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Development and Evaluation of ALEC Micro-Wand IIIe™ Training

by
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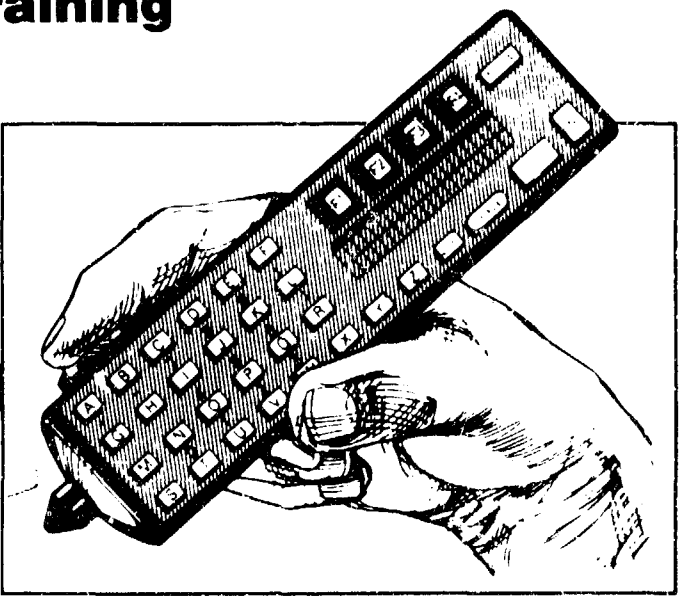

To be effective in today's fast-paced economy, the U.S. Army is rapidly introducing automation to replace time-consuming manual procedures. The key to effective implementation of this automation is its acceptance by the work force. This report documents a study examining potentially efficient methods for training the maintenance force at Army installation Directorates of Engineering and Housing (DEHs) or Directorates of Public Works (DPWs) in automated technology.

The study examined change theory and recent views on teaching and learning, and tested the relative effectiveness of two types of instructional workbook. One workbook type emphasized a procedural, "step-by-step" approach to learning; the other focused on scenarios that promoted a "whole task" approach to learning. Each workbook provided training for the same menu-based barcoding program, the Automated Labor and Equipment Card (ALEC) Micro-Wand IIIe™ program.

Training based on the workbooks was offered at two installations: Fort Sam Houston and Fort Lee. A total of 61 DEH/DPW employees completed the training. At each installation one group learned from the procedural workbook while another group used the scenario-based workbook. A post-training performance exercise assessed the subjects' proficiency with the Micro-Wand™.

Although the results are not statistically significant, the subjects who used the scenario-based workbook performed better on the post-training exercise than those who used the procedural workbook. Problems encountered during the study are identified and discussed, which should be helpful to project engineers and trainers involved in technology transfer. Based on observations made while conducting the training, recommendations are provided regarding ways to improve the Micro-Wand™ software and training, the barcoded service orders, and DEH/DPW's ability to support technology transfer of labor and equipment automation

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13. ABSTRACT (Maximum 200 words)

For today's fast-paced economy, the U.S. Army is introducing automation to replace time-consuming manual procedures. This report documents examination of potentially efficient methods for training the maintenance force at Army installation Directorates of Engineering and Housing (DEHs) or Directorates of Public Works (DPWs) in automated technology.

The study examined change theory and recent views on teaching and learning, and tested the relative effectiveness of two types of instructional workbook. Each workbook provided training for the menu-based barcoding program, Automated Labor and Equipment Card Micro-Wand IIIe™.

Training based on the workbooks was offered at Fort Sam Houston and Fort Lee. At each installation one group learned from the procedural, "step-by-step" workbook while another group used the "whole task" scenario-based workbook. A post-training performance exercise assessed the subjects' proficiency with the Micro-Wand IIIe™.

Subjects using the scenario-based workbook performed better on the exercise than those using the procedural workbook. Problems encountered during the study are discussed, which should be helpful to project engineers and trainers involved in technology transfer. Recommendations are made on improving Micro-Wand™ software and training, barcoded service orders, and DEH/DPW's support of technology transfer of labor and equipment automation.

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Foreword

This investigation was done under reimbursable funding from Fort Hood and Fort Sam Houston as part of the delivery process for the Automated Labor and Equipment Card (ALEC).

The work was performed by the Technical Assistance Center (TAC), U.S. Army Construction Engineering Research Laboratories (USACERL). Appreciation is expressed to the staff at Fort Sam Houston and Fort Lee for their cooperation and assistance in conducting this side-by-side test of two different instructional packages. Gary W. Schanche is Chief, CECER-TAC. The USACERL technical editor was Audrey Fisher, Information Management Office.

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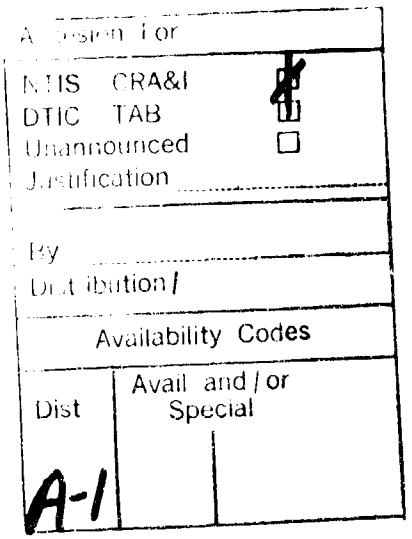

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1 Introduction

Background

The Need for Automation

The U.S. Army, like business and industry, is rapidly implementing automation-based technology innovations to be competitive in the expanding world economy. The current climate of governmental budget and staff reductions is forcing many governmental offices to aggressively identify productivity enhancement procedures, including automation wherever possible. The key to success of the automation of office processes is quick implementation, and the key to effective implementation is rapid acceptance of these automation concepts by the work force. With many of these innovations, the work force has had little prior experience or educational background to build on. The trainer is thus faced with an important issue: how to deliver and train the work force to use automation technologies to the highest level of proficiency in a minimum period of time. The success of the implementation process is typically judged in terms of the time required for students to demonstrate mastery of the process and low overall training costs.

Effective and timely adoption of new technology-based systems typically requires training in use of the system. Most research on implementing change has dealt with either an overview of who participates (Rogers 1983) or what factors influence the change process (Harvey 1990). The effectiveness of the training itself on learning has not yet been adequately explored.

Automating Labor and Equipment Data Entry

One existing time-intensive manual process within Directorates of Engineering and Housing (DEHs) or Directorates of Public Works (DPWs) is entering shop labor and equipment costs into the DEH/DPW upward reporting system, the Integrated Facilities System - Mini/Micro (IFS-M). Since it is not uncommon for larger installations to generate 50,000 or more service orders per year, the manual entry into IFS-M of labor and equipment (L & E) data for these service orders is often weeks or months behind. The Automated Labor and Equipment Card (ALEC) program, coupled with the MicroWand™ entry device marketed by HAND HELD PRODUCTS™, has proved effective

for entering this large amount of data quickly and accurately. ALEC was developed at the U.S. Army Construction Engineering Research Laboratories (USACERL).

Quick and cost-effective implementation of ALEC at an installation requires the development of an effective method to train maintenance and repair personnel to use the Micro-Wand™ to collect L & E data. This report documents an effort to examine potentially efficient methods for training the maintenance force at Army installation DEH/DPWs. The focus of training involved the use of the Micro-Wand™, a handheld barcode reader for individual repair personnel to record L & E charges against each of their daily work orders.

The Micro-Wand™ (Figure 1) is essentially a handheld personal computer. It contains a central processing unit (CPU) with a preprogrammed chip that collects data in a prescribed manner. Data input is requested via a liquid crystal display (LCD) on the unit. Data can be entered by scanning a barcode, by using the alphanumeric keyboard, or by using the four function keys.

The preprogrammed wand program has four major components: initialization (identification of who the wand user is), data collection, closing out the day's work on the wand, and downloading the data from the wand to a personal computer for processing.

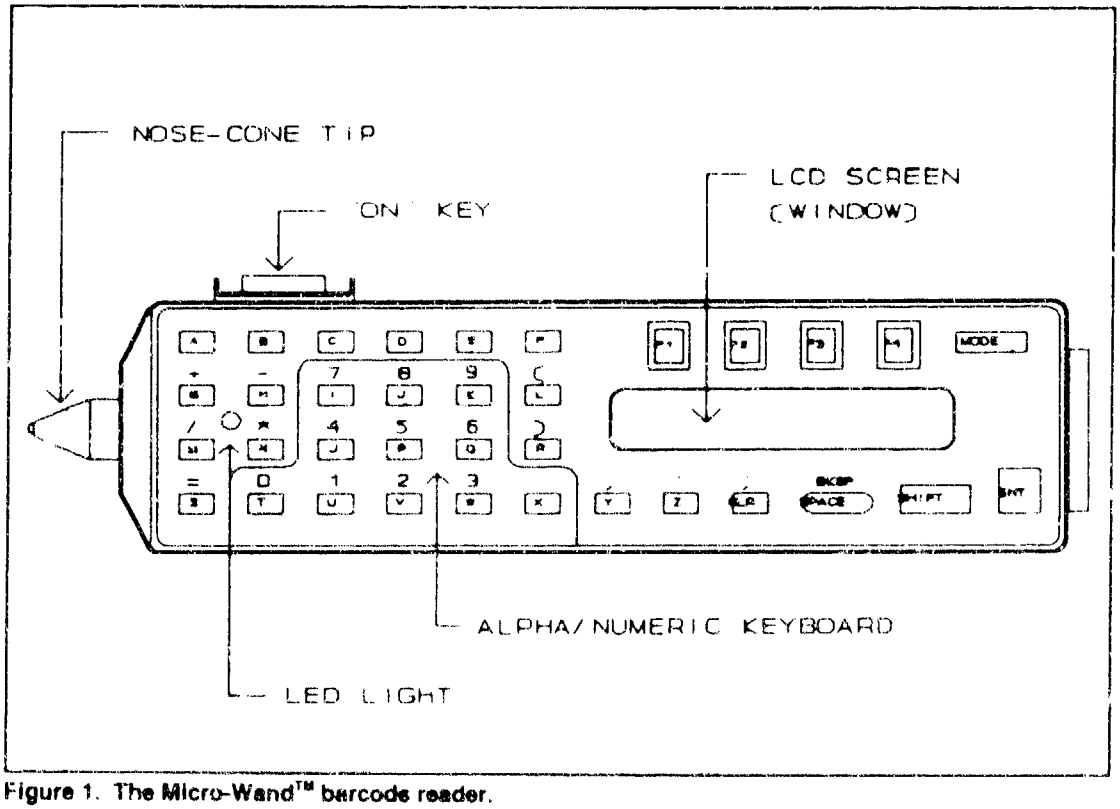

Figure 1. The Micro-Wand™ barcode reader.

Objective

The objective of this research is to experimentally determine which of two cost-effective methods gets better results. Results are measured by the method's effectiveness in training blue collar maintenance and repair workers without automation experience to use a handheld barcode reader to record I, & E costs during their daily work.

Approach

This research involved the design and conduct of a small-scale experiment focused on testing two instructional delivery methods. Work began with analyzing the ALEC Micro-Wand™ program and examining literature regarding current educational practice in technology training and adult educational methods in order to identify promising methods to teach use of the wand. Two promising approaches for training were identified, and instructional support materials were designed and developed. These materials included lesson plans and separate training workbooks—one procedural and one scenario-based—for each instructional approach. In addition, a test was developed to measure trainees' mastery of the procedures taught to determine the effectiveness of each training method.

The actual training activity took place at two installations: Fort Sam Houston in San Antonio, Texas, and Fort Lee in Richmond, Virginia. Immediately following the training, data analysis was used to examine the effectiveness of each training method.

2 Change and Learning Theories Considered in Designing Micro-Wand™ Training

The Process of Change

Although change occurs constantly throughout life, people still have difficulty adjusting to it. Stress, frustration, pessimism, and fear are only a few of the emotions change can evoke. Hall and Hord (1987) offer a development model of innovation adoption that helps to explain the process individuals go through when confronted with change. Their explanation of the change process revolves around the Stages of Concern model.

The Stages of Concern Model

Hall and Hord suggest that people go through seven "stages of concern" when confronted with an innovation that is likely to change their lives. These stages are the (1) awareness stage, (2) informational stage, (3) personal stage, (4) management stage, (5) consequence stage, (6) collaboration stage, and (7) refocusing stage.

When initially confronted with innovative change, individuals have little concern or involvement with the innovation as yet. Either by choice or by force, they begin to become *aware* of the innovation. After an initial awareness is gained individuals move into the informational stage, which involves gaining a general awareness of the innovation and developing more interest in learning about it. In the third stage, individuals become concerned about personal implications: the demands of the innovation on their time, their own ability or adequacy to meet those demands, and the role they will be expected to play when the innovation is implemented. When individuals reach the management stage, their attention turns to the process and the tasks of using the innovation and the best use of available information and resources. In this stage, they are more focused on task-related concerns than on personal concerns. During the final three stages of the model (consequence, collaboration, and refocusing), individuals focus on the impact of the innovation on other individuals and the organization. At these advanced levels, individuals cooperate with others on issues related to the innovation and work toward the development of policies and procedures that will lead to improvement of the innovation.

The Stages of Concern model has direct relevance to the transfer of barcoding automation technology to the Army installations. The prime movers of technological innovation need to be aware of the stages people go through when faced with an innovation. Managers, shop foremen, and technical trainers need to know what stages individuals are at and what strategies can be used to help advance them to the upper levels of the model. Hall and Hord (1987) describe these strategies and how to identify a trainee's stage of concern.

It is important to recognize that supporters of this technological innovation as well as those opposed to automation will be at various levels of the model. The actual level in the Stages of Concern model for each individual will likely depend on how well informed he or she is about the decision to implement barcode reading technology into the workplace. If the trainees are well informed about the proposed changes, one would expect them to be more accepting of the innovation and the training. But if the management in each installation has done very little to promote the technology among the workers, it would be expected that most of the DEH/DPW blue collar workers would be at one of the first three stages of concern. If this is true, one could expect the trainees to be more concerned about the impact of the innovation on their personal lives than concerned about doing well in the training sessions. Many of the employees would be expected to know very little about the Micro-Wand™ (awareness stage), some would have a general awareness and be interested in learning more (informational stage), while many others would be most concerned about how this new technology would change the way they do their work (personal stage). Training should, therefore, be designed to help employees advance beyond the personal stage of concern so they become more concerned about the best uses of the technology for the organization.

Managers, and ideally the shop foremen as well, should be past the awareness, informational, and personal stages, and would most likely be at the management and consequence stages. Based on this prediction, the managers and foremen should be most concerned about how the Micro-Wand™ should be used on a daily basis. For example, questions such as how they should be issued, where they should be stored, and who will be responsible for downloading the information should be foremost on the minds of people at these stages.

The Levels of Use Model

From a training standpoint, the Stages of Concern model and its counterpart, the Levels of Use model (Hall, Loucks, Rutherford, and Newlove 1975) provide a framework around which instruction can be designed. Hall et al. (1975), through their Levels of Use model, describe the levels of use that trainees develop through as they

learn to use a new innovation: nonuse, orientation, preparation, mechanical use, routine, refinement, integration, and renewal.

When first confronted with an innovation, individuals are at the level of *nonuse*. They know nothing about the innovation. Appropriate training for these individuals provides an *orientation* to the innovation through general information about the innovation such as its origin, characteristics, and implementation requirements. *Preparation* to use the innovation follows the initial orientation. Trainees are provided with the specific information and resources needed to use the innovation in their own setting. Trainees then become focused on *mechanical use*; the focus is on the short-term, day-to-day use of the innovation with little time for reflection. At this level of use trainees will begin asking questions about logistics, scheduling, and techniques, and will offer ideas for reducing the amount of time and work required of the person using the innovation. Although there are additional levels of use, the final one relevant to initial training is *routine*. At this point, trainees will have had sufficient time to practice using the innovation and have become quite competent in its use.

