AFHRL-TP-88-4 DTIC FILE COPY

(2)

AIR FORCE

HUMAN RESOURCES

AD-A206 672

COMPUTERIZED PERFORMANCE TESTING AS A SURROGATE JOB PERFORMANCE MEASURE

Janet H. Blunt

Universal Energy Systems, Inc.
Manpower, Personnel and Training Division
4401 Dayton-Xenia Road
Dayton, Ohio 45432-1894

TRAINING SYSTEMS DIVISION
Brooks Air Force Base, Texas 78235-5601

March 1989
Final Technical Paper for Period December 1986 - October 1987

Approved for public release; distribution is unlimited.

LABORATORY

AIR FORCE SYSTEMS COMMAND
BROOKS AIR FORCE BASE, TEXAS 78235-5601

NOTICE

This paper has been reviewed and is approved for publication.

HENDRICK W. RUCK, Technical Advisor
Training Systems Division

RODGER D. BALLENTINE, Lt Col, USAF
Chief, Training Systems Division

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION Unclassified

1b. RESTRICTIVE MARKINGS

2a. SECURITY CLASSIFICATION AUTHORITY

2b. DECLASSIFICATION/DOWNGRADING SCHEDULE

3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution is unlimited.

4. PERFORMING ORGANIZATION REPORT NUMBER(S)

5. MONITORING ORGANIZATION REPORT NUMBER(S) AFHRL-TP-88-4

6a. NAME OF PERFORMING ORGANIZATION Universal Energy Systems, Inc.

6b. OFFICE SYMBOL *(If applicable)*

7a. NAME OF MONITORING ORGANIZATION Training Systems Division

6c. ADDRESS *(City, State, and ZIP Code)*
4401 Dayton-Xenia Road
Dayton, Ohio 45432-1894

7b. ADDRESS *(City, State, and ZIP Code)*
Air Force Human Resources Laboratory
Brooks Air Force Base, Texas 78235-5601

8a. NAME OF FUNDING/SPONSORING ORGANIZATION Air Force Human Resources Laboratory

8b. OFFICE SYMBOL *(If applicable)* HQ AFHRL

9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER F41689-86-D-0052

8c. ADDRESS *(City, State, and ZIP Code)*
Brooks Air Force Base, Texas 78235-5601

10. SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT ACCESSION NO.
62205F	7734	13	01

11. TITLE *(Include Security Classification)*
Computerized Performance Testing as a Surrogate Job Performance Measure

12. PERSONAL AUTHOR(S)
Blunt, J.H.

13a. TYPE OF REPORT Final

13b. TIME COVERED FROM Dec 86 TO Oct 87

14. DATE OF REPORT *(Year, Month, Day)* March 1989

15. PAGE COUNT 54

16. SUPPLEMENTARY NOTATION

17. COSATI CODES

FIELD	GROUP	SUB-GROUP
05	08	
05	09	

18. SUBJECT TERMS *(Continue on reverse if necessary and identify by block number)*
computerized performance testing; job performance testing; performance measurement; simulation

19. ABSTRACT *(Continue on reverse if necessary and identify by block number)*

As part of the Joint-Service Job Performance Measurement-Enlistment Standards Project, the Air Force has undertaken a program of research focused on the development of surrogate measures of job performance that are as close as possible to measures of hands-on performance yet less costly to develop and administer. ~~Although a number of surrogate measurement techniques have already been explored, an area that has not received any attention is computerized job performance testing.~~ Computerized performance testing (CPT) involves the use of interactive computer graphics or interactive video disk (IVD) to test both procedural and psychomotor job skills. CPT is a promising alternative to hands-on performance testing for several reasons: It could incorporate built-in scoring and item analysis, provide instant results, and allow tests to be administered on an individual basis; it could ensure standardization of administration and evaluation; the use of state-of-the-art computer technology could produce highly realistic simulations of complex tasks that would relieve the testing burden now placed on operational equipment; and it could provide diagnostics of the process of job performance as well as products. ~~A review of the state of the art in CPT yielded no published CPT research. Applications primarily aimed at testing procedural skills were found in the training arena.~~ Of special interest are two examples of PC-based simulations

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS

21. ABSTRACT SECURITY CLASSIFICATION Unclassified

22a. NAME OF RESPONSIBLE INDIVIDUAL Nancy J. Allin, Chief, STINFO Branch

22b. TELEPHONE *(Include Area Code)* (512) 536-3877

22c. OFFICE SYMBOL AFHRL/SCV

DD Form 1473, JUN 86 — *Previous editions are obsolete.*

SECURITY CLASSIFICATION OF THIS PAGE

Unclassified

19. Concluded

that test a psychomotor skill. They demonstrate the high degree of fidelity that can be attained with CPT. In order to evaluate the feasibility of CPT for the Air Force job performance measurement research effort, the stimulus and response characteristics of tasks drawn from four representative Air Force specialties (AFSs) were evaluated for CPT applicability. With the exception of interpersonal tasks, it was determined that the procedural component of all tasks reviewed can be easily evaluated with CPT; at an increased cost, the psychomotor components can also be assessed with existing technology. Because the investment would be great for high-fidelity psychomotor simulations, it was recommended that CPT development be pursued in conjunction with the Advanced On-the-job Training System (AOTS), where the simulations could be used for training as well as assessment.

AFHRL Technical Paper 88-4 March 1989

COMPUTERIZED PERFORMANCE TESTING AS A SURROGATE JOB PERFORMANCE MEASURE

Janet H. Blunt

Universal Energy Systems, Inc.
Manpower, Personnel and Training Division
4401 Dayton-Xenia Road
Dayton, Ohio 45432-1894

TRAINING SYSTEMS DIVISION
Brooks Air Force Base, Texas 78235-5601

Reviewed by

Martin Pellum, Capt, USAF
Chief, Job Performance Measurement Section

Submitted for Publication by

Nestor K. Ovalle, Lt Col, USAF
Chief, Training Assessment Branch

This publication is primarily a working paper. It is published solely to document work performed.

SUMMARY

The Air Force's Job Performance Measurement (JPM) Project is developing a technology for measuring job performance consisting of hands-on job performance tests along with less expensive substitute tests. This technology will provide personnel and training managers with cost-effective job performance measurement procedures that ultimately can be used to collect performance information for setting enlistment (classification) standards, developing and evaluating training programs, and improving force quality.

The JPM Project initiated research into computerized performance testing (CPT) in order to assess CPT's usefulness to future JPM Project research and development efforts. The CPT study sought to answer several questions:

1. Can CPT serve as a surrogate measure of job performance; i.e., can it present high-fidelity job samples that elicit near-real job behaviors reflecting job proficiency?

2. What is the potential application of CPT; i.e., what specific Air Force specialties (AFSs) and types of tasks can be evaluated with CPT?

3. To what extent does the concept of CPT complement the current configuration and capabilities of, and anticipated Air Force actions with regard to, the AOTS?

4. What are the trade-offs--in terms of time, money, effort, and efficiency--in developing and implementing CPT as a stand-alone system or in conjunction with AOTS?

5. Weighing costs and benefits, is it worthwhile for the Air Force to pursue CPT?

The study found evidence supporting CPT as a potential high-fidelity technique for measuring job performance. However, an assessment of CPT's suitability for a broad range of Air Force career fields could not be made based on the small sample of Air Force specialties (AFSs) examined in this study. CPT could certainly be considered for many Air Force jobs, but its utility should be evaluated on a case-by-case basis. Regarding job tasks, a CPT approach was found suitable for all classes of job tasks except interpersonal tasks; again, CPT's utility varies considerably in terms of cost and ease of development depending upon the task type. Given these considerations, it is unwise to develop CPT as a stand-alone concept, with its focus solely limited to the JPM Project and/or a testing function. CPT best fits Air Force needs if developed in conjunction with an existing program. One such program, the Advanced On-the-job Training System (AOTS), was examined for CPT compatibility in terms of technology and potential payoffs. Developing CPT in conjunction with AOTS could prove advantageous as it would explore CPT's training potential as well as its assessment capabilities.

PREFACE

This technical paper was prepared by Universal Energy Systems, Inc., Dayton, Ohio, for the Training Assessment Branch of the Air Force Human Resources Laboratory's Training Systems Division. The research was accomplished in support of the Air Force's Job Performance Measurement (JPM) Project.

The JPM Project is a research effort aimed at developing a technology for objectively measuring the job performance of first-term Air Force enlisted personnel. The primary reason for this research is to provide Air Force personnel and training managers with a standard, or criterion, against which to evaluate the effectiveness of Air Force selection and training procedures.

The Project's overall program of research focuses on a performance measurement technology called Walk-Through Performance Testing, for collecting valid, accurate, and reliable hands-on job performance information. These hands-on performance measures are then used as benchmarks against which a variety of additional performance measures (such as rating forms or knowledge tests) are evaluated as substitutes for, or supplements to, the more expensive, labor-intensive, hands-on performance techniques. Although a variety of measurement methods have been examined for their usefulness as substitutes for hands-on testing, a computerized performance testing (CPT) approach has not been explored within the JPM Project.

Computerized performance testing shows promise as a potential substitute for hands-on testing for two reasons. First, advances in interactive video disk technology as well as current computer graphic capabilities are sufficiently powerful to allow complex simulations of job tasks, greatly increasing the fidelity of computer-based simulations; and second, the advantages inherent in a computer-based testing approach (such as instantaneous scoring, enhanced test security, standardization, etc.) make CPT an attractive, potentially cost-effective substitute. A computerized performance test using state-of-the- art interactive computer capabilities could prove to be a highly accurate substitute for hands-on performance measures, with significant impact on future performance testing technology.

TABLE OF CONTENTS

LIST OF TABLES

COMPUTERIZED PERFORMANCE TESTING AS A SURROGATE JOB PERFORMANCE MEASURE

I. INTRODUCTION

A major research and development (R&D) program is underway in the Department of Defense (DoD) "to develop improved indicators of the job performance of enlisted personnel and, if successful, to explore the feasibility of linking job performance to standards for enlistment into military jobs" (Wigdor & Green, 1986, p. 13). The focus of the Joint-Service Job Performance Measurement/ Enlistment Standards Project has been on developing empirically valid measures of job performance that capture, as faithfully as possible, the capability of individuals to carry out their jobs. Simultaneously, the measures are designed to incorporate controls for the inherent biases of the observation/measurement/evaluation process.

One type of measure designed to provide high-fidelity assessment of job proficiency is hands-on tests. Hands-on tests are a type of work sample which allows the incumbent to exhibit the same behaviors as those required on the job. This type of testing takes place using operational equipment, materials and procedures. This requirement poses several potential limitations for hands-on testing as a routine performance assessment method; it takes equipment and people away from supporting the immediate mission and, at times, presents the possibility of equipment damage and risk to personal safety. In an effort to overcome these difficulties, alternative (or surrogate) measures of job performance have been identified. Hands-on performance tests, then, form the benchmark measure against which other potential measurement techniques are being evaluated. These measures are "further removed" from the ultimate criterion of actual job performance, but have fewer of the practical problems inherent in hands-on measures.

