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Computer-Based Training of Cannon Fire Direction Specialists

Hilary Farris, William L. Spencer, John D. Winkler, James P. Kahan

Arroyo Center

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Preface

This report documents results of a research project entitled "Future Individual Training Strategies." The overall project objectives are to identify and assess alternative training strategies that may be more efficient and affordable than current techniques for conducting Army individual training, with special attention given to resident training conducted in U.S. Army schools. Here the authors present results of one of three case studies of specialized skill training in an Army military specialty. Each case study examines current job requirements and training approaches, identifies alternative methods of conducting training consistent with new Army training concepts, and analyzes resources, costs, and potential consequences of changes in training strategy.

The project has released five other publications:

R-4228-A, *Linking Future Training Concepts to Army Individual Training Programs*, John D. Winkler, Stephen J. Kirin, and John S. Uebersax, 1992.

N-3527-A, *The Army Military Occupational Specialty Database*, Stephen J. Kirin and John D. Winkler, 1992.

R-4224-A, *How to Estimate the Costs of Changes in Army Individual Skill Training*, Susan Way-Smith, 1993.

MR-118-A, *Distributed Training of Armor Officers*, John D. Winkler, Susan Way-Smith, Gary A. Moody, Hilary Farris, James P. Kahan, and Charles Donnell, 1993.

MR-119-A, *Device-Based Training of Armor Crewmen*, Gary A. Moody, Susan Way-Smith, Hilary Farris, John D. Winkler, James P. Kahan, and Charles Donnell, 1993.

The results described in this report should be of interest to policymakers concerned with military education and training, and to managers responsible for the design and implementation of training programs for specific Army military specialties. The research was conducted in the Manpower and Training program of the Arroyo Center and was sponsored by the Office of the Deputy Chief of Staff for Training, U.S. Army Training and Doctrine Command.

The Arroyo Center

The Arroyo Center is the U.S. Army's federally funded research and development center (FFRDC) for studies and analysis operated by RAND. The Arroyo Center provides the Army with objective, independent analytic research on major policy and organizational concerns, emphasizing mid- and long-term problems. Its research is carried out in four programs: Strategy and Doctrine, Force Development and Technology, Military Logistics, and Manpower and Training.

Army Regulation 5-21 contains basic policy for the conduct of the Arroyo Center. The Army provides continuing guidance and oversight through the Arroyo Center Policy Committee (ACPC), which is co-chaired by the Vice Chief of Staff and by the Assistant Secretary for Research, Development, and Acquisition. Arroyo Center work is performed under contract MDA903-91-C-0006.

The Arroyo Center is housed in RAND's Army Research Division. RAND is a private, nonprofit institution that conducts analytic research on a wide range of public policy matters affecting the nation's security and welfare.

James T. Quinlivan is Vice President for the Army Research Division and Director of the Arroyo Center. Those interested in further information about the Arroyo Center should contact his office directly:

James T. Quinlivan
RAND
1700 Main Street
P.O. Box 2138
Santa Monica, CA 90407-2138

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Summary

In an era of declining training resources and budgets, the Army is searching for more efficient training methods to use in individual training programs. Individual training conducted in-residence in the U.S. Army school system (generally termed "institutional training") is very costly, encompassing a large portion of the entire U.S. Army budget—$5.7 billion in fiscal year 1992, for example (Department of Defense, 1992). Conducting this training requires numerous installations, facilities, equipment, and manpower (instructors and trainees) while consuming large quantities of ammunition, fuel, and other resources.

To meet Army training requirements and overcome restraints imposed by declining resources, Army policymakers are considering initiatives that may fundamentally change the nature of individual training. Doctrinal publications have proposed, for example, sizable reductions in the length and scope of resident training and expanded use of training technologies (U.S. Army Training and Doctrine Command [TRADOC], 1990a). Because of their potentially far-reaching effects on soldier proficiency and Army capability, a thorough evaluation of proposed new approaches is needed. Training policymakers need to know which occupations and training courses would be affected, how such changes would be specifically implemented, and whether such changes will provide savings and prove feasible in practice. More generally, the Army needs improved techniques for identifying alternatives to current training approaches and assessing potential costs and consequences of changing its customary training methods. Currently, there is no agreed-upon methodology for identifying training approaches suitable for specific occupational specialties or for evaluating the resource and cost implications of new training approaches.

Research Objectives

The overall objective of this research is to develop improved techniques for identifying alternative approaches for conducting individual training and analyzing their cost implications. We first analyze the characteristics of Army occupations and link them with concepts for changing existing methods of

training (such as distributed training or increased use of training technologies).[1] Then, in subsequent case studies of specific individual training programs we: (a) define options for reorganizing training, (b) analyze potential effects of training changes on resources and costs, and (c) identify further implications of training changes. We conduct these analyses within specialized skill training programs selected as potentially amenable to new training strategies under consideration by the Army: The Armor Officer Advanced Course (AOAC), Abrams Armor Crewman One-Station Unit Training (MOS 19KOSUT), and Cannon Fire Direction Specialist Advanced Individual Training (MOS 13E10 AIT).

A common analytic method is used in each of the case studies. First, we perform a *job analysis* of tasks performed in the duty assignment for which the soldier is being prepared. This job analysis is based on task performance data obtained by the Army Occupational Survey Program (AOSP), augmented with subject matter expert ratings of task characteristics relevant to training organization and delivery. The data are statistically analyzed to determine requirements and to set priorities for resident and nonresident training in conjunction with other elements of instructional design (i.e., timing, location, and training technologies). We use these results to suggest potential modification to the existing program of instruction (POI), balancing key course objectives against potential changes in training approaches and methods.

