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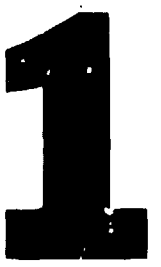

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TITLE: TECHNICAL AREA 55 ENTRY CONTROL SYSTEM (ECS)

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TECHNICAL AREA 55 ENTRY CONTROL SYSTEM (ECS)

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Abstract. The exchange badge system which was used at the Plutonium Facility located in Technical Area 55 was replaced on a trial basis with an automated Entry Control System.

As a result of the success of the trial system, a new system incorporating expanded features and increased reliability is being implemented. The new Entry Control System incorporates several features not previously available in relatively inexpensive entry systems.

The reliability of the system is enhanced by redundant microprocessors incorporating bubble memory for nonvolatile storage of the system data base. The badge readers incorporate dual communication lines to two different controllers to further increase the total system reliability.

System installation is anticipated in April of 1984.

Introduction

The Los Alamos National Laboratory Plutonium Facility is located at Technical Area 55 (TA-55) in Los Alamos, New Mexico. When the TA-55 Facility was built in the middle 1970s, an exchange badge system was used to control access into the plutonium building. The exchange badge system proved to be cumbersome, time-consuming, and difficult in handling the normal working traffic, and in particular, the large number of visitors.

In the late 1970s, a new security badge incorporating a high energy magnetic stripe was put into service by the Laboratory Security Division. The high energy stripe was chosen because of its flexibility, ease of encoding, durability, and it may be procured and laminated at a reasonable cost by the Laboratory Badge Office.

An automated Entry Control System (ECS) incorporating this new badge was implemented and installed in parallel with the existing exchange badge system. The automated system quickly proved its superiority in providing more detailed records, a monitor capability in the event of emergencies, and much better real-time control over the operational data base. After three years of successful operation, a new ECS has been designed with improved reliability and expanded capabilities. This new system is the subject of this paper.

Purpose

The primary purpose of the ECS is to monitor and control all personnel movement at TA-55. The ECS is not a replacement for, but an aid to the security force. Security is still provided by the guards through badge verification.

Authorizing visitors into the Plutonium Facility is the responsibility of the site operating group. The ECS provides the operating group with a real-time control on all visitor activity. Visitor badges are assigned and entered into the data base by the operating group during normal operating hours and by control room personnel after hours. Visitors are required to have an escort before entering the Plutonium Facility. The ECS provides verifications to the guards of individuals authorized as escorts. At the end of the day, the ECS provides detailed reports on all visitor activity.

Safety is of primary importance at TA-55. All operating personnel are required to have periodic training in order to continue working in the Plutonium Facility. ECS provides checks on all personnel and denies access to anyone whose training has expired. To aid the operating group in maintaining records, badge readers are being installed at the TA-55 auditorium entrance. Records of all personnel logged into required training meetings are automatically updated. Meeting attendance can also be logged as a service to any auditorium user.

The muster capability provided by ECS enables the operating group to determine if any personnel remain in the Plutonium Facility in the event of an emergency evacuation.

Movement of special nuclear materials (SNM) can only be done by authorized material handlers. ECS validates to security guards that personnel moving SNM are so authorized.

The operating group must maintain records on all activity in the SNM storage vaults. ECS, through the use of readers at each vault entrance, provides a daily log on all vault activity.

System Operators

Control of ECS is exercised by employing either the operator station located in the Group Office or the one in the Site Control Room. Each of these stations is equipped with a CRT terminal, badge reader, and printer. Only authorized personnel are permitted to use the terminals to perform the many functions necessary for the daily execution of the ECS operational procedures. System security and integrity is maintained through the use of need-to-know passwords.

The Group Office station is primarily employed to perform the system administrative functions such as data base enrollment and data base maintenance. The Site Control Room station is primarily used for system control, monitoring, and maintenance. It is also used for administrative functions as needed during the normal work day and is used almost exclusively for all purposes after the normal work hours.