The Joint-Service Project entails assessing these alternative measures as possible criteria to replace hands-on tests in validating personnel and training decisions. A number of surrogate measurement techniques have already been explored, including rating forms, paper-and-pencil job knowledge tests, and interview work sample testing. Another candidate measure that has not as yet been researched in detail is computerized performance testing (CPT).

For the purposes of this paper, computerized performance testing (CPT) is defined as "**any system involving the use of an interactive computer system to test a job skill.**" The interactivity occurs between the user, via a computer keyboard or other input/response medium, and a screen that employs computer graphics or video disk technology. As opposed to high-fidelity simulators, CPT is typically limited to micro- or minicomputer simulation of performance tasks.

This definition implies that CPT goes beyond what is typically thought of as computer-based training (CBT), where a computer is used to administer, score, analyze, and evaluate a paper-and-pencil test. CPT includes an assessment of both procedural and psychomotor skills and may occur well after training on specific tasks. However, many of the features of CBT are required to support CPT. Most of the commonly used hardware of CBT, such as keyboard, touch screen, light pen, and mouse, could be used in CPT. Common CBT software is also an integral part of CPT. Color, sound, graphics, animation, multiple input fields on a single screen, interface with videodisk or videotape, and provision for multiple correct and close responses are CBT presentation and testing features necessary to support CPT. Finally, the administrative functions of tracking user progress and reporting user status and results are essential to a viable CPT system. CPT is the natural extension of applying technological advances to both training and performance assessment.

The purpose of this paper is to report the results of a feasibility study which considered the viability of CPT as a job performance measurement technique. Included here are findings from both published and unpublished sources, and a detailed discussion of potential CPT applications within the Joint-Service Project and other R&D programs.

II. FEASIBILITY STUDY

The purpose of this feasibility study was to examine the potential of CPT as part of the wider Air Force JPM Project. Feasibility was examined with CPT as a stand-alone system and with CPT as part of a larger computer application R&D effort. Demonstrating that CPT findings and applications complement other computer-based R&D efforts is essential to assessing the costs and benefits associated with CPT. Additionally, complementary findings would be readily translated into future research and practical applications. A current R&D effort which utilized computer application and provided the opportunity to examine CPT is the Advanced On-the-job Training System (AOTS).

In this investigation, "feasibility" was defined in the broadest terms to include a consideration of "utility." In this context, various aspects of the feasibility of CPT were specified by the following questions:

1. Can CPT serve as a surrogate measure of job performance; i.e., can it present high-fidelity job samples that elicit near-real job behaviors reflecting job proficiency?

2. What is the potential application of CPT; i.e., what specific Air Force specialties (AFSs) and types of tasks can be evaluated with CPT?

3. To what extent does the concept of CPT complement the current configuration and capabilities of, and anticipated Air Force actions with regard to, the AOTS?

4. What are the trade-offs--in terms of time, money, effort, and efficiency--in developing and implementing CPT as a stand-alone system or in conjunction with AOTS?

5. Weighing costs and benefits, is it worthwhile for the Air Force to pursue CPT?

In this "paper study" of CPT's feasibility as a surrogate job performance measure, there were three main sources of information: technical documents and published literature; observation of relevant industrial and Air Force applications of computer technology; and expert opinion. These three sources were used in all phases of the investigation.

The first question addressed the ability of computer technology (e.g., interactive computer graphics and Interactive Video Disk [IVD]) to simulate job stimuli and response options. Three sites were visited with the purpose of observing computerized job simulations and training applications and identifying various CPT approaches or formats. The three sites were the Navy Personnel Research and Development Center (NPRDC), Keesler AFB Technical Training Center, and Ixion, Inc. (see Appendix A).

In order to identify jobs and types of tasks that have potential for CPT applications, task characteristics that can be appropriately represented with interactive computer graphics, IVD, or other computerized approaches were compared to the task characteristics of Air Force jobs. Although the jobs of interest are all those held by first-term enlisted personnel, in practical terms evaluating all first-term enlisted jobs and tasks for CPT applicability was beyond the scope of this effort and more than was required for a "paper study." As an alternative, this investigation focused on a small number of jobs considered to be representative of broad classes of jobs or AFSs. Four AFSs were chosen, one from each of the major aptitude index areas measured by the Armed Services Vocational Aptitude Battery (ASVAB); i.e., Electronics, Mechanical, Administrative, and General. Specifically, the four AFSs were Precision Measuring Equipment

Specialist (324X0), Aerospace Ground Equipment Specialist (423X5), Personnel Specialist (732X0), and Aircrew Life Support Specialist (122X0). These AFSs were chosen because they are currently under investigation as part of the Joint-Service JPM effort. For the same reasons that not all first-term enlisted jobs were considered, not all tasks associated with each AFS were evaluated. Drawing on task data generated for use in developing Walk-Through Performance Tests for these AFSs, only a subset of tasks was chosen for evaluation. (See Dittmar, 1987; Hassett, 1987; Pedersen, 1987; and Wall, 1987 for complete explanations of the methodology used to identify the subset of tasks for each AFS.) Tasks for all four AFSs were clustered based on their stimulus and response characteristics and an evaluation was made of the feasibility of assessing these task types with the various approaches to CPT. In addition, each AFS was evaluated for CPT applicability based on the stimulus and response characteristics of its tasks.

In order to answer the third and fourth feasibility questions, the AOTS and the Instructional Support Software (ISS) system were reviewed. The final feasibility question was answered by evaluating how easily CPT could be integrated with or take advantage of AOTS, as well as the wider implications of CPT for Air Force training and job performance measurement.

Literature Review

A review of published CPT literature was initially conducted using a computerized literature search. The DIALOG Information Retrieval Service, a collection of public on-line data bases, the data bases of the National Technical Information Service (NTIS) and PsychInfo, was searched using the following key words:

1. job performance measurement
2. job performance testing
3. computerized performance testing
4. symbolic performance testing
5. symbolic testing
6. validation and selection
7. selection and prediction
8. selection, validation, and performance.

In addition, Joint-Service Project (JSP) documents were reviewed and contacts were made with professionals in a number of organizations to identify unpublished CPT or related work. The JSP documents reviewed are listed in Appendix B; the organizations contacted are listed in Appendix C.

The search for published findings in the area of computerized performance testing yielded little relevant research. In spite of the fact that "the lack of capability to measure job and training performance of military personnel is a chronic constraining factor on progress in a wide range of research and development areas" (Lane, 1986, p. 1), the literature in general indicates a paucity of research directed toward measuring individual job proficiency.

In a review of military literature addressing the prediction of job performance, Vineberg and Joyner (1982) found that measures of job proficiency and performance were the least-used criteria in validation studies published between 1952 and 1980. Of 114 studies considered in their review, 48% used only global ratings of performance as criteria and 30% used some measure of suitability. A measure of job proficiency was used in only 21 studies, and the test of proficiency involved actual job performance in only 15 of these. Vineberg and Joyner did, however, discern a relative increase in the use of performance tests to provide criteria over this period. They noted: "In the 1950s and 1960s, the ratio of studies using ratings to those using knowledge tests and those using performance tests was about 12 to 2 to 1; between 1970 and 1980, the ratio was about 6 to 1 to 2" (p. 5).

This general lack of emphasis on actual job performance as a criterion measure has not changed much in the 1980s. A cursory review of the validation literature published between 1982 and 1987 revealed that neither job performance nor proficiency has dramatically gained favor as a criterion measure. Where actual job performance or components of job performance were used, it has generally been limited to validating physical abilities tests.

Common arguments against using performance criteria point to the high cost of development, the greater administration time, the obtrusiveness, and the effort required of evaluators in comparison to those for other measures. Nevertheless, Vineberg and Joyner (1982) argued that "an effective strategy for predicting performance is to maximize the match between the behavior sampled by predictors and the sample of behavior to be predicted, as well as the match between the methods of measurement used in sampling each" (p. 23). Thus, despite the difficulty of designing and administering job performance tests, it is clear that they afford the greatest opportunity for accurately predicting job performance.

This argument has been endorsed for a number of years. Early investigations related to this issue specifically addressed the lack of realism in both training and job performance testing. Foley and Shriver (Foley, 1974; Shriver & Foley, 1974a, 1974b) sought to systematically identify criterion-referenced job performance tests that evaluated behaviors required on the job. These realistic measures of job performance were a sharp contrast to the paper-and-pencil tests of theory and job knowledge that were the most commonly used method of assessing training and job performance. However, such measures may not always be necessary. Foley (1974) hypothesized that if highly realistic "symbolic substitute tests" could be developed, they could provide an alternative, less costly measure of job performance.

Two such measures reported in the literature were graphic symbolic substitutes (Shriver & Foley, 1974b) and symbolic testing using videotapes (Shriver, Hayes, & Hufhand, 1974). In both cases, subjects viewed portions of tasks, either as a picture (graphic) or videotape sequence, and were asked to note what was occurring and comment on the the correctness of the performance or describe subsequent steps that should be taken in performing the task. The researchers identified several limitations in both techniques, including cost of development and administration. But perhaps the most significant limitation was that both methods placed the subject in a passive role of watching the performance of others.

Published reports on the use of CPT are even more rare than those on performance criteria in general. One notable exception involves a computerized troubleshooting test developed by the U.S. Navy for the North Atlantic Treaty Organization (NATO) Seasparrow Surface Missile System (NSSMS) (Conner, 1987). Developers of this system recognized the need for an objective measure of job proficiency in troubleshooting the NSSMS. They chose to build the test for delivery via a microcomputer since it allowed for simulation of electronic faults and the recording of performance data without test administrator involvement; was portable, for convenient transportation to the testing sites; and enabled the participant to freely use NSSMS-related documentation for fault diagnosis. The resulting Troubleshooting Proficiency Evaluation Program (TPEP) proved effective in evaluating troubleshooting proficiency and the concept was recommended for expansion to other occupational areas.

CPT Applications

Navy Personnel Research and Development Center (NPRDC). The Navy has begun a program within the context of JPM R&D to investigate the feasibility of utilizing training devices and simulators as tools for measuring job performance. As a first step, the Navy Personnel Research and Development Center (NPRDC) asked the Naval Training Systems Center (NTSC) to survey "all training devices in inventory which could be used to measure the performance of personnel in E-1 through E-4 paygrades in critical maintenance and operator ratings" (Morris, Best, & McDaniel, 1985, p. 5). NTSC was also asked to select 10 candidate devices associated with five critical Navy ratings (career fields) for a field performance measurement survey. The critical ratings of interest were two operator ratings--Radioman and Operations Specialist; and three maintenance ratings--Electrician's Mate, Fire Control Technician, and Electronics Technician.