The resulting set of alternative POIs is then subjected to *resource and cost analyses*.[2] The analyses provide quantitative estimates of changes in resources and costs resulting from potential changes in training organization and delivery while highlighting trade-offs and implications for all Army organizations affected by the changes. The steps of the cost analysis involve: (a) defining the program's current methods and resources and specifying how alternatives will be implemented; (b) detailing how activities and workload will change for training delivery, development, and support; (c) analyzing the type and quantity of resources required to accomplish the changes (manpower, equipment, and facilities); and (d) calculating specific costs, recurring costs and savings, break-even points, and implications for soldiers, schools, and units.

[1]See Kirin and Winkler, 1992; Winkler et al., 1992.

[2]This method, termed the Training Resource Analysis Method (TRAM), is described in detail in Way-Smith (1993).

Advanced Individual Training of Cannon Fire Direction Specialists

This report presents our analysis of training options and costs for advanced individual training of Cannon Fire Direction Specialists. This course provides AIT to enlisted personnel who operate battery fire direction centers (FDCs) and provide technical support to artillery fire missions. This course was selected for study because of its potential suitability for strategies that seek to reduce the length of resident training and expand the use of training technologies. Cannon fire direction specialist training involves extensive instruction in hard-to-train cognitive tasks, for which computer-based training (CBT) could prove a more cost-effective substitute for current methods of instruction. The course also includes some material that might be considered for nonresident training.

We review these assumptions using our analytic method while analyzing the feasibility of specific alternatives that better align training with job requirements and expand use of CBT in the POI. Our analysis seeks to determine how much training needs to be conducted in-residence and how much may be conducted using CBT. The analysis also seeks to determine how these concepts might be implemented and supported in the most cost-effective manner given course objectives to prepare soldiers to fight on the battlefield as skill-level one (SL1) fire direction specialists.

Results

Our analyses suggest that the current course can be reorganized to reduce course length and conserve resources while meeting fundamental training objectives. Moreover, a substantial number of tasks can be taught using CBT. As described below, such changes in the current methods of instruction could generate significant cost savings.

Training Requirements of Cannon Fire Direction Specialists

Our results indicate that fire direction specialists' tasks can be characterized by a small number of general dimensions, which together indicate the extent to which the tasks are performed frequently by other MOS 13E10 soldiers, are combat urgent for the execution of fire missions, require procedural versus cognitive skills, and involve individual versus interactive skills. In the body of the report, we discuss criteria for using these characteristics to suggest tasks needing training, where and when to train them, and which training technologies to use. The criteria first distinguish tasks that require further training from those that do not; then, among those tasks that require training, they suggest the "minimum essential" set to train *in-residence* versus those that could be considered for nonresident training. The criteria further identify tasks particularly suited for training using CBT. Next we examine how these tasks are currently trained and suggest alternative POIs that align resident training with duty requirements and incorporate CBT.

Based on this analysis, we identify three potential POIs for resident instruction that contain tasks performed by cannon fire direction specialists that meet fundamental course objectives: (a) a "shortened" course focusing on core duties of SL1 cannon fire direction specialists, which trims the current POI without admitting new candidate tasks for resident instruction; (b) an "add-in" course that eliminates the same tasks while admitting others that meet resident training criteria; and (c) an "add-in" course that incorporates CBT.

Options for Reorganizing Resident Training

In the "shortened POI," tasks remaining for resident instruction compose 80 percent of the current seven-week POI (200 of 250 current instructional hours). This POI focuses training toward attaining proficiency at tasks identified in the analysis as most important for operation of the fire direction center and the technical support of fire missions. Consistent with current course objectives, the alternative resident POI emphasizes the use of practical exercises to provide this training.

Among the remaining tasks, some are considered for training in units following graduation from AIT. Such tasks compose 7 percent of current training (approximately 18 hours). These tasks consist mainly of procedures for installing and maintaining some types of communications equipment specific to units. Generic preparation, operation, and maintenance skills for this equipment are taught in-residence. Some interactive communications procedures are also among these tasks considered for training in units. For the purposes of this analysis, we assume such training could be provided as part of initial on-the-job training.

Other tasks, encompassing roughly 13 percent of current training time (32 of 250 hours), are identified by our analysis as not commonly required of SL1 cannon fire direction specialists (primarily SL2 tasks involved with meteorological messages). This material appears to represent unnecessary training that might be "trimmed" from the resident POI.

The analysis further identifies some SL2 tasks not currently trained in-residence that fit the profile for SL1 resident training.[3] These tasks encompass 29 hours of instruction that could be added in as others are removed. This second "Add-In" POI would still require 8 percent fewer hours of instruction than the current POI.

Options for Using CBT in MOS 13E10 AIT

Our analysis further identifies tasks well suited for CBT. Those tasks, covering primarily FDC and fire mission operations, require complex computational and diagnostic skills (e.g., manual gunnery computations). They are also hard to train and lend themselves to individualized instruction provided in quality CBT courseware.

If CBT were simply substituted one-for-one in relevant practical exercises, nearly half of the time devoted to practical exercises could be conducted using CBT (70 of 157 hours). Overall, CBT could be used for 31 percent of instructional hours in the "Add-In" POI while retaining sufficient hands-on training. However, given evidence that CBT can shorten training time up to 33 percent, our analysis of the "CBT POI" alternative also considers potential gains in efficiency in using CBT for the practical exercises.

Savings and Costs of Alternative POIs

We next estimate resource and cost effects of implementing each of the alternative POIs generated by our analyses. First we examine the effects of eliminating 1.25 weeks (50 hours) of instruction along the lines described above, followed by the reintroduction of about one week of new resident instruction using "hands-on" practical exercises. Next we analyze the effects of substituting CBT for one-half of the practical exercises. Further, we consider alternative assumptions for implementing the alternatives, including a high-cost and low-cost scenario. The assumptions differ in how they treat development and support costs and training delivery (e.g., improved efficiency of CBT).