Terminal operators communicate with the computer system by employing directives that have been implemented for this purpose. Use of these directives provides the means by which the operators are able to manipulate and command the ECS via a two-way dialogue between themselves and the computer.

Operational CRT screens are normally divided into four quadrants, as shown in Fig. 1. The upper left quadrant is used to display general information concerning the system operation. The upper right quadrant is used to specifically present, step-by-step, what is to be achieved by the directives. Normally, the operator is given a short explanation of what is to be accomplished and the options that are available. This quadrant is the computer's "talking" partition. In addition, the date, time, and number of people in the plutonium processing building (PF4) are displayed on the top line of this quadrant at all times.

The lower left quadrant is used to accept operator responses which are initiated by a computer-generated prompt. Usually, the operator will respond with an option number or a very short message. This quadrant is the computer's "listening" partition. The lower right quadrant is used to display messages from the computer informing the operator that the dialogue is not proceeding as it should and what corrective action must be taken. This partition is also used to report any operational system problems that may exist and require the operator's immediate attention.

System directives fall into one of the several distinct functional categories listed below.

- Operational system control
- System access (password control)
- Emergency situations

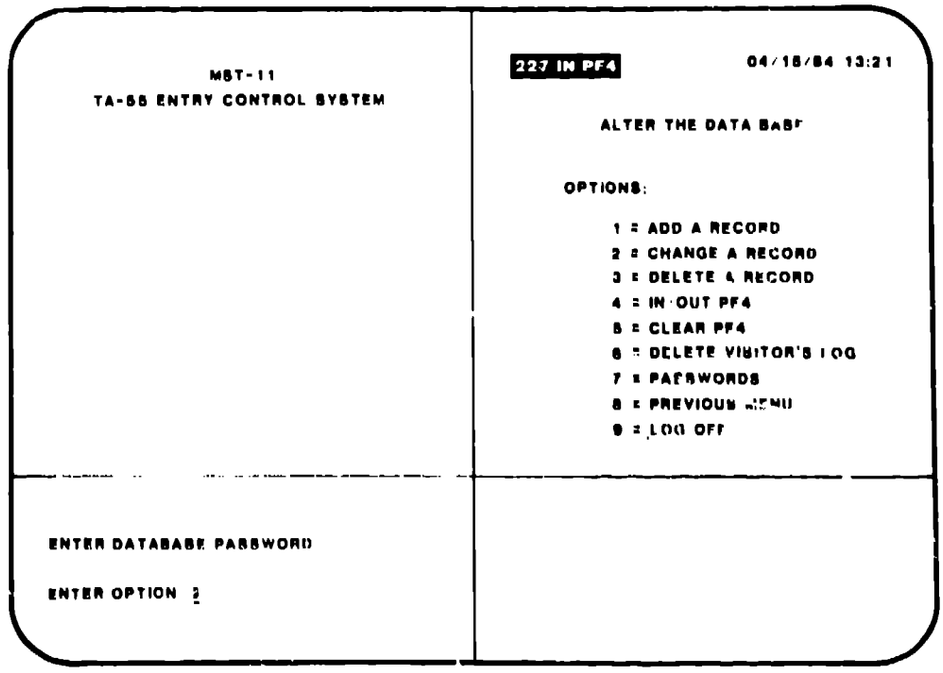


Fig. 1.

- Data base maintenance
- Displays and reports
- Auditorium control
- Data base transmission

These categories represent three major areas of operator expertise which are system control, administration, and maintenance. Each area is equally important to the total system operation and each area requires personnel who have been trained to perform specific tasks in those functional areas.

The most used administrative function is that of data base enrollment and data base maintenance. The next few paragraphs present a short explanation on the purpose of the ECS data base and a brief example of the procedure used to change an individual's data base record. This will serve to illustrate the basic methods employed by man to communicate with the ECS.