NTSC established, for all the devices in inventory, a data base that included information on device category, training activity, serial number, description, building number (i.e., location), and year installed. This data base was used to select 10 candidate devices associated with the five critical ratings. This device-based performance measurement data base was developed to identify the relationships among devices, skill levels trained, and performances evaluated. First, from a listing of the job tasks associated with the five critical ratings, NTSC identified key simulators/devices used to train them. Subject-matter experts (SMEs) identified specific tasks that could be performed on the selected devices. Using a survey approach, descriptive performance information was generated for each device. The device's function, complexity, and specialization were described. Factors needed to evaluate job task performance measurement capabilities were described in terms of the Instructional Systems Development (ISD) model components and SME-specified relevant performance standards for each job task. A description of the stimulus, response, and measurement properties of job task performance on the device was obtained from SMEs. Estimates of the device's fidelity and potential modifications needed to improve its performance measurement capability were provided. Finally, characteristics of the target population to be tested were specified. This work resulted in the identification of 8 of the 10 devices as potential surrogates for job performance measurement.

Subsequent work at NPRDC has built on these results. The 8 candidate devices have been further evaluated for their practicality as surrogate measures. Each device was reviewed for its hardware and software requirements and its output; its hands- on, cognitive, and environmental fidelity were examined; and its applications, both current and potential, were described. The outcome of these evaluations was the recommendation that the Electronic Equipment Maintenance Trainer (EEMT) used by the Electronics Technician rating be field-tested as a high-fidelity measure of hands-on job performance.

The EEMT is a generic trainer that uses a personal computer (PC), monitor, keyboard, and touch panel. As a training device, it steps a student through knowledge and procedural task requirements in both a teaching and a testing mode. Although demonstration of job knowledge is important, for the purpose of performance measurement it is evaluation of correct procedure that is of interest. NPRDC has found that EEMT hardware is suitable for evaluation, but software modifications are necessary. For example, the teaching mode is not required for performance measurement; and though the testing mode is relevant, modifications are required to eliminate the feedback and branching functions that serve to enhance training. The newest version of the EEMT will be used for the surrogate measure test. Alternative measures of job performance will also be compared to EEMT results. Comparison measures will be a hands-on test, behaviorally anchored rating scale (BARS)-type ratings, and peer and supervisor evaluations.

Keesler AFB. A site of widespread computer use is the Keesler AFB technical training center. For the most part, computer technology at this location is used for computer-based instruction (CBI) and computer-managed instruction (CMI), not CPT. Particularly in technical career fields, computers are used to impart theory and procedural knowledge, not to teach actual performance. Operational equipment is used for learning the hands-on components of the job. However, in the administrative and personnel career fields, computers are often very much a part of the job. To the extent that this is so, the training may also teach operational skills. There is one project underway at Keesler AFB that is taking computerized training one step beyond CBI towards CPT. For electronics training, the Air Force is developing a radar maintenance trainer that uses IVD. The AN/GPN-22 radar simulation uses a PC, monitor, videodisk player, keyboard, and light pen. In many ways, however, the simulation is still a procedural trainer; that is, although pictures are used in conjunction with text, the purpose is to teach the student the correct procedure for performing a number of maintenance tasks on this radar equipment.

Ixion, Inc. The computer applications described thus far have been limited to the training arena and, more importantly, to tests of procedural knowledge. Although procedures are an important part of task performance, the focus of computerized performance testing is the demonstration of a "skill." This focus emphasizes psychomotor, rather than procedural, components of the tasks. Computer skills that could be demonstrated in computer operation training courses would be an example of a psychomotor task, but most technical tasks have not been similarly simulated except in high-fidelity simulators. An important exception in this area was found at Ixion, Inc.

Mr. David Hon of Ixion, Inc. has developed a welding simulation trainer for the College of Aeronautics at LaGuardia Airport in New York. Using videodisk technology, he has created a simulated welding environment that can be used virtually anywhere by tilting a cathode-ray tube (CRT) on its back to simulate a welding table. The simulation includes adjusting the flame and moving a hot puddle of metal through a simple butt weld. There are three parts to the training program. First, the equipment is presented, including set-up and shut-down procedures. Second, the student learns the theory of gases. Mastery of safety procedures is also an important part of this initial training. Finally, the student moves to training with a mock torch, which has the look and feel of the real thing. The values of the torch adjust the flame on the screen; its mercury switches sense if the angle is correct; and its light pen senses not only its X-Y position, but also the all-important distance from the molten metal displayed on the screen. With the use of instant jump on the videodisk, the puddle actually changes, appearing hotter and colder on the screen as the torch is held too close or too far away. And as with real heat, the trainee can self-correct, if he/she does so quickly. This simulation represents a significant advance in CPT technology. In addition to the teaching and assessment of procedural tasks, the welding simulation assesses a psychomotor task of multiple dimensions.

Mr. Hon has also developed an interactive cardiopulmonary resuscitation (CPR) learning system to teach and certify CPR proficiency. A CPR mannequin is outfitted with numerous electronic sensors that monitor chest compression, both pressure and timing; ventilation, both volume and timing; and body and/or head position. A CRT provides graphic feedback of the CPR actions. The students use a light pen to select a training, demonstration, or testing segment and move through the course at their own pace. The CPR simulation uses technology similar to that of the welding simulation (i.e., electronic sensors and mercury switches), but it takes the fidelity one step further by using a three-dimensional device that more realistically simulates the actual task requirements.

CPT Formats

The CPT applications described above demonstrate a technology that can be used to create computerized performance tests possessing varying degrees of fidelity. Degree of fidelity is a factor that can be used to classify the technologies and thus define several CPT approaches or formats. These formats are defined in Table 1 and described below.

In the most basic configuration that still fits the current definition of CPT, a CRT is used to present the stimuli, and responses are made on a keyboard or directly on the screen using a touch-sensitive panel or a light pen. Whether interactive computer graphics or IVD is used to present the stimuli, there are two kinds of tasks that can be evaluated. Highly proceduralized technical tasks can be evaluated by having the user "point" to the components of the equipment in the proper order of execution. For decision-making tasks, the user can be presented with an ongoing scenario (e.g., a control panel in a state of flux or a task being performed by someone else) and asked to stop the action at the appropriate (i.e., critical) point by pointing to the critical or out-of-tolerance component or action. In both cases, the choice of computer graphics or IVD would be based on a number of factors such as cost to develop, degree of realism required, and user acceptance. Of course, in either case, realism in the stimuli would be limited to what can be presented on a CRT. The response mode lacks much in the way of fidelity for most technical tasks and would be appropriate only for tasks where the response component is less important than the procedural component or where the ability to make an adequate psychomotor response is not in question.

Table 1. CPT Formats

Format	Stimulus medium	Response medium	Skills assessed
1	CRT	Standard computer hardware such as keyboard, touch screen, light pen	Declarative knowledge Procedural knowledge Decision making
2	CRT	Computerized device that simulates psychomotor task requirements	Declarative knowledge Procedural knowledge Decision making Psychomotor
3	Computerized device that simulates three-dimensional task characteristics/requirements	Computerized device that simulates psychomotor task requirements	Declarative knowledge Procedural knowledge Decision making Psychomotor

The welding simulator exemplifies a second CPT format, one where the stimulus and response devices are standard computer hardware yet the psychomotor component of the task can be evaluated. In this case, the stimulus is found on a CRT and the response is made to the CRT but in a manner that requires the demonstration of both the procedural and psychomotor components of the task. This use of computer technology to assess job performance is a departure from the traditional approach limited to two-dimensional stimuli and discrete responses. Though the stimulus mode is basically unchanged, the response mode is greatly improved in terms of fidelity and allows for the evaluation of the previously ignored psychomotor component.

The third, and by far most realistic, CPT format is illustrated by the computerized CPR simulation. The distinguishing characteristics of this simulation are the stimulus and response media (in this case, they are the same thing--a computerized mannequin). The mannequin, in repose and as it "responds" to the ministrations of CPR, serves as the stimulus, changing as a result of human input and thus updating itself. The mannequin is also the response medium, the input device for the CPR itself. While by definition CPT requires use of a computerized format, encasing the computer in a three-dimensional device that requires the user to mimic the psychomotor requirements of the task results in a more realistic simulation than can be achieved with a two-dimensional CRT, because the stimulus and response media are three-dimensional and are therefore closer approximations of actual task requirements. In fact, this CPT format approximates a high-fidelity simulator yet uses a PC and is portable. However, since the stimulus/response device is specific to the task, this format requires significant hardware as well as software development.

CPT Feasibility for the Air Force

Evaluation by Task Type. Descriptions of the four AFSs chosen for this investigation and the subset of tasks under consideration for each can be found in Appendixes D through G. Based on stimulus/response characteristics relevant to CPT applicability, five types of tasks were identified. These are outlined in Table 2. In Table 3, a sample of tasks from all four AFSs are clustered according to these task types. The AFS to which each tasks belongs is listed to the left of the task. The entire task list appears in Appendix H.

Table 2. CPT Task Types

Task type	Task characteristics: Stimulus	Response	Skills
Administrative	Written/pictorial materials	Written/organized information	Declarative Knowledge Procedural Knowledge
Interpersonal	Verbal	Verbal	Declarative Knowledge Procedural Knowledge Interpersonal
Administrative with gross psychomotor component	Written or pictorial materials	Psychomotor (gross)	Declarative Knowledge Procedural Knowledge
Simplistic psychomotor	Dials, gauges, and other displays	Psychomotor (fine)	Declarative Knowledge Procedural Knowledge Decision Making Psychomotor
Complex psychomotor	Equipment (three-dimensional)	Psychomotor (fine)	Declarative Knowledge Procedural Knowledge Decision Making Psychomotor

Cluster 1 tasks are primarily administrative. Stimuli generally take the form of written materials, either hard copies of such things as reports, forms, memos, and reference manuals or CRT displays of the same. The response requirement also involves "writing" (e.g., completing a form, writing a letter, making calculations, or organizing materials such as assembling manning statistics or performing records reviews). These tasks could be easily translated to a CPT format since the stimuli can be presented on a CRT and responses can be made via the keyboard. In fact, many of these tasks are already performed on a computer; so, the face validity of the CPT format would be very high.

Cluster 2 tasks are interpersonal tasks. Interpersonal tasks generally involve the interaction of two individuals speaking. Both stimulus and response are the spoken word. Although it is certainly possible to use IVD to present the stimulus and to present subsequent stimuli that are appropriate consequences of user inputs, the difficulty lies in making that input. At some future time, the technology of voice recognition will advance to the point that free-form discourse can be interpreted by the computer and result in appropriate branching. At the present time, however, user input must be limited to the modes discussed previously; i.e., keyboard or screen inputs. An interpersonal simulation that relies completely on the computer has been developed by Assessment Designs International of Orlando, Florida. Scenarios are presented via IVD, followed by a multiple-choice format of possible actions. The user indicates a choice on the keyboard and an appropriate consequence is played out. Though the stimulus is relatively realistic, the fidelity of the response format is very low and constrained. Jackson Smye, Inc. of Toronto, Canada, uses the same stimulus format, but allows a free verbal response that is monitored and evaluated by an assessor. Obviously, this approach is more realistic but falls outside the current definition of CPT because observation and evaluation of performance are carried out by individuals, not by computer. Therefore, at this time, CPT assessment of interpersonal tasks is not feasible.