Our cost analysis provides three major findings. First, under either set of assumptions, shortening the course to focus on core cannon fire mission tasks

[3]These tasks cover the Battery Communication System (BCS) and are currently included in a "fast-track" version of this course.

would provide almost immediate returns—approximately $187,000–$283,000 per year in less than one year, depending on the assumptions.[4]

Second, we find that respectable savings can be realized even as new tasks are included for in-residence training while these other tasks are eliminated. The "Add-In" POI, which includes BCS training, can still provide annual recurring savings of $84,000 to $117,000 within two or three years. This alternative, however, requires nonrecurring "start-up" costs of $139,000–$296,000, primarily for new training development.

Third, under both sets of assumptions, the introduction of CBT to conduct one-half of the practical exercises can provide some savings. If CBT were substituted on a one-for-one basis in the "Add-In" POI, the Field Artillery School could realize annual recurring savings of $148,000 after seven years (and initial start-up costs of $1,018,000) under our "high-cost" assumptions. Under more optimistic assumptions, slightly larger savings are achieved more quickly ($167,000 annually after two years).

This analysis reveals, however, that the level of costs and savings in the CBT POIs is very sensitive to assumptions about the cost of courseware development. We think the "high-cost" estimates using estimated time values are likely to be more accurate than those using flat dollar rates. Thus, the higher start-up costs and longer payback period provide a more conservative basis for determining whether to implement CBT in this course.

Conclusions and Implications

To cope with declining resources and budgets, the Army is reviewing its customary methods of training individual skills, with the goal of finding ways to train more efficiently. Our analysis suggests that training efficiency can be improved through mechanisms that improve the alignment between training courses and job requirements. Expanding the use of training technologies can be part of this solution.

Our analysis shows that MOS 13E10 AIT (and presumably similar initial skill training courses) contains tasks that may not be performed in the subsequent duty assignment (e.g., because they are performed at higher skill levels). The resources required to train nonessential or extraneous material can be

[4]This analysis assumes, however, that units can accommodate 18 hours of training (involving mainly communications equipment) using existing training equipment, facilities, and manpower. These savings would be diminished if additional resources were required to support this training.

considerable. Moreover, such training may take the place of other training that bears directly on subsequent job requirements (e.g., "fast-track" tasks commonly performed by all soldiers).

As a first step for improving efficiency, TRADOC and the proponent schools should review the content of training programs in light of actual job requirements. Tasks that bear directly on job performance requirements should receive highest priority for in-residence training. A formal method for analyzing training requirements can provide the objective information needed to determine the "minimum essential" content of training programs.

Our analysis further suggests a potential role for CBT as the Army considers additional methods for improving training efficiency. The suitability and instructional advantages of CBT argue for its inclusion for substantial portions of this training. Moreover, if CBT were implemented along with other steps to realign this course, additional savings in training manpower and costs could be realized. The key uncertainty is the cost of courseware development. Higher development costs lengthen the payback period, which must be evaluated in light of other risks and benefits (e.g., the obsolescence of the courseware versus improvements in quality and exportability). Still, given the continuing battlefield requirement for technical support to cannon fire missions, a payback period of seven years could be economically justified.

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List of Acronyms and Abbreviations

ACPC	Arroyo Center Policy Committee
AF	Absolute Frequency
AIT	Advanced Individual Training
AOAC	Armor Officer Advanced Course
AOSP	Army Occupational Survey Program
AR	Army Regulation
ARNG	National Guard
ARPRINT	Army Program for Individual Training
ATRRS	Army Training Requirements and Resources System
BCS	Battery Computer System
BT	Basic Training
BUCS	Backup Computer System
CBT	Computer-Based Training
CED	Communications/Electronics Department
CODAP	Comprehensive Occupational Data Analysis Program
COIP	Consequences of Inadequate Performance
CPX	Command Post Exercise
DA	Department of the Army
ETV	Estimated Time Value
FDC	Fire Direction Center
FFE	Fire for Effect
FFRDC	Federally Funded Research and Development Center
FM	Field Manual
FPS	Facilities Planning System
GFT	Graphical Firing Table
GS	General Service
HB	High Burst
ICH	Instructor Contact Hour
ICM	Improved Conventional Munitions
IVD	Interactive Videodisc
LCU	Lightweight Computer Unit
MET	Meteorology
MOS	Military Occupational Specialty
MPI	Mean Point of Impact
MS3	Manpower Staffing Standards
OJT	On-the-Job Training
OMA	Operation and Maintenance, Army
OSMIS	Operations and Support Cost Management Information System
PCS	Permanent Change of Station
PE	Practical Exercises
PMCS	Preventive Maintenance Checks and Services
POI	Program of Instruction
POL	Petroleum, Oil, and Lubricants
RTS	Relative Time Spent

SAT	Systems Approach to Training
SL	Skill Level
SME	Subject Matter Expert
TAD	Target Acquisition Department
TADSS	Training Aids, Devices, Simulators, and Simulations
TDA	Tables of Distribution and Allowances
TDY	Temporary Duty Assignment
TOE	Tables of Organization and Equipment
TRADOC	U.S. Army Training and Doctrine Command
TRAM	Training Resource Analysis Method
TRAS	Training Requirements Analysis System
TV	Television
USAFAS	United States Army Field Artillery School
USAR	U.S. Army Reserve

1. Introduction

Background

The U.S. Army faces serious challenges in training its soldiers and leaders in the coming years. Training is vital to the combat readiness of the Army, but it is also very costly. In an era of declining resources and growing constraints on traditional methods of training, and as continuing technological advances increase skill requirements and drive up operating and support costs, the Army will need new methods of training that maintain proficiency but reduce operating costs, resource utilization, and manpower requirements.

The programs of military education and training conducted in the U.S. Army school system are experiencing especially intense pressures to change customary training methods. The Army conducts numerous programs of training for officers, warrant officers, noncommissioned officers, and enlisted personnel to impart the job-specific skills and military knowledge needed to perform wartime missions (Department of the Army, 1987). These occur "in residence" at Army schools, during on-the-job training in Army units, and through self-development at home stations. The portions conducted in-residence (generally termed "institutional training") are visible and costly, involving numerous installations, facilities, equipment, and manpower (instructors and trainees). Conducting this training consumes large quantities of ammunition, fuel, and other resources (e.g., spare parts). In fiscal year 1992, for example, individual training cost the Army $5.7 billion (Department of Defense, 1992).