Becoming a routine user of an innovation clearly takes more practice time than is possible through formal training. The goal of initial technical training is to provide enough instruction and practice to facilitate the development of sufficient mastery for the trainees to attain routine use of the innovation on their own. Therefore, the training program designed to support the automation of the I. & E process was designed to orien the trainees to the technology, prepare them to use the technology, and provide enough practice and additional job aids to advance them to the level of mechanical use. Reaching the routine level will require additional independent effort on the part of the DEH/DPW employees.

New Approaches to Training

Changes in Learning Theory

Practice in education and training has changed in recent years, due to a switch from behaviorism to constructivism as the predominant learning theory. Under behavioral learning theory, learning is viewed as a change in behavior. Traditional industrial training, with its emphasis on the development of specific skills, has been a strong proponent of behaviorism. In traditional training programs, trainees are presented with information through lectures, skills are broken down into small tasks, and students memorize information or repeat skills until they can be repeated accurately.

By contrast, constructivist learning theory views learning as a process of adding new information to what is already known. In other words, students "construct" meaning based on their experiences and what they currently know. Using this learning theory, instructors design curricula in a way which allows students to develop understanding rather than simply memorizing new content and procedures. Instead of "throwing out information" and expecting trainees to absorb it, the cognitive view requires a learning environment in which trainees are active participants in the planning, delivery, and evaluation of instruction.

Both the procedural and the scenario-based training workbooks were designed to tie into the trainees' knowledge and past experience, although in different ways.

Learning in Context

Careful selection and planning of the instructional context is essential in instructional design. If training is to support learning that is useful outside of the training environment, it must take place in contexts that resemble the situations in which the knowledge and skills will be used. Students who learn under such conditions are more likely to spontaneously use the knowledge in new situations. Such an approach appears to develop "conditionalized knowledge": knowledge that includes information about the conditions and constraints of its use (Bourne, Dominowski, and Loftus 1979; Gentner and Stevens 1983). The concept of using instructional context to maximize accessibility of information is not new to education. Scholars have urged that education be based in reality and that what is learned should have a practical application that is recognized by students (Dewey 1956; Whitehead 1929).

Learning in context benefits trainees who are concrete thinkers rather than abstract thinkers. The benefits of learning in context are indexing, transfer of learning, and situated cognition, all described below. The scenario-based training workbook was written to take advantage of learning in context.

Indexing. The context in which knowledge is learned influences later use of that knowledge. From an information processing perspective, knowledge is "indexed" when it is learned so that it can be retrieved when needed at a later time (Gilhooly 1987; Paris, Saarnio, and Cross 1986). Indexing information in memory is analogous to using a card catalogue to index books in a library. With such an indexing system, specific books can be easily identified and located. It appears that the context of the learning situation influences the degree to which information stored in memory will be properly indexed. Contexts and situations similar to those that existed when the knowledge was acquired seem to facilitate recall of that knowledge at later times.

Transfer of Learning. Transfer of learning from the training environment to the job is a primary concern in industrial training. "Transfer" refers to the ability to apply the knowledge and skills learned in one context to completely new contexts and situations. While research has not been extremely promising about the success of attempts to achieve transfer of learning, new models and ways of approaching the transfer problem are emerging.

Numerous researchers have identified two broad categories of transfer: near transfer and far transfer (Clark and Voogel 1985; Perkins and Salomon 1988; Royer 1986; Salomon 1988). Near transfer occurs when the learner is able to apply previously learned knowledge and skills to situations and contexts that are similar to those in which the learning occurred. Near transfer occurs as a result of the similarity between the learning situation and the situation within which the application of the skill takes place. Far transfer occurs when a skill is performed in a context very different from that in which it was learned. Far transfer involves developing generalizable skills that are acquired and used in different contexts (Coladarci and Lancaster 1989). Far transfer is more cognitively taxing than near transfer because the individual must deliberately analyze the situation in order to extract the rules and concepts that are needed to apply ones' knowledge and skill in that particular situation (Psotka 1985).

The issue of transfer is an important one. Near transfer has been a priority of industrial training for many years. Students in vocational education courses and industrial training programs are trained in job tasks that use specific types of equipment. Attempts are made to procure and maintain "state-of-the-art" equipment that resembles the equipment graduates will use when they become employed. However, when the training environment differs greatly from the environment where the learning will be applied, far transfer must occur. Because far transfer is more difficult to achieve, from both the trainer's and the trainee's perspective, instructional design should focus on near transfer. The design of instructional materials that closely simulate the real-world applications will promote near transfer and should lead to better transfer of the new knowledge and skills.

Situated Cognition. Situated cognition is a term that describes the acquisition of knowledge and skills in instructional contexts that reflect the way the knowledge and skills will be used in real life (Brown, Collins, and Duguid 1988). The influence of context on performance was also noticed by Lave (1988) in a study of the use of school-learned arithmetic procedures in situations after school. Lave found that students could correctly solve 98 percent of the arithmetic problems presented to them in a supermarket but could only solve 59 percent of the same problems on a test. Apparently mathematics problems are less difficult in the "real world" than in school! This example shows how important the environment is in supporting learning. The

lack of "rich," real-life-like learning environments in many instructional settings deprives the student of contextual cues that are needed to support learning and transfer. Numerous other examples of the importance of situations and context on learning are described by Brown and colleagues (1988).

Instruction must occur in contexts that support encoding and representation of new information so it can be indexed in ways that make it accessible at a later time. Experiences that occur within rich contexts reduce the chances of students developing "inert" or "fragile" knowledge: that is, knowledge that one possesses but does not use in problem-solving situations (Perkins, Schwartz, and Simmons 1991; Whitehead 1929).

3 Methodology

Subject and Training Site Descriptions

Site Selection

The installations originally selected to receive the Micro-Wand™ training were Fort Sam Houston, located in San Antonio, Texas and Fort Riley, located in Platte City, Kansas. These installations had demonstrated their interest in automating their labor and equipment recordkeeping by acquiring the ALEC program, wands, and supporting computer equipment from the U.S. Army Construction Engineering Research Laboratories (USACERL). Following an initial site visit to Fort Riley, the point of contact (POC) at Fort Riley requested that the hardware installation and training for the ALEC system be delayed until the program was altered to better meet their needs. To maintain uniformity of the training to be tested and to avoid delay, Fort Lee, located in Richmond, Virginia, was substituted for Fort Riley as the second installation for this study.

An initial site visit was conducted to familiarize the researchers with each installation's DEH/DPW organization and their readiness to receive Micro-Wand™ training. During the initial site visits to each installation, DEH/DPW shops were visited and shop foremen were interviewed.

Fort Lee lies approximately 30 miles south of Richmond, Virginia. It has 7,338,395 square feet of covered space on 5,384 acres. A DEH work force of 206 maintains these buildings and grounds with an annual budget of $30,000,000. Approximately 40,000 service orders are generated each year.

Fort Sam Houston is situated within the San Antonio, Texas metropolitan area. The DEH is responsible for maintaining not only Fort Sam Houston but also Camp Bullis, approximately 30 miles away. Camp Bullis has its own work force to maintain the 307,000 square feet of covered space on 27,000 acres. Fort Sam Houston has 11,000,000 square feet of covered space on 3,150 acres. The combined Fort Sam Houston/Camp Bullis DEH work force is 400 with an annual budget of $57,000,000, dealing with 39,000 service orders per year

Shop Selection

Each of the two test sites has multiple specialized maintenance shops. It was decided that implementation of ALEC at the sites would be based on the following three criteria:

1. The unit of selection should be shops rather than individual workers.
2. The selected shops should work primarily with service orders (SOs).
3. The majority of the personnel in the selected shop should work on SOs.

The reason for the emphasis on SOs is that of the three major types of work order used by DEH/DPW personnel—standing operation order (SOO), individual job order (IJO), and SO—ALEC, during this initial test period, was designed to record L & E information only for SOs, which represent the greatest volume of work performed at the selected installations.

Recommendations for candidate shops were made by USACERL based on shop workload; however, the test site POCs had the final responsibility for selecting the shops and the individuals to receive the training.

Trainees

Several shop personnel who were scheduled to attend the training were unable to participate due to urgent maintenance orders on the day of the scheduled training, thus some "data points" in the sample were lost. Additionally, the number of people who attended the training sessions differed from the number who actually completed the training because many management level personnel, as well as shop foremen, attended the formal training sessions but did not participate in the competency examinations that followed the training. Forty-nine people attended the training sessions conducted at Fort Sam Houston; 27 shop personnel completed the entire training program. At Fort Lee, 49 employees participated in the training sessions; 34 shop personnel completed the entire training program. Table 1 shows which shops at each installation participated in the training and the number of shop personnel who completed the Micro-Wand™ training (attended the formal training sessions *and* completed the competency examination).

Instrumentation Development

Two data collection instruments were designed for this study. First, a questionnaire was developed to collect demographic data about the trainees, determine their

Table 1. Distribution of shop personnel receiving ALEC training.

Installation	Shop Name	Shop Code	# of workers Completing Training
Fort Sam Houston	Carpentry	001	2
	Interior Electric	002	8
	Plumbing	003	1
	Sheet metal	004	3
	AC/Refrigeration	006	4
	Heating	009	2
	Public Building Maintenance	100	3
	Preventive Maintenance	103	4
Fort Lee	Carpentry	01	8
	Elecrical	02	5
	Plumbing/Pipe Fitting	03	8
	Climate Control	06	13

perceptions of the training experience, and assess their knowledge of standard operating procedures related to wand use (see Appendix A). The questionnaire was filled out by each training participant at the completion of the training but just prior to the post-training performance exercise. The questionnaire consisted of the following:

1. *Background Information* measured job experience, degree of difficulty with the current system of L & E preparation, and an indication of computer experience and anxiety.
2. *Training Assessment* measured satisfaction with the formal training, instructor, workbook, and determined preferred learning styles.
3. *ALEC Questions* measured the degree of material learned from lecture and workbook exercises plus student perceptions of the benefits of ALEC.
4. The unstructured *Comment Section* allowed students to comment on the instructor, the workbook, the Micro-Wand™ program, and the training in general.

The second data collection instrument was a post-training performance exercise developed to assess the trainees' ability to competently use the Micro-Wand™ to record simulated L & E data for situations that would normally be encountered on the job (see Appendix B).

Since the purpose of the post-training performance exercise was to assess the trainees' ability to use the Micro-Wand™ on the job, the fidelity of this instrument was critical. The exercises developed were based on real SOs from various shops at each installation, lists of local equipment codes, and local task code lists. The information from these sources was used to create a simulated day of work that reflected the actual orders, equipment, facilities, and tasks that are encountered each day by the

employees. Thus, the context of the exercise was purposely formulated to resemble the actual work environment where Micro-Wands™ would be used.

As shown in Appendix B, the performance exercise provided written instructions that would take the trainee through a simulated full day of work. The performance exercise began with the trainee picking up a Micro-Wand™ at the beginning of a shift and completing the login process. The trainee was then instructed to check out various equipment items, start and complete SOs that were provided in the test packet, log into and out of lunches and breaks, and indicate that a shift had ended.

Training Workbook Development

Prior experiences with Micro-Wand™ training at Fort Shafter in Hawaii and with training involving similar technologies had illuminated some of the problems that could be encountered. For example, it would be difficult for a large group of trainees to see a demonstration of each step in the Micro-Wand™ process. Due to the multiple steps involved in using the Micro-Wand™, it would also be naive to assume that trainees could learn the many steps in the process through direct instruction. With guided practice being a necessity for this type of training, it was further assumed that managing a large group of trainees who would be at different steps in the Micro-Wand™ process would be a formidable and unmanageable task.

Because of these concerns, it was determined that the Micro-Wand™ training program would be more effective if a self-paced training workbook were used to support the formal training sessions. Large group instruction could be used to provide an overview of the Micro-Wand™ and to demonstrate its general features. This portion of the training was directed toward individuals at the awareness and informational stages of concern. Follow-up discussions were included to address the personal concerns of the trainees. The workbook would be used to aid the students as they individually applied the skills demonstrated during the large group instruction. The workbook was also viewed as a potential aid in facilitating transfer of Micro-Wand™ skills from the training program to the workplace.

To test the effectiveness of training workbooks as a support tool for this type of instruction, this study was designed to examine two different types of training workbook. One type of workbook emphasized the procedural, "step-by-step," menu-based approach to learning (see Appendix C). The context of this workbook built on the similarities between the current procedures and new automated approaches. Thus, learning should occur through this workbook because learners will be able to index their new knowledge by comparing it to the procedure they currently use to

complete L & E records. The second type of workbook was designed around scenarios that promoted a "whole task" approach to learning (see Appendix D). The context of this scenario-based workbook built on situations encountered on the job. Thus, learning should occur because the "richness" (real-life-likeness) of the handbook will allow learners to index their new knowledge to their previous experiences in the job. Each of these approaches, the procedural and the scenario-based, is valid from a learning standpoint because both emphasize important aspects of the technology and the conditions in which it will be used.

Before actual development of the workbooks, a task analysis was conducted to learn more about the ALEC program and about the Micro-Wand IIIe™, which is produced by HAND HELD PRODUCTS™. Activities conducted during the task analysis included: (1) a review of all existing ALEC and Micro-Wand IIIe™ documentation, (2) observations of both beginner and experienced Micro-Wand™ users, and (3) extensive practice with the Micro-Wand IIIe™ to complete L & E cards.

Building on insights gained through this task analysis, the sections to be included in both types of workbook were written. These common sections included an introduction to bar coding technology, a listing of the technical specifications and components of the Micro-Wand™, a brief description of the basic procedure for scanning barcodes, a graphic portrayal of the menu scheme for the wand program, a table defining the menu abbreviations, a short section describing problems that might be encountered, and a set of service orders taken from the installation where the training was to take place.

The only difference between the two versions of the workbook was the section describing the process for recording L & E data with the Micro-Wand™. In the procedural workbook, this section was organized around the 17 competencies that trainees were expected to achieve before they could use the Micro-Wand™ on the job (see Table 2). Each competency was described by a statement followed by the step-by-step procedures that must be practiced and learned by the trainees. Each set of procedures was directly related to the desired competency, and little connection was shown between the various competencies.

In contrast, the scenario-based workbook was designed around ten scenarios that correlated with the seventeen competencies found in the procedural workbook. Rather than presenting step-by-step procedures to be followed, the scenario-based workbook facilitated learning through situations that resembled real work activity. Each scenario taught new skills to the trainee and reinforced skills taught by earlier scenarios. For example, in scenario 4 the trainee learns how to indicate the start of work on an SO by scanning the document ID and the work rate (regular time or overtime). In order to complete this scenario, the trainee must be able to complete the

Table 2. Desired competencies for Micro-Wand™ users.

1.	Scan barcodes quickly and consistently.
2.	Use the function keys.
3.	Manually enter information.
4.	Remove and replace the battery.
5.	Enter the correct date.
6.	Enter the correct time.
7.	Enter your employee ID.
8.	Enter your shop code.
9.	Indicate that work has started on a Service Order.
10.	Sign out equipment for the day.
11.	Sign out equipment for a job.
12.	Sign-out for breaks, lunch, and leaves.
13.	Indicate that work has ended on a Service Order.
14.	Enter Task Code, Task Unit, and Component Code correctly.
15.	Indicate the Close of Business for the day.
16.	Record information for jobs that are not yet on printed Service Orders.
17.	Correct mistakes by completing accurate L & E cards by hand.

login process that was taught in scenarios 2 and 3. The final two scenarios each take the trainee through a complete day of work, which requires the use of all of the skills taught in the workbook. Because the scenarios build on the skills taught in previous scenarios, the trainees are provided with additional practice opportunities, which should reinforce and enhance their competency with the Micro-Wand™.

