system by a variety of methods including the use of diskettes or the Internet. Once the information is received, completion information is sent from the central system to the national system of records, CPMIS. This training becomes part of an individual's national training record.

According to Szabo, M. & T.C. Montgomerie (1992), CMI must perform two functions. It must first test the student. It must then diagnose and prescribe actions to strengthen weak areas in the student's knowledge of the material:

> Computer managed instruction is a highly specialized application of the computer to assist in the process of managing an individualized instructional plan for students. It consists of two required functions. First, the computer tests the student to identify his/her strengths and weaknesses. The result is a diagnosis, which indicates which objectives the student has and has not mastered. (Szabo & Montgomerie, 1992)

The main purpose of Computer Managed Instruction and Administration should be to assist study and learning. However, many times it becomes a hindrance and a burden to the student. Lieberman and Maulsby (1996) warned:

> The complexity of computer interfaces has accelerated recently. The prevalent view has been that a computer interface is a set of tools, each tool performing one function represented by an icon or menu selection. If we continue to add to the set of tools, we will simply run out of screen space, not to mention user tolerance. We must move from a view of the computer as a crowded toolbox to a view of the computer as an agency – one made up of a group of agents, each with its own capabilities and expertise, yet capable of working together. (Lieberman & Maulsby, 1996)

The more transparent that CMI and Administration are to the student, the better the system – so long as it performs the functions required.

CMI should be flexible enough to be compatible with a variety of CBI courses such as: existing courses, off of the shelf courses, and specially developed courses, etc.

CMI can be and is often used in conjunction with existing learning materials. Thus, an instructor can incorporate CMI without substantially restructuring his/her ongoing instruction. In addition, CMI makes mastery learning possible in that retests to determine when mastery has been obtained are much easier to manage (administer, score, document, and report) than are conventional classroom tests (Szabo & Montgomerie, 1992).

Beside the obvious task of keeping the student's completions and grades, the administrative part of CMI involves several other tasks. Farance and Tonkel state, "Learners are nomadic and, typically, change teachers frequently, i.e., a single Learner does not have a single teacher for his/her lifetime of learning." (1998). A primary reason for a Records Database is "handing off" Learners to other teachers and/or institutions.

Another significant design issue is that learners learn over long periods of time. It may take long periods of interaction with the learner to determine the best strategy. Typically, there will be more than one teacher associated with a learner's lifetime of learning experience, so performance information is stored in Record Databases for the purpose of communication to other teachers so that each can "pick up where the last left off," that is, the next teacher minimizes the amount of observation (of behavior) and evaluation needed to determine where the student "is at." Of course, learners, students, parents, and employers are interested in performance information in their history (Records Database) because they can influence the learning experience, too.

In summary, a Records Database containing performance information supports the long-term analysis of student performance and supports better "hand-offs" from one teacher (or learning technology system) to another. A Records Database is commonly used to store information about the past (the learner history), but the Records Database may also be used to store information about the present (that is, assessments and current position) and the future (that is, learner or employer objectives) (Farance & Tonkel, 1998).

Student's Role in a Computer Managed Instruction Administration System

> Meeting the instructional needs of students is the cornerstone of every effective distance education program, and the test by which all efforts in the field are judged. Regardless of the educational context, the primary role of the student is to learn. This is a daunting task under the best of circumstances, requiring motivation, planning, and an ability to analyze and apply the instructional content being taught. When instruction is delivered at a distance, additional challenges result because students are often separated from others sharing their backgrounds and interests, have few if any opportunities to interact with teachers outside of class, and must rely on technical linkages to bridge the gap separating class participants. (Distance Education)

The student remains central to the purpose of the entire system. Without the student, there is no requirement for the system to exist. This basic tenet has not been lost on those who have guided and directed the computer-based instruction and associated Computer Managed Instruction system now in use within the FAA. Each of the 16 items listed in the "CBI Lesson Checklist" within the previously quoted section of FAA Order 3120.4J, Air Traffic Technical Training (July 30, 1998) deals directly with effectively presenting the instructional material to the student.

While it is true that the computer is unique among educational media in that it can interact with a student, the student must actively participate in that interaction. Comparing conventional instruction with computer instruction, Martin and Szabo stated:

> People learn best when they can be made to actively and consciously process the information they encounter when they encounter it. Conventional instruction discourages the individual from processing information other than by trying to copy it to short-term memory, which has been shown to be most ineffective (some would say counterproductive) to learning.

The computer is unique among media in that it can interact with a student in a processing way (Martin & Szabo, 1990) and stimulate deep cognitive processing (Anderson, et al, 1975). The student, therefore, is not without responsibility in the CMI system.

Students participating in the FAA's CMI system have only a limited awareness of the system itself, and are allowed to focus on their primary objective: learning the new information and skills presented in the course material. Beyond signing into the system, a task called logging in, the student has no direct interaction with the system. The mechanics of recording scores, annotating the location within a lesson where the student stops, and other administrative details are dealt with automatically by the system itself.

Administrator's Role in a Distance Learning Record Tracking System

Abernathy points out the many hats worn by the traditional trainer:

> The traditional trainer roles include instructional designer, instructional developer, trainer, and materials supporter. As an instructional designer, the trainer performs the initial analysis and instructional design tasks. He or she also advises on course exercises and revision. As an instructional developer, the trainer writes course materials, exercises, and auxiliary materials and develops overheads. A trainer also does course development, becomes familiar with course flow, and learns how to use the technology. As a materials supporter, the trainer produces the training materials, manuals, overheads, graphics, exercises, and so forth. (1998)

Under CMI, a specialist would probably perform each of these roles. "Many researchers agree that technology will never replace the trainer or instructional designers, but technology brings with it more demands for teamwork and collaboration among a diverse group of workers" (Wagner & Reddy, 1999).

"Lastly, a trainer also facilitates. In addition to the existing roles, trainers are now involved in technology support, facility support, and distant-site facilitating." (Chute, Sayers, & Gardner, 1999).

> It has also become essential for trainers to use new technologies in working with participants. Instructors become an orchestrator of multimedia technologies. Much like a conductor of a symphony orchestra, the instructor calls up inputs from various media sources to enhance the presentation effectively. (Chute, Thompson, & Hancock, 1999; Davie & Wells, 1998; Weinstain, 2000)

Leonard (1996) describes the new trainer's role as "someone who facilitates, mentors and guides employers and employees to use the best and most timely training available. The goal of the corporate trainer," Leonard says, "is to find, interpret and assess a wide range of information and technologically sophisticated products."