As part of its long-range planning process, the Army is considering new ways to conduct training that can maintain effectiveness while reducing costs and resource consumption in Army schools. These have been described in doctrinal publications (e.g., U.S. Army Training and Doctrine Command [TRADOC], 1990a), which identify several new concepts and strategies for conducting individual training. The overall architecture is termed "Army Training 2007," which is intended to guide training plans and resource projections at Army schools. Contained within are a number of elements, including TRADOC's long-range training plan and four initiatives, together termed the "integrated training strategy." Two of these bear directly on how training will be organized and conducted in Army schools in the future. They are

- A "distributed training strategy" that envisions a reduction in the length of institutional training courses, accompanied by increased individual training in Army field units using paper-based instruction, videotape, computer-based training, interactive videodisc, and televideo
- A "device-based training strategy" that calls for expanded use of advanced technologies, including training aids, devices, simulators, and simulations (TADSS), to reduce equipment and ammunition usage during training at institutions, home stations, and combat training centers, and as part of the distributed training system.[1,2]

These potential initiatives would significantly alter the nature of current "schoolhouse" training. Such changes would affect the length and content of training courses, the location of some individual training (e.g., at home station versus in-residence), the timing of training within an individual's career, and the methods and media used to deliver training. At the same time, they contain a number of assumptions regarding the eventual costs and consequences associated with such changes. Advocates believe, for example, that distributed training will permit reduction and consolidation of schools and resident course offerings. This would be accompanied by increased training opportunities and improvements in the quality and standardization of instruction. Device-based training is also seen as permitting reductions in the resources required to conduct individual training while improving the sustainment of skills in the field. Thus, both of these initiatives are expected to provide training more efficiently at less overall cost to the Army.

Because such initiatives could have far-reaching effects on soldier proficiency and Army capability, a thorough evaluation of them is needed. To evaluate competing strategies, training policymakers need to know which Army military occupational specialties (MOSs) would be affected, how such changes would be implemented in specific training courses, and whether such changes will provide sufficient cost savings and prove feasible in practice. Moreover, decisionmakers need assurance that such changes will provide the Army with sufficient capability, flexibility, and timeliness in responding to contingencies requiring the mobilization and training of Army personnel.

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[1] The remaining two initiatives are termed "combat training centers" and "Reserve Components training strategy." The former proposes continued use of assets such as the National Training Center to provide "realistic battlefield training experience." The latter provides general guidance for soldier and leader training, collective training, training support, and training management (e.g., in stating that non-prior-service soldiers will complete initial entry training in-residence at TRADOC schools).

[2] In addition to these "strategies," TRADOC's long-range training plan contains a number of additional "concepts" for changing the organization and delivery of individual training. They include, for example, expanded use of contract service training, increased reliance on civilian vocational education in lieu of military training, and expansion of joint-service training.

Research Objectives and Approach

The overall objective of this research is to develop improved techniques for identifying alternative approaches for conducting individual training and analyzing their potential costs and consequences. Specifically, we seek to determine whether and how new initiatives such as distributed and device-based training can be implemented in existing training programs to improve efficiency and to reduce costs. Currently, there is no agreed-upon methodology for determining how to reorganize existing training courses while analyzing the prospective costs and benefits, along these or other lines. Such methods would help "flesh out" the details of existing initiatives. They may also suggest additional techniques for improving the efficiency of training, reducing resource consumption and costs, and meeting other goals (e.g., maintaining training quality and improving standardization).

The research has proceeded in two phases. First, we conducted background analyses that defined and analyzed characteristics of Army occupational specialties related to future strategies for delivering Army individual training. We developed a database describing training-related characteristics of Army MOSs relevant to future training concepts. Second, we analyzed these data to identify general training-related dimensions of MOSs, rank the MOS on each training-related dimension, and link these to concepts for changing Army individual training in the future.[3]

Our analysis, for example, suggested that the concept of distributed training, as currently described in doctrinal publications (TRADOC, 1991), might prove especially suitable and cost-effective in leader development courses and MOSs in which cognitive tasks are dominant. It further identified specific characteristics of MOSs that may lend themselves to a device-based training strategy (i.e., where procedural skills are dominant and similarity to civilian occupations is low). Drawing on this analysis, we selected three occupations for further intensive study. They are: Armor Officer Advanced Course (AOAC), Abrams Armor Crewman One-Station Unit Training (MOS 19K OSUT), and Cannon Fire Direction Specialist Advanced Individual Training (MOS 13E10 AIT).

In the next phase, we develop analytical tools and conduct case studies of the costs and feasibility of changing training in the selected specialties. We analyze job requirements and current training approaches and identify new training approaches for organizing and delivering training, consistent with the training concepts under consideration. Then we develop and apply a methodology for

[3]The database and analyses are described in Kirin and Winkler (1992) and Winkler et al. (1992).

estimating probable costs of changes to baseline/current approaches, based on key resource factors associated with changes in content, timing, location, and method of training. Finally, we identify the broader implications of changing training in the ways considered by the analysis. These analytical tools are described in more detail beginning in Section 2.[4]

Plan of the Document

The remainder of this document describes the results of our analysis of the MOS 13E10 course, focusing on the potential for reducing the length of in-residence training and expanding the use of training technologies. The next section of this report describes the analytical approach taken in this research. Section 3 presents our analysis of current training in MOS 13E10 and options for reorganizing existing training. Our cost analyses of the options developed in this research are contained in Section 4. Finally, in Section 5 we present our conclusions regarding the feasibility of reorganizing training to expand the use of training technologies in programs like that for MOS 13E10. Technical material supporting the case study is contained in the appendices.

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[4]They are also described in detail in a companion publication (Way-Smith, 1993).