Training Procedure

Each iteration of Micro-Wand™ training and data collection occurred over 2 days: training on the first day, and data collection on the second day. Subjects at each site were divided into two groups. Since training was to be conducted by shops, shops were randomly selected in each group. Each group was given one of the training workbooks. Micro-Wand™ training began with a formal training session. The formal training session included an introduction to barcoding technology and an explanation of the reasons barcoding was selected as the technology of choice for recording L & E data. The trainees were then shown the primary components of the Micro-Wand™ and a short demonstration of the procedures for scanning barcodes and working through the various menu layers within the wand program. Wand demonstrations were conducted using a video camera and a large color monitor, which allowed the trainees to better see the wand, its buttons, and the LCD window. The formal training session lasted approximately 30 minutes.

A guided practice session immediately followed the formal training session. The trainees were told to practice using the Micro-Wand™ to record L & E data with the workbook as a guide. During this time, the two researchers circulated around the classroom to provide individual assistance. The guided practice session lasted approximately one and one-half hours. Before the trainees left the classroom to return to

work, they were told that they should continue practicing with the Micro-Wand™ to enhance their skills prior to taking the competency exercise the next day.

Data Collection and Analysis Procedures

The day after training was devoted to data collection activities. The trainees had previously signed up for half-hour time blocks for these assessment activities. Five trainees were assessed during each half-hour time period. The assessment began by having the trainees complete the demographic questionnaire and knowledge test (Appendix A). The trainees were then given the post-training competency exercise booklet (Appendix B) and were asked to carefully follow the instructions. When a trainee indicated that the exercise was completed, the data from the Micro-Wand™ used for the exercise was downloaded to a portable computer. The trainee's data file was then compared to a data file containing the correct information. Any discrepancy between the trainee's data file and the correct data file was noted on a checklist and shown to the trainee. Trainees who performed poorly were given the opportunity to complete the competency exercise again to see if they could improve their performance.

Analysis of the post-training competency exercise data was completed using a microcomputer-based statistical package. Post-training performance was determined by comparing the trainee's wand data with a data file containing accurate data. Downloaded wand data for each trainee was compared, item by item, to the master file. When an item in a trainee's L & E data differed from the master data, that item was highlighted and added to the trainee's error list. Final scores on the post-training performance exercise were then calculated through the following formula:

$$\text{Performance score} = \frac{\text{\# of correct items possible} - \text{\# of wrong items}}{\text{\# of correct items possible}} \qquad \text{[Eq 1]}$$

This formula resulted in a score for each trainee that reflected the proportion of correct items on the exercise and served as the dependent variable in this study. The percentage of correct scores for each trainee was used to calculate *t*-test comparisons of group learning differences by installation, training time (a.m. or p.m.), and workbook type. Correlations were also used to examine the magnitude of the relationship between the trainees' performance score, knowledge score, workbook type, instructor rating, and workbook rating.

4 Results

Description of Actual Training Sessions

The training sessions were conducted during one-week site visits to each installation. The training at Fort Sam Houston was conducted in a large conference room and took place in May 1993. At Fort Lee the employee lunch room was the setting, and the training took place in August 1993.

The conference room at Fort Sam Houston was ideal for training purposes. The room was an adequate size for the number of participants, and a large table allowed the trainees to spread their training materials out as they participated in the guided practice activities. A chalkboard, lectern, overhead projector, and large color monitor were available in the room.

The training environment at Fort Lee was less than adequate. The training sessions were conducted in two different employee lunch rooms. These rooms were not designed for training purposes and were certainly not conducive to effective teaching and learning. The overall size and shape of the lunch room made it difficult for all trainees to see the demonstrations. The color monitor that was provided at Fort Lee had a small screen that further reduced the effectiveness of the demonstrations. The small tables in the room resulted in cramped conditions during the guided practice activities. Because this room was used as a gathering place during breaks and lunch, disturbances during training became common as other DEH/DPW employees would enter the room for food or beverages.

Quality of Training

A survey was conducted at the end of each training session but prior to administering the competency exercise. The background section of the questionnaire included limited demographic information to identify trainees' on-the-job experience level, their current effort and error rate with L & E report preparation, and their level of computer anxiety level. The training assessment section of the questionnaire included questions derived from the content of the workbook, inquired about the skill of the instructors, measured post-training confidence levels in using the Micro-Wand, and examined learning style

preference. The ALEC questions section of the questionnaire posed specific questions relating to the purpose and use of the Micro-Wand™, assessed trainees' interpretation of various menu prompts, and measured the trainees' personal interest in using the Micro-Wand™.

No significant differences between sites were noted in the results of the background survey. Average job experience was in excess of 11 years. The workers averaged 6 service orders per day. The necessary time to complete L & E cards at the end of each day was slightly over 17 minutes and, as a group, they reported an average of .48 L & E reporting errors per day. The trainees also reported that they were, on average, "somewhat comfortable" with personal computers.

The instructors received "effective" ratings from both the procedural and scenario-based training groups. The procedural group tended to rate the instructors slightly higher (3.9 vs. 3.7). The group that received the scenario workbook indicated a slightly higher preference for the workbook than the group that received the procedural one (3.6 vs. 3.5).

Effectiveness of the Procedural and Scenario-Based Training Workbooks

The effectiveness of the type of workbook was measured through the post-training competency exercise performed the day after the training session. This exercise required trainees to demonstrate their ability to use the wand to record L & E data during a simulated day of work. The competency exercise took each trainee approximately 30 minutes to complete.

Because the exercises were designed specifically for each installation, they differed slightly in appearance and content. The exercise for Fort Sam Houston had 29 correct entries while the exercise for Fort Lee had 40 correct entries. It was possible for a trainee to have more errors than the number of correct entries; for example, a trainee could have checked out much more equipment than necessary, generating multiple errors from one data entry item, or could have entered phase codes when they were not needed.

Overall, the average score on the post-training performance exercise was .71 (SD = .315). Performance exercise scores ranged from perfect scores at both installations to a low score of >.034 at Fort Sam Houston and .025 at Fort Lee. As a group, the Fort Sam Houston trainees averaged .68 (SD = .253) while the Fort Lee trainees averaged .72 (SD = 3.58). The difference between the average performance scores at each installation was non-significant: $t(59) = .668$, $p > .10$. Based on these data, it did not

appear that the employees at one installation performed better than their peers at the other installation.

Before conducting this study, it was hypothesized that the trainees who received the scenario-based workbook would perform better than the trainees who received the procedural workbook. This hypothesis was based on the assumption that learning occurs best in realistic situations and that transfer of learning is more likely to occur when the learning situation simulates the desired application of the learning. Although the results are not significant at alpha =.05, the group that used the scenario-based workbook did perform better on the post-training performance exercise than the procedural workbook group, $t(59) = -1.718$, $p = .091$. The scenario-based workbook group averaged .79 on the examination ($SD = .250$) while the procedural group averaged .65 ($SD = .349$). Although the performance difference between the two groups was not great enough to be statistically significant, it is large enough to warrant further investigation into the effectiveness of scenario-based instructional support materials.

Effectiveness of Immediate Feedback

Immediate feedback from the post-training exercise affected trainees' attitudes toward the Micro-Wand™ and their confidence in their ability to use the Micro-Wand™ program. After each trainee completed the post-training exercise, his or her Micro-Wand™ data was downloaded to a portable computer and compared to a data file containing the correct information. The trainees were able to observe the quick process of "downloading" information and could immediately see the types of errors they made on the exercise. The trainees appeared to be genuinely impressed with the technological capabilities of the Micro-Wand™ and seemed pleased to receive immediate feedback on their performance. Many of the trainees made positive comments about the barcoding process and several wanted to work through the performance exercise a second time in an attempt to correct their previous errors. Although its impact on learning and motivation was not formally examined in this study, it appears that immediate feedback to the trainees regarding their post-training performance enhances their attitude toward the innovation, increases their confidence levels, and leads to further independent practice.

Problems Encountered

Problems were encountered during this study that impacted the results. The identification and discussion of these problems will be helpful to project engineers and

technical trainers involved in technology transfer. The concerns raised in the following sections include the ability of DEH/DPW to provide and support training initiatives, the readiness and motivation of DEH/DPW employees to move toward automation, the lack of adequate field testing prior to training, and the interface and structure of the Micro-Wand™ program.

Inappropriate Facilities and Class Size

The co-author who has previous experience conducting automation technology training felt that the DEH/DPWs were less supportive of training than other technology-oriented organizations. Problems were encountered with class size and training facilities provided.

Both installations were provided with a list of classroom and equipment needs during the initial visit. Fort Sam Houston provided a large conference room that was conducive to serious, task-oriented training while Fort Lee provided two break rooms that were less than ideal environments for this type of training. Learning environments that are quiet, comfortable, and void of outside distractions support rather than detract from the instruction, and are essential for effective learning. *Explicit* emphasis of needs and expectations must be made to DEH/DPW personnel prior to training.

Proper attention must also be given to the scheduling of training and assignment of trainees to classes. DEH/DPW personnel were provided with recommendations regarding which employees should receive training and how many should participate in each session. Although Fort Lee was unable to provide an environment that supported training, they did schedule their employees appropriately in terms of which shops participated and how many attended. Fort Sam Houston, however, had difficulty determining which shops should be involved in the training and how many participants were appropriate for each training session. At the first training session at Fort Sam Houston, 26 individuals were scheduled for training. This was a surprise, because it had been requested in advance to limit the number of participants in each session to 15 individuals.

The importance of small class sizes cannot be underestimated. When twice as many participants show up for training, people need to sit further away from the instructors and the screen used to show close-up images of the Micro-Wand™ and its functions. Increased class sizes also limit the amount of individual attention received while practicing with the Micro-Wand™. It was obvious that the large class sizes at Fort Sam Houston contributed toward decreased learning and increased frustration on the part of both the trainees and the instructors.

Low Readiness and Motivation To Move Toward Automation

It was observed that the majority of the shop foremen and all of the DEH/DPW leadership personnel were enthusiastically supportive of the move toward L & E automation. Unfortunately, that enthusiasm had not transferred to the shop employees. It appeared that many of the foremen were not pre-briefed by management about ALEC and the Micro-Wand™ training; therefore, they had not briefed the employees in their shops about the importance of successfully implementing ALEC. Many of the DEH/DPW employees were obviously not enthusiastic about the decision to implement L & E automation and many seemed very pessimistic about the chances for the change to automation to succeed. This difficulty could have been reduced if the shop foremen had briefed their employees of the importance of ALEC.

Using the Micro-Wand™ for L & E recordkeeping was a significant change in DEH/DPW installations. Therefore, the change process was a concern. It was expected that many of the employees who participated in the training would initially be critical of the decision to use the Micro-Wands™. This expectation certainly held true. Every training session at each installation began with negative comments from the trainees expressing dissatisfaction with the change toward automation and with questions regarding the need for the change and the cost of the Micro-Wands™. Fortunately, these types of negative comments and questions were expected, and responses to them were as honest and positive as possible.

Since change is a constant phenomenon, careful planning needs to take place to see that desired changes are accepted by those who will be impacted by the change. Change is often difficult for people to accept, and it is natural to immediately work against new changes. Training is a vehicle that can positively support the change process. Training must be more than a process of disseminating information; it must also reassure and persuade. Management, too, has a role in helping changes gain acceptance in the workplace. If management is supportive of a change, it must see that employees are provided with the training they need to become competent with the new procedures and processes. Management must also attend to employees' concerns about the impact changes will have on their daily work roles.

Lack of Adequate Field Testing Prior to Training

Conducting training for a microchip-based device that is still under development is an arduous task. Numerous problems were encountered during the training sessions as a result of the inconsistencies in the wand program and problems with the program interface design. Undoubtedly, these problems will be solved prior to large scale implementation of ALEC.

During various training sessions, many Micro-Wand™ problems were encountered. These included weak or dead batteries, faulty microchips, and improperly cleared memories. It was sometimes time-consuming to determine the cause of the technical problems encountered. A surprising large number of rechargeable batteries supplied by the manufacturer were defective. The instructors were forced to use a "parts replacement" strategy in an attempt to determine if a weak battery was at fault. Hence, the trainees observed the instructors frantically replacing batteries in an attempt to get enough Micro-Wands™ functioning so they could be given to the trainees prior to training. The difficulty could have been avoided if the ROM chip used in the training wands had had the "battery test" feature enabled.*

At Fort Sam Houston, the version of the microchip program that was installed in the Micro-Wands™ on hand did not allow the user to enter component codes larger than "09" even though this installation commonly used component codes greater than "09." By the time the program was revised and new microchips were burned and delivered overnight from USACERL to Fort Sam Houston, some of the wands had been distributed and used for training. This caused some confusion as to which wands contained the revised chip and which still had the older version. In addition, the need to change the microchips drew attention to the fact that the Micro-Wand™ was still in the design phase and was not ready for full implementation.

An additional problem occurred during this changing of the microchips and also during several training sessions at Fort Lee. When changing the microchips in the Micro-Wand™, it is necessary to completely "clear" the internal memory. Unfortunately, the instructors were not told this; they assumed that many of the wands contained internal faults. After it was determined that the problem was simply the result of a failure to clear the memory, the instructors were able to get most of the wands working properly.

These are the types of problems one expects to confront during an initial pilot test of a product. However, it is unusual to conduct formal training with products that have not been extensively field tested. These technical problems hampered the delivery of the training and seemed to undermine the credibility of the trainers, the Micro-Wand™ technology, and the USACERL project team.

* These problems have been addressed by USACERL researchers since this field test, and appropriate program and procedural changes have been implemented.

Micro-Wand™ Program Bugs

During the training, observations were made of what problems the trainees had in using the Micro-Wand™. Many of the problems resulted from a poorly programmed user interface. Due to the small LCD window on the Micro-Wand™, it was necessary to rely on short abbreviations and acronyms within the menu structure. Several of the abbreviations and acronyms seemed to confuse the users, especially when the obscurity was compounded by terms chosen from a programmer's point of view rather than from a user's point of view. For example, when starting work on an SO, the user must select the "OP DOC" command (Open Document). When indicating the work on an SO was done, the user must select the "CL DOC" command (Close Document). The use of terms that are familiar to the end user and are a part of their everyday conversation is important. For example, rather than using the term "Open Document" to indicate the start of work on a service order, the terms "Start Work" or "Begin Work" are more clear and easily interpreted. These examples illustrate problems that can be overcome by using the correct context.

Several of the branching decisions within the wand program also confused the trainees. The biggest problem for the trainees occurred while learning how to issue equipment for a job. Because the program returns the user to the "Issue Equipment" menu after he or she correctly issues a piece of equipment for a job, many of the users thought they had not properly issued the equipment and, therefore, issued the same equipment again. This resulted in multiple equipment charges being made against a service order. Some trainees issued the same truck to a job as many as five times! A simple solution to this problem would be to return the user to the work menu after a piece of equipment had been properly issued. Although the need seldom occurs, they could easily issue more equipment to a job by pressing the "EQP" command again.

A similar problem occurred in the lunch portion of the program. When indicating the end of a lunch break, the user must select the "END LUNCH" command and then select the "END BREAK" command. The need for two key presses to indicate the end of a lunch break is confusing. It was also apparent that the lunch portion of the program was too complex. The procedure for taking a lunch break should be as simple as the procedure for taking break, that is, one function key press to being (lunch) break and another key press to end (lunch) break. There is no need to include the option to issue equipment during break.