In CMI, the new trainer's role changes from a person who is an instructional designer, instructional developer, trainer, and materials supporter to a person who is an orchestrator, facilitator, mentor and guide. An additional role is record monitor. Although record tracking occurs in the background it should be carefully monitored by the site administrator.

Summary

Organizational leaders want to maintain training records of staff to help predict effectiveness and competitive position. According to Holton (1995) pressure is being placed on HRD and training departments to demonstrate that interventions and programs are contributing to "the bottom line" of the organization. In order to quantify training value, training professionals must provide evidence that the expenses associated with designing, developing, and delivering a given training program will add value to the organization. Therefore, the emphasis on record tracking systems is increasing.

The thirty-year history of the use of computers as a teaching tool by the FAA has been one of thoughtful planning and preparation, driven for a continuing need to provide effective training to an ever-growing staff confronted with rapidly developing technologies and ever-present budget constraints.

Today's CMI system has evolved from early systems that were limited in their functions to little more than electronic "page turning" information delivery systems. Often these systems tied the user to a single hardware platform, limiting teaching material to that currently existing for the system or requiring that courseware be developed for the system at extremely high cost. A change in the system's hardware platform meant recreating existing courseware so it could be used on the new system.

While the CMI system itself is concerned primarily with recording student progress and accomplishment, through the establishment of standards like the ones put forth by the Aviation Industry CBI Committee (AICC), computer-based training courses have become integrated into the functionality of the CMI system. The establishment of a standard protocol for exchanging information about both the student and the student's course progress permits CBT courses from a variety of sources complying with the AICC standard to be used with any CMI system that is equally AICC standard compliant.

The goal through the years has been to provide effective training to a large, geographically disparate student body in the most cost-effective manner possible, while providing a management tool that could assess and accurately record and report student progress, including course completion and any certifications resulting from that completion. Based on the results of the survey taken and reported in Chapter IV, Findings, it is apparent that the system in use has met the goals of delivering effective training and providing accurate and reliable record management and reporting functions.

CHAPTER III

METHODOLOGY

This chapter presents information about the sample population, research questions, instrumentation, procedures for gathering data, data analysis technique, and a summary.

Purpose of the Study

This study described FAA training systems and attempted to gather information about site administrators' perceptions of the distance learning record-tracking system.

Population

The National Airspace System (NAS) contains Airways Facilities, Air Traffic, Airports and Logistics, and Regulatory Standards organizations. These organizations, combined, contain 1266 site administrators who are responsible for the administration of training in their areas. Based on the recommendations of Wiersma (2000), probability sampling procedures that included a form of random selection were used to select the participants. It is understood that not all members of the population selected are equal data sources, but they are "information-rich" (Weirsma 2000). The study represented a cross section of site administrators. The sample consisted of 500 site administrators.

Research Questions

To achieve the purpose of this study, the following research questions were presented:

1. What is the local training administrator's perception of the current FAA Computer Managed Instruction administrative capabilities?
2. What are the student's perceptions provided to training administrators of the current FAA Computer Instruction student capabilities?
3. Have training administrators received training on the Distance Learning Administrative Tracking System (DLATS)?
4. What type of Internet connectivity is available at local training facilities?
5. What do training administrators believe to be the most important features of the DLATS?
6. What do training administrators think their management believe to be the most important features of the DLATS?

Sample

For this study, purposeful sampling of a population of 500 was performed. According to Isaac and Michael, "purposeful sampling is a method of data sampling that is particularly appropriate for research which occurred in a natural setting and is used in order to capture central contributing themes or principal outcomes" (1997).

This study purposefully sought to use site administrators from various organizations in the National Aerospace System for analysis purposes. The participants were located throughout the United States. They met the selection criteria listed in the Population section of this chapter.

Instrumentation

A survey was the source of data for this study. A panel of experts, including professors and classmates at Oklahoma State University and an Education Specialist at the FAA Academy reviewed the survey to determine validity. Revisions were made based on recommendations and suggestions from the panel. This survey is provided in Appendix A.

The survey was designed to determine the site administrators' perceptions of the FAA's current CMI system. The survey contained mostly items pertaining to the administration and record tracking of that system.

Procedures for Gathering Data

The gathering of data was made as convenient as possible. A cover letter was included with the survey explaining the purpose of the study and instructions for completing it. Also, a self addressed stamped envelope was provided to ensure that the survey could be easily returned.

Data Analysis Technique

The results of the survey were broken down into percentages. The responses were totaled by item number and then the percentage for each possible answer was calculated. Answers from excellent to poor were compared. Then *yes* answers were compared with the *no* answers. The percentage of *I don't know* was calculated to gauge the lack of awareness. Once the calculations were made for each item, the overall percentage for all of the items was calculated.

Summary

In summary, this chapter provided a general description of the design and methodology used in this study. Major areas discussed were the population, research questions, sample, instrumentation, procedures for gathering data, and the data analysis technique.

CHAPTER IV

FINDINGS

Introduction

This section presents the results and a brief analysis of a survey of FAA Computer Based Instruction site administrators. The findings of this study were used for two purposes:

- To present a short evaluation of users' perceptions of the current system
- To provide a basis for planning and design of future systems.

In the following pages, the parameters used to conduct the survey are discussed, the raw information that was returned is examined, and some conclusions are drawn from that analysis.

Study Parameters

This study described FAA training systems and attempted to gather information about site administrators' perceptions of the distance learning record-tracking system.

Target Audience

The target audience for this administration system is the FAA. Therefore, the Federal Aviation Administration CBI site administrators were the population for this experiment. Out of 1266 site administrators in the survey population, 500 were randomly selected. As with virtually any population of interest, it was expected that some individuals in the sample destined to receive the questionnaire would not have valid addresses. As indicated below there were 18 surveys returned as undeliverable (Table II). However, the overall return rate was 48% as indicated in Figure 2.