The ECS data base holds a record for every individual working within the TA-55 complex. These records must be accurate at all times since they contain important authorization and status information. Only personnel holding cleared Laboratory badges and with a need to enter the area on a regular basis are enrolled in the ECS data base. All other personnel are enrolled in the data base on a daily basis as cleared or uncleared visitors and are issued visitor badges. The data base is checked and purged at regular intervals to ensure its integrity is always at the maximum level.

All operators must know the first-level password that is required to gain access to the ECS. This level will permit the operator to enter requests for only certain displays and reports. In order to manipulate the data base, the operator also must know a second password which is known only to personnel who are authorized to alter the contents of the data base.

The operator is able to perform the function of altering the data base by selecting that option from the operational menus. Figure 1 shows the screen that is displayed when the "ALTER THE DATA BASE" option has been selected by the operator from a previous menu. It can be seen that there are many options available to the operator in this directive.

The operator must enter the data base password as requested by the prompt in the lower left quadrant. For security reasons, the password will not appear on the screen as it is being keyed-in. If the correct password is not entered, the computer will display a message to that effect in the lower right quadrant and present the corrective actions available.

Once the data base password has been validated by the computer, the message "ENTER OPTION" will appear on the screen. A "2" is entered for the "CHANGE A RECORD" option and the screen shown in Fig. 2 will be immediately displayed.

The operator is given the option to search for the individual's data base record using either name or Z-Number as the key. In this case, a "1" was entered and the prompt "ENTER Z-NUMBER" appeared on the screen. When the operator enters the Z-Number and the record is found, the screen shown in Fig. 3 will be displayed.

The contents of the individual's data base record are now displayed in the upper left quadrant. The prompt now reads "ENTER FIELD NUMBER" permitting the operator to change the contents of any of the fields in the record. Once all the

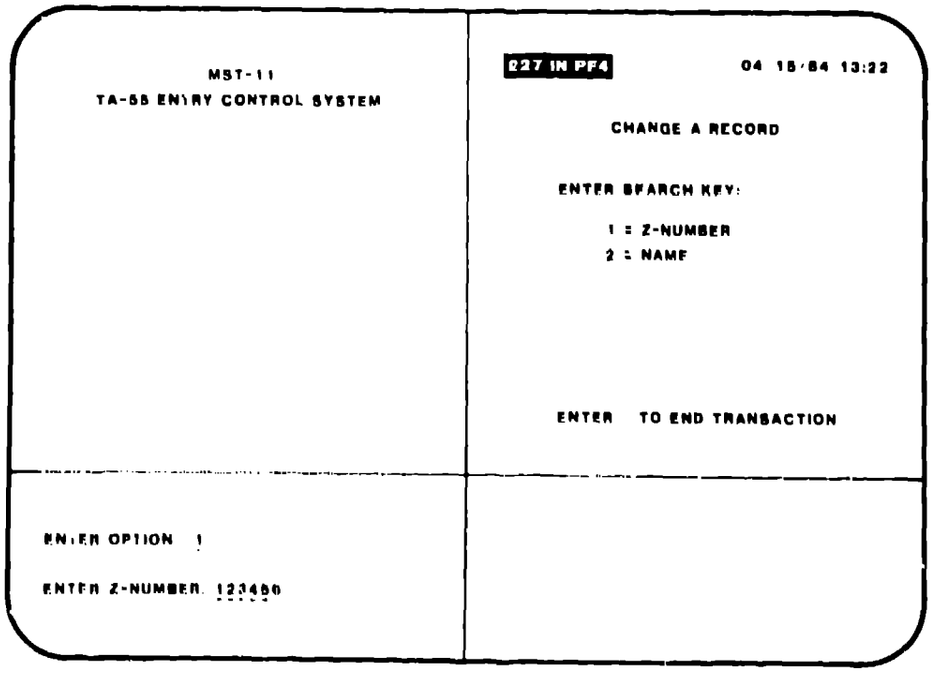


Fig. 2.