One final programming problem observed during the training occurred when the trainees needed to manually enter information. Although scanning a barcode is fast and accurate, it is sometimes necessary to type information into the Micro-Wand™ manually. Due to the small key pad on the Micro-Wand™, it is necessary to "shift"

between alphabetic and numeric modes. With SOs containing both numbers and letters, it becomes a rather difficult task to enter those codes manually. Part of the problem lies in the lack of a visual cue which indicates which mode the wand is currently in. Trainees were observed pressing a key to determine which mode their wand was in and then needing to use the backspace key to erase the entered information if it was in the wrong mode. This process was further hampered by the need to switch between the forward and backspace commands. If a visual cue were provided to indicate the wand's current mode, users could more easily enter information by hand. It is interesting that the Micro-Wand™ manual discusses a character on the screen that indicates the mode—but, unfortunately, this feature had been removed from the current version of the program.

The problems described above are critical hindrances to achieving positive technology transfer. Such problems are typically worked out during field testing; however, conducting formal training during the initial phases of field testing hampered the effectiveness of the training. When trainees become confused as a result of weak interface designs, it adds an additional layer of complexity to the training environment and lessens the potential of the trainees to accept the new technology and become "routine users" of the new approach to L & E recordkeeping.

Accessibility of Personal Tutorial Instruction

The workbooks tested were designed to be used for self-guided training. However, during the training sessions, many of the students took advantage of the researchers' presence to ask questions or seek assistance. Because the primary goal was to train the employees, with the experiment described here being only a secondary goal, the researchers (also the trainers) chose to answer the questions at the expense of the purity of the testing environment.

This could explain the high p obtained and thus the low statistical significance of the differential effectiveness between the two workbook types. The more the trainees' competence relied on identical training resources outside of the workbooks, the more nearly identical their competence should have become.

5 Conclusions and Recommendations

The experiment described in this report tested the relative effectiveness of a procedural workbook versus a scenario-based workbook for training. The results revealed little difference between the two workbook types in terms of their ability to teach the proper procedures for using the HAND HELD PRODUCTS™ Micro-Wand IIIe™ to record L & E data. Although not statistically significant, the scenario-based method seems to provide a slight benefit over the procedural one.

Although the study was not able to demonstrate a significant advantage of one workbook type over the other, it did succeed in identifying problems that should be either controlled for or examined as potential dependent variables. Two specifically uncontrolled variables were: (1) the students' readiness and motivation to learn and (2) management commitment to success.

To enhance the transfer of ALEC Micro-Wand™ barcoding technology to DEH/DPW installations, it is recommended that the following steps be taken:

Regarding the Training Program

1. A firm schedule for training needs to be determined and agreed upon between the trainers and DEH/DPW leadership before training plans are developed and completed.
2. Guided practice during the training session must continue until each trainee has reached a minimum competency level. If trainees are allowed to leave the training environment before they have achieved this minimum competency level, they cannot be expected to be able to practice using the Micro-Wand™ on their own.
3. Trainees need to understand the importance of practice in learning how to use the Micro-Wand™. This needs to be reinforced explicitly and firmly before, during, and after training.
4. It would benefit training effectiveness if DEH/DPWs were provided with an automated scoring program like the one used with the post-training competency exercise. If each DEH/DPW installation had such a program, future users of the

Micro-Wand™ could receive immediate, individua ;ed feedback about their performance as they practice.

5. Future Micro-Wand™ training should be planned so as to refine the current design and further investigate the potential of the training workbooks as support materials for technical training. If the training workbooks are to be used on a self-guided basis, they should be tested in self-guided training environment.

Regarding Micro-Wand™ Program Improvements

1. The battery test feature programmed into the Micro-Wand™ at the factory should be added to the existing program.*
2. The wand program should be revised as follows:
   a. Change the order of input for Task Number, Task Units, and Component Code to Task Number, Component Code, and then Task Units. When working with the current order, new users input the Task Number, but when they see "Task Units" in the LCD window, they think that they did not enter the Task Number correctly. If the Component Code was inserted between the two "Task" inputs, this common input error by new users may be eliminated.
   b. Increase the double-checking features of the wand program. A hidden code should be added to every barcoded item, and the program should be instructed to look for a code corresponding to the correct type of input expected at each input point to preclude incorrect data entry. For example, the use of a hidden alpha character within the "Task Code" barcode would allow the program to check that a task had been entered, not a bulldozer.
5. Provide a visual cue that indicates the current status of the "SHIFT" key.
6. Change abbreviations to be more relevant and meaningful to the wand users. For example, "OP DOC" could be "START" or "BEGIN"; "CL DOC" could be "DONE" or "STOP."
7. Have "END LUNCH" be sufficient for ending a lunch break, rather than requiring "END LUNCH" followed by "END BREAK."
8. Consider deleting the "EQP" command from the lunch menu. If employees need to issue equipment, they will do so before or after taking their lunch break, not during it.
9. Have the wand display branch back to the main menu after a piece of equipment is issued. Returning to the "Issue Equipment" menu is confusing to new users.

* These problems have been addressed by USACERL researchers since this field test, and appropriate program and procedural changes have been implemented

Regarding Barcoded Service Orders

1. The Task Number, Task Units, and Component Code for each service order should be printed in the upper right of service orders to speed data entry.
2. Because new users of the Micro-Wand™ have difficulty scanning barcodes when the spaces between the lines of a bar code are small, laser printers should be adjusted to provide more space between the bars.

Regarding DEH/DPW Support for Technology Transfer of L & E Automation

1. DEH/DPW managers and shop foremen must provide support, resources, and encouragement to ensure that implementation of L & E automation is successful. This includes releasing trainees from their normal duties for a long enough time to gain sufficient practice and achieve the desired competency level.
2. DEH/DPW managers and shop foremen need to communicate to the employees the rationale for moving toward automation and make clear the importance of L & E automation to the DEH/DPW organization and to each employee. This communication process should be planned so the entire DEH/DPW organization understands why automation is important, how the change will be implemented, and what changes in work roles and expectations should occur.
3. Forms and labels should be prepared in advance to facilitate the training process and make it easier for the employees when they begin using the Micro-Wands™ on the job. For example, each trainee should be provided at the start of training with a form containing the barcode of his or her worker identification number as well as barcodes for the trucks and equipment typically used. This form should be laminated for long-term use. In addition, barcoded labels should be printed for employee identification numbers, trucks, and equipment so they can be attached to employee ID cards, clip boards, equipment, and truck dash boards.

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Appendix A: Demographic Questionnaire and Knowledge Examination

BARCODE L & E TRAINING SURVEY

BACKGROUND INFORMATION

SSN :_____Shop :_____

1. How many years have you been in your present position?

_____

2. How much time each day do you spend preparing a L & E Card?

_____

3. How many service orders do you typically complete in a day?

_____

4. Please estimate the average number of errors on your daily L & E card.

_____errors

5. How many minutes per day do you spend correcting L & E data entry errors?

_____minutes

6. Have you used a personal computer before?

yes __ no __

if yes, how comfortable are you using one? (circle answer)

not at all comfortable	somewhat comfortable	very comfortable

TRAINING ASSESSMENT

7. The training session objectives were: (circle number)

very unclear				very clear
1	2	3	4	5

8. The barcode wand workbook was:

very unclear				very clear
1	2	3	4	5

9. My overall evaluation of the course workbook is:

poor				excellent
1	2	3	4	5

10. The instructor was:

ineffective				very effective
1	2	3	4	5

11. After completing the barcode wand training, my confidence in using the wand correctly is:

very low confidence				very high confidence
1	2	3	4	5

12. I learn more from workbooks, such as this one, than from lecture presentations.

strongly disagree				strongly agree
1	2	3	4	5

13. I prefer to learn primarily in a logical step-by-step manner.

strongly disagree				strongly agree
1	2	3	4	5

14. I prefer to learn primarily by trying real world examples.

strongly disagree				strongly agree
1	2	3	4	5

ALEC QUESTIONS

15. The purpose of the barcode wand is to: (check all that apply)

assist with payroll ___
automate L & E card ___
reduce L & E data error ___
reduce data entry time ___

16. More than one person can use the same wand at the same time.

true ___ false ___

17. The total number of equipment that can be checked out within a shift is ____.

18. At the completion of a shift, what must happen to the wand?

secure the wand so you can use it tomorrow ___
close the last job and then do a close of business ___
erase (purge) the wand memory immediately ___
the battery should be removed ___
turn in the wand for downloading ___

19. Which way can a barcode be scanned? (check all that apply)

right to left ___
up to down ___
left to right ___

20. What does the "mode" key do?

erases the previous entry ___
shifts between upper and lower case ___
moves program to prior menu ___
changes keypad between numbers and letters ___

21. If when you turn on your wand, you see the following:

_TRANS	PURGE_
_DATA	DATA _

What does this mean? (check all that are correct)

battery is bad ___
wand has been downloaded ___
program is defective ___
wand has not been downloaded ___
wand contains data ___

22. If you are out on a job and the wand fails to operate properly what should you do?

return to shop for new wand ___
fill out L & E at end of day ___
radio for a new wand ___

22. Are you looking forward to using ALEC?

strongly disagree 1 2 3 4 5 strongly agree

23. Do you think ALEC will improve the accuracy of <u>your</u> L & E data entry process?

strongly disagree 1 2 3 4 5 strongly agree

24. Do you think ALEC will reduce <u>your</u> record keeping time?

strongly disagree 1 2 3 4 5 strongly agree

COMMENT SECTION

Comments on training:

Comments on instructor:

Comments on workbook:

Comments on Wand Program:

THANK YOU FOR YOUR ASSISTANCE

Appendix B: Post-Training Competency Exercise

ALEC Bar Coding Practical Exercise

This practical exercise is designed to assess your ability to use the bar code wand to record Labor and Equipment data. The purpose of this exercise is to determine if you have the skills needed to accurately use the wand on-the-job. If you perform at or above the desired level, you will be ready to use the wand as a part of your normal workday.

This exercise simulates a full day of work. **Carefully** read each step and enter the necessary information. You will be asked to correct the time and date on the wand, log in properly, start and stop work on Service Orders, and record breaks, lunch, and leaves. Please note that when you are told to take a break it does not mean a real break! You only need to use the wand to indicate that a break has started.

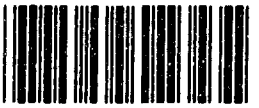
At the end of your "Day" turn in your wand so the data can be "downloaded." You will then receive feedback about your performance.

Simulated Day

1. You arrive at work at 8:00 AM and pick up your wand.
2. Use the following information to complete the log in procedures:
   - The date is July 11, 1993
   - The time is 8:15 AM
   - Enter your own employee ID #
   - Your shop is #10
3. Check out a Utility Truck for the day. (NOTE: The Equipment Codes are on the attached sheet.)

4. Locate Service Order ID# 51315QT 332213R and begin work on that job at regular time. You need a Sewer Cleaner to complete this job.
5. You have now completed that Service Order which involved 1 Task Unit.
6. Locate Service Order ID# 51315QT 333063R and begin work on that Service Order at regular time.
7. Take a break in the middle of this job.
8. You cannot do any more work on this job because you are waiting for supplies.
9. Locate Service Order ID# 51315PA 327753R. Begin work on that Service Order at regular time. You need an Air Compressor for this job.
10. Take your lunch in the middle of this job.
11. You have now completed your lunch.
12. You have now completed Service Order ID# 51315PA 327753R (1 Task Unit).
13. A radio call tells you to complete an urgent job before your afternoon break. This is an electrical repair job that involves repair of three water fountains. The Document ID number will be 51315QT 052923R.
14. The urgent job is completed (Task Code=0805; 3 Task Units; Component Code=07).
15. Locate Service Order ID# 51315QT 333063R and **continue** work on that job.
16. Take your afternoon break.
17. Your afternoon break is now over.
18. You have completed Service Order ID# 51315QT 333063R (1 Task Unit).
19. Your shift is over. It is time to go home.

Fort Lee Equipment List

E3	Air Compressor	
E58	Backhoe	
E157	Scavenger Sweeper	
E78	Sewer Cleaner	
E238	Utility Truck	
E239	Utility Truck	
E240	Utility Truck	
E241	Utility Truck	
E242	Utility Truck	

****

Labor and Equipment Work Request
Creation Date: 08/18/93 14:29:24 Shop: 010

****

Inst: LEE Short Desc: TOILET STOPPED UP Task: 01PM

---------- Job Identification ----------

Document ID: 51315QT 332213R Phase: Facility: 00610

Date Requested: / / Priority: 3 Component Code: 08

---------- Job Location ----------

Part: FH_QTR: RPF_EQP: RPF_USE:
Location: 610-D CHERBOURG ROAD
POC Name: DREW POC Phone: 862-1197

---------- Job Description ----------

Description: TOILET STOPPED UP - UPSTAIRS TOILET/HOME

Remark:

---------- Work Status ---------- ---------- Labor Code ----------

Break Lunch Regular Work Overtime Work

Time In COB

---------- Job Status ---------- ---------- Misc ----------

Close Job Complete SHP Yes No

Supply Not Home Mode

****

****

Labor and Equipment Work Request
Creation Date: 08/18/93 14:29:14 Shop: 010

****

Inst: LEE Short Desc: REPAIR SCREEN DOOR Task: 01PM

---------- Job Identification ----------

Document ID: 51315QT 333063R Phase: Facility: 00079

Date Requested: / / Priority: 3 Component Code: 09

---------- Job Location ----------

Part: FH_QTR: RPF_EQP: RPF_USE:
Location: 79-B BASTOGNE ROAD
POC Name: JONES POC Phone: 732-4726

---------- Job Description ----------

Description: QTRS. 79-B REPAIR SLIDING SCREEN DOOR

Remark:

---------- Work Status ---------- ---------- Labor Code ----------

Break Lunch Regular Work Overtime Work

Time In COB

---------- Job Status ---------- ---------- Misc ----------

Close Job Complete SHP Yes No

Supply Not Home Mode

****

****

Labor and Equipment Work Request
Creation Date: 08/18/93 14:48:31 Shop: 003

****

Inst: LEE Short Desc: INTERIOR PIPE WORK Task: 03IP

---------- Job Identification ----------

Document ID: 51315PA 327753R Phase: Facility: 05000

Date Requested: / / Priority: 2 Component Code: 08

---------- Job Location ----------

Part: FH_QTR: RPF_EQP: RPF_USE:
Location: 5000
POC Name: CLEMONS POC Phone: 44389

---------- Job Description ----------

Description: CEILING PIPE LEAKING ROOM 249

Remark:

---------- Work Status ---------- ---------- Labor Code ----------

Break Lunch Regular Work Overtime Work

Time In COB

---------- Job Status ---------- ---------- Misc ----------

Close Job Complete SHP Yes No

Supply Not Home Mode

****

Appendix C: Procedure-Based Training Workbook

US Army Corps
of Engineers
Construction Engineering
Research Laboratory

Bar Code Training Handbook

Automated Labor and Equipment Card

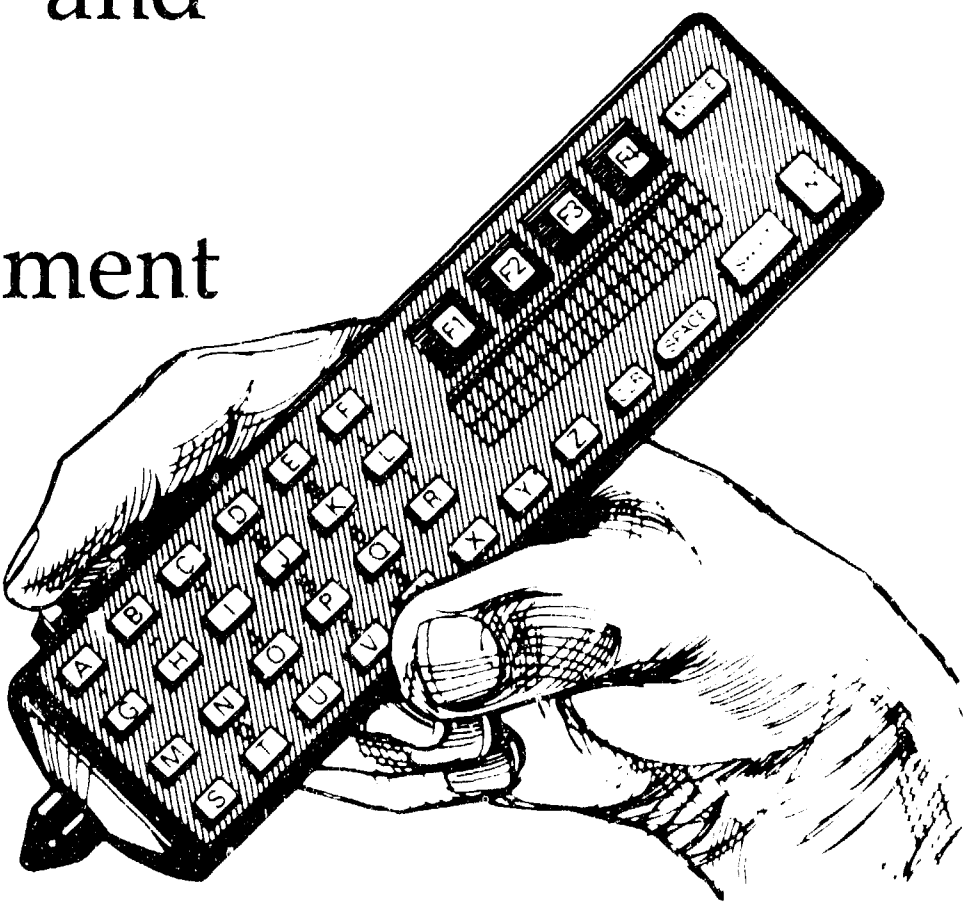


Table of Contents

Note: MicroWand IIIe is a trademark of HANDHELD PRODUCTS, INC.™

The drawings in this document are copied courtesy of HANDHELD PRODUCTS, INC.™

Introduction

Bar coding is rapidly replacing other methods of data entry. This is partly due to the fact that bar coding technology has an accuracy rate of only 1 error in every 3-5 million scans. Scanning bar codes is also faster and easier than typing entries on a computer keyboard or hand recording them on paper. Present day uses for bar code scanning include package tracking, inventory control, self-checkout at grocery stores, security systems, and games and toys.