Fundamentally, a desired 95% level of confidence with an acceptable margin of error of plus or minus 6% determined the appropriate sample size for the survey. The sample size required was calculated according to the following formula.

$$s = \frac{N}{1 + N(e)^2}$$

Description:
s = required sample size
N = population size
e = level of precision (using a 6% margin of error)

This produced the following results:

$$\frac{1266}{1 + 1266\,(.06)^2} = 227.796 \text{ required sample size}$$

TABLE II

STUDY PRECISION GOALS

Category	Number	Percentage
Total Mailed	500	100%
Total Returned	238	47.6%
Undeliverable	18	3.6%
Non Returned	244	48.8%

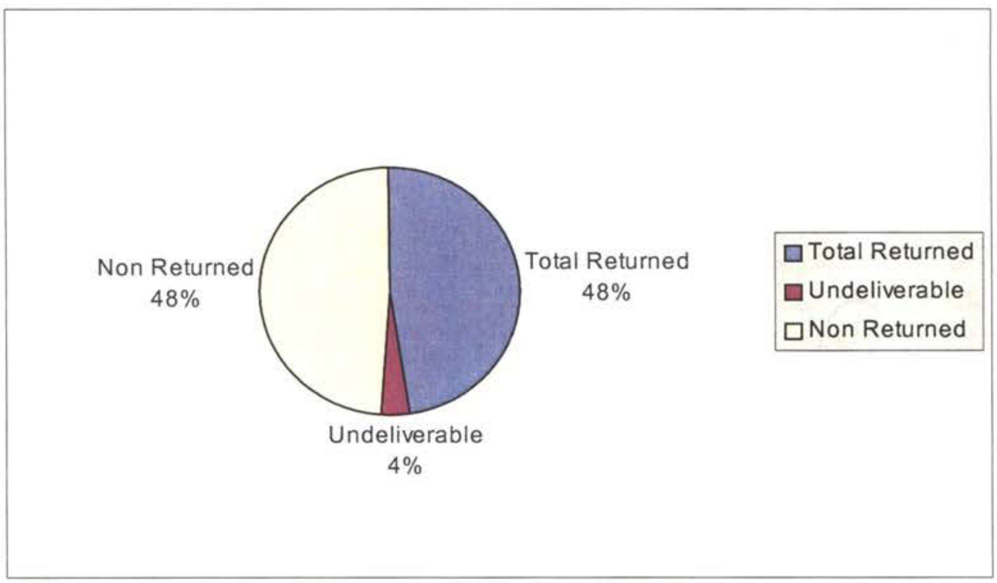

Figure 2. Overall Return Rate.

There were 338 actual surveys returned. It is also important to note the return rate that was achieved is slightly higher than the expected 228 responses.

Study Package Content

The questionnaire contained seven questions and was printed on one side of an 8.5 by 11 sheet of paper. Great care was taken in deciding exactly how respondents would be asked to indicate their answers on the questionnaire. The concern at this point was ensuring that the questions were easily understood. Site administrators were not characterized individually; the study judged input based on the person's position, and not on other characteristics.

The overall response rate on each survey question was very high. An examination of the total number of questions left unanswered reveals that of the seven questions asked, questions 1,2,4, and 6 had higher completion rates while questions 3,5 an 7 had lower completion rates. However, out of 238 responses the highest number of questions unanswered was 7 as indicated in Table III.

TABLE III

QUESTION COMPLETION RATE

Question #	Responded	No Response
1	236	2
2	237	1
3	232	6
4	234	4
5	231	7
6	237	1
7	232	6

Even with seven missing inputs from any given question, the required goal of 228 samples was still achieved. Missing inputs will be given only cursory consideration in the discussions that follow.

Survey Results

Survey Question One: As a Site Administrator, select the answer that best describes your overall perspective of the current FAA Computer Managed Instruction (CMI) administrative capabilities.

Most administrators generally agreed that the current FAA CMI System is average (see Table IV, Figure 3).

This is a question with a subjective answer. The question focuses only on current FAA CMI administrative capabilities. Without knowing the extent of the respondent's experience with other systems, no confidence in their evaluation of it in comparison to other systems can be determined.

What can be inferred from the results is that 92% of the administrators feel that the system is providing capabilities at or above their expectations. The fact that 44% of the respondents felt that the system was exceeding their expectations would seem to indicate that the system was well thought out during the design stages, and that the implementation of the design was carried out in a manner that provides an understandable and functional tool to the end user.

Two individuals failed to provide a response to this question.

TABLE IV

QUESTION ONE RESULTS

Category	Number	Percentage
Excellent	21	9
Above average	83	35
Average	112	47
Below average	17	7
Poor	3	1
Total:	236	

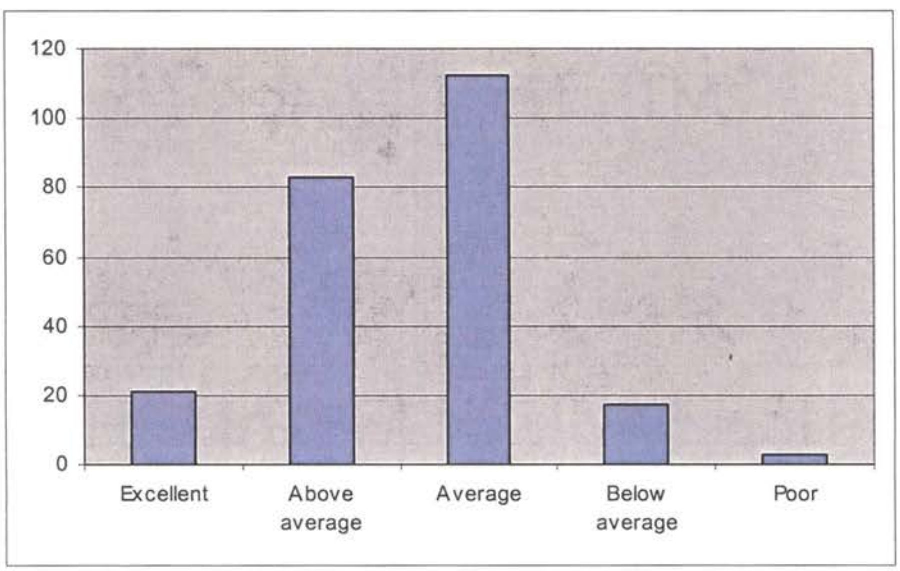

Figure 3. Question One Results.

Survey Question Two: Select the answer that best describes the overall feedback you receive from students about the current Computer Managed Instruction (CMI) student capabilities.

According to most administrators, students felt the current FAA CMI System is average (see Table V, Figure 4).

As with the first question, this is a question with a subjective answer. It answers the question with regard only to the current FAA CMI student capabilities. Without knowing the extent of the students' experiences with other systems, no confidence in their evaluation of it in comparison to other systems can be determined.

What can be inferred from the results is that 86% of the students feel that the system is providing capabilities at or above their expectations for the system. The fact that 29% of the students felt the system was more than meeting their expectations (average) would once again seem to indicate that the system was well thought out during the design stages and that the implementation of the design was carried out in a manner that provides an understandable and functional tool to the student.

According to the site administrators perceptions of what students said, 14% of the students feel that the system is not meeting their expectations. It would appear that studies of student critiques with negative comments could lead to improvements in the system in the future. However, it must be kept in mind that the numbers provided here are second hand; they were obtained not directly from the students, but from the administrators who may or may not have performed any detailed research into actual comments received from past students of the system.

Only one individual failed to provide a response to this question.