2. Analytical Method

This section describes how we identify and analyze alternative approaches for conducting training within specific training programs. Our method of analysis considers skill requirements, resources required to train, and cost-effective combinations of resources under alternative training approaches. The analysis proceeds in two stages, as follows:

- An initial *job analysis* analyzes tasks performed in duty assignments and compares these with the current program of instruction (POI). The analysis next develops alternative POIs that change content and length, location, timing, and/or training technologies, consistent with broad training concepts applicable to the training program (e.g., distributed or device-based training).
- A subsequent *cost analysis* estimates changes in resources and costs associated with the various alternative POIs under consideration. It identifies specific resourcing mechanisms for implementing proposed changes in POIs, ramifications of changes for training activities and resources across the Army, and resulting costs. The cost analysis further identifies start-up costs, net recurring costs or savings, and break-even points for alternatives under consideration.

Current Army Training Development Procedures

The Systems Approach to Training (SAT) is the Army's training development process that drives the development of courses used for resident and nonresident training. The SAT process integrates five distinct phases—analysis, design, development, implementation, and evaluation. Training developers and subject matter experts (SMEs) identify all tasks appropriate for a specific occupational specialty and skill level and determine which tasks are critical to mission accomplishment and survival on the battlefield and require training (Melton, 1988; TRADOC, 1989). Subsequently, these tasks are further analyzed to identify conditions and standards of performance, the learning objectives for training, and method of training, including media and location (TRADOC, 1988a). A task selection board then reviews the task inventory, selection of "critical" tasks, and other decisions governing training (e.g., selection of training site). These decisions are based on cost-effectiveness, availability of needed resources, and other constraints. Tasks selected for resident training are then configured within larger training events. A supporting POI is generated that displays the training events; the methods used to conduct training; and required resources, including manpower, equipment, and training technologies.

These procedures are used to develop new training programs, e.g., when new MOSs are established. They are also used to revise and improve existing courses, e.g., as equipment is added, deleted, or modified. The POI is updated when major changes or an accumulation of changes makes it necessary. Unless major changes external to existing training occur, however, courses are subject to minimal revision with respect to methods and resources used to train. Training development management often fails to apply the SAT process to the design and development effort when making such changes. If faced with reductions in training resources, a common response is to maintain standards with reduced resources ("take it out of hide") or, alternatively, to "salami slice" (eliminate) portions of existing training programs across the board. Major redeployments of resources within existing courses are rarely considered.

Our approach is similar to the SAT in certain respects, but it offers a number of advantages. Its goal is to suggest new and different approaches for organizing and delivering training that are less costly than current methods. It is especially useful for suggesting how to reorganize existing courses in response to reduced training budgets. For a particular course, we generate several *alternative* POIs that seek to improve the efficiency of training by varying the content, location, timing, and technologies for conducting training. Whereas subjective considerations by SMEs figure heavily in designing training programs, we conduct objective analyses combining data on task performance in units with systematic ratings by SMEs of task attributes related to training. Finally, the results of the task analysis are linked to an analysis that evaluates resource and cost implications of each alternative.

Job Analysis and Identification of Alternative POIs

The job analysis follows a series of steps, demonstrated in Figure 2.1. The steps involve identifying the universe of relevant tasks; collecting quantitative data regarding job performance from field surveys and SME ratings of task attributes relevant to training; analyzing these data statistically to identify general job dimensions and group and rank tasks according to training priorities; examining the current POI in light of these results; and constructing new POIs that vary content and length of resident training, location and timing of training for tasks

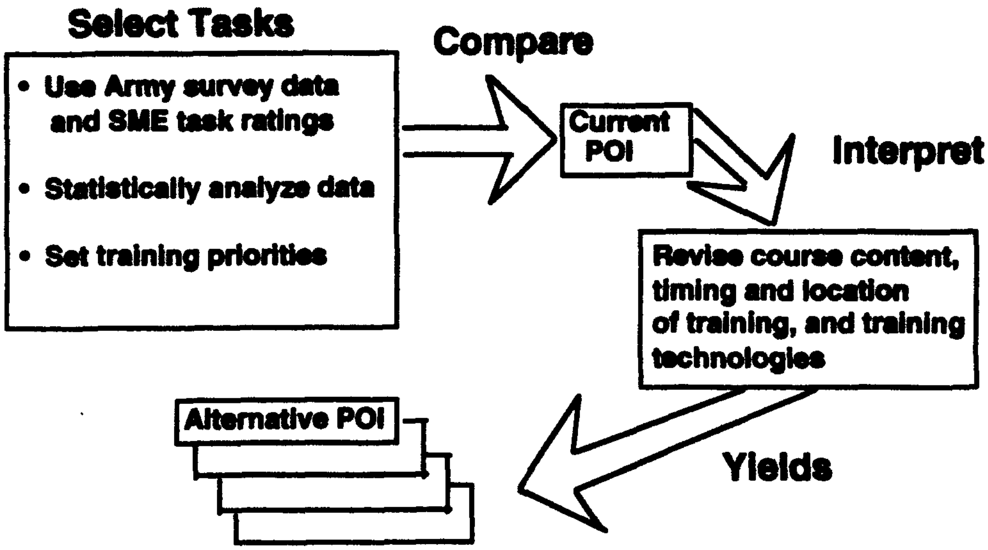

Figure 2.1—Job Analysis Method

not trained in-residence, and media and technologies for supporting resident and nonresident training.

Selection of Tasks

The universe of tasks included in the job analysis incorporates all tasks that might be performed in the duty assignment for which the soldier is being prepared. In order to determine what soldiers actually do, the universe includes tasks from adjacent skill levels. For example, consideration of a captain's tasks includes tasks performed at the grade levels immediately above and below it (a major's and lieutenant's tasks, respectively).[1] For entry-level soldiers, both skill-level one and skill-level two tasks are included in the job analysis. Major sources of MOS task lists include (a) the master task list, (b) the critical task list, (c) the POI, (d) the soldiers' manuals, and (e) Army Occupational Survey Program (AOSP) field surveys.