Micro-Wand IIIe™, manufactured by HANDHELD PRODUCTS, INC.™, is a bar coding device that combines state-of-the-art technology and rugged durability in a small one-piece unit. This wand is engineered to keep on working -- even when dropped from a height of seven feet onto concrete.

Your wand has been programmed to automate the entry of information on Labor and Equipment cards. You will use the wand to:

1. Log in at the beginning of your shift.
2. Keep track of your time on Service Orders.
3. Keep track of breaks, lunch, and leave periods.
4. Keep track of the equipment you use on a job.
5. Log out at the end of your shift.

The wand is currently programmed to record work on Service Orders. If you are working on a Standing Operations Order (SOO) or an Individual Job Order (IJO) you will need to record your time and equipment for those jobs on the paper L & E cards. In the future, it is expected that the wand program will be capable of keeping track of all DEH labor and equipment costs.

Micro Wand IIIe Specifications™

Size & Weight

- 7.2 x 1.75 x 1.25 inches
- 8 ounces

Power

- Uses one 9-volt Ni-Cad, lithium, or Alkaline battery
- Low-battery detection and automatic shut-off.
- Capacitor back-up for memory and real-time clock. Up to 1 hour of security is provided by the capacitor.

Environmental

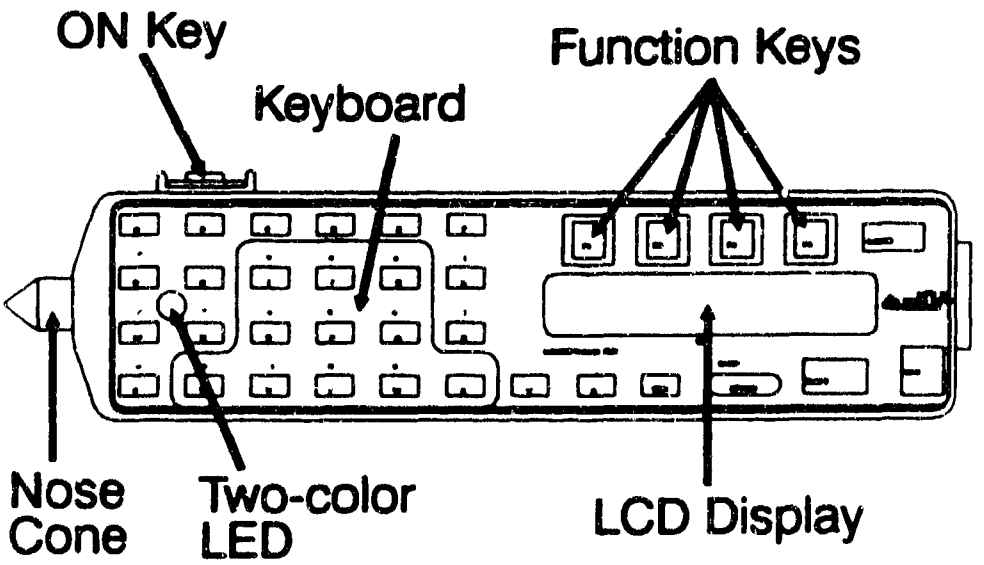
- 32° to 113° F (recommended operating temperature range)
- -4° to 158° F (storage temperature range)
- Operates in up to 85% non-condensing humidity

Case Specifications

- ABS plastic, UV stabilized case material
- Withstands 7 foot drop to painted concrete

Fire Retardant Rating

- UL 94-V0



Micro Wand IIIe Components™

- ON Key – The ON key is located on top of the wand. To conserve power, the wand goes into a "sleep mode" when it has not been used for 30 seconds. The ON key is used to "wake up" the wand from its "sleep mode."
- Light Emitting Diode (LED) -- The LED provides a visible light that indicates that the bar code has been properly scanned.
- Alpha/Numeric Keyboard -- The keyboard consists of 35 rubber keys which allow key entry even when wearing gloves. The light-gray color marks on the keyboard show the numeric keys. These keys can be activated by pressing the SHIFT key.
- Liquid Crystal Display (LCD) Window – The LCD display consists of two rows of characters that provide instructions for scanning and for displaying manually input information.
- CLR (CLeaR) Key -- The CLR key is used to erase letters that have been manually input.
- Function Keys (F1, F2, F3, F4) -- The Function keys are used to quickly input information or respond to questions shown on the LCD display.
- SPACE/BKSP Key -- When the wand is in the alphabetic mode, the Space key is like the spacebar on a standard keyboard; it moves the underlining cursor forward one character position. When the wand is in the numeric mode, the BKSP key is like the Backspace key on a standard keyboard; it deletes characters as it moves the cursor backward.
- SHIFT Key -- The SHIFT key is used to switch from alphabetic mode to numeric mode and vice-versa. Therefore, when typing in alphabetic characters, simply press the SHIFT key to begin entering numbers.
- MODE Key -- The MODE key has been programmed to exit from a menu, cancel a menu choice, or exit from a data entry request without making an entry. If the wand screen is not displaying the options you wish, press the MODE key or scan the MODE bar code until the desired option is displayed.
- ENT (ENTer) Key -- The ENT key performs the same function as the Return or Enter keys on a standard keyboard. Pressing it lets the wand know that you are done entering information from the keyboard.
- Nose Cone -- To read a bar code, the wand sends out a light beam that is reflected from the white spaces and absorbed by the black lines of the code. The nose cone protects the optical sensor that performs this function. Dirt or scratches on the tip can hinder the wand's ability to read bar codes. Use a soft, dry cloth to periodically clean the exterior of the nose cone.
- Battery Access Cover (on back) -- This cover is used to provide easy access to the wand's battery during battery changes.

Basic Wand Competencies

Scanning Bar Codes

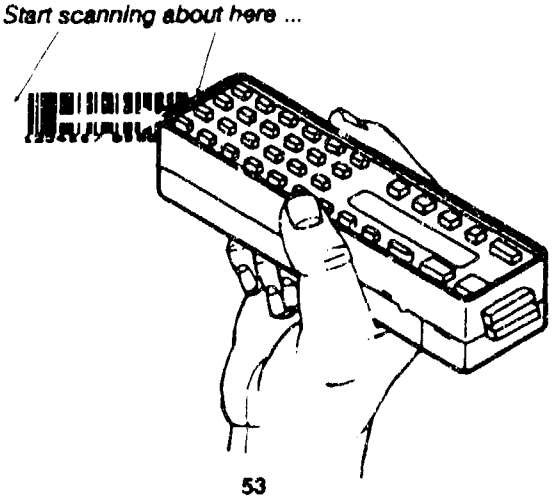
Scanning bar codes is a simple task that takes only a few minutes of practice to master. Later in this workbook you will practice scanning the bar codes. Practice moving the wand faster and slower over the bar code until you find the speed that is comfortable for you. Try scanning from right to left and left to right -- the wand will read bar codes from either direction. *Note: If the display goes blank at any time, simply press the **ON** key again.*

Step #1: Hold the wand, keyboard side up, in the palm of your hand.

Step #2: Turn the wand on by pressing the **ON** key. The wand is now ready to scan bar codes. All scanned bar codes will be saved in the wand's memory until they are transmitted to a computer.

Step #3: Place the nose-cone tip about one-quarter of an inch before the beginning of the bar code. Be sure to hold the wand at an angle of about 45 degrees from the page. The angle is very important! Reading a bar code at angle A or at angle C will give much better results than using angle B.

Step #4: In a smooth, uniform motion, move the nose cone tip of the wand across the bar code. Be sure to move the nose cone tip completely across the bar code and continue to move the tip about one-quarter of an inch past the last black line in the bar code. Don't press too hard with the nose cone tip. Run it lightly over the bar code but make sure it always touches the page. The speed and motion used when scanning with the wand is about the same as if you were drawing a quick line with a sharp pencil. If the bar code is scanned successfully, the wand will beep and the LED will flash green. If the wand does not beep and the LED is not green, scan the bar code again.



Menu Scheme for the Wand

After you complete the Log In Sequence, you will go to the **Main Menu**.

Main Menu

Select this option when you are starting work on a Service Order. When this option is selected to must scan the Service Order number and indicate if you are on regular time or overtime. You wil then be at the **Work Menu**.

Select this option when you are done working for the day.

This option takes you to the **Equipment Menu**. Use the option to charge equipment to each job you complete during the day.

Select this option when you take your lunch break or leave.

Work Menu

Select this option when you take your breaks.

Select this option when you are done working on a Service Order. This option wil return you to the **Main Menu**.

This option takes you to the **Equipment Menu**. Use this option to charge equipment to each job you complete during the day.

Select this option when you take your lunch break or leave.

Equipment Menu

Select this option to charge equipment to each job completed during the day.

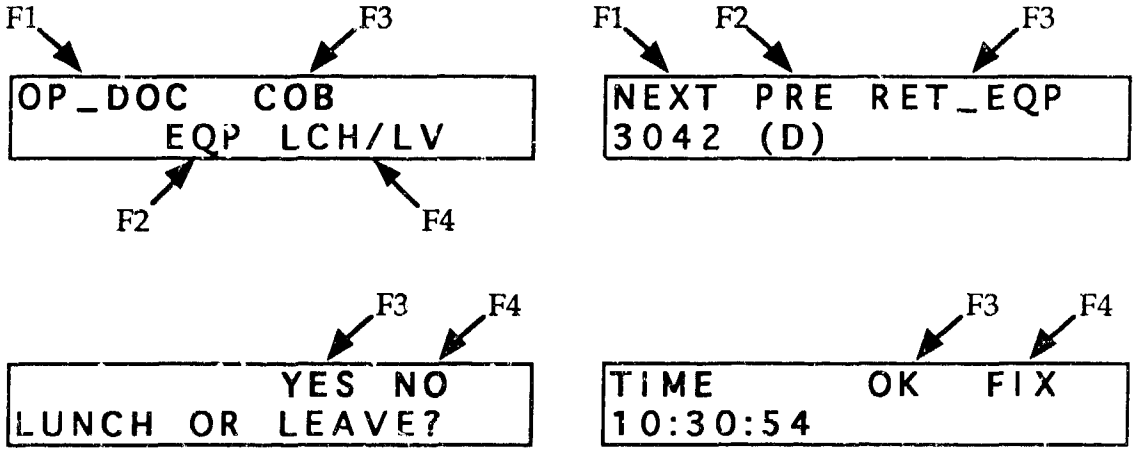
Select this option to see what equipment is stored in the wand's memory.

Select this option if you no longer want your equipment charged to each job.

Using the Function Keys

The Function Keys (F1, F2, F3, F4) are used to quickly input information or respond to questions from the wand. Preprinted bar codes and the Function Keys can generally be used interchangeably. While some bar code choices skip past several steps, it is generally faster to press the Function Keys.

The Function Keys are programmed in a fairly consistent manner. F1 always relates to the command at the top left of the screen and the other Function Keys relate to commands that are directly beneath them Note that the commands can be in either the top or bottom row of the screen. The following examples show how the Function Keys relate to their commands.



Manually Entering Information

Numbers and letters can be entered manually by using the small keyboard on the wand. This is a simple process if the wand is in the correct mode. If you want to type in a truck number such as E243, you will need to switch between alphabetic and numeric modes. The following steps show you how to change from numeric to alphabetic modes.

Step #1: Press a key to determine which mode the wand is currently in. If a number is displayed in the screen, you are in the numeric mode. If a letter is displayed, you are in the alphabetic mode.

Step #2: Switch from the current mode to the other mode by pressing and releasing the wand's **SHIFT** key. Do not hold the **SHIFT** key down!

Step #3: If you type a mistake, you must use the **SPACE** key to erase the unwanted character. The **SHIFT** key toggles the space key into a backspace key, which is used for correcting errors.

Recording L & E Data with the Wand

The wand has been programmed to be very easy to use. Directions are shown in the LCD window and a few scans of bar codes or several key presses are usually all that is needed to record your labor and equipment costs.

You will notice that the wand records the same information that is written on your L & E cards. If you think about what information was needed to complete the L & E cards, you should have no problem learning how to use the wand.

The following set of competencies MUST be reached before you can use the wand on the job. Use the Service Orders at the back of this workbook to complete each of the following practice exercises. Practice each competency by following the steps until you are satisfied that you have mastered the task.

After you have been given enough time to practice using the wand, you will be given a practical exam to assess your level of competence. This exam will involve using the wand as you would on-the-job. Before taking the practical exam, be sure you can do the following things:

- ❑ Remove and replace the battery.
- ❑ Enter the correct date.
- ❑ Enter the correct time.
- ❑ Enter your employee ID.
- ❑ Enter your shop code.
- ❑ Indicate that work has started and ended on a Service Order.
- ❑ Sign-out for breaks, lunch, and leaves.
- ❑ Indicate the Close of Business for the day.
- ❑ Record information for jobs that are not yet on printed Service Orders.
- ❑ Correct mistakes by completing accurate L & E cards by hand.

Work Request Forms

Service Orders for wand users will now be printed with bar codes. A sample Service Order is shown at the end of this manual. The old and new Service Order forms contain the same information but the newer form has bar codes printed on it. You will use these bar codes to enter your actual work time, equipment used during the day, and non-productive time such as breaks, lunch, and leaves.

Note: The sample Service Order will be used when you practice using the wand.

Changing The Battery

Competency: Remove the battery from the wand and re-insert it properly.