Table 3. Representative Air Force Tasks Clustered by CPT Task Type

Cluster 1 - Administrative
Stimulus Type: Written/Pictorial Materials (Hardcopy or CRT)
Response Type: Written (Hands or Keyboard) or Organization of Information

AFS	
324X0	Make entries on AFTO Forms 350 (Repairable Item Processing Tag).
122X0	Schedule maintenance repair of life support equipment.
423X5	Research Technical Orders (T.O.'s), charts or diagrams for Aerospace Ground Equipment (AGE) enclosures, chassis, and drive maintenance information.
732X0	Annotate personnel data rosters.
732X0	Process hardship discharge requests.
732X0	Draft correspondence.
732X0	Review selection of personnel for attendance at Noncommissioned Officer (NCO) academies or leadership schools.
324X0	Research manuals for parts numbers.
324X0	Interpret calibration correction charts for reference and working standards.
324X0	Calculate current, voltage, impedance, or power parameters.

Cluster 2 - Interpersonal
Stimulus Type: Verbal
Response Type: Verbal

732X0	Conduct classification interviews.
732X0	Conduct initial out-processing briefings.
732X0	Conduct in-processing briefings.
732X0	Conduct separation briefings or interviews for pending separatees.

Cluster 3 - Administrative with gross psychomotor component
Stimulus Type: Written/Pictorial Materials
Response Type: Psychomotor (gross)

732X0	Collect ID cards or passports from separatees or retirees.
732X0	Post standard publications such as regulations or manuals.
732X0	Assemble senior NCO promotion selection folders.
732X0	File documents in personnel records.

Cluster 4 - Simplistic psychomotor
Stimulus Type: Dials, Gauges, and Other Displays
Response Type: Psychomotor (fine)

324X0	Calibrate digital voltmeters or multimeters.
423X5	Measure resistance of AGE electrical systems.
324X0	Align DC voltage standard.
324X0	Adjust humidigraphs.

Table 3. (Concluded)

Cluster 5 - Complex psychomotor
Stimulus Type: Equipment (three-dimensional)
Response Type: Psychomotor (fine)

732X0	Operate cathode-ray tubes.
122X0	Pour and fabricate helmet liner molds.
122X0	Disassemble, assemble, purge, and refill emergency oxygen cylinders.
423X5	Remove or install fuel lines and fittings.
324X0	Replace electronic equipment pins, connectors, or plugs.
423X5	Prepare AGE for mobility or training exercises.
122X0	Perform nuclear flash blindness goggle kit 180-day inspections.
423X5	Inspect vehicles for safety of operation.
423X5	Isolate engine, motor, or generator mechanical malfunctions.
324X0	Troubleshoot power supplies.

Tasks in Cluster 3 involve a gross psychomotor response to written or pictorial materials. Although the tasks are primarily administrative, they do not belong in Cluster 1 because the response requires other than a written action. Since the primary focus is on their administrative or procedural aspects, not the psychomotor components, tasks in this cluster could be evaluated by the same CPT format as Cluster 1 tasks if ability to perform the psychomotor component is ignored.

Cluster 4 tasks require a psychomotor response to dials, gauges, and similar displays. In contrast to the response required by Cluster 3 tasks, the psychomotor component of these tasks is important, equal with interpreting the displays themselves. A computer can present realistic displays using either computer graphics or IVD. If the keyboard has a built-in rheostat, many of the responses could be simulated with existing equipment. If the adjusting mechanism must be developed, it could function very much like the torch in the welding simulation. In either case, developing a relatively high- fidelity CPT for tasks in this cluster is possible without an inordinate amount of hardware or software development.

In order to develop high-fidelity CPT for Cluster 5 tasks, complex hardware and software development will be required. (An obvious exception is the first task in the list, "operate cathode-ray tubes.") Tasks in this cluster involve complex psychomotor responses to equally complex equipment. To go beyond assessing procedural knowledge, the equipment itself must be simulated, much as the human is simulated with the CPR mannequin. It may be possible to simulate selected parts or functions of the equipment with less complicated hardware, but each task would have to be considered on an individual basis. As a whole, to assess the important psychomotor components of tasks in this cluster, a significant technological investment would be required.

The foregoing arguments for the ease (or difficulty) of developing and implementing CPT for the various task types are summarized in the rank-ordered list presented in Table 4.

CPT and the Joint-Service Project

Referring again to Appendixes D through G, an assessment of each AFS for CPT applicability can be made based on the preceding evaluation of task type applicability. The percentage of CPT task types in each AFS is listed in Table 5. With the exception of interpersonal tasks, all Personnel Specialist tasks can be easily addressed with a CPT format that uses common hardware. With the exception of the administrative tasks, all Aircrew Life Support Specialist tasks fall into Cluster 5 and can be assessed only with complex hardware simulations unless the fidelity of the response mode is compromised and the assessment is limited to procedural knowledge. Of the 29 Aerospace Ground Equipment Specialist tasks, two are administrative, one is a Cluster 4 task that can use a CRT display and a simple psychomotor response device, and the remaining are Cluster 5 tasks. Just over half the Precision Measuring Equipment Specialist tasks (30 out of 58) are Cluster 4 tasks, with the remaining tasks almost evenly split between Cluster 2 (15) and Cluster 5 (13).

Table 4. **Rank Order of CPT Feasibility for CPT Task Types**

1	Administrative
2	Administrative with Gross Psychomotor Component[a]
3	Simplistic Psychomotor
4	Complex Psychomotor
5	Interpersonal[b]

[a]For the sample of tasks considered in this study, the psychomotor component is incidental to the essentially administrative nature of the task and this task type can be ranked equal to the other administrative type.

[b]Interpersonal tasks are the only type incapable of CPT implementation at this time.

Table 5. **Percentage of CPT Task Types in Representative AFSs**

	CPT task types				
AFS	Admin	IP	AGP	SP	CP
PMEL (AFS 324X0)	26	-	-	52	22
AGE (AFS 432X5)	7	-	-	3	90
Personnel (AFS 732X0)	87	5	8	-	-
ALS (AFS 122X0)	16	-	-	-	84

Note. IP = Interpersonal; AGP = Administrative with Gross Psychomotor; SP = Simplistic Psychomotor; CP = Complex Psychomotor.

Table 6 summarizes the rank order of the four AFSs for CPT development and implementation, taking into consideration the ease of developing high-fidelity simulations for the types of tasks characteristic of each. The decision to rank Precision Measuring Equipment Specialist above Aerospace Ground Equipment (AGE) Specialist is due to the greater percentage of Precision Measuring Equipment tasks that require only a simplistic psychomotor response. In addition to requiring a less complex response device, it appears that many of these tasks would use virtually the same response device; so, the effort expended in hardware development would likely benefit several tasks and require only software modifications to tailor the simulation to different tasks. Although the percentage of AGE Mechanic tasks requiring a complex psychomotor response is slightly larger than the percentage for Aircrew Life Support Specialist, it is likely that two-dimensional simulations of significant portions of AGE tasks can be developed whereas most Aircrew

Life Support tasks will require three-dimensional simulations to be effective. Hence, the feasibility of CPT development is greater for the AGE career field.

Table 6. **Rank Order of CPT Feasibility for Representative AFSs**

1	Personnel Specialist	732X0
2	Precision Measuring Equipment Specialist	324X0
3	Aerospace Ground Equipment Mechanic	423X5
4	Aircrew Life Support Specialist	122X0

Although ease of development and implementation are important considerations in determining CPT feasibility, several other critical factors have a bearing on this decision. These factors are listed in Table 7. One factor, potential payoffs associated with CPT development, is further detailed in Table 8.

Table 7. **Critical Factors for Consideration of CPT Feasibility**

1	Ease of development
2	Ease of implementation
3	Cost
4	Potential payoffs
5	Face validity

An evaluation of each AFS in terms of these critical factors is outlined in Table 9,where each AFS is rank-ordered on each factor. The rank-orderings for each AFS are not consistent across all factors. For example, Personnel Specialist is consistently ranked first on every factor except potential payoffs. Given the administrative nature of the tasks and heavy computer use, CPT for this AFS would be easy to develop and implement (by taking advantage of existing equipment), would involve relatively low costs, and would have high face validity. However, the nature of the tasks also makes them easy to evaluate without CPT; so, the payoff is less than for other AFSs. Conversely, CPT for AGE tasks requires a greater commitment to hardware development, a commensurate commitment of resources, uncertain face validity due to the three-dimensional characteristics of many tasks, but a greater potential payoff in terms of training and assessment accuracy, flexibility, and safety. While not all factors should carry the same weight in the final determination of feasibility, it seems that, taken as a whole, consideration of these factors does not change the AFS rank orderings of CPT feasibility presented in Table 6.

CPT and the Advanced On-the-job Training System

The Advanced On-the-job Training System (AOTS) is an Air Force R&D effort to design, develop, demonstrate, test, and evaluate a prototype state-of-the-art training system that will integrate and effectively manage, evaluate, and automate job site training to make on-the-job training (OJT) more responsive to mission requirements.

AOTS is comprised of five subsystems. The Management Subsystem provides an integrated, computer-based OJT management system which helps supervisors define job/task training requirements, manage airman training progress toward position qualification, and identify and allocate base-level resources. The Development and Delivery Subsystem supports the production, maintenance, and delivery of task-specific evaluation and training materials for job site task training and certification. The Evaluation Subsystem provides the mechanisms necessary to support the evaluation of both individual airman task proficiency and the system effectiveness of the AOTS. The Computer Support Subsystem applies state-of-the-art computer technology to support the management and evaluation of job site training. The Personnel and Logistics Support Subsystem specifies the qualitative and quantitative personnel requirements of an operational AOTS, as well as requirements associated with maintenance, reliability, logistics, and transition of the system.