TABLE V

QUESTION TWO RESULTS

Category	Number	Percentage
Excellent	5	2
Above average	64	27
Average	135	57
Below average	26	11
Poor	7	3
Total:	237	

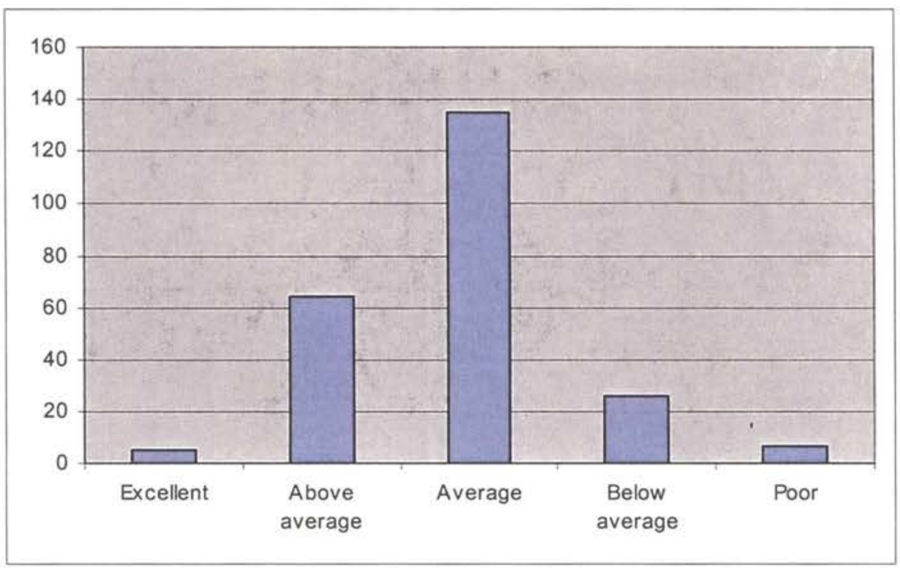

Figure 4. Question Two Results.

Survey Question Three: Have you had sufficient training on the Computer Managed Instruction (CMI) administrative capabilities?

Although the count was close, most administrators felt they did not have adequate training on the current administration system (see Table VI, Figure 5).

The response to this question is not to be taken lightly. If the users are not confident in their knowledge of the system, then both the effective use of the system and any recommendations regarding it made by those users can become suspect.

If the user is insecure in their knowledge of the system, they may be hesitant in attempting to use it to its maximum effectiveness: features may remain unused, and where knowledge of a teaching function is weak there may be a failure to use the system to its best advantage as a teaching tool.

The goal of the training for this system should be to bring the user to a level at which they are familiar and comfortable with the basic features of the system and at the very least aware of its advance features.

Six individuals failed to provide a response to this question.

TABLE VI

QUESTION THREE RESULTS

Category	Number	Percentage
Yes	107	46
No	125	54
Total:	232	

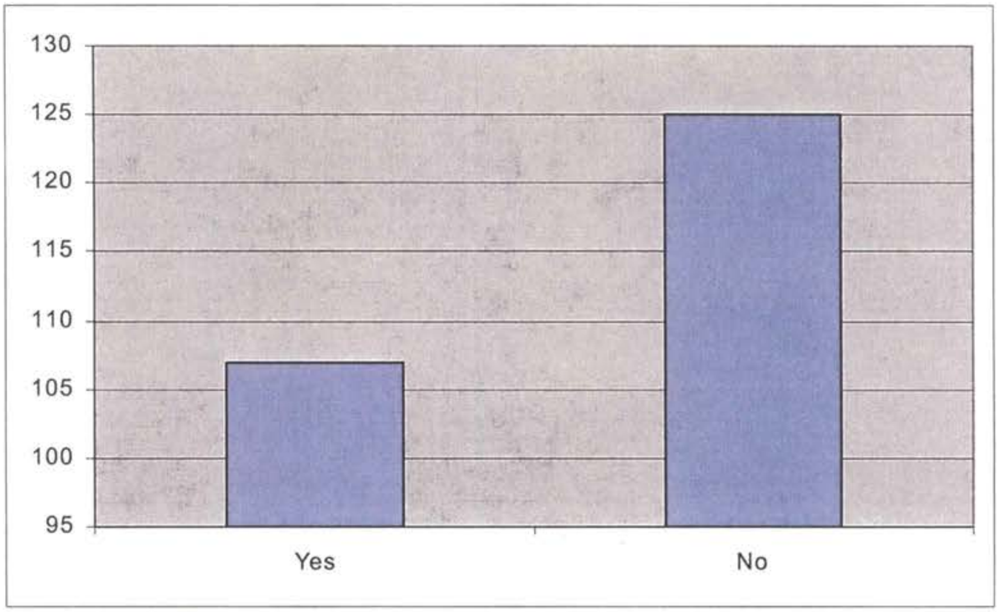

Figure 5. Question Three Results.

Survey Question Four: What type of Internet access is available at your site? (Select All that Apply) (see Table VII, Figure 6). This question was asked to see what capabilities are available for web-enabled administration systems. Most administrators had very fast Internet connections.

With some 13% of the administrators indicating they have no Internet connection, it is obvious that 100% dependence on a web-based administrative tool cannot be given consideration at this time.

TABLE VII

QUESTION FOUR RESULTS

Category	Number	Percentage
None	30	13
Dial-up modems	14	6
DSL/Cable modem	5	2
T1 or higher	155	66
Other	25	11
Don't know	5	2
Total:	234	