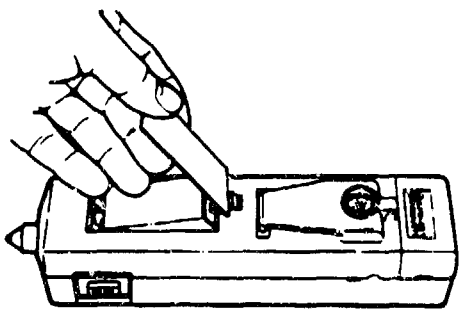
Step #1: Push the tab on the battery access cover toward the nose-cone end of the wand and pull up.

Step #2: Remove the battery from the battery well by using the wedge on the cover to pry out the bottom of the battery.

Step #3: Check to ensure that the positive and negative terminals on the new battery are aligned with the positive (+) and negative (-) symbols shown on the bottom of the battery well.

Step #4: Place the terminal-end of the battery into the well first. Press down until the battery fits snugly in the battery well.

Step #5: Replace the battery access cover.



Login Procedure

Before using the wand, you need to be sure the date and time are correct and then enter your employee identification number and your shop code.

Competency: Be able to login properly by entering date, time, employee ID, and shop code.

Step #1: Press the **ON** key at top of the wand. You should momentarily see this on the screen:

JOB COST
ACCOUNTING

Step #2: If you see the following screen, then the data from the previous user of the wand has been sent to ALEC *but has not been erased (purged) from the wand.* Let your shop foreman know that the data from this wand was not erased, then press **F3** wice to erase the data. A new shift cannot start until the data from a prior shift has been saved and erased.

F3

TRANS	**PURGE**
DATA	**DATA**

Step #3: If you see the following screen, then the data from the previous worker **has not been downloaded to a computer**. You will not be able to use this wand until the data is downloaded. Let your shop foreman know that this wand is not ready to use.

```
                    F3   F4
                   YES  NO
TRANSMIT DATA?
```

Step #4: If the correct date is shown on the screen, press **F3**. If the date is incorrect, press **F4** and the following screen appears. Enter the correct date and press the **ENT** key and then **F3**. For example, January 3, 1993 would be entered as 010393. If you make a mistake, press the **SPACE** key to erase your error.

```
                    F3   F4
DATE >>        OK   FIX
MM/ DD/ YY
```

Step #5: If the time shown on the screen is correct, press **F3**. If the time is incorrect, press **F4** and the following screen appears. Enter the correct time in 24 HR format and press the **ENT** key and then **F3**. For example, 8:05 AM should be entered as 0805 and 2:30 PM should be entered as 1430.

```
                    F3   F4
TIME           OK   FIX
HH:MM:SS
```

Step #6: The wand next asks for your personal identification number. It is easiest to scan your personal identification number. If you type it in be sure to use no hyphens and press the ENT key after it is entered.

```
YOUR_ID >>
_
```

Step #7: Next you scan (or type) in your shop code. If you type in your shop code be sure to press the ENT key after it is entered.

```
SHOP_CODE>>
_
```

Step #8: The login process is now completed. You may now tell the wand to begin charging time and equipment to a Service Order.

Starting Work on a Service Order

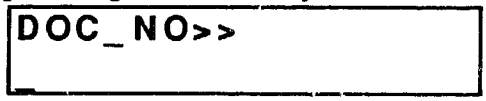
After you have logged in to the wand, you need to let the wand know what Service Order will be worked on.

Competency: ***Be able to properly enter data indicating the start of work on a Service Order.***

Step #1: From this ***Main Menu*** screen, press **F1** to indicate that you are starting work on a Service Order.

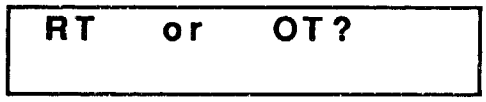
F1

Step #2: Scan the **Document ID** number bar code shown on the Service Order or enter it manually by using the keypad and then pressing the **ENT** key.



Step #3: Indicate if you are working on regular time (press **F1** or scan the **Regular Work** bar code) or overtime (press **F3** or scan the **Overtime Work** bar code).

F1 **F3**



Step #4: The following ***Work Menu*** appears and you can now begin work on the Service Order.

Charging Equipment to a Service Order

Equipment can be checked in and out at any time. You can check out equipment before starting a job, during a job, or even during breaks and lunch-leave periods. Note that you are limited to charging only five pieces of equipment during a shift.

Competency: ***Be able to accurately enter data regarding the issue of equipment.***

Step #1: Press F2 when any of these screens are showing to charge equipment to a Service Order.

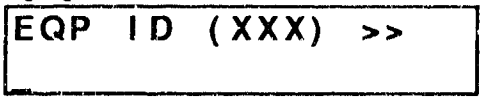
Step #2: You are now in the ***Equipment Menu*** portion of the wand program. Pressing **F1** will allow you to issue equipment to a Service Order.

F1

Step #3: From this screen, press **F1** to charge equipment to all jobs during the day or press **F3** to charge equipment only to the job you are currently working on.

F1 **F3**

Step #4: Depending on your response in Step #3, either **DAY** or **JOB** will appear in place of the XXX on the screen. Scan the equipment code or enter it manually and press the **ENT** key.



Listing Equipment Used on a Service Order

Competency: ***Be able to accurately list the equipment currently being used.***

Step #1: To see a listing of the equipment you have issued for the day or the job, either press **F3** from the ***Equipment Menu*** or press **F4** from the ***Equipment Return Menu.***

F3

```
ISSUE     LIST
     RET_EQP
```

F4

```
EQP ID>>       LIST
```

Step #2: When this screen appears, YYYY is the first item in the list of checked out equipment and X indicates if it was checked out for the job (J) or the day (D). Press **F1** to scroll to the next item in the list or press **F2** to scroll to the previous item in the list. When you reach the end of the list the next item shown will be the first item on the list. Press **F3** to display the menu for returning equipment and proceed to Step #3 above.

F1 **F2** **F3**

```
NEXT  PRE  RET_EQP
YYYY (X)
```

Accounting for Breaks

Competency: ***Be able to account for breaks that interrupt work on a Service Order.***

Step #1: From this menu screen, press **F1** or scan the **Break** bar code to indicate that a break has started.

F1

```
BREAK     CL_JOB
      EQP LCH/LV
```

Step #2: After a break has started, the following menu appears. Press **F1** or scan the **Time In** bar code to end the break and return you to the ***Work Menu.***

F1

```
END_BREAK
      EQP LCH/LV
```

Accounting for Lunch and Leaves

Competency: ***Be able to account for lunch and leave breaks that interrupt work on a Service Order.***

Step #1: From this menu screen, press **F4** or scan the **Lunch/Leave** bar code to indicate that a Lunch or Leave break has started.

F4

```
BREAK     CL_JOB
       EQP  LCH/ LV
```

Step #2: The wand always requests confirmation of the Lunch or Leave selection. Press **F3** or scan the **Yes** bar code to confirm that you are beginning your lunch break.

F3

```
              YES  NO
LUNCH  OR  LEAVE?
```

Step #3: After confirming that a Lunch or Leave break has started, the following menu appears. Press **F1** or scan the **Time In** bar code to end the Lunch or Leave break and return you to the *Main Work Menu*.

F1

```
END_LCH/ LV
    EQUIP
```

Step #4: Again the wand will ask you confirm your choice. Press **F3** or scan the **Yes** bar code to confirm that your lunch break is done.

F3

```
              YES  NO
LCH/ LV  OVER?
```

Stopping Work on a Job

Competency: ***Be able to indicate that the work on a job is stopping because the Service Order is being returned to the shop, you are waiting for supplies, the client is not home, or the work is complete.***

Step #1: Press **F3** or scan the **Close Job** bar code to indicate that you are done working on the Service Order you previously started.

F3

```
BREAK    CL_JOB
      EQP  LCH/ LV
```

Step #2: When the Close Job (**CL_JOB**) option has been selected, you must designate the current status of the Service Order. Your choices are that the job is Complete (**CMP**), the Service Order is incomplete and is being returned to the Shop (**SHP**), you are waiting for parts or supplies (**SUP**), the client is not home (**NH**). Press one of the function keys or scan the appropriate bar code to indicate your choice.

```
  F1    F2    F3    F4
 CMP  SHP  SUP  NH
JOB STATUS>>
```

Step #3: The wand will now prompt for the task code, the task units, and then an optional component code. You can scan or type the task code as indicated on the Service Order.

```
TASK CODE>>
```

Step #4: Enter the number of task units completed.

```
TASK UNITS>>
```

Step #5: Enter a Component Code value between 01 and 09 (both digits are required) and then press the **ENT** key. You can press just the **ENT** key to omit the component code.

```
COMP_CODE>>
```

Step #6: The wand program will return to the *Main Menu*.

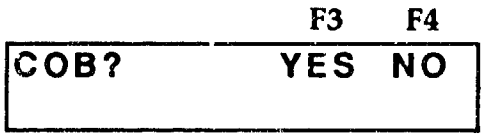
```
OP_DOC   COB
      EQP  LCH/ LV
```

Quitting for the Day

Competency: Be able to logoff from the wand when you are quitting for the day.

Step #1: To indicate that you are done working for the day, press **F3** or scan the **COB** bar code to declare the **close of business** or the end of the shift.

Step #2: When the *Close of Business* choice has been selected, the wand requests confirmation of that choice. If you are not done for the day, indicate **NO** by pressing the **F4** key, the **MODE** key, or scanning the **NO** bar code. If you are done for the day, press the **F3** key or scan the **YES** bar code. The screen will then go blank and the wand will enter its "sleep mode."



Dealing with Problems

The main reasons for using the wand are its simplicity, its accuracy, and the ease with which the records can be entered in the IFS-M computer. However, it is expected that you will have some problems using the wand at first. For example, someone might forget to charge the battery during the night which could leave you at a job site with a wand that does not work. It is also possible that you will forget to use the wand to indicate that you are done with one job and are starting another. If these things happen, you will need to complete an L & E card by hand as you have done in the past. In these cases, your foreman will need download your wand data and then enter the L & E card data into the computer by hand. Your foreman will certainly appreciate having your records on the wand rather than on paper because the data can be entered into the computer much faster and more accurately.

Menu Definitions

Menu Terms	Definition
BREAK	A required work break is beginning.
CL_JOB	Work is ending on a job. (Close Job)
CMP	The job is complete. (Complete)
COB	You are done working for the day. (Close of Business)
DOC_NO>>	Identification number for a Service Order.
END_BREAK	A required break is over.
END_LCH/ LV	Lunch or Leave is over.
EQP	Go to the Equipment menu. (Equipment)
ISSUE	Equipment is being checked out for a job or the day.
LCH/ LV	A lunch break or a leave of absence is going to start.
LIST	Lists the equipment information stored in the wand.
NH	The job must be interrupted because the client is not home.
OP_DOC	Work is starting on a new job. (Open Document)
OT	Work is done at overtime rate.
PURGE DATA	Asks if the data should be erased from the wand.
RET_EQP	Equipment used for the day or a job is being returned.
RT	Work is done at regular rate.
SHP	The job is incomplete and is being returned to the shop.
SUP	The job must be interrupted because supplies or material are not available.
TRANS DATA	Asks if the data should be sent to the computer.

****

Labor and Equipment Work Request
Creation Date: 08/18/93 16:14:57 Shop: 00

****

Inst: LEE Short Desc: INTERIOR PIPE WORK Task: 03IP

---------- Job Identification ----------

Document ID: 51315PA 327923R Phase: Facility: 02609

Date Requested: / / Priority: 2 Component Code: 08

---------- Job Location ----------

Part: FH_QTR: RPF_EQP: RPF_USE:
Location: 2609
POC Name: NESTER POC Phone: 52314

---------- Job Description ----------

Description: WATER COMING UP THRU FLOOR IN FOYER AT FRONT DOOR. UNKNOWN ORIGIN.
Remark:

---------- Work Status ---------- ---------- Labor Code ----------

Break Lunch Regular Work Overtime Work

Time In COB

---------- Job Status ---------- ---------- Misc ----------

Close Job Complete SHP Yes No

Supply Not Home Mode

****

****

Labor and Equipment Work Request
Creation Date: 08/18/93 14:48:20 Shop: 010

****

Inst: LEE Short Desc: DOOR OFF TRACK Task: 01PM

---------- Job Identification ----------

Document ID: 51315QT 330903R Phase: Facility: 00053

Date Requested: / / Priority: 3 Component Code: 09

---------- Job Location ----------

Part: FH_QTR: RPF_EQP: RPF_USE:
Location: 53-A ST LO ROAD
POC Name: SCHELLY POC Phone: N/A

---------- Job Description ----------

Description: DOOR OFF TRACK UPSTAIRS BEDROOM CLOSET

Remark:

---------- Work Status ---------- ---------- Labor Code ----------

Break Lunch Regular Work Overtime Work

Time In COB

---------- Job Status ---------- ---------- Misc ----------

Close Job Complete SHP Yes No

Supply Not Home Mode

****

****

Labor and Equipment Work Request
Creation Date: 08/18/93 16:15:20 Shop: 003

****

Inst: LEE Short Desc: INTERIOR PIPE WORK Task: 03IP

---------- Job Identification ----------

Document ID: 51315PA 327753R Phase: Facility: 05000

Date Requested: / / Priority: 2 Component Code: 08

---------- Job Location ----------

Part: FH_QTR: RPF_EQP: RPF_USE:
Location: 5000
POC Name: CLEMONS POC Phone: 44389

---------- Job Description ----------

Description: CEILING PIPE LEAKING ROOM 249

Remark:

---------- Work Status ---------- ---------- Labor Code ----------

Break Lunch Regular Work Overtime Work

Time In COB

---------- Job Status ---------- ---------- Misc ----------

Close Job Complete SHP Yes No

Supply Not Home Mode

****

Ft. Lee Equipment List

E3	Air Compressor	
E58	Backhoe	
E157	Scavenger Sweeper	
E78	Sewer Cleaner	
E238	Utility Truck	
E239	Utility Truck	
E240	Utility Truck	
E241	Utility Truck	
E242	Utility Truck	

Appendix D: Scenario-Based Training Workbook

US Army Corps
of Engineers
Construction Engineering
Research Laboratory

Bar Code Training Handbook

Automated Labor and Equipment Card

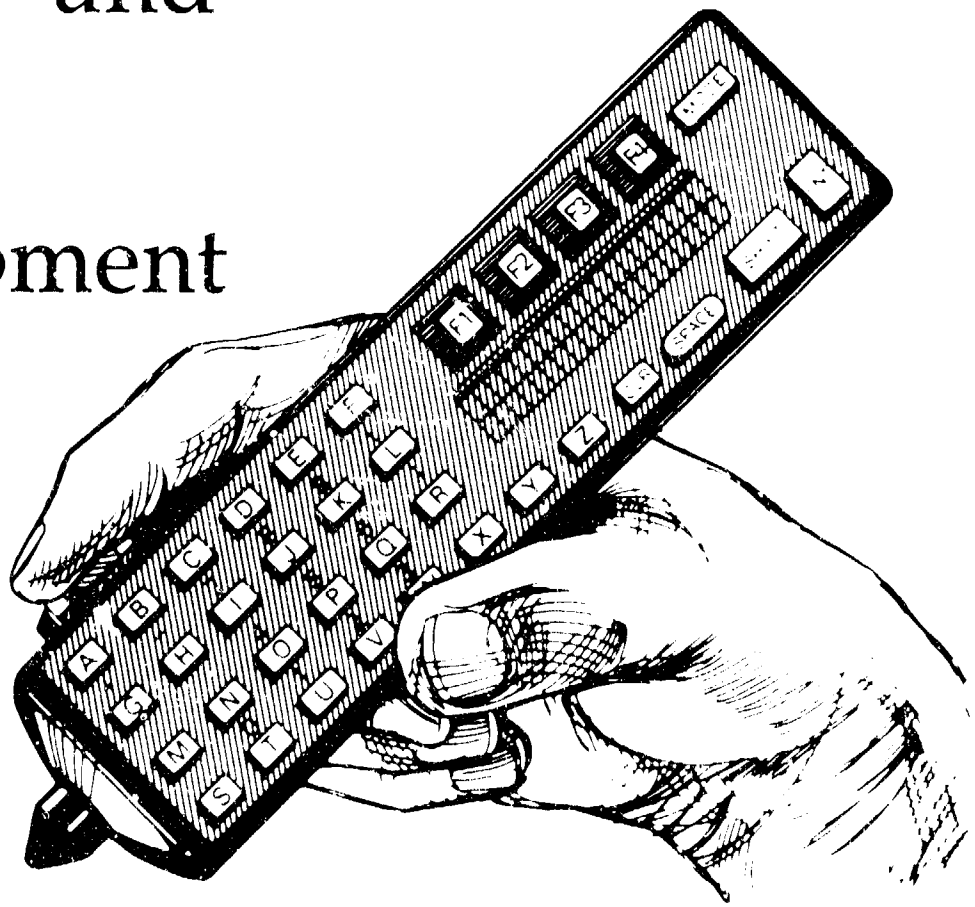


Table of Contents

Introduction

Bar coding is rapidly replacing other methods of data entry. This is partly due to the fact that bar coding technology has an accuracy rate of only 1 error in every 3-5 million scans. Scanning bar codes is also faster and easier than typing entries on a computer keyboard or hand recording them on paper. Present day uses for bar code scanning include package tracking, inventory control, self-checkout at grocery stores, security systems, and games and toys.