Table 8. Potential Payoffs of CPT Development for Representative AFSs

All Four AFSs	
1	Higher-fidelity performance assessment
2	Potential for training applications
3	Assurance of standardization of training and assessment
4	Ability to train to a higher standard and assess with a greater degree of accuracy
5	Training and assessment not dependent on actual equipment
Personnel Specialist	
1	High face validity due to substantial computer use in performing tasks
2	Assessment format easily adapted to newly reconfigured positions
Precision Measuring Equipment Specialist	
1	Graphic or videodisk simulations and requisite hardware developed for one piece of equipment would address "calibrate," "troubleshoot," and "align" tasks for that equipment
2	Additional simulations with high face validity associated with anticipated introduction of computerized calibration equipment and computer-controlled equipment
Aerospace Ground Equipment Specialist	
1	Reduced risk associated with training and assessment on potentially hazardous equipment
2	Unusual malfunctions or anomalies more easily simulated
Aircrew Life Support Specialist	
1	Reduced risk associated with training and assessment on potentially hazardous equipment
2	Unusual malfunctions or anomalies more easily simulated

The Trainee Evaluation Subcomponent of the Evaluation Subsystem is of particular relevance when considering the usefulness of CPT. This subcomponent provides the capability to administer both task performance tests and knowledge tests. Trainees, trainers, and supervisors will have the option to use both kinds of tests in a pre-test mode. Airmen who successfully complete a pre-test may bypass otherwise necessary training requirements. However, in general, task performance evaluations will follow completion of all training associated with the task and will serve the purpose of certifying the airman to perform the task.

Table 9. Rank Order of CPT Characteristics for Representative AFSs

AFS	Critical CPT Factors Ease of devel	Ease of implem	Cost	Potential payoffs	Face validity
PMEL (AFS 324X0)	2	2	2	3	2
AGE (AFS 432X5)	3	2	3	1	3
Personnel (AFS 732X0)	1	1	1	4	1
ALS (AFS 122X0)	4	3	3	2	3

Note. Where distinctions cannot reasonably be made, more than one AFS may receive the same rank.

In addition, two components of the Development and Delivery Subsystem are related to the concept of CPT. With the Training Development component, the AOTS will be able to produce instructional and evaluation materials to support job site training and performance certification. This component will, among other things, develop and catalog behavioral objectives that reflect task performance requirements; maintain a test bank of current task-related test items and performance measurement instruments keyed to specific objectives and tasks; and develop, validate, and catalog job site task evaluation and training materials that support task proficiency training and position qualification. The Training Delivery component will store and deliver all instructional and evaluation materials developed with the Training Development component.

An important part of the AOTS is the Instructional Support Software (ISS) system, a computer-based authoring system that supports both CMI and computer- assisted instruction (CAI). The CAI system provides development and delivery capability for on-line CAI. It allows nonprogrammers to develop and evaluate individualized, interactive CAI modules containing a variety of text and graphics. Using the CAI editors, development of courseware takes the form of an ongoing dialog between the author and the system.

The test authoring portion of ISS supports the use of five modes of response: true/false, matching, multiple choice, constructed response, and touch. For tests of procedural knowledge, these response types could be used in a CPT approach, although true/false, matching, and multiple choice would constitute very low-fidelity response modes. The more complex the response, the more difficult it would be to use a constructed response approach that approximates task requirements. For the higher-fidelity CPT approaches described earlier (i.e., two- and three-dimensional psychomotor response mediums), only the touch response mode would be suitable, but, in many cases, still not sufficient.

In all three CPT formats, the use of interactive computer graphics or IVD is an integral part of the simulation. Even for highly proceduralized tasks where psychomotor responses are perhaps less important, it is the pictorial representations of equipment or tools that make the CPT format more than simply a knowledge test. Although it is impossible to discuss the trade-off in terms of utility between graphics and IVD without considering specific tasks, IVD is certainly receiving most of the attention. Two major milestones have recently been met in this regard. First, the Air Force made a commitment to developing an in-house capability to produce IVD. A production facility is now operational at Hill AFB, UT and another is in the final stages of completion at Keesler AFB, MS. Second, an IVD capability has been added to the AOTS for both development and delivery of IVD training and evaluation materials. Both of these occurrences significantly increase the potential for CPT within the Air Force.

III. DISCUSSION

CPT Benefits

Individualized Administration. As with CBT, CPT enables evaluations to be conducted on an individual basis. The software can be designed to adapt to each individual (i.e., proceed based on individual performance through a hierarchy of test "items"), thus saving time for those who do well and allowing more thorough testing of those who do not. The need for proctors to monitor the testing process is reduced since all testing materials are housed within the CPT system.

Improved Test Administration. CPT allows immediate item analyses and calculation of test item scores. There is reduced subject cueing (i.e., information in the test that assists the respondent in identifying the correct answer without requiring technical knowledge) since test items are embedded in actions, not presented all together with a finite set of multiple-choice alternatives. Standardization of administration and scoring is assured.

Realistic Simulations Without Operational Equipment. IVD technology has advanced considerably over the last few years; highly realistic simulations of job tasks are now possible. Additionally, CPT can be designed to require psychomotor actions very similar to those required in actually performing the task. For example, a light pen can simulate a screwdriver in certain CPT tasks.

Ability to Present Component Innerworkings and System Operations. The task simulations presented through CPT use pictures of actual equipment in various stages of assembly. This allows an inside look at components and makes it easier to see parts or components that are located in confined spaces. In addition, the simulations can depict interdependencies among various components and between individual actions and outcomes.

Ability to Capture Individual Thought Processes. As a diagnostic, CPT permits identification of the reasons for inadequate performance. CPT would appear extremely useful for those complex behavioral situations where knowledge is necessary but not sufficient to successful task performance (as in the welding trainer described above).

Summary and Conclusions

In considering the feasibility of CPT as a surrogate job performance measure, a number of questions were posed that focused this investigation on pertinent aspects specifically related to the utility of CPT to the Air Force. Site visits were made to observe application of state-of-the-art computer technology to the measurement of job performance. Four representative AFSs were evaluated for CPT applicability, and the AOTS was reviewed for compatibility with the CPT concept. These activities made it possible to answer the feasibility questions outlined previously.

Question 1. **Can CPT serve as a surrogate measure of job performance?**

The site visits provided promising indications of the capability of computer technology to measure complex job performance, including psychomotor skills. The welding and CPR simulations are concrete examples of the kinds of complex psychomotor tasks that can be taught and assessed with a PC-based computerized simulation. True to the spirit of CPT, they both use existing technology and a PC that can be portable. It is not hard to envision this kind of equipment on the job site for the purposes of training or assessment. This is also the case for the CPT approach that uses a CRT for two-dimensional representation of task stimuli and a keyboard, light pen, or touch screen for responses. For highly proceduralized tasks or for tasks where operational equipment is unavailable, inaccessible, or highly sensitive, this CPT approach may prove an acceptable surrogate measure for hands-on performance.

Question 2. **What is the potential application of CPT?**

CPT's potential application in terms of specific AFSs and types of tasks was determined by considering four representative AFSs. This resulted in the determination that only interpersonal tasks cannot be assessed at an acceptable level of fidelity with existing computer technology. The Personnel Specialist career field, being comprised primarily of administrative tasks--many of which are carried out on a computer terminal--is the most promising for CPT implementation because of the ease of CPT development and the fidelity of the proposed simulation. The Precision Measuring Equipment Specialist, Aerospace Ground Equipment Specialist, and Aircrew Life Support Specialist fields can all be assessed from a procedural point of view using either IVD or graphics. The use of IVD would enhance the fidelity of the simulation, but the use of two- and three-dimensional psychomotor simulations would make the greatest difference. Although the intent was to generalize to other Air Force specialties based on the findings for these four, it is clear that consideration of CPT feasibility must be made on a case-by- case basis. However, given the wide-ranging capabilities of computer technology for performance assessment, it can be said that no specialty should be exempt from careful consideration as a possible application.

Question 3. **To what extent does CPT complement the AOTS?**

Question 4. **What are the trade-offs--in terms of time, money, effort, and efficiency--in developing and implementing CPT as a stand-alone system or in conjunction with AOTS?**

CPT's feasibility was considered in terms of both a stand-alone system and AOTS. Given this consideration, it was necessary to examine the compatibility of AOTS with the CPT concept. This compatibility could be addressed only in conceptual terms. An important goal of AOTS is to provide on-site training and evaluation of job tasks via PCs that are easily accessed and used by enlisted personnel. The kinds of performance assessment that would support this goal fall well within the definition of CPT. Therefore, the CPT technique developed could equally benefit the AOTS and the JPM Project. Moreover, the concept of CPT as a separate (i.e., stand-alone) research effort is probably untenable; unless it is tied to an effort with established support, CPT is unlikely to be funded. At the present time, the most significant obstacle to a symbiotic relationship with AOTS is its reliance on mainframe computers. However, a recently acquired IVD capability and plans to enable the AOTS to be less mainframe-reliant should make it very compatible with the CPT concept. Furthermore, development of CPT solely as a method of performance measurement ignores its high-fidelity training capability. If the concept of CPT is argued from both an assessment and a training perspective, then developing CPT in conjunction with AOTS would ensure that both capabilities are available to the Air Force.

Question 5. **Weighing costs and benefits, is it worthwhile for the Air Force to pursue CPT?**

Given that the development of some CPT approaches (e.g., three-dimensional psychomotor simulations) can be very expensive, there must be two caveats to recommending that CPT be pursued. First, the more expensive the development, the more important it becomes that the simulation assess either (a) a task performed by a large number of airmen, (b) a task which is critical to mission performance and which occurs infrequently, (c) a task that cannot be safely assessed any other way (e.g., bomb disposal), or (d) a task with generic characteristics that suggest adaptability of the simulation to similar tasks. The second requirement is that the simulation assess the task more efficiently and accurately than existing methods, including the Walk-Through Performance Test. For example, there is little to be gained in developing an elaborate CPT for an administrative task that can be just as accurately assessed by the Walk-Through method; the bomb disposal task is a more appropriate candidate.

In speculating on the feasibility of computerized performance testing as a surrogate measure of job performance, it is important to consider the long-range implications of such a program of research. Although the focus of the Joint-Service Project is on developing surrogate performance measures for validation purposes, potential applications for other purposes should also be considered. The same advantages that make CPT a promising surrogate measure for the Joint-Service Project make it worth considering as a criterion for a variety of uses.

Although computerized performance testing has not yet been given due consideration, the application of computer technology to simulation and training has relevance to a consideration of the feasibility of computerized performance testing.

To the extent that a computerized performance test realistically simulates on-the-job performance requirements, it should be a valid measure of the respondent's job performance. If the test incorporates complex aspects of performance such as interaction and branching that are generally missing in paper-and-pencil tests and provides a test environment that maintains the real-life evaluative aspects of the situation while minimizing irrelevant evaluative aspects, the test is more likely to elicit real-life behavior (Newsom, Schultz, & Friedman, 1978, p. 425). In the final analysis, CPT is a technique that has great potential for measuring what respondents can do rather than what they say they will do, at least to the extent that the test requires the demonstration of actual job behaviors.