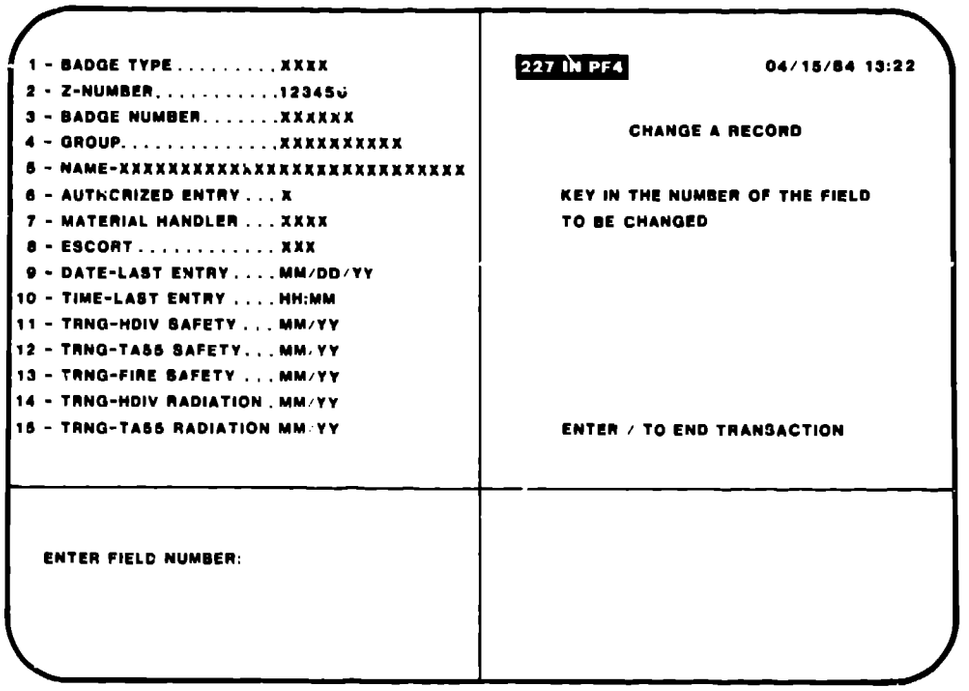


Fig. 3.

changes have been made, the screen shown in Fig. 4 will be displayed. The operator may now exercise the options to permanently change the record in bubble memory and to leave the "CHANGE A RECORD" option.

Various reports and displays may be requested by the terminal operators. For example, a CRT display and/or hardcopy report may be generated tracking an individual through the badge stations. Other important displays include those that present the building PF4 status, PF4 vault status, and the current visitor activity.

Badge Reader Stations

Figure 5 schematically presents the operational modules which comprise the ECS. It shows the locations of the badge reader stations and how they are connected to the controllers. The badge readers acquire information from the user's badges and transmit the information to the controllers enabling them to maintain the status of all personnel in the area at all times.

Badge readers provide audio signals which are used as operational prompts to indicate a badge cannot be read, entry or exit is permitted, and entry or exit is denied. If a badge cannot be read, a "REINSERT BADGE" indicator is lit and a warble tone sounded. When a badge has been validated and entry is allowed, the "ENTRY PERMITTED" indicator is lit and a pleasant steady tone sounded. Upon exit, the "EXIT PERMITTED" indicator will be lit and a pleasant pulsating tone sounded. If access is denied, the "ACCESS NOT PERMITTED" indicator will be lit and a warble tone sounded.

If the badge holder is an authorized special nuclear material handler, the "SNM" indicator is lit. If the badge holder is authorized to escort visitors into Building PF4, the "ESCORT" indicator is lit.