Micro-Wand IIIe™, manufactured by HANDHELD PRODUCTS, INC.™, is a bar coding device that combines state-of-the-art technology and rugged durability in a small one-piece unit. This wand is engineered to keep on working -- even when dropped from a height of seven feet onto concrete.

Your wand has been programmed to automate the entry of information on Labor and Equipment cards. You will use the wand to:

1. Log in at the beginning of your shift.
2. Keep track of your time on Service Orders.
3. Keep track of breaks, lunch, and leave periods.
4. Keep track of the equipment you use on a job.
5. Log out at the end of your shift.

The wand is currently programmed to record work on Service Orders. If you are working on a Standing Operations Order (SOO) or an Individual Job Order (IJO) you will need to record your time and equipment for those jobs on the paper L & E cards. In the future, it is expected that the wand program will be capable of keeping track of all DEH labor and equipment costs.

Micro Wand IIIe Specifications™

Size & Weight

- 7.2 x 1.75 x 1.25 inches
- 8 ounces

Power

- Uses one 9-volt Ni-Cad, lithium, or Alkaline battery
- Low-battery detection and automatic shut-off.
- Capacitor back-up for memory and real-time clock. Up to 1 hour of security is provided by the capacitor.

Environmental

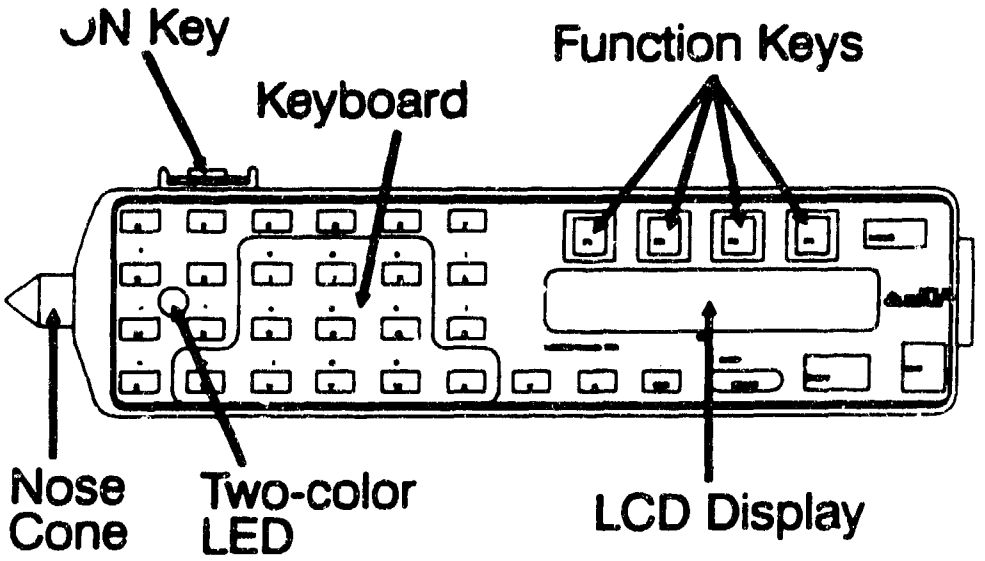
- 32° to 113° F (recommended operating temperature range)
- -4° to 158° F (storage temperature range)
- Operates in up to 85% non-condensing humidity

Case Specifications

- ABS plastic, UV stabilized case material
- Withstands 7 foot drop to painted concrete

Fire Retardant Rating

- UL 94-V0



Micro Wand IIIe Components™

- ON Key -- The ON key is located on top of the wand. To conserve power, the wand goes into a "sleep mode" when it has not been used for 30 seconds. The ON key is used to "wake up" the wand from its "sleep mode."
- Light Emitting Diode (LED) -- The LED provides a visible light that indicates that the bar code has been properly scanned.
- Alpha/Numeric Keyboard -- The keyboard consists of 35 rubber keys which allow key entry even when wearing gloves. The light-gray color marks on the keyboard show the numeric keys. These keys can be activated by pressing the SHIFT key.
- Liquid Crystal Display (LCD) Window -- The LCD display consists of two rows of characters that provide instructions for scanning and for displaying manually input information.
- CLR (CLeaR) Key -- The CLR key is used to erase letters that have been manually input.
- Function Keys (F1, F2, F3, F4) -- The Function keys are used to quickly input information or respond to questions shown on the LCD display.
- SPACE/BKSP Key -- When the wand is in the alphabetic mode, the Space key is like the spacebar on a standard keyboard; it moves the underlining cursor forward one character position. When the wand is in the numeric mode, the BKSP key is like the Backspace key on a standard keyboard; it deletes characters as it moves the cursor backward.
- SHIFT Key -- The SHIFT key is used to switch from alphabetic mode to numeric mode and vice-versa. Therefore, when typing in alphabetic characters, simply press the SHIFT key to begin entering numbers.
- MODE Key -- The MODE key has been programmed to exit from a menu, cancel a menu choice, or exit from a data entry request without making an entry. If the wand screen is not displaying the options you wish, press the MODE key or scan the MODE bar code until the desired option is displayed.
- ENT (ENTer) Key -- The ENT key performs the same function as the Return or Enter keys on a standard keyboard. Pressing it lets the wand know that you are done entering information from the keyboard.
- Nose Cone -- To read a bar code, the wand sends out a light beam that is reflected from the white spaces and absorbed by the black lines of the code. The nose cone protects the optical sensor that performs this function. Dirt or scratches on the tip can hinder the wand's ability to read bar codes. Use a soft, dry cloth to periodically clean the exterior of the nose cone.
- Battery Access Cover (on back) -- This cover is used to provide easy access to the wand's battery during battery changes.

Basic Wand Competencies

Scanning Bar Codes

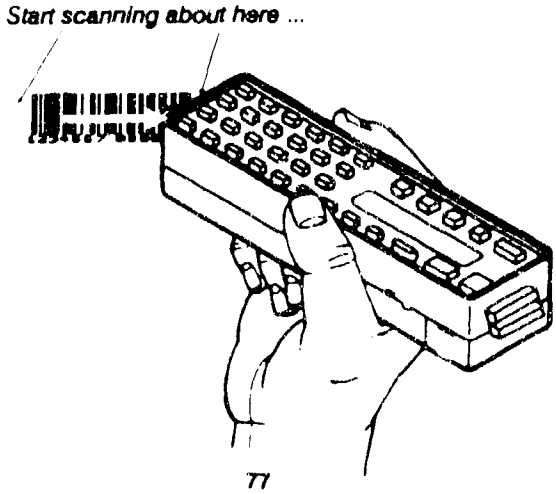
Scanning bar codes is a simple task that takes only a few minutes of practice to master. Later in this workbook you will practice scanning the bar codes. Practice moving the wand faster and slower over the bar code until you find the speed that is comfortable for you. Try scanning from right to left and left to right -- the wand will read bar codes from either direction. *Note: If the display goes blank at any time, simply press the **ON** key again.*

Step #1: Hold the wand, keyboard side up, in the palm of your hand.

Step #2: Turn the wand on by pressing the **ON** key. The wand is now ready to scan bar codes. All scanned bar codes will be saved in the wand's memory until they are transmitted to a computer.

Step #3: Place the nose-cone tip about one-quarter of an inch before the beginning of the bar code. Be sure to hold the wand at an angle of about 45 degrees from the page. The angle is very important! Reading a bar code at angle A or at angle C will give much better results than using angle B.

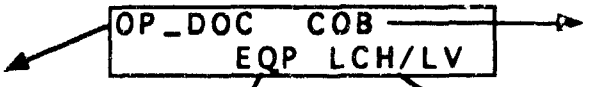
Step #4: In a smooth, uniform motion, move the nose cone tip of the wand across the bar code. Be sure to move the nose cone tip completely across the bar code and continue to move the tip about one-quarter of an inch past the last black line in the bar code. Don't press too hard with the nose cone tip. Run it lightly over the bar code but make sure it always touches the page. The speed and motion used when scanning with the wand is about the same as if you were drawing a quick line with a sharp pencil. If the bar code is scanned successfully, the wand will beep and the LED will flash green. If the wand does not beep and the LED is not green, scan the bar code again.



Menu Scheme for the Wand

After you complete the Log In Sequence, you will go to the **Main Menu**.

Main Menu



Select this option when you are starting work on a Service Order. When this option is selected to must scan the Service Order number and indicate if you are on regular time or overtime. You wil ther be at the **Work Menu**.

Select this option when you are done working for the day.

This option takes you to the **Equipment Menu**. Use the option to charge equipment to each job you complete during the day.

Select this option when you take your lunch break or leave.

Work Menu

Select this option when you take your breaks.

Select this option when you are done working on a Service Order. This option wil return you to the **Main Menu**.

This option takes you to the **Equipment Menu**. Use this option to charge equipment to each job you complete during the day.

Select this option when you take your lunch break or leave.

Equipment Menu

Select this option to charge equipment to each job completed during the day.

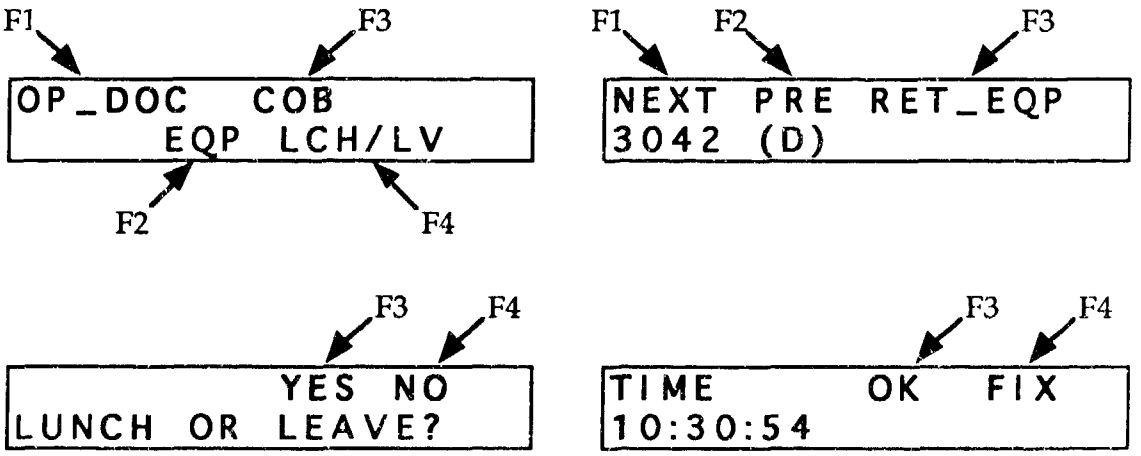
Select this option to see what equipment is stored in the wand's memory.

Select this option if you no longer want your equipment charged to each job.

Using the Function Keys

The Function Keys (F1, F2, F3, F4) are used to quickly input information or respond to questions from the wand. Preprinted bar codes and the Function Keys can generally be used interchangeably. While some bar code choices skip past several steps, it is generally faster to press the Function Keys.

The Function Keys are programmed in a fairly consistent manner. F1 always relates to the command at the top left of the screen and the other Function Keys relate to commands that are directly beneath them Note that the commands can be in either the top or bottom row of the screen. The following examples show how the Function Keys relate to their commands.



Manually Entering Information

Numbers and letters can be entered manually by using the small keyboard on the wand. This is a simple process if the wand is in the correct mode. If you want to type in a truck number such as E243, you will need to switch between alphabetic and numeric modes. The following steps show you how to change from numeric to alphabetic modes.

Step #1: Press a key to determine which mode the wand is currently in. If a number is displayed in the screen, you are in the numeric mode. If a letter is displayed, you are in the alphabetic mode.

Step #2: Switch from the current mode to the other mode by pressing and releasing the wand's **SHIFT** key. Do not hold the **SHIFT** key down!

Step #3: If you type a mistake, you must use the **SPACE** key to erase the unwanted character. The **SHIFT** key toggles the space key into a backspace key, which is used for correcting errors.

Recording L & E Data with the Wand

The wand has been programmed to be very easy to use. Directions are shown in the LCD window and a few scans of bar codes or several key presses are usually all that is needed to record your labor and equipment costs.

You will notice that the wand records the same information that is written on your L & E cards. If you think about what information was needed to complete the L & E cards, you should have no problem learning how to use the wand.

Work Request Forms

Service Orders for wand users will now be printed with bar codes. Sample Service Orders are shown at the end of this manual. The old and new Service Order forms contain the same information but the newer form has bar codes printed on it. You will use these bar codes to enter your actual work time, equipment used during the day, and non-productive time such as breaks, lunch, and leaves.

The remainder of this workbook will walk you through a set of situations or "scenarios" that will help you learn how to use the wand effectively. Work through each scenario several times until you feel comfortable with your ability to use the wand. After you have had enough time to become skilled in the use of the wand, you will be given a practical examination which will determine if you are ready to use the wand on the job.

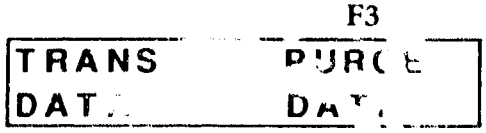
The exam simulates 2 full days of work activity. You will be asked to correct the time and date on the wand, log in properly, start and stop work on Service Orders, charge your truck jobs, and record breaks, lunch, and leaves. Be sure you can do all of these things before attempting to take the exam!

IMPORTANT!!!

The wand stores the information that you enter. Normally, when you are done for the day you will give the wand to someone who will transfer your information to a computer. They will also clear the wand's memory so it is ready for the next user. In order to complete the following practice exercises you need to be able to clear the wand's memory. **You should only do the following steps when you are practicing.** If you clear the memory when you have real information stored in the wand, you will have to manually fill in an L & E card for the day.