In sum, the evidence supports the utility of CPT for a variety of Air Force tasks that can be expected to be performed by first-term enlisted personnel. This makes CPT of interest to and compatible with the Joint-Service Job Performance Measurement Project. However, it is unlikely that CPT will be supported if it is pursued as a stand-alone concept aimed only at performance measurement. A more reasonable approach is to develop it within an existing program. The AOTS is a compatible program, at least in theory. The strength of this recommendation rests on the accomplishment of the recent and planned modifications of IVD and PC compatibility. The advantage of developing CPT in conjunction with AOTS is that its training potential, as well as its assessment function, can be fully realized. Following this approach will allow the Air Force to take full advantage of the technological advances in performance measurement for both the JPM Project and CPT.

REFERENCES

Conner, H.B. (1987, May). *Troubleshooting Proficiency Evaluation Program (TPEP) for the NATO Seasparrow Surface Missile System (NSSMS)*. Paper presented at the National Security Industrial Association Conference, Luxembourg.

Dittmar, M.J. (1987). *Task selection report for AFS 324XO Precision Measuring Equipment (PME)*. Dayton, OH: Universal Energy Systems.

Foley, J.P., Jr. (1974, October). *Evaluating maintenance performance: An analysis* (AFHRL-TR-74-57(I), AD-A004 761). Wright-Patterson AFB, OH: Advanced Systems Division, Air Force Human Resources Laboratory.

Hassett, C.E. (1987). *Task selection report: Aircrew Life Support (AFS 122XO)*. Dayton, OH: Universal Energy Systems.

Lane, N.E. (1986). *Issues in performance measurement for military aviation with applications to air combat maneuvering* (Technical Report TR-86-008). Orlando, FL: Naval Training Systems Center.

McDonnell Douglas Astronautics Company. (1986). *Instructional Support Software System* (AFHRL-TR-85-53, AD-A166 776). Lowry AFB, CO: Training Systems Division, Air Force Human Resources Laboratory.

Morris, C.L., Best, B.J., & McDaniel, W.C. (1985). *Simulator/device based performance measurement* (Special Report 85-002). Orlando, FL: Training Analysis and Evaluation Department, Naval Training Systems Center.

Newsom R.S., Schultz, J.V., & Friedman, R.B. (1978). Evaluation of complex human performance: The promise of computer-based simulation. *Evaluation Quarterly*, 2, 421-433.

Pedersen, L.A. (1987). *Task selection report for AFSC 423X5 Aerospace Ground Equipment Mechanic*. Dayton, OH: Universal Energy Systems.

Shriver, E.L., & Foley, J.P., Jr. (1974a). *Evaluating maintenance performance: The development and tryout of criterion referenced job task performance tests for electronic maintenance* (AFHRL-TR-74-57(II), Part I, AD-A004 845). Wright-Patterson AFB, OH: Advanced Systems Division, Air Force Human Resources Laboratory.

Shriver, E.L., & Foley, J.P., Jr. (1974b). *Evaluating maintenance performance: The development of graphic symbolic substitutes for criterion referenced job task performance tests for electronic maintenance* (AFHRL-TR-74-57(III), AD-A005 296). Wright-Patterson AFB, OH: Advanced Systems Division, Air Force Human Resources Laboratory.

Shriver, E.L., Hayes, J.F., & Hufhand, W.R. (1974). *Evaluating maintenance performance: A video approach to symbolic testing of electronics maintenance tasks* (AFHRL-TR-74-57(IV), AD-A005 297). Wright-Patterson AFB, OH: Advanced System Division, Air Force Human Resources Laboratory.

Vineberg, R., & Joyner, J.N. (1982). *Prediction of job performance: Review of military studies* (NPRDC Technical Report 82-37). San Diego, CA: Navy Personnel Research and Development Center.

Wall, M.L. (1987). *Task selection report: Personnel secialist (AFS 732XO)*. Dayton, OH: Universal Energy Systems.

Wigdor, A.K., & Green, B.F. (1986). *Assessing the performance of enlisted personnel: Evaluation of a Joint-Service Research Project*. Washington, DC: National Academy Press.

APPENDIX A: CPT APPLICATION SITES VISITED

Dr. Pam Kidder
Department of the Navy
Navy Personnel Research and Development Center
(Code 621)
San Diego, CA 92152-6800

Mr. Hal Clark
Technology Application Officer
3300 TCHTW/TTGH
Keesler AFB, MS 39534-5000

Mr. David Hon
Ixion, Inc.
1335 N. Northlake Way
Seattle, WA 98103

APPENDIX B: JOINT-SERVICE PROJECT DOCUMENTS REVIEWED

Job Performance Measurement Research Summary - AFHRL/IDE

Job Performance Measurement: A Systematic Program of Research and Development - Hedge & Teachout

Air Force Plan for the Development of Job Performance Measurement (JPM) Technology

Job Performance Measurement in the Military: A Classification Scheme, Literature Review, and Directions for Research - Kavanagh, Borman, Hedge, & Gould

Assessing the Performance of Enlisted Personnel: Evaluation of a Joint-Service Research Project - Wigdor & Green (Eds.)

Walk-Through Performance Testing (WTPT) Procedural Manual

Walk-Through Performance Testing: An Innovative Approach to Work Sample Testing - Hedge & Lipscomb (Eds.)

Sample Occupational Survey Reports

Sample Walk-Through Performance Test and Rating Form booklets for the Jet Engine Mechanic Specialty

APPENDIX C: ORGANIZATIONS CONTACTED

Air Force Human Resources Laboratory (AFHRL), Logistics and Human Factors Division
American College Testing (ACT)
Army Research Institute (ARI)
Assessment Designs International
Assessment Systems Corporation
Aviation Research Laboratory at the University of Illinois
Center for Instructional Development at Florida State University
Defense Training Performance and Data Center
Development Dimensions International
Educational Testing Service (ETS)
Human Resources Research Organization (HumRRO)
Ixion, Incorporated
International Business Machines (IBM)
The Johns Hopkins University
National Cash Register (NCR)
New York and New England Telephone (NYNEX)
Navy Personnel Research and Development Center (NPRDC)
Pennsylvania State University

As a result of investigating the feasibility of using simulators and training devices for performance measurement, NPRDC recommended that the Electronic Equipment Maintenance Trainer (EEMT) used by the Electronics Technician rating be field-tested as a surrogate job performance measure.

APPENDIX D: PRECISION MEASURING EQUIPMENT SPECIALIST - AFSC 324X0

The specialty summary for AFS 32430/50 specifies the repair, calibration, and certification of test, measurement and diagnostic equipment (TMDE). This includes the use of TMDE to perform voltage, current, power, impedance, frequency, microwave, temperature, physical-dimensional, and radiac measurements. Primary duties focus on: (a) detection and isolation of malfunctions in TMDE; (b) repair and modification of TMDE, including the removal and replacement of components; and (c) calibration and certification of TMDE, including laboratory standards.

Personnel enter the Precision Measuring Equipment career ladder from civilian life or from electronics, avionics, or maintenance specialties via the basic technical training school (course G3ABR32430-002) mandatory for the award of the semiskilled AFS. The 30-week, 4-day course, taught at Lowry AFB, CO, is designed to train personnel in the principles of electronics and methodology. Course instruction includes the use of Air Force calibration standards to perform calibration, malfunctional analysis and isolation, and repair of DC and low- frequency AC electrical-electronic precision measuring equipment. Instructional design is self-paced and computer-managed. The course contains six blocks of instruction totaling 924 hours of classroom and laboratory time and 239 hours of supervised study.

Upon completing initial technical training, AFS 32430 personnel are generally assigned to a precision measuring equipment laboratory (PMEL). These laboratories maintain Air Force reference standards and are responsible for calibrating, certifying and repairing precision measuring equipment. Almost all PMELs are internally organized into a set of nine functional areas (K1 to K9) that correspond to a specific group or type of equipment calibrated and maintained by personnel assigned to those areas. K areas by function are as follows:

K1/K2	Voltage, current, and impedance equipment
K3	Frequency-generating/waveform analyzing equipment
K4	Microwave equipment
K5/K6	Electro-mechanical/dimensional equipment
K7	Radiac equipment
K8	Electrical measurement consoles and equipment
K9	Automatic test equipment

Sample Tasks for AFS 324X0

Make entries on DD Forms 1577 (Unserviceable (Condemned) Tag- Material).

Make entries on AFTO Forms 350 (Repairable Item Processing Tag).

Make entries on DD Forms 1577-2 (Unserviceable (Repairable) Tag- Material).

Make entries on AFTO Forms 22 (Technical Order System Publication Improvement Report/Reply).

Appendix D. (Continued)

Make entries on AF Forms 2005 (Issue/Turn-In Requests).

Make entries on AFTO Forms 108 or 394 (PME Certification Label).

Research alternate technical information or procedures when "K" procedures are not available.

Research manuals for parts numbers.

Research microfiche documents for parts information.

Interpret calibration correction charts for reference and working standards.

Convert temperature among Fahrenheit, Celsius, Kelvin, or Randine scales.

Perform waveform spectrum analysis.

Perform digital integrated circuit analysis.

Convert reference power ratios in db to specific power levels in dbm.

Calculate current, voltage, impedance, or power parameters.

Troubleshoot RF millivoltmeters.

Troubleshoot electronic counters.

Troubleshoot ohmmeters.

Troubleshoot AC/DC analog ammeters.

Troubleshoot test oscillators.

Troubleshoot AC/DC analog voltmeters.

Troubleshoot general-purpose oscilloscopes.

Troubleshoot digital multimeters or voltmeters.

Troubleshoot power supplies.

Troubleshoot differential voltmeters.

Calibrate digital voltmeters or multimeters.

Calibrate AC/DC analog voltmeters.

Appendix D. (Continued)

Calibrate RF millivoltmeters.

Calibrate constant amplitude generators.

Calibrate distortion analyzers.

Calibrate time mark generators.

Calibrate VHF sine wave generators.

Calibrate scales.

Calibrate microwave power meters.

Calibrate AC/DC analog ammeters.

Calibrate general-purpose oscilloscopes.

Calibrate Bourdon tube pressure gauges.

Calibrate square wave generators.

Calibrate decade resistors.

Calibrate micrometers.

Calibrate microwave signal generators.

Calibrate AC voltage standards.

Calibrate DC voltage standards.

Calibrate attenuators other than microwave.

Solder or desolder discrete circuit components or single-layer circuit boards using PACE kits.

Replace electronic equipment pins, connectors, or plugs.

Reconstruct lands, runs, or soldering pads.

Align AC/DC analog multimeters.

Align general-purpose oscilloscopes.

Align horizontal time base plug-in units.

Appendix D. (Concluded)

Align DC voltage standards.

Align UHF signal generators.

Align microwave power meters.

Adjust humidigraphs.

Align electronic counters.

Align RF millivoltmeters.

Align audio frequency generators.

Align Bourdon tube pressure gauges.