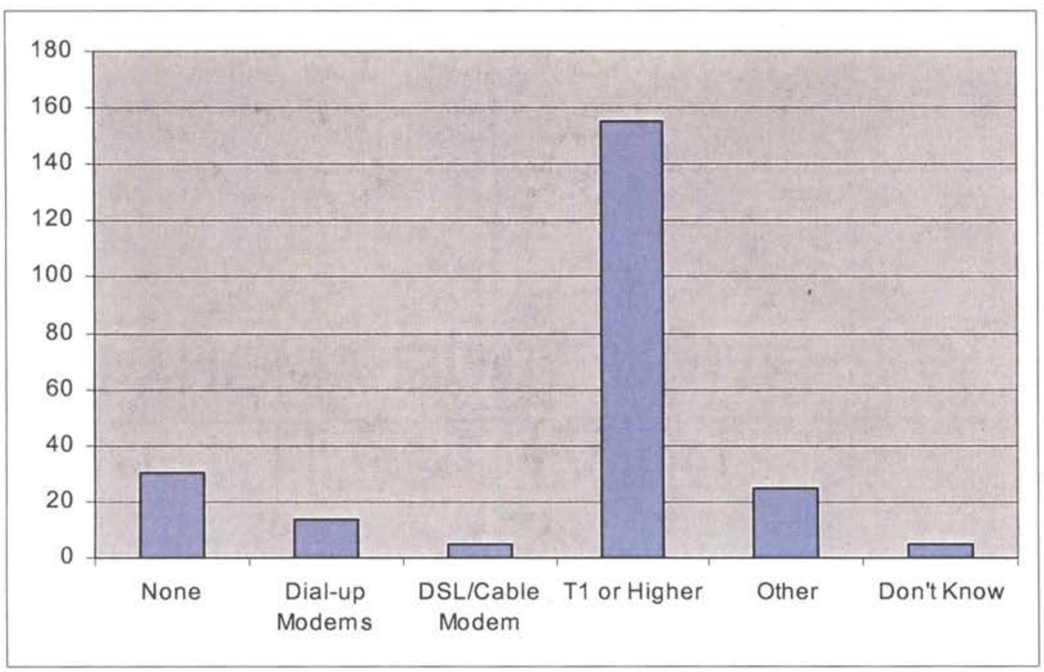

Figure 6. Question Four Results.

<u>Survey Question Five</u>: Are you satisfied with the support you receive when you encounter problems associated with the Computer Managed Instruction (CMI) system?

Without a doubt, most administrators perceived no problems with the help they are receiving (Table VIII, Figure 7).

TABLE VIII

QUESTION FIVE RESULTS

Category	Number	Percentage
Yes	222	96
No	9	4
Total:	231	

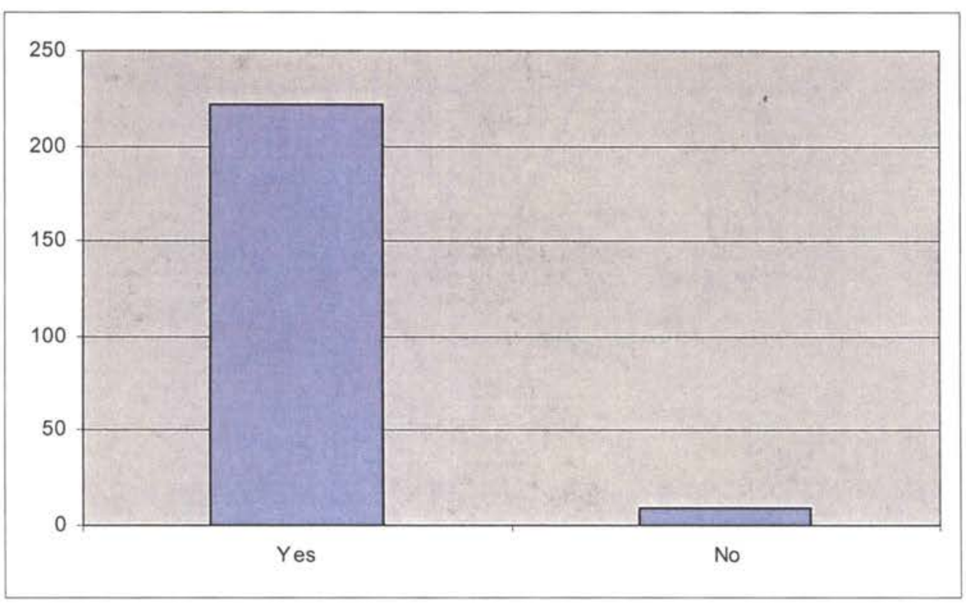

Figure 7. Question Five Results.

There is little else to say about this result. The only additional consideration that might be given in the future would be to determine the number of support requests made by each individual. One could expect that the nine negative responders might also turn out to have only attempted to use the help system once or twice.

Seven individuals failed to provide a response to this question.

Survey Question Six: Rank the following items from 1 to 6 in order of importance from your perspective. (1=most important 6= least important)

The majority of administrators believe reliability of the system the most important feature of all the available options. It was closely followed by accuracy of information (Table IX, Figure 8).

It is important to note that this question was asked from the viewpoint of the administrator, as opposed to the next question (7) that asks for the administrator's perception of how management would respond to the same question. A comparison of the results will be provided after the discussion of the results of question 7 in the next section.

By rearranging the chart, we find that the respondents considered the order of importance as follows:

Most Important:	Reliability of the System
	Accuracy of Information
	Ease of Use (User Friendly)
	Help Line Support
	Ease of setup and installation
Least Important:	CMI Report Functions

Only one individual failed to provide a response to this question.

TABLE IX

QUESTION SIX RESULTS

Item	Avg Point	Total points	Count	Percentage
CMI report functions	4.96	1175	237	24
Accuracy of information	2.65	629	237	13
Reliability of the system	2.50	592	237	12
Ease of setup and installation	3.83	908	237	19
Ease of use (User friendly)	2.71	643	237	13
Help line support	3.64	862	237	18
Total		4809	237	

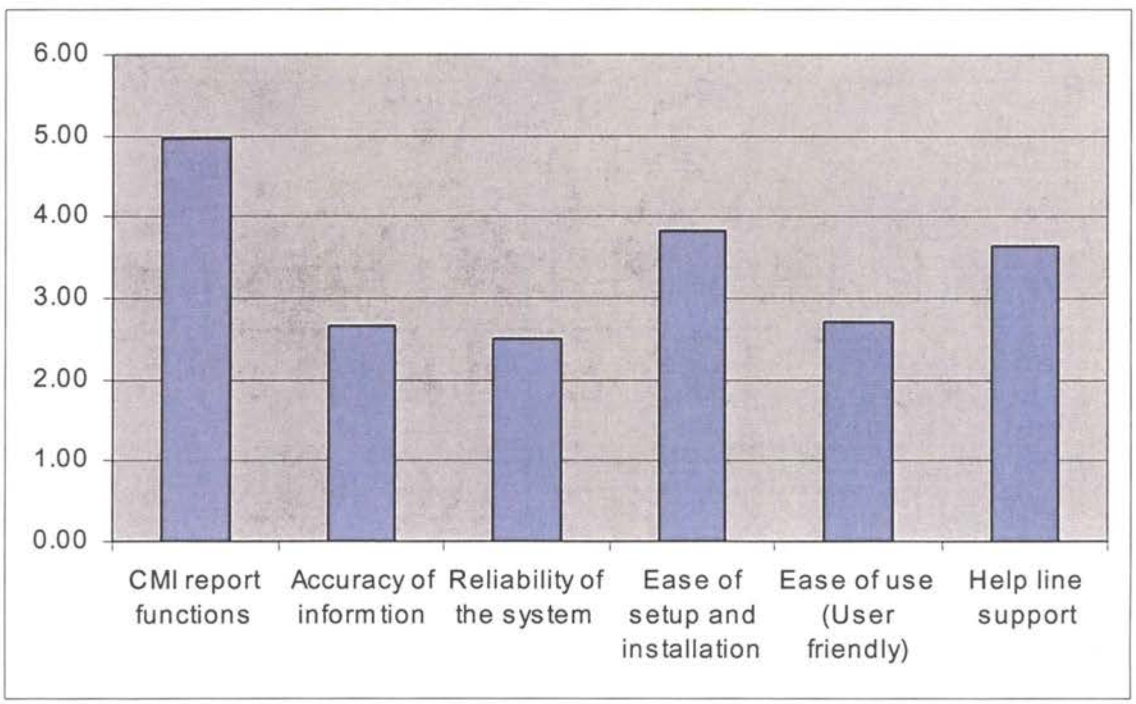

Figure 8. Question Six Results.