Note #1: If you see the following screen, then the data in the wand **has not been sent to a computer.** You will not be able to use this wand until the data is downloaded. Let your shop foreman know that this wand is not ready to use. *If you see this screen during the practice exercises you should press F3, the press the ENT key and press F3 again to clear the memory.*

Note #2: If you see the following screen, then the data in the wand **has been sent to ALEC but has not been erased (purged) from the wand.** Normally you should let your shop foreman know that the data from this wand was not erased, then press F3 twice to erase the data. A new shift cannot start until the data from a prior shift has been saved and erased. *If you see this screen during the practice exercises you should press F3 twice to clear the memory.*



Scenario 1: Bad Battery

You arrive at work in the morning and pick up a wand. When you try to turn it on you notice that nothing shows up on the screen. When this happens you probably have a dead battery. **Remove and replace the battery in your wand now.**

To change the battery follow these steps:

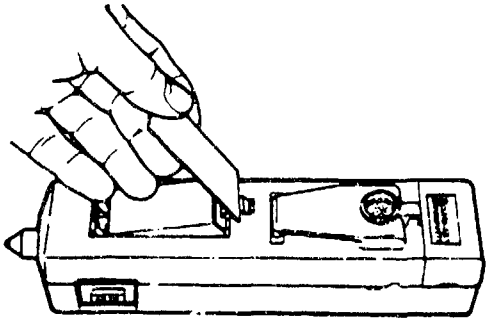
Step #1: Push the tab on the battery access cover toward the nose-cone end of the wand and pull up.

Step #2: Remove the battery from the battery well by using the wedge on the cover to pry out the bottom of the battery.

Step #3: Check to ensure that the positive and negative terminals on the new battery are aligned with the positive (+) and negative (-) symbols shown on the bottom of the battery well.

Step #4: Place the terminal-end of the battery into the well first. Press down until the battery fits snugly in the battery well.

Step #5: Replace the battery access cover.



Scenario 2: Logging in and Out

In this scenario, you will prepare the wand for the day and then close it out for the day.

- ❑ You arrive at work and pick up a wand.
- ❑ Turn on the wand. (Press the **ON** key at top of the wand.)
- ❑ Assume that the date is correct. (Press **F3.**)
- ❑ Assume the time is correct. (Press **F3.**)
- ❑ The wand next asks for your ID number. Use the keyboard to enter your ID number and then press the **ENT** key. If you have your ID already bar coded, you can scan it instead of typing it.
- ❑ You now need to scan (or type) in your shop code. If you type in your shop code be sure to press the **ENT** key after it is entered.
- ❑ You are now logged in and ready to begin work.
- ❑ Assume that your day is now over and you are ready to go home. To indicate that you are done working for the day, press **F3** or scan the close of business **(COB)** bar code on the Service Order at the end of this manual to declare the close of business or the end of the shift.
- ❑ When the *Close of Business* choice has been selected, the wand requests confirmation of that choice. Since you are done for the day, press the **F3** key or scan the **YES** bar code. The screen will then go blank and the wand will enter its "sleep mode."

Scenario 3: Changing the Date and Time

The date and time will usually be set correctly unless something happens such as the battery failing or entering daylight savings time. In these cases, you may have to set the correct date and time. This scenario will walk you through that process.

- ❑ You pick up your wand when you arrive at work.
- ❑ Turn on the wand. (Press the **ON** key.)
- ❑ Change the date to July 10, 1993. (Press **F4** then use the keypad to enter 071093 and then press the **ENT** key. If you make a mistake, press the **SPACE** key to erase your error.) Press **F3** if your changes are correct.
- ❑ Change the time to 8:05 in the morning. (Press **F4** then use the keypad to enter 0805.) Press **F3** if your changes are correct.
- ❑ Enter your own employee ID #.
- ❑ Your shop code for today is #15.
- ❑ You are now done for the day so close out the wand. (Press **F3** or scan the **COB** bar code to declare the ***close of business*** or the end of the shift and then press the **F3** key or scan the **YES** bar code. The screen will then go blank and the wand will enter its "sleep mode.")

Scenario 4: Starting and Stopping Work on a Service Order

After you log in to the wand, you need to let the wand know what Service Order you will work on and when you are finished with it.

- ❑ Pick up a wand and log in using the following information:
  - The date is March 21, 1993
  - The time is 8:30 AM
  - Your employee ID # is 987654321.
  - Your shop for today is #10.
- ❑ After logging in, you will be at the ***Main Menu*** screen. Press **F1** to indicate that you are starting work on a Service Order.
- ❑ Scan the **Document ID** bar code shown on the Service Order at the end of this manual and then press the **ENT** key.
- ❑ Indicate that you are working on regular time (Scan the **Regular Work** bar code or press **F1**).
- ❑ You are now done working on that Service Order so scan the **Stop Work** bar code or press **F3**.
- ❑ Indicate that the job is complete. (Scan the **Complete** bar code or press **F3**.)
  Note: When the Close Job (**CL_JOB**) option has been selected, you must designate the current status of the Service Order. Your choices are that the job is Complete (**CMP**), the Service Order is incomplete and is being returned to the Shop (**SHP**), you are waiting for parts or supplies (**SUP**), or the client is not home (**NH**).
- ❑ Scan the Task Code shown on the Service Order you just completed.
- ❑ Type the number 2 to indicate that you completed two task units.
- ❑ Scan the Component Code shown on the Service Order you just completed.
  Note: If you type in the Component Code you must enter two digits. For example, Component Code 1 must be entered as 01. Remember to press the ENT key after typing in the number. You can press just the ENT key to omit the Component Code.
- ❑ You now return to the ***Main Menu***.

Scenario 5: Taking a Break

When logged in to the wand, you will need to indicate when you start and stop your break.

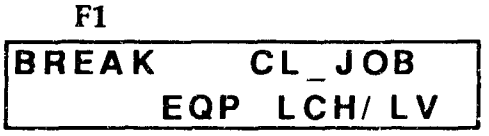
- ❑ From the ***Main Menu,*** indicate that you are starting work on a Service Order at the Overtime rate. (Press **F1**. Scan the Document ID. Scan **Overtime Work** bar code or press **F3**.)
- ❑ Scan the **Break** bar code or press **F1** to indicate that a break has started.
- ❑ You are now on break.
- ❑ Your break is now over. (Scan the **Time In** bar code or press **F1** to indicate the your break is over.)
- ❑ You now return to the ***Work Menu.***

F1

Scenario 6: Taking a Lunch or Leave Break

Lunch and leaves are recorded the same as breaks. Accurate lunch and leave records are important because your time on lunch and leave breaks is not charged to the customer.

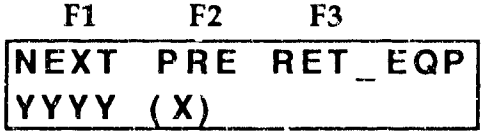
- ❑ From the ***Work Menu*** screen, scan the **Lunch** bar code or press **F4** to indicate that a Lunch or Leave break has started.
- ❑ The wand always requests confirmation of the Lunch or Leave selection. Scan the **Yes** bar code or press **F3** to confirm that you are beginning your lunch break.
- ❑ You are now on a lunch or leave break.
- ❑ Scan the **Time In** bar code or press **F1** to end the Lunch or Leave break and return you to the ***Work Menu***.
- ❑ Again the wand will ask you to confirm your choice. Scan the **Yes** bar code or press **F3** to confirm that your lunch break is done.
- ❑ Scan the **Time In** bar code again or press **F1**.
- ❑ You now return to the ***Work Menu***.



Scenario 7: Charging Equipment to a Service Order and Listing It

Equipment can be checked in and out at any time. You can check out equipment before starting a job, during a job, or even during breaks and lunch-leave periods. Note that you are can charge only five pieces of equipment during a shift. You can also see a listing of the equipment you have checked out.

- ❑ From the ***Work Menu*** screen, press **F2** to indicate that you are going to check out equipment. You are now in the ***Equipment*** portion of the wand program.
- ❑ You need to check out a truck for the day. (Press **F1** to issue equipment to a Service Order.)
- ❑ Press **F1** to charge the truck to all jobs during the day.
- ❑ Scan the truck bar code or enter it manually and press the **ENT** key. (Use the equipment bar codes at the end of this manual.)
- ❑ To see a listing of the equipment you have issued for the day or the job, press **F3** from the ***Equipment Menu***.
- ❑ When the following screen appears, YYYY is the first item in the list of checked out equipment and X indicates if it was checked out for the job (J) or the day (D). Press **F1** to scroll to the next item in the list or press **F2** to scroll to the previous item in the list. When you reach the end of the list the next item shown will be the first item on the list.



- ❑ Press the **Mode** key twice to return to the ***Work Menu***.

Scenario 8: Returning Equipment Used on a Service Order

When you close a job, all equipment charged to that job is automatically returned. However, if you are done using a piece of equipment for a job that is still being worked on, you should indicate that it has been returned. That way the customer will be charged only for the time the equipment was actually used on the job.

- ❑ Check out a Scavenger Sweeper for the job. (Use the equipment bar codes at the end of this manual. See Scenario 7 above if you have trouble.)
- ❑ Press **F2** to indicate that equipment has been returned.
- ❑ Next enter or scan the code for the equipment item to be returned. If you forget what equipment is issued, press **F4** to see a list of the equipment you have checked out. You will see the equipment item's code on the screen and either a **D** (for the full day) or a **J** (for the job). Press **F3** when the correct equipment item is shown on the screen to indicate that the equipment has been returned.
- ❑ Scan the **Yes** bar code or press **F3** to confirm that the item has been returned. Scan the **No** bar code or press **F4** to cancel the return.

Before beginning the next scenario, you must close out the current job and erase the wand's memory so it is ready for a full day of work. To prepare the wand, complete the following steps:

1. Press **F3** to **Close the Job**.
2. Press **F1** to show the job is complete.
3. Scan the **Task Code**.
4. Enter 1 **Task Unit**.
5. Scan the **Component** Code.
6. Press **F3** to indicate **Close of Business** for the day.
7. Press **F3** to confirm that your day is over.
8. Follow the steps to erase the memory.

Scenario 9: A Complete Day!

You have now completed most of the steps involved in using the bar code reader. The following two scenarios will take you through two short days of work. If you have trouble with any of the steps in the following scenarios, go back and review the previous scenarios. Note that the complete day scenarios are similar to the practical exam you must pass before you can use the wand on the job!

1. You arrive at work in the morning and pick up a wand.
2. Use the following information to complete the log in procedures:
   - The date is September 13, 1993
   - The time is 8:00 AM
   - Enter your own employee ID #
   - Your shop code is #9
4. Check out a Utility Truck for the day. (Use the equipment codes at the end of this manual.)
5. Locate Service Order ID# 51315PA 327923R and begin work on that job at regular time.
6 Check out an Air Compressor (E3) for this job.
7. Take your lunch in the middle of this job.
8. Your lunch is now over.
9. This job is now complete. You completed 1 Task Unit.
10. Your shift is over. It is time to go home.

Scenario 10: Another Complete Day!

1. You arrive at work and pick up a wand.
2. Use the following information to complete the log in procedures:
   - The date is July 3, 1993
   - The time is 8:20 AM
   - Enter your own employee ID #
   - Your shop code is #7
3. Check out a Utility Truck for the day.
4. Locate Service Order ID# 51315QT 333753R and begin work on that job at regular time. You need a Backhoe (E58) to complete this job.
5. Take your morning break.
6. You have now completed that Service Order which involved 2 Task Units.
7. Take your lunch break.
8. Locate Service Order ID# 51315QT 330903R and begin work on that Service Order at regular time.
9. Take your afternoon break in the middle of this job.
10. You completed 2 Task Units but cannot do any more work on this job because you are waiting for supplies.
11. Your shift is over. It is time to go home.

Dealing with Problems

The main reasons for using the wand are its simplicity, its accuracy, and the ease with which the records can be entered in the IFS-M computer. However, it is expected that you will have some problems using the wand at first. For example, someone might forget to charge the battery during the night which could leave you at a job site with a wand that does not work. It is also possible that you will forget to use the wand to indicate that you are done with one job and are starting another. If these things happen, you will need to complete an L & E card by hand as you have done in the past. In these cases, your foreman will need download your wand data and then enter the L & E card data into the computer by hand. Your foreman will certainly appreciate having your records on the wand rather than on paper because the data can be entered into the computer much faster and more accurately.

Menu Definitions

Menu Terms	Definition
BREAK	A required work break is beginning.
CL_JOB	Work is ending on a job. (Close Job)
CMP	The job is complete. (Complete)
COB	You are done working for the day. (Close of Business)
DOC_NO>>	Identification number for a Service Order.
END_BREAK	A required break is over.
END_LCH/ LV	Lunch or Leave is over.
EQP	Go to the Equipment menu. (Equipment)
ISSUE	Equipment is being checked out for a job or the day.
LCH/ LV	A lunch break or a leave of absence is going to start.
LIST	Lists the equipment information stored in the wand.
NH	The job must be interrupted because the client is not home.
OP_DOC	Work is starting on a new job. (Open Document)
OT	Work is done at overtime rate.
PURGE DATA	Asks if the data should be erased from the wand.
RET_EQP	Equipment used for the day or a job is being returned.
RT	Work is done at regular rate.
SHP	The job is incomplete and is being returned to the shop.
SUP	The job must be interrupted because supplies or material are not available.
TRANS DATA	Asks if the data should be sent to the computer.

****

Labor and Equipment Work Request
Creation Date: 08/18/93 16:14:57 Shop: 003

****

Inst: LEE Short Desc: INTERIOR PIPE WORK Task: 03IP

---------- Job Identification ----------

Document ID: 51315PA 327923R Phase: Facility: 02609

Date Requested: / / Priority: 2 Component Code: 08

---------- Job Location ----------

Part: FH_QTR: RPF_EQP: RPF_USE:
Location: 2609
POC Name: NESTER POC Phone: 52314

---------- Job Description ----------

Description: WATER COMING UP THRU FLOOR IN FOYER AT FRONT DOOR. UNKNOWN ORIGIN.
Remark:

---------- Work Status ---------- ---------- Labor Code ----------

Break Lunch Regular Work Overtime Work

Time In COB

---------- Job Status ---------- ---------- Misc ----------

Close Jor Complete SHP Yes No

Supply Not Home Mode

****

****

Labor and Equipment Work Request
Creation Date: 08/18/93 14:48:20 Shop: 0

****

Inst: LEE Short Desc: DOOR OFF TRACK Task: 01PM

---------- Job Identification ----------

Document ID: 51315QT 330903R Phase: Facility: 00053

Date Requested: / / Priority: 3 Component Code: 09

---------- Job Location ----------

Part: FH_QTR: RPF_EQP: RPF_USE:
Location: 53-A ST LO ROAD
POC Name: SCHELLY POC Phone: N/A

---------- Job Description ----------

Description: DOOR OFF TRACK UPSTAIRS BEDROOM CLOSET

Remark:

---------- Work Status ---------- ---------- Labor Code ----------

Break Lunch Regular Work Overtime Work

Time In COB

---------- Job Status ---------- ---------- Misc ----------

Close Job Complete SHP Yes No

Supply Not Home Mode

****

****

Labor and Equipment Work Request
Creation Date: 08/18/93 16:15:20 Shop: 003

****

Inst: LEE Short Desc: INTERIOR PIPE WORK Task: 03IP

---------- Job Identification ----------

Document ID: 51315PA 327753R Phase: Facility: 05000

Date Requested: / / Priority: 2 Component Code: 08

---------- Job Location ----------

Part: FH_QTR: RPF_EQP: RPF_USE:
Location: 5000
POC Name: CLEMONS POC Phone: 44389

---------- Job Description ----------

Description: CEILING PIPE LEAKING ROOM 249

Remark:

---------- Work Status ---------- ---------- Labor Code ----------

Break Lunch Regular Work Overtime Work




Time In COB


---------- Job Status ---------- ---------- Misc ----------

Close Job Complete SHP Yes No





Supply Not Home Mode



****

Ft. Lee Equipment List

E3	Air Compressor	
E58	Backhoe	
E157	Scavenger Sweeper	
E78	Sewer Cleaner	
E238	Utility Truck	
E239	Utility Truck	
E240	Utility Truck	
E241	Utility Truck	
E242	Utility Truck	

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