Entry into the TA-55 area requires a Q-clearance but not the special authorization necessary to access the Plutonium Facility. The two readers located at the TA-55 entrance are for monitoring personnel traffic into the area and to help locate personnel who are in the system data base. If the TA-55 area becomes an exclusion area in the future, the ECS system will be in place and personnel control can be implemented immediately.

There are two entries into building PF4, the plutonium processing plant. They are Guard Stations 403 and 404. All personnel entering or leaving PF4 must pass through one of these two stations. To gain entry into PF4, the badge must be surrendered to the guard who will pass it through the badge reader. If the person is authorized to enter PF4 and his/her training records are current, the appropriate indicator will be lit and the proper audio tone sounded. If the person is an authorized escort and/or an authorized special nuclear material handler, the appropriate indicator(s) will also be illuminated permitting the guards to properly perform the access control function for PF4. Upon exit, the badge must again be surrendered to the guard who passes it through the badge reader.

A vault in PF4 is used for storage of nuclear materials. Badge readers are located at each of the two entrances to the vault. The purpose of the badge readers is to record all traffic entering and leaving the vault. Personnel using the vault are required to pass their own badges through the badge readers and strictly adhere to the two-man rule of access control.

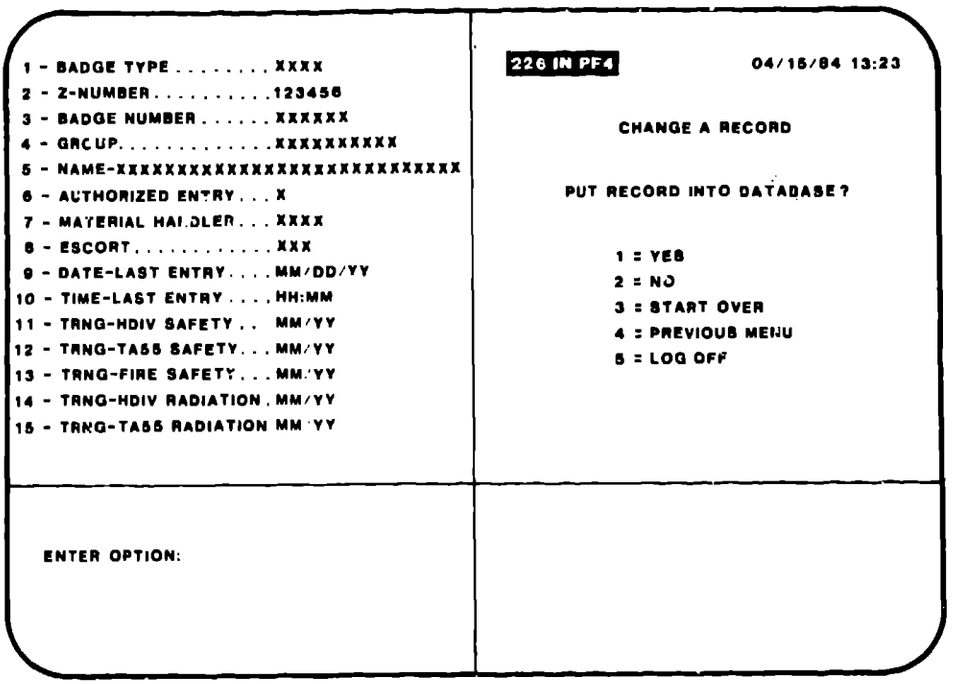
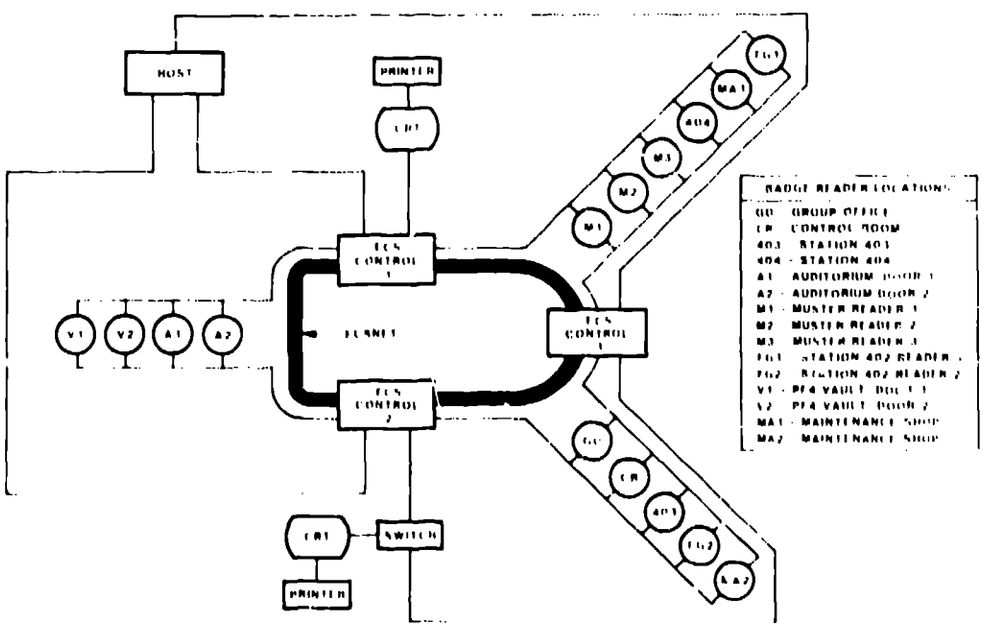