Survey Question Seven: Rank the following items from 1 to 6 in order of importance the way you believe your management would prefer. (1=most important, 6= least important)

The majority of administrators believe their bosses would value accuracy of information and reliability of the system (Table X, Figure 9).

When viewed in a slightly different manner, we find that the respondents considered that management would perceive the order of importance as follows:

Most Important:	Accuracy of Information
	Reliability of the System
	Ease of Use (User Friendly)
	CMI Report Functions
	Help Line Support
Least Important:	Ease of setup and installation

This order would tend to indicate that the responses were well thought out from a generalized, functional standpoint: if the system is not accurate and reliable, it is of little value as a tool of any type. A tool that is cumbersome to use will most likely not be used to the extent that the designers had intended. Having covered the actual early stage functionality (accuracy, reliability, and ease of use) respondents then considered the reporting functions to be the next most important issue. Obviously, without accurate and reliable information, the reporting functions would be suspect; and without a robust set of reports, the data provided captured during data entry remains inaccessible.

The fact that the *Help Line Support* and *Setup* processes were considered the least important of the group indicates that the respondents feel that if the Accuracy, Reliability

TABLE X

QUESTION SEVEN RESULTS

Item	Avg Point	Total Points	Count	Percentage
CMI report functions	3.78	877	232	19
Accuracy of information	2.25	523	232	11
Reliability of the system	2.56	593	232	13
Ease of setup and installation	4.29	996	232	21
Ease of use (User friendly)	3.09	717	232	15
Help line support	4.25	987	232	21
Total		4693	232	

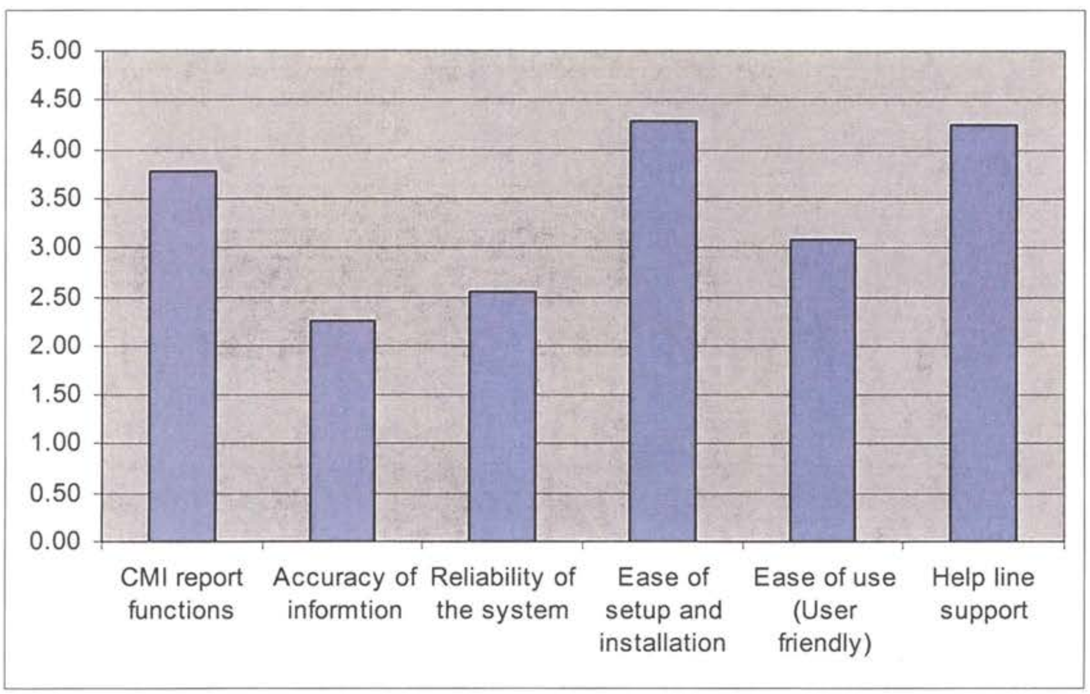

Figure 9. Question Seven Results.

and Ease of Use factors have been dealt with adequately, then there would be a minimal need for help line support. Logic dictates that simple, well-designed tools require less maintenance during use. By placing ease of setup and initialization as the least important aspect, the respondents have said, in effect, that even though the setup and initialization may be a more complex issue than day to day use, that less concern for convenience is needed because it is a one time activity.

Six individuals failed to provide a response to this question.

Administrator and Manager Views Compared

In this view, we can compare the feelings of system administrators regarding the importance of various features with their beliefs about management's feelings regarding those same features (Table XI).

It is interesting to note that both system reliability and information accuracy appear at the top of the lists in relative importance. The fact that reliability is considered more important than accuracy by administrators is understandable: they must be able to use the system when required to accomplish their daily tasks. By noting that they felt accuracy would be of more concern to management, administrators express their opinion that management is more concerned with the report contents than with how long it takes to obtain them.

TABLE XI

ADMINISTRATOR AND MANAGER VIEWS COMPARED

Administrator View	Manager View
Most Important:	Most Important:
Reliability of the System	Accuracy of Information
Accuracy of Information	Reliability of the System
Ease of Use (User Friendly)	Ease of Use (User Friendly)
Help Line Support	CMI Report Functions
Ease of setup and installation	Help Line Support
Least Important:	Least Important:
CMI Report Functions	Ease of setup and installation

The survey results indicate that the administrators believe that management places an importance on the importance of ease of use equal to that of the administrators. This indicates that there exists among the administrators a general opinion that management is concerned with the quality and ease of use of the tools being provided to administrators. To a degree, this could be seen as a morale indicator; the feeling that management is actually concerned with the quality of the tools being used by others in the organization contributes to higher morale within the organization.