The wider selection of tasks allows for the identification of actual job boundaries, which might be different from official doctrine. By this method of task selection, some new tasks may be identified for training and some tasks may be eliminated from current training.

[1]A similar procedure would be followed in a job analysis of noncommissioned officers.

Collection of Data

Next, we seek data to characterize the tasks identified in the previous step in ways relevant to training organization and delivery. We wish to know more than whether a task is *critical;* we also seek measures that reveal organizational and delivery characteristics of "what, where, when, and how" tasks should be trained.

Measures used in our analysis are drawn primarily from three sources. One is the master task list established by proponent schools as part of the SAT process and used to develop soldiers' manuals and POIs. A second is the most recent survey of job incumbents and their supervisors conducted under the AOSP. We examine responses of only those job incumbents in tables of organization and equipment (TOE) units who are at the skill level, grade/rank, and duty position for the specialty of interest. Ideally, the job performance measures include five measures recommended in three SAT task selection models (TRADOC, 1989): learning difficulty, task significance (importance), frequency of performance, training emphasis, and consequences of inadequate performance (COIP).[2]

Measures drawn from the AOSP seem useful for determining *what* should be trained, but they do not contain information that relates directly to training organization and delivery (i.e., when, where, and how tasks could be trained). To obtain systematic information addressing these concerns, we collect SME ratings for eight additional task attributes. The measures include: the *location* where the task is most commonly performed (e.g., in garrison, field, or both); whether the skills required by the task are *prerequisite* to the performance of other tasks; the *immediacy* with which the task may need to be performed on duty assignment; the potential *transferability* of the skill between military and civilian settings; and whether the task requires *cooperative skills*, *reasoning skills*, *direction giving*, and *equipment* as part of performance.[3]

These ratings are intended to make explicit the criteria used to design and organize resident training programs within one analytic process. When integrated with field-based measures of task performance, they provide a more comprehensive and objective set of indicators for analyzing job requirements to determine which tasks are "minimum essential" (versus trainable on-the-job) for the initial job assignment and which require hands-on experience and interaction with instructors and peers, and so forth.

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[2]These measures are not routinely collected in all AOSP surveys. At a minimum, the AOSP collects data on frequency of task performance from job incumbents and training emphasis from supervisors. Additional data on learning difficulty and consequences of inadequate performance may be collected from supervisors, depending on the specific survey.

[3]Complete descriptions of measures used in this case study are provided in the next section.

Statistical Analysis of Tasks

Following the next step of our job analysis, we evaluate task data assembled from field surveys and SME ratings using formal, statistical methods. We use factor analysis (Harman, 1976), an exploratory statistical procedure, to identify general dimensions that summarize the various task measures. The analysis is conducted using the task as the unit of analysis and including all relevant measures derived from the master task list, AOSP surveys of job incumbents and supervisors, and SME ratings. The analysis examines the interrelationships among these measures to determine if they can be represented by a smaller number of hypothetical variables.

Once we have identified general dimensions of tasks, we next use the results of the analysis to identify specific tasks with common characteristics. We do this by calculating factor scores for all tasks on all dimensions and then ranking all tasks on each of the general dimensions. The training developer may observe which tasks are ranked high, middle, or low on each dimension and use the rankings to establish cutoff values for determining the importance of each task with respect to each general dimension.

The objective of the analysis is exploratory; that is, we seek to uncover general characteristics of tasks that may be relevant to training organization and delivery. We expect that the results can be interpreted to guide training development (e.g., to select tasks for resident instruction or identify tasks that might be especially suitable for new training strate ies).

Development of Alternative Training Programs

Next we use the statistical results to suggest possible changes in training organization and delivery methods to improve operational efficiency and resource utilization. First, we consider training content, location, and timing of training (i.e., determining what should be trained in-residence and as nonresident instruction). Then we consider media and technology used to conduct resident and nonresident training.

The analysis begins by using the statistical results to suggest key task characteristics to consider in developing resident and nonresident instruction. We attempt to identify the set of tasks necessary to assume the duty position and distinguish these from tasks that may not need to be trained at all (e.g., because they are not actually performed by job incumbents in the duty assignment). Within these, we then seek the tasks that are "minimum essential" for resident instruction and tasks that may be considered for nonresident instruction (as prerequisites or follow-ons to resident instruction).[4] We then examine the current POI in light of these results, and we suggest options for revising or reconstituting training events to support resident and nonresident training.

Once options for reorganizing the content, timing, and location of training are devised, we next define options for using training media and technologies in ways that preserve training effectiveness but reduce costs. Current practices of assigning "proven" training methods and media to training events may overlook some training approaches that are potentially cost-effective. For those tasks and training events that remain in-residence and for nonresident instruction, we aim to substitute equally effective media and technologies when they are less expensive than those in current use (e.g., increased use of simulation, as appropriate). For those tasks where new training needs to be developed (for resident or nonresident instruction), we seek to identify the media and technologies with acceptable effectiveness and the lowest possible development and maintenance costs.

Identification of alternative media is guided by the results of our statistical analyses, along with principles of instructional design and media selection gleaned from the literature on educational technology (e.g., Melton, 1988). As in the earlier step, we examine current training methods and, based on the characteristics of tasks, suggest alternative media and technologies. For example, TADSS are often found to be equally effective and less costly than equipment-based training (Martellaro et al., 1985; Hughes et al., 1987; Winkler and Polich, 1990). Recent advances in the computer tutoring of individuals suggest equivalent and efficient self-paced instruction alternatives to current conference methods on a variety of abstract reasoning and technical tasks (e.g., Brown, 1985; Fischer et al., 1991; Legree and Gillis, 1991; Newman, 1991; Towne and Munro, 1991). Other technological advances in video teletraining and video teleconferencing may provide useful "distance learning" options for presenting information to students and testing their understanding (e.g., Bailey, 1989).