Fig. 4.



TA-55 MST ENTRY CONTROL SYSTEM

Fig. 5.

In the event an emergency situation occurs in PF4, an alarm is sounded and all personnel are required to immediately evacuate to a preassigned muster area. It is very important to quickly determine whether the building has been completely evacuated. There are three badge reader stations located at the outdoor muster area that are used for this purpose. All personnel are required to surrender their badges to the responsible person at one of the stations so the badges may be passed through the badge reader. In this manner, it is possible to quickly produce a report that will identify any personnel who may still be in PF4.

A badge reader is located at each of the two entry doors to the TA-55 auditorium. These readers are employed to record attendance at the mandatory training meetings. From this information, the ECS data base records are automatically updated to reflect the current training status for those individuals attending the meetings. These readers also serve to provide the information needed to produce attendance reports for any type of meeting that may be held in the auditorium.

There are badge readers located in the Group Office and Site Control Room that are used to accomplish the same purpose. They are employed to facilitate the enrollment of personnel into the ECS data base. The information encoded on the magnetic stripe is read and used to speed up the enrollment process with a high degree of accuracy. Also, badges that may be erroneously encoded are quickly identified.

There are two badge reader stations located at the Building TA-55 electronics maintenance shop. When a faulty badge reader has been repaired by the maintenance personnel, it is thoroughly tested on-line through these stations to determine if it can be successfully restored to the system.

System Architecture

The new ECS has been designed blending the hardware and software modules to achieve a highly reliable and user-responsive system. Figure 5 presents the operational hardware modules configured in a manner that will ensure that the high reliability so critical to the operation of the ECS has been realized.

It is required that the ECS be continuously on-line. Heavy system usage occurs during the normal 8-hour day, 5-day per week schedule. After hours and weekend traffic will range from light to very light. It is very important for the ECS to be operational at all times. Further, in the event of a critical operational module failure, the system is able to be automatically reconfigured without losing any transactions and without compromising the contents of the data bases.

The system complex shown in Fig. 5 provides the redundancy for effectively and efficiently operating in a nonstop mode. There are three controllers in the system each able to communicate with one another via the data communication link labeled ECSNET. Figure 6 points out the major modules that comprise the ECS controllers as well as the modules with which they communicate.