The last three items in the lists are not directly related, but their sequence in each list does appear to show that the respondents gave careful thought to the viewpoint of the group under consideration in each question.

Conclusions

Technical Aspects

Results of this survey coincided with the findings of Mehta and Sivadas (1995) who concluded that unsolicited surveys are generally unacceptable. They found that people who received a questionnaire without prior notification were less likely to respond.

The survey used was relatively short and not exceedingly complex. Research by Alreck and Settle (1994) indicates that technological factors involved in longer questionnaires could make them more problematic.

Value to Future Systems

In general, the current system appears to provide an excellent system model for any planned replacement system. Questions directed at the suitability and effectiveness of the current system indicate that the system is meeting current requirements and expectations.

One area that was identified as being weak was that of administrator training. The response to Question 3 indicates that the majority of administrators feel that the training they received was less than optimal at best, and inadequate at worst. Even the training methodology may need to be examined. Typically, initial training in a completely new area of content is not retained as well as training in an area of content that is already familiar. One possible improvement would be a form of follow-on/review training, instituted after enough time has past to allow administrators to develop a sense of where their initial training fell short.

Consideration might even be given at the present time to develop and make available short self-study courses that would focus on various aspects of the system. The administrators could then choose courses that would further their knowledge in those areas of content where they feel weak.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

This study described FAA training systems and attempted to gather information about site administrators' perceptions of the distance learning record-tracking system.

In the review of literature, it was explained that one must not forget that the main purpose of an administration system is to track student progress in study and learning. The system must be accurate and collect useful information. To achieve the purpose of this study, the following research questions were presented.

1. What is the local training administrators' perception of the current FAA Computer Managed Instruction administrative capabilities?
2. What is the student's perception provided to training administrators of the current FAA Computer Managed Instruction student capabilities?
3. Have training administrators received training on the tools available?
4. What type of Internet connectivity is available at local training facilities?

5. What do training administrators believe to be the most important features of the administration system?

6. What do training administrators think their management believe to be the most important features of the administration system?

The study found that Federal Aviation Administration (FAA) site administrators were most concerned with having an administration system that provided high accuracy and reliability. This would tend to indicate that the responses were well thought out from a generalized, functional standpoint: if the system is not accurate and reliable, it is of little value as a tool of any type. A tool that is cumbersome to use will most likely not be used to the extent that the designers had intended. It was found that most site administrators felt they did not have sufficient training. The lack of training possibly had an effect on the perception of the administration system. Nevertheless, site administrators, based upon their personal experience and the input received from their students, rated the system above average.

Having covered the actual early stage of functionality (accuracy, reliability and ease of use), respondents then considered the reporting functions to be the next most important issue. Obviously, without accurate and reliable information, the reporting functions would have little value, and without a robust set of reports, the data captured during the data entry stages would be inaccessible, disorganized, and of little value.

Question One – What Are the Current Training Systems? As it relates to this study, the current training system for the FAA is an administration package called Computer Managed Instruction (CMI). There is also an off-the-shelf web-based system that delivers training but does not collect student data. Therefore the strength of one system, CMI's record keeping, is offset by the weakness of the other system (its lack of a data collection function).

Question Two – What Methods Are Currently Being Used by the FAA to Capture and Administer Student Training? Currently, the FAA captures training information using a number of auxiliary systems. However, most of these auxiliary systems feed the main system of records called the Consolidated Personnel Management Information System (CPMIS). CPMIS is generally passed only completion information. Two main systems, namely CMI and Correspondence Study, have their own internal record keeping. CMI is the FAA national computer-based instruction standard.

Question Three – What Type of Training Information Do Administrators Need in Order to Be More Effective? As found in the survey discussed in Chapter IV, training administrators feel that they lack sufficient information on the capabilities of the administration system. Reinforcing this conclusion, the survey found that adequate help line support was very important to the site administrators. As with any system, if there is a lack of training information, then the need for support increases.

Question Four – What Additional System Interfaces Will Be Required for a Fully Functional Administration System? One of the main requirements that the survey clearly identified was a need for reports. The ideal would be a system that provides the user with the ability to create ad-hoc reports on demand. Since the target audience has a number of different connection types and capabilities, the ideal system would offer flexible support of as many different connection methods as possible. The main system should provide at the very least a local and generic web interface to be considered a fully functional administration system.

Question Five – How Will the Administration Functions Be Performed and by Whom? The administration functions will be directed by each individual organization. However, it is important to note that regardless of how the function is performed, the administration of training is always performed by the local site administrator. This gives all participants a single point of contact (SPOC) for each individual site location.

Conclusions

After studying the perceptions of CBI site administrators, it is clear that one type of system will not work in all situations. For example, a web-based system alone would be difficult to implement in some cases where not all locations have Internet connections. The ideal system should have the ability to support administration locally and over the Internet. As shown in the survey, reports are also an important requirement for any system. A system is useless if data is captured but not reported.

Recommendations

Based upon the information obtained, it is recommended that all training systems provide a method of support and reporting. Many systems are judged not by their performance but rather by the support available for training administration. A system that does not cover all the bases can still be perceived as adequate if necessary support is provided. However, an otherwise adequate system with no support will be perceived to be inadequate.

Recommendations for Further Studies

As technology continues to evolve and more reliance is placed on the Internet, further study into progressing web-based administration is recommended. To make such a system possible, more individuals and organizations need access to faster Internet connections. Once ubiquitous high-speed connectivity becomes available, it would be interesting to look at the long-term effects of web-based administration as compared with local administration.

There are technological changes on the horizon that could significantly enhance the quality of CBI in general. Specifically, there are plans to increase the storage of various media that would permit training courses to contain more ancillary information in the form of graphics, diagrams and animation. All of these features generally require more storage than plain text and significantly increase the bandwidth required to deliver content.

The Shareable Content Object Reference Model Initiative (SCORM) and extensible markup language (XML) may potentially become major factors in the development and delivery of courseware in the near future. On the near horizon is "blue laser" DVD (Shim, 2003). This technology will greatly increase the storage capacity of DVDs by a factor of six.

Further away on the horizon are technologies such as holographic discs that will offer both increased storage capacity and rapid direct access to the stored information

(Holographic Disk), and MicroElectroMechanical systems (MEMS) that will provide mass storage with application programming on a single chip using nano-technology (Designing Systems with MEMS).