APPENDIX E: AEROSPACE GROUND EQUIPMENT MECHANIC - AFS 423X5

The specialty summary for AFS 423X5 includes inspecting, maintaining, repairing, and modifying aerospace ground equipment used in support of aircraft systems or subsystems and Tactical Air Control Systems (TACS). The duties and responsibilities outlined in the regulation include: performing preventive maintenance, troubleshooting, repairing, overhauling, and modifying AGE and TACS support equipment; operating towing equipment; and supervising maintenance personnel.

Entrance into the AFS is normally made through the basic technical training school (course C3ABR42335-000). The basic course is 86 academic days (17.2 weeks) in length and taught at Chanute AFB, IL, in a straight group-paced instructional design. The course contains 11 blocks of instruction with 516 hours of classroom/laboratory time and 172 hours of supervised study and military training time.

Sample Tasks for AFS 423X5

Make entries on AFTO Forms 350.

Measure resistance of AGE electrical systems.

Research T.O.'s, charts or diagrams for AGE enclosures, chassis, and drive maintenance information.

Isolate brake system malfunctions.

Isolate pneumatic system malfunctions.

Isolate engine, motor, or generator mechanical malfunctions.

Isolate hydraulic system malfunctions.

Isolate heater system malfunctions.

Perform aircraft support air conditioner service inspections.

Perform aircraft support load bank service inspections.

Perform hydraulic test stand service inspections.

Perform aircraft support generator service inspections.

Perform gas turbine compressor periodic inspections.

Perform AGE electrical system operational checks.

Perform hydraulic test stand periodic inspections.

Inspect vehicles for safety of operation.

APPENDIX E. (Concluded)

Clean motor or generator commutators or slip rings.

Adjust turbine engine fuel system components.

Remove or install hydraulic lines or fittings.

Remove or install burner control valves.

Change generators or alternators.

Splice electrical system wiring.

Remove or install AGE tire, tube, or wheel assemblies.

Remove or install engine fuel pumps (fuel transfer pumps).

Remove or install carburetors.

Remove or install fuel lines and fittings.

Pack wheel bearings.

Prepare AGE for mobility or training exercises.

Build bleed air hoses.

APPENDIX F: PERSONNEL SPECIALIST - AFS 732X0

AFS 73210, 73230, and 73250, Personnel Specialist, airmen prepare personnel action requests and other source documents, including unit, field, and master personnel records.

The Personnel Specialist technical training course (number D3ABR73230 000) at Keesler AFB, MS takes 40 academic days to complete according to the Course Chart dated 5 November 1984. Training equipment includes electric typewriters and remote computer terminals. Training primarily consists of instruction on Consolidated Base Personnel Office (CBPO) organization and mission, administrative practices (e.g., drafting correspondence), Personnel Data System (PDS) procedures, touch typing, and processing officer/airman classification actions (e.g., awarding officer AFSCs).

Sample Tasks for AFS 732X0

Clear overdue data on transaction registers.

Research system purges such as unknown, expired, or incompatible data.

Evaluate requirements for Specialized Experience Indicators (SEIs), prefixes or reporting identifiers.

Conduct records reviews.

Release information from Personnel Records Group (PRG).

Remove obsolete documents from records.

Compute service dates.

Draft correspondence.

Select Personnel Transaction Identifiers (PTI).

Review special orders to determine Change of Reporting Official (CRO) report requirements.

Review officer promotion orders to confirm update of promotion data by HQ USAF.

Establish suspense systems.

Construct Immediate Inquiries.

Dispose of Personnel Data Systems (PDS) products.

Distribute correspondence.

Distribute Field Personnel Record (FPR) groups for separatees or retirees.

Maintain charge-out record forms (AF Form 614).

Distribute completed enlistment, re-enlistment, extension, or separation documents.

Appendix F. (Continued)

Maintain meal card control logs.

Assemble manning statistics or manning summaries.

Prepare Initial Duty Assignment (IDA) Report on Individual Personnel (RIP).

Prepare actions affecting intrabase assignments or duty changes.

Perform actions pertaining to Overseas Duty Selection Date (ODSD) such as ODSD changes or assignments.

Award officer Air Force Specialty Codes (AFSCs).

Prepare incoming Permanent Change of Station (PCS) processing folders.

Distribute allocation briefs.

Assign personnel to duty positions.

Process PCS or Temporary Duty (TDY) declination statements.

Prepare medical and educational clearance for dependent overseas travel forms (AF Form 1466).

Prepare request and authorization for change of administrative order forms (AF Form 973).

Prepare assignment reclamas.

Prepare nomination documents for personnel being assigned to Special Compartmentalized Information (SCI) positions.

Audit incoming records for receipt of items reflected on records transmittal/request forms (AF Form 330).

Check personnel reporting dates for overdue personnel.

Process applications for concurrent travel.

Prepare request authorization for PCS - military forms (AF Form 899).

Verify completion of assignment relocation processing.

Maintain clearance record files on personnel who have departed PCS.

Review selection of personnel for attendance at Noncommissioned Officer (NCO) academies or leadership schools.

Appendix F. (Continued)

Process AFS withdrawal actions.

Process formal training allocation changes or cancellations.

Process retraining declination statements.

Prepare applications for retraining.

Perform temporary duty relocation actions such as preparing relocation preparation checklist forms (AF Form 907).

Prepare request and authorization for temporary duty forms (DD Form 1610).

Process hardship discharge requests.

Prepare requests for discharge for miscellaneous reasons.

Evaluate Palace Chase separation requests.

Prepare report of separation from active duty forms (DD Form 214).

Prepare pregnancy discharge requests.

Prepare Palace Chase "Category A" unit selected reserve service contract forms (AF Form 3028).

Prepare separation orders.

Maintain separation preparation project folders.

Advise first-term 4-year enlistees on military service obligation.

Collect ID cards or passports from separatees or retirees.

Post standard publications such as regulations or manuals.

Annotate personnel data rosters.

Maintain unit leave control log forms (AF Form 1486).

Send sponsorship kits or letters of welcome.

Coordinate promotion testing notification.

Review Airman Performance Reports/Officer Evaluation Reports (APRs/OERs) for accuracy and completeness.

Process assignment notification actions.

Prepare personnel duty status report (AF Form 1240).

Establish records folders from prior service packages.

Audit Records Review Listings (RRL) or Report on Individual Personnel (RIP) products.

Perform periodic records inventories.

Verify data provided on Veterans Administration (VA) forms such as for educational purposes.

Prepare statements of service for purposes such as Federal Housing Authority (FHA) loan application.

Review official photographs for file.

Type informal form administrative communications using manual or electric typewriters.

File documents in personnel records.

File personnel records folders.

Operate cathode-ray tubes (CRT).

Assemble senior NCO promotion selection folders.

Conduct classification interviews.

Conduct initial out-processing briefings.

Conduct in-processing briefings.

Conduct separation briefings or interviews for pending separatees.

APPENDIX G: AIRCREW LIFE SUPPORT SPECIALIST - AFS 122X0

Aircrew Life Support Specialists (AFS 122X0) inspect, maintain, and adjust life support and chemical defense equipment. Members of this AFS also provide aircrew life support, chemical defense, and survival continuation training.

Entry into the 122X0 career field is made through the basic technical training school located at Chanute AFB, IL. The course length is 31 academic days (248 hours) and the instructional design for this course is group- paced. The course trains personnel to perform duties described in AFR 39-1 for Aircrew Life Support Specialist, AFS 12230. Some of these duties include the use, operation, inspection, and maintenance of aircrew life support equipment and constant shelter equipment. The course also includes instruction on procedures for conducting aircrew chemical decontamination and procedures for managing a protective shelter area.

Sample Tasks for AFS 122X0

Make entries on AFTO Form 406 (Mesh Net Survival Vest Inspection Record).

Make entries on DD Form 1574 (Serviceable Tag-Material).

Make entries on AFTO Form 338 (Survival Kit Record).

Make entries on AFTO Form 392 (Parachute Repack, Inspection and Component Record).

Schedule maintenance repair of life support equipment.

Disassemble, assemble, purge, and refill emergency oxygen cylinders.

Assemble emergency passenger oxygen kits.

Fit or adjust parachute harnesses.

Assemble 12P oxygen masks.

Replace switch kits in the quick-don assembly.

Remove and replace seat kits.

Replace nape straps and pads.

Remove or replace emergency oxygen cylinders in parachutes.

Pour and fabricate helmet liner molds.

Size and fit oxygen masks.

Repack software pack survival kits.

Fit helmets using custom liners.

Build up helmets from shells.

Remove or replace headsets in helmets.

Weight test carbon dioxide (CO_2) cylinders or cartridges.

Perform mask exchanges in the vapor hazard area while wearing the ground crew ensemble.

Wearing the ground crew ensemble, in-process an individual wearing the aircrew ensemble through the liquid hazard area.

Remove and install the filter elements in the Crew SO/P while wearing the gloves and mask of the ground crew ensemble.

Perform oxygen mask connector periodic inspections.

Perform oxygen mask periodic inspections.

Perform nuclear flash blindness goggle kit 180-day inspections.

Perform 30-day routine parachute inspections.

Perform survival kit mandatory component periodic inspections.

Perform helmet periodic inspections.

Inspect Chemical Warfare Defense (CWD) equipment.

Perform aircraft life support equipment acceptance inspections.

Perform anti-G suit periodic inspections to include the leak test.

APPENDIX H: REPRESENTATIVE AIR FORCE TASKS CLUSTERED BY CPT TASK TYPE

Cluster 1 - Administrative

Stimulus Type: Written/Pictorial Materials (Hardcopy or CRT)
Response Type: Written (Hands or Keyboard) or Organization of Information

AFS	
324X0	Make entries on DD Forms 1577 (Unserviceable (Condemned)Tag-Material).
324X0	Make entries on AFTO Forms 350 (Repairable Item Processing Tag).
324X0	Make entries on DD Forms 1577-2 (Unserviceable (Repairable) Tag-Material).
324X0	Make entries on AFTO Forms 22 (Technical Order System Publication Improvement Report/Reply).
324X0	Make entries on AF Forms 2005 (Issue/Turn-In Requests).
324X0	Make entries on AFTO Forms 108 or 394 (PME Certification Label).
423X5	Make entries on AFTO Forms 350.
122X0	Make entries on AFTO Form 406 (Mesh Net Survival Vest Inspection Record).
122X0	Make entries on DD Form 1574 (Serviceable Tag- Material).
122X0	Make entries on AFTO Form 338 (Survival Kit Record).
122X0	Make entries on AFTO Form 392 (Parachute Repack, Inspection, and Component Record).
122X0	Schedule maintenance repair of life support equipment.
423X5	Research Technical Orders (T.O.'s), charts or diagrams for Aerospace Ground Equipment (AGE) enclosures, chassis, and drive maintenance information.
732X0	Annotate personnel data rosters.
732X0	Maintain unit leave control log forms (AF Form 1486).
732X0	Type informal form administrative communications using manual or electric typewriters.
732X0	Distribute allocation briefs.
732X0	Assign personnel to duty positions.
732X0	Process Permanent Change of Station (PCS) or Temporary Duty (TDY) declination statements.