Cost Analysis

Next we estimate the potential costs and savings that would result from implementing the alternative POIs generated in the job analysis. A key problem in determining the potential cost of changing training is that the Army does not

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[4]We describe our method for doing this in more detail in the next section. Briefly, we define "minimum essential" tasks for resident instruction as those ranked most highly in the statistical analysis as *key duties of job incumbents* and *necessary for survival on the battlefield*.

now have accurate methods for estimating costs of individual training. General estimates of costs of training courses exist, but the aggregate manner in which costs associated with manpower, equipment, and base operations are estimated does not permit detailed analysis of the activities associated with producing and executing a training course. This is a serious problem because many of the proposed alternative training strategies will be implemented at the training course level and the Army needs to know whether these strategies do, in fact, reduce the costs for a particular course.

In response, we have developed a course-level costing method that can be used to develop estimates of the costs of changing Army individual training. The method evaluates alternative strategies for conducting training courses and various potential implementations of these alternatives. This method—the training resource analysis method (TRAM)—examines how an alternative training strategy would change training and training support activities and resource use.[5]

The Training Resource Analysis Method

TRAM is different from current Army training cost methods in three ways. First, the method examines activities, resources, and costs at a much lower level of detail than the current Army costing methods. TRAM examines activities, resources, and costs at the course and lesson plan/event level of detail.

Second, TRAM differs because it focuses on *changes* in costs that result from a training decision. The Army's current methods allocate total fixed and variable costs.[6] While these Army methods may have been sufficient for budgeting purposes in a relatively stable environment, the present context of major end-strength reductions, budget cuts, and mission changes requires a method that can determine whether new training strategies can actually generate savings.[7]

Third, in addition to quantitatively measuring costs, TRAM also highlights trade-offs by detailing the specific changes that result from implementing alternative training strategies and places those changes in a broad context. Training activities in schools ultimately affect activities in units, and if changes are to be made to individual training programs, decisionmakers need to know not only

[5]A detailed explanation of the training resource analysis method is provided in Way-Smith (1993).

[6]A cost that is uniform on a per unit basis but that fluctuates, in total, in direct proportion to changes in activity levels is variable. A cost that remains constant in total despite fluctuations in activity for a given period of time is considered fixed.

[7]The Army's current methods are able to account only for changes in student input and course length.

the costs of those changes for schools *and* units, but what they are potentially trading for the savings.

TRAM has three objectives:

1. Evaluate training options
2. Assess the effects of alternative implementations of training options
3. Estimate changes in costs and savings.

TRAM uses four steps to calculate the changes in resources and costs of alternative POIs. They are (a) specify the training programs, (b) analyze activities, (c) analyze resources, and (d) calculate costs. These steps are illustrated in Figure 2.2 and described below.

Specify the Training Programs

The most important step in the analysis is to thoroughly define the current course (the baseline) and the proposed alternative training programs.

Define the Baseline. In the first step of the method, we convert the current course POI to a spreadsheet that contains each current training event, instructing

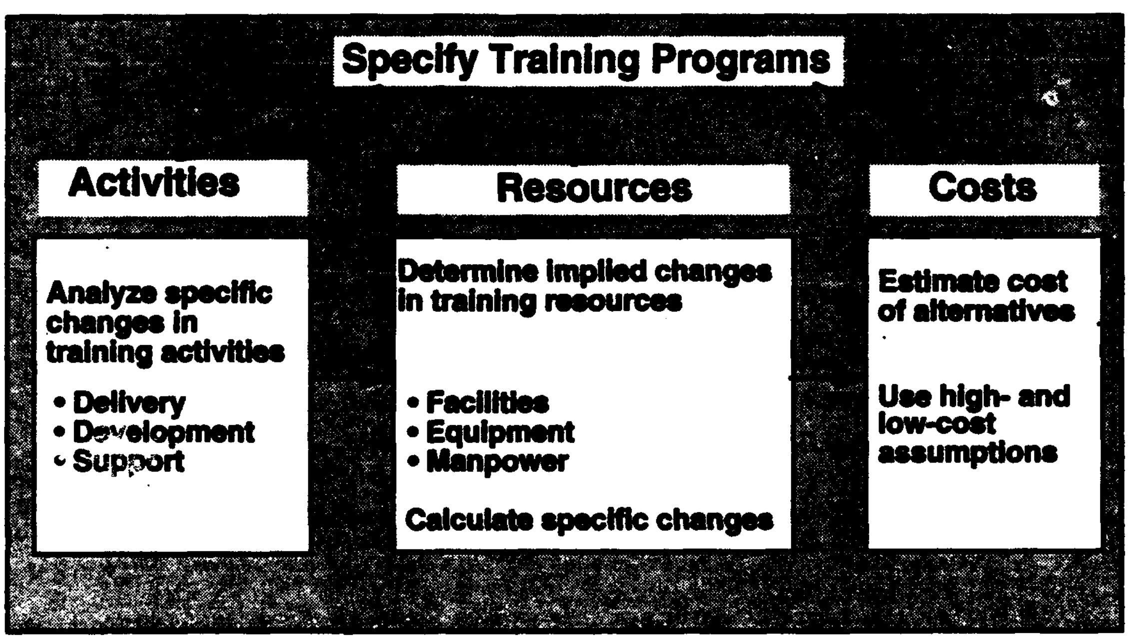

Figure 2.2—Training Resource Analysis Method

department, academic hours, methods of instruction, equipment, ammunition, facilities, and instructor contact hours.

Define the Alternatives. Next we specify the alternative training programs. We identify changes to the baseline associated with the alternatives proposed by the job analysis that affect who is conducting the training (e.g., are training responsibilities being transferred?); what methods or lessons change; and when, where, and how the changes will be implemented. We also highlight key assumptions that may need to be made concerning how the alternative POI will be developed, delivered, and supported.