A further advantage of a centralized training system would be the use of a standard user interface to accomplish the tasks associated with administering, managing and using the system as an actual training tool. The benefits of a standard interface cannot be stressed too much. By reducing the learning curve necessary to actually use a new system, you allow end users to actually *use* the system. An excellent example of this approach is the Microsoft®™ software product line, which uses the same basic user interface and metaphor for all its products, implementing minor changes only where they are required by the unique functionality of a specific software package. This standard user interface is analogous to today's web browsers.

The main restriction to immediate implementation of such a centralized system is the lack of adequate high-speed connectivity for all prospective users of the system. This survey indicated that only 68% of respondents had high-speed Internet connections. This would force the other 32% to seek other ways of implementing the systems. An alternative would be to use an internal network with points of connection provided at various site training locations. The worst-case scenario is that an individual would have no high-speed connectivity. In this instance the training would have to be provided as a stand-alone application on a single system.

Another factor that must be considered is system security. The risk and the level of difficulty in implementing security is actually the inverse of the difficulties involved in providing access to the system by various means; a more accessible system is a less secure one, and a more secure system is less accessible. Security on a single system is easier to implement than on a wide area networked system that uses a public network, such as the Internet, to provide connectivity.

There are many other facets of this issue to consider. To discuss them all in any detail is beyond the scope of this document.

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APPENDIXES

APPENDIX A

DATA COLLECTION DOCUMENTS

Consent for Site Administrator Participation in a Research Project

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Dear Site Administrator:

You are being asked to participate in a study to desirable qualities in a Computer-Based Instruction Administration system. A critical stage in this process is to determine the most important areas in need of automation. Your position has been identified as one that can have significant impact on the process and people associated with the learning management system. Consequently, you have been selected as a *survey candidate* for the attached questionnaire.

As stressed in the correspondence and training documents, each of us play a vital role in creating an environment that is accountable to the public while being responsive to the needs and direction of the FAA.

The form takes about 10 minutes to complete. You do not need to include your name or ID, and your anonymity is ensured. Please return the completed questionnaire using the self-addressed stamped envelope we have provided.

All responses are completely anonymous. You will not be identified as an informant, nor will the name of your facility or organization be divulged in any publication or presentation. Your participation in this study is voluntary.

Return of the completed questionnaire shall signify your consent to participate in this study.

Should you have any further questions about this study, please contact me, Terry Salmon, at (405) 604-3277. Should you have questions about your rights as a research subject you may contact Sharon Bacher, Institutional Review Board Executive Secretary, 305 Whitehurst, Oklahoma State University, Stillwater, OK 74078; telephone number: (405) 744-5700.

Sincerely,

Terry L. Salmon
Doctoral Candidate

Site Administrator Questionnaire

1. As a site Administrator, select the answer that best describes your overall perspective of the current FAA Computer Managed Instruction (CMI) administrative capabilities:
   - □ Excellent
   - □ Above average
   - □ Average
   - □ Below average
   - □ Poor

2. Select the answer that best describes the overall feedback you receive from students about the current Computer Managed Instruction (CMI) student capabilities:
   - □ Excellent
   - □ Above average
   - □ Average
   - □ Below average
   - □ Poor

3. Have you had sufficient training on the Computer Managed Instruction (CMI) administrative capabilities?
   - □ YES
   - □ NO

4. What type of Internet access is available at your site? (Select All that Apply)
   - □ None
   - □ Dial-up modems
   - □ DSL / Cable Modem
   - □ T1 or Higher
   - □ Other (please specify)__________________________
   - □ Don't Know

5. Are you satisfied with the support you receive when you encounter problems associated with the Computer Managed Instruction (CMI) system?
   - □ YES
   - □ NO

6. Rank the following items from 1 to 6 in order of importance ***from your perspective.*** (1= most important 6= least important)
   - ______ CMI report functions
   - ______ Accuracy of information
   - ______ Reliability of the system
   - ______ Ease of setup and installation
   - ______ Ease of use (User friendly)
   - ______ Help line support

7. Rank the following items from 1 to 6 in order of importance ***the way you believe your management would prefer.*** (1= most important 6= least important)
   - ______ CMI report functions
   - ______ Accuracy of information
   - ______ Reliability of the system
   - ______ Ease of setup and installation
   - ______ Ease of use (User friendly)
   - ______ Help line support

APPENDIX B

INSTITUTIONAL REVIEW BOARD

APPROVAL FORM

Oklahoma State University
Institutional Review Board

Protocol Expires: 2/18/2004

Date: Thursday, February 20, 2003 IRB Application No ED0372

Proposal Title: A FEDERAL AVIATION ADMINISTATION COMPUTER MANAGED ADMINISTRATION SYSTEM FOR CD/DVD AND INTERNET COURSES

Principal Investigator(s):

Terry Salmon
PO Box 7244
Oklahoma City, OK 73153

Steven Marks
308 Cordell North
Stillwater, OK 74078

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved *

Dear PI :

Your IRB application referenced above has been approved for one calendar year. Please make note of the expiration date indicated above. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved projects are subject to monitoring by the IRB. If you have questions about the IRB procedures or need any assistance from the Board, please contact Sharon Bacher, the Executive Secretary to the IRB, in 415 Whitehurst (phone: 405-744-5700, sbacher@okstate.edu).

Sincerely,

Carol Olson

Carol Olson, Chair
Institutional Review Board

*NOTE: Change IRB office address to 415 Whitehurst

VITA 2

Terry L. Salmon

Candidate for the Degree of

Doctor of Education

Thesis: A FEDERAL AVIATION ADMINISTRATION SITE ADMINISTRATORS' PERCEPTIONS OF A DISTANCE LEARNING RECORD TRACKING SYSTEM

Major Field: Applied Educational Studies

Biographical:

Personal Data: Born in Lawton, Oklahoma, on January 27, 1960, the son of Jesse and Louretha Salmon.

Education: Graduated from Eisenhower High School, Lawton, Oklahoma in May 1978; received a Bachelor of Science degree from Cameron University, Lawton, Oklahoma in May 1984; received a Master of Science degree from Oklahoma State University, Stillwater, Oklahoma in June 1998. Completed the requirements for the Doctor of Education degree with a major in Applied Educational Studies with an emphasis in Aviation and Space Management at Oklahoma State University in May 2003.

Experience: Began working for the State Department of Education as a computer programmer analyst in July 1984. Joined a Financial Service Center as a Senior programmer in February 1985. Progressed to PC system Department Leader, answering directly to the vice president November 1989. Became a Senior Analyst in support of the Federal Aviation Administration in July 1993. Started own full-time company December 1994. The Small Business Administration selected the company as the Oklahoma 2001 service firm of the year. At the close of 2002, had over 100 employees.

Professional Memberships: Tinker Leadership Council; Air Traffic Control Association; Armed Forces Communications and Electronics Association.