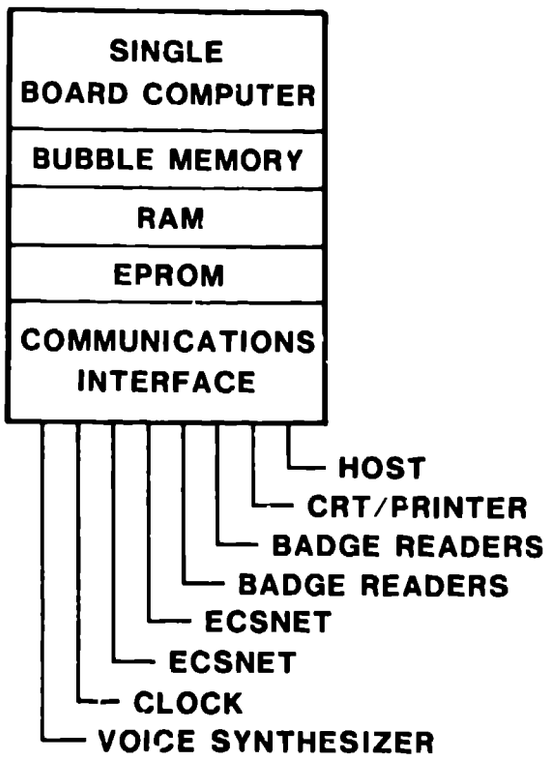


Fig. 6.

The bubble memory module in the controllers enables this configuration to be a most feasible solution to the problem of operating with and maintaining a dynamic data base. ECSNET is the module that permits the same data base contents to be redundantly present and usable in all three of the controllers well within the necessary operational time constraints. The contents of the ECS data bases in the three controllers must always be operationally "alike." The speed and processing power of the microprocessor modules in the controllers have made this design approach possible.

Each badge reader is connected to two controllers through two-party lines as shown in Fig. 5. This redundancy provides an alternate line to another controller in the event an outage occurs on either of the party lines or in one of the controllers. Each controller is in communication with the other controllers via ECSNET. ECSNET is the collection of the hardware and software needed by the controllers to transmit and receive messages from one to another.

Figure 5 shows each controller able to communicate with a host system. Operational data and the data bases are transmitted to the host by the controllers for storage and more elaborate report generation. The host may also transmit data bases

to the controllers as required. The host system is currently a Hewlett Packard E-Series HP-1000.

ECS performance is not degraded when a single controller is lost to the system. The system will notify the operator, automatically be reconfigured, and continue with its normal operation. When two controllers are lost to the system, it is still possible to provide most of the system functions although somewhat degraded. However, the most important function of controlling access to PF4 will still be possible.

The two system CRT terminals are Hazeltine ESPRIT III units. The printers are OKIDATA ML84s. These units were selected because they better satisfied most of the system operational peripheral requirements.

The badge readers are manufactured by HARCO Industries, Inc. These units are based on the 8085 microprocessor and feature dual data communication ports, wipe-through read mechanism, six indicator lights, audio tones, and self-test diagnostics. HARCO produces both standard and portable badge readers. The ECS uses portable readers at the auditorium and muster areas. Standard badge readers are available in the wall-mounted or table-top models. ECS utilizes both types.

The controllers are based on the Intel 8024SBC microprocessor board. For primary memory, they are each equipped with 8K SBC301 RAM and 32K 2764 EPROM modules. For secondary storage, they each contain the ISBC 254S-Z bubble memories. Currently, the controllers have two bubble memories, 128K bytes in each bubble chip for a total of 256K bytes. Bubble storage can be expanded to a total of four units yielding a maximum of 512K bytes per controller. Each controller has nine RS232 data communication ports and Fig. 6 shows the port assignments.

There are currently 600 users in the operational data base. The new ECS will accommodate 1200 users in the data base plus another 1000 transactions for logging of personnel who are not in the data base but visiting the area. The ECS data base will also accommodate all the additional information generated by providing the auditorium control functions.