732X0	Prepare medical and educational clearance for dependent overseas travel forms (AF Form 1466).
732X0	Prepare request and authorization for change of administrative order forms (AF Form 973).
732X0	Prepare assignment reclamas.
732X0	Prepare nomination documents for personnel being assigned to Special Compartmentalized Information (SCI) positions.
732X0	Audit incoming records for receipt of items reflected on records transmittal/request forms (AF Form 330).
732X0	Check personnel reporting dates for overdue personnel.
732X0	Process applications for concurrent travel.
732X0	Distribute correspondence.
732X0	Distribute Field Personnel Record (FPR) groups for separatees or retirees.
732X0	Maintain charge-out record forms (AF Form 614).
732X0	Distribute completed enlistment, re-enlistment, extension, or separation documents.
732X0	Maintain meal card control logs.
732X0	Assemble manning statistics or manning summaries.
732X0	Prepare Initial Duty Assignment (IDA) Report on Individual Personnel (RIP).
732X0	Prepare actions affecting intrabase assignments or duty changes.
732X0	Perform actions pertaining to Overseas Duty Selection Date (ODSD) such as ODSD changes or assignments.
732X0	Award officer Air Force Specialty Codes (AFSCs).
732X0	Prepare request authorization for PCS - military forms (AF Form 899).
732X0	Verify completion of assignment relocation processing.
732X0	Maintain clearance record files on personnel who have departed PCS.
732X0	Review selection of personnel for attendance at Noncommissioned Officer (NCO) academies or leadership schools.

Appendix H. (Continued)

732X0	Process AFS withdrawal actions.
732X0	Process formal training allocation changes or cancellations.
732X0	Process retraining declination statements.
732X0	Prepare applications for retraining.
732X0	Perform temporary duty relocation actions such as preparing relocation preparation checklist forms (AF Form 907).
732X0	Prepare request and authorization for temporary duty forms (DD Form 1610).
732X0	Process hardship discharge requests.
732X0	Prepare requests for discharge for miscellaneous reasons.
732X0	Evaluate Palace Chase separation requests.
732X0	Prepare report of separation from active duty forms (DD Form 214).
732X0	Prepare pregnancy discharge requests.
732X0	Prepare Palace Chase "Category A" unit selected reserve service contract forms (AF Form 3028).
732X0	Prepare separation orders.
732X0	Maintain separation preparation project folders.
732X0	Advise first-term 4-year enlistees on military service obligation.
732X0	Clear overdue data on transaction registers.
732X0	Research system purges such as unknown, expired, or incompatible data.
732X0	Evaluate requirements for specialized experience indicators (SEIs), prefixes, or reporting identifiers.
732X0	Conduct records reviews.
732X0	Release information from personnel records group (PRG).
732X0	Remove obsolete documents from records.
732X0	Compute service dates.
732X0	Draft correspondence.

Appendix H. (Continued)

732X0	Select personnel transaction identifiers (PTI).
732X0	Review special orders to determine change of reporting official (CRO) report requirements.
732X0	Review officer promotion orders to confirm update of promotion data by HQ USAF.
732X0	Establish suspense systems.
732X0	Construct Immediate Inquiries.
732X0	Dispose of personnel data systems (PDS) products.
732X0	Send sponsorship kits or letters of welcome.
732X0	Coordinate promotion testing notification.
732X0	Review Airman Performance Reports/Officer Effectiveness Reports (APRs/OERs) for accuracy and completeness.
732X0	Process assignment notification actions.
732X0	Prepare personnel duty status report (AF Form 1240).
732X0	Establish records folders from prior service packages.
732X0	Audit records review listings (RRL) or report on individual personnel (RIP) products.
732X0	Perform periodic records inventories.
732X0	Verify data provided on Veterans' Administration (VA) forms such as for educational purposes.
732X0	Prepare statements of service for purposes such as Federal Housing Administration (FHA) loan application.
732X0	Review official photographs for file.
324X0	Research alternate technical information or procedures when "K" procedures are not available.
324X0	Research manuals for parts numbers.
324X0	Research microfiche documents for parts information.
324X0	Interpret calibration correction charts for reference and working standards.
324X0	Convert temperature among Fahrenheit, Celsius, Kelvin, or Randine scales.

324X0 Perform waveform spectrum analysis.

324X0 Perform digital integrated circuit analysis.

324X0 Convert reference power ratios in db to specific power levels in dbm.

324X0 Calculate current, voltage, impedance, or power parameters.

Cluster 2 - Interpersonal

Stimulus Type: Verbal
Response Type: Verbal

732X0 Conduct classification interviews.

732X0 Conduct initial out-processing briefings.

732X0 Conduct in-processing briefings.

732X0 Conduct separation briefings or interviews for pending separatees.

Cluster 3 - Administrative with gross psychomotor component

Stimulus Type: Written/Pictorial Materials
Response Type: Psychomotor (gross)

732X0 Collect ID cards or passports from separatees or retirees.

732X0 Post standard publications such as regulations or manuals.

732X0 Assemble senior NCO promotion selection folders.

732X0 Prepare incoming PCS processing folders.

732X0 File documents in personnel records.

732X0 File personnel records folders.

Cluster 4 - Simplistic psychomotor

Stimulus Type: Dials, Gauges, and Other Displays
Response Type: Psychomotor (fine)

324X0 Calibrate digital voltmeters or multimeters.

324X0 Calibrate alternating current/direct current (AC/DC) analog voltmeters.

324X0 Calibrate radio frequency (RF) millivoltmeters.

Appendix H: (Continued)

324X0	Calibrate constant amplitude generators.
324X0	Calibrate distortion analyzers.
324X0	Calibrate time mark generators.
324X0	Calibrate very high frequency (VHF) sine wave generators.
324X0	Calibrate scales.
324X0	Calibrate microwave power meters.
324X0	Calibrate AC/DC analog ammeters.
324X0	Calibrate general-purpose oscilloscopes.
324X0	Calibrate Bourdon tube pressure gauges.
324X0	Calibrate square wave generators.
324X0	Calibrate decade resistors.
324X0	Calibrate micrometers.
324X0	Calibrate microwave signal generators.
324X0	Calibrate AC voltage standards.
324X0	Calibrate DC voltage standards.
324X0	Calibrate attenuators other than microwave.
423X5	Measure resistance of AGE electrical systems.
324X0	Align AC/DC analog multimeters.
324X0	Align general-purpose oscilloscopes.
324X0	Align horizontal time base plug-in units.
324X0	Align DC voltage standards.
324X0	Align ultra high frequency (UHF) signal generators.
324X0	Align microwave power meters.

324X0	Adjust humidigraphs.
324X0	Align electronic counters.
324X0	Align RF millivoltmeters.
324X0	Align audio frequency generators.
324X0	Align Bourdon tube pressure gauges.

Cluster 5 - Complex psychomotor

Stimulus Type: Equipment (three-dimensional)
Response Type: Psychomotor (fine)

732X0	Operate cathode-ray tubes.
122X0	Pour and fabricate helmet liner molds.
122X0	Size and fit oxygen masks.
122X0	Repack software pack survival kits.
122X0	Fit helmets using custom liners.
122X0	Build up helmets from shells.
122X0	Remove or replace headsets in helmets.
122X0	Weight-test carbon dioxide (CO_2) cylinders or cartridges.
122X0	Perform mask exchanges in the vapor hazard area while wearing the ground crew ensemble.
122X0	Wearing the ground crew ensemble, in-process an individual wearing the aircrew ensemble through the liquid hazard area.
122X0	Remove and install the filter elements in the Crew SO/P while wearing the gloves and mask of the ground crew ensemble.
122X0	Disassemble, assemble, purge, and refill emergency oxygen cylinders.
122X0	Assemble emergency passenger oxygen kits.
122X0	Fit or adjust parachute harnesses.
122X0	Assemble 12P oxygen masks.

Appendix H. (Continued)

122X0	Replace switch kits in the quick-don assembly.
122X0	Remove and replace seat kits.
122X0	Replace nape straps and pads.
122X0	Remove or replace emergency oxygen cylinders in parachutes.
324X0	Solder or desolder discrete circuit components or single-layer circuit boards using PACE kits.
324X0	Replace electronic equipment pins, connectors, or plugs.
324X0	Reconstruct lands, runs, or soldering pads.
423X5	Clean motor or generator commutators or slip rings.
423X5	Adjust turbine engine fuel system components.
423X5	Remove or install hydraulic lines or fittings.
423X5	Remove or install burner control valves.
423X5	Change generators or alternators.
423X5	Splice electrical system wiring.
423X5	Remove or install AGE tire, tube, or wheel assemblies.
423X5	Remove or install engine fuel pumps (fuel transfer pumps).
423X5	Remove or install carburetors.
423X5	Remove or install fuel lines and fittings.
423X5	Pack wheel bearings.
423X5	Prepare AGE for mobility or training exercises.
423X5	Build bleed air hoses.
122X0	Perform oxygen mask connector periodic inspections.
122X0	Perform oxygen mask periodic inspections.
122X0	Perform nuclear flash blindness goggle kit 180-day inspections.

Appendix H. (Continued)

122X0	Perform 30-day routine parachute inspections.
122X0	Perform survival kit mandatory component periodic inspections.
122X0	Perform helmet periodic inspections.
122X0	Inspect Chemical Warfare Defense equipment.
122X0	Perform aircraft life support equipment acceptance inspections.
122X0	Perform anti-G suit periodic inspections to include the leak test.
423X5	Perform aircraft support air conditioner service inspections.
423X5	Perform aircraft support load bank service inspections.
423X5	Perform hydraulic test stand service inspections.
423X5	Perform aircraft support generator service inspections.
423X5	Perform gas turbine compressor periodic inspections.
423X5	Perform AGE electrical system operational checks.
423X5	Perform hydraulic test stand periodic inspections.
423X5	Inspect vehicles for safety of operation.
423X5	Isolate brake system malfunctions.
423X5	Isolate pneumatic system malfunctions.
423X5	Isolate engine, motor, or generator mechanical malfunctions.
423X5	Isolate hydraulic system malfunctions.
423X5	Isolate heater system malfunctions.
324X0	Troubleshoot RF millivoltmeters.
324X0	Troubleshoot electronic counters.
324X0	Troubleshoot ohmmeters.
324X0	Troubleshoot AC/DC analog ammeters.

Appendix H. (Concluded)

324X0	Troubleshoot test oscillators.
324X0	Troubleshoot AC/DC analog voltmeters.
324X0	Troubleshoot general-purpose oscilloscopes.
324X0	Troubleshoot digital multimeters or voltmeters.
324X0	Troubleshoot power supplies.
324X0	Troubleshoot differential voltmeters.