Analyze Activities

Once the baseline and alternatives are defined, we examine how the changes affect the activities at the school and other organizations that may be affected by the training changes. In this step, we determine which activities change, for whom they change, how they change, and when they change. The activity analysis focuses on the changes that occur in the areas of *training delivery, development*, and *support*.

Changes in activities are next translated into changes in workload. We use a balance sheet to record the changes in workload that accompany the changes in training separately for training delivery, development, and support. The balance sheet is the centerpiece of the method, and we use it to track both activity and resource changes. Table 2.1 is the template for the activity balance sheet. It contains information on four types of changes: activity/resource increases, activity/resource decreases, transfer from/to other courses or organizations, and transfer from/to excess capacity. Targeted organizations are those specifically targeted and directly affected by the change. Other courses or organizations are

Table 2.1

Balance Sheet: General Format

	Targeted Organization				
Activities	Increases	Decreases	Transfer from(–)/ to (+) other courses or organizations	Transfer from (–)/ to (+) excess capacity	Net Change
Delivery Development Support					

those that may be indirectly affected by the change. The net change then totals all types of changes for a given activity.

Each of the major activities has a number of associated workload factors. In analyzing changes in training delivery, for example, we consider implications of training changes for student input and load and instructor contact hours in schools and nonresident training locations. The major workload factors for the training development area are the estimated man-hours required to develop new training products and to sustain existing training products. Tracing the changes in support activities is difficult because support activities exist at many different organizational levels within the schools, and many support functions may not change in a linear fashion based on student load changes. However, thorough understanding of each training installation's support activities should permit inferences regarding how training changes will affect such support activities as maintenance, housing, and transportation.

Analyze Resources

Next we determine how activity changes translate into changes in type and quantity of resources required to implement and support the training changes for each alternative (i.e., for training manpower, equipment, and facilities). TRAM uses available information and resourcing factors to determine changes in resources (see Way-Smith, 1993). For example, we analyze changes in the composition of manpower using appropriate tables of distribution and allowances (TDA), authorizations, and manpower staffing standards (MS3).

We identify changes in equipment that result from a change in training, including one-time and recurring costs of the major weapon systems, support equipment, maintenance support and test equipment, training equipment, other major end-items of equipment (e.g., trucks), spare parts, and munitions affected by a training change. Finally, we seek to identify similar costs associated with increasing, decreasing, or altering training ranges, maintenance facilities, administrative and classroom buildings, and other support facilities.

Calculate Specific Costs

Once all of the resource changes are identified, we determine the costs associated with these resource changes. We use the general equation:

$$\text{Cost} = (\text{Cost Factor}) \times (\text{Resource Change})$$

Table 2.2 defines the elements of this equation.

Table 2.2

Cost Model Definitions

Category	Definition
Cost factor	The dollar amounts for individual aspects of cost. They are costs per person, per piece of equipment, etc. There is typically a multitude of cost factors reflecting the variety of personnel, equipment, and facilities types.
Resource change	The changes in the particular resources involved in the alternatives. These include changes in manning type, manning quantity, equipment type, equipment quantity, and facilities that are generated by alternatives.
Cost	Cost of the category is produced by multiplying a cost factor by a resource change.

To develop specific cost models, we use a general cost template that includes the types of costs that may be incurred when training changes are made to a POI (see Table 2.3). The template serves as a planning tool and checklist to ensure that important cost and resource factors are considered in the analysis. Major sources of the cost data include TRADOC's *Resource Factor Handbook, Operations and Support Cost Management Information System (OSMIS)*, and *Facilities Planning System (FPS)* (see Way-Smith, 1993). We have filled in some of the cells of the template to illustrate how the analyst would develop the specific cost equations for the example we have been using. The column entitled "activity level" refers to specific changes in equipment-utilization rates and facility-utilization rates.

Place Costs in Context

Once we have calculated the costs for the various alternatives, we need to place them in a broader policy context. This involves comparing the costs of alternatives, "sizing" the costs and savings, identifying the trade-offs, highlighting the limitations of the analysis, and identifying potentially larger issues that surface during the analysis. The decisionmaker needs to know how the alternatives differ in terms of costs and savings and the flow of costs and savings over time. And the decisionmaker needs a meaningful benchmark to determine whether the savings are large or small. The context of the decision and the level of the decisionmaker are critical in determining the appropriate benchmark. For example, we may want to present the results in terms of a percentage of the current budget for the school, if the decisionmaker is a school commandant TRADOC- or DA-level person. In other cases the decisionmaker

Table 2.3

Cost Template

Costs	Activity Level	Resource Factors: Manning Amount	Manning Type	Equipment Amount	Equipment Type	Facilities Amount	Facilities Type
NONRECURRING COSTS							
Civilian personnel cost							
Acquisition							
Initial training							
Separation		X	X				
Transfer							
Military personnel cost							
Initial training							
Transfer		X	X				
New training products		X	X				
Equipment procurement				X	X		
Equipment transfer				X	X		
Initial spares/stock							
Construction remodels						X	X
RECURRING COSTS							
Civilian personnel cost							
Replacement acquis.							
Replacement training							
Pay and allowances		X	X				
Military personnel cost							
Replacement training							
Student PCS[a]		X	X				
Student TDY[b]		X	X				
Instructor TDY							
Training product maint.		X	X				
Fuel, oil, etc. (POL[c])	X				X		
Replenishment spares							
Ammunition							
Equipment maintenance	X			X	X		
Product distribution							
Product reproduction							
Facility maintenance						X	X

[a]Permanent change of station.
[b]Temporary duty assignment.
[c]Petroleum, oil, and lubricants.

may be a brigade commander, and the appropriate benchmark may be the brigade budget.

Once the costs and savings are placed in context, the next step is to consider potential trade-offs and risks that may result from the decision. This step of the analysis includes consideration of potential direct and indirect qualitative effects. There are two levels of trade-offs and risks, as illustrated in Figure 2.3. The first level includes detailed effects on how training changes could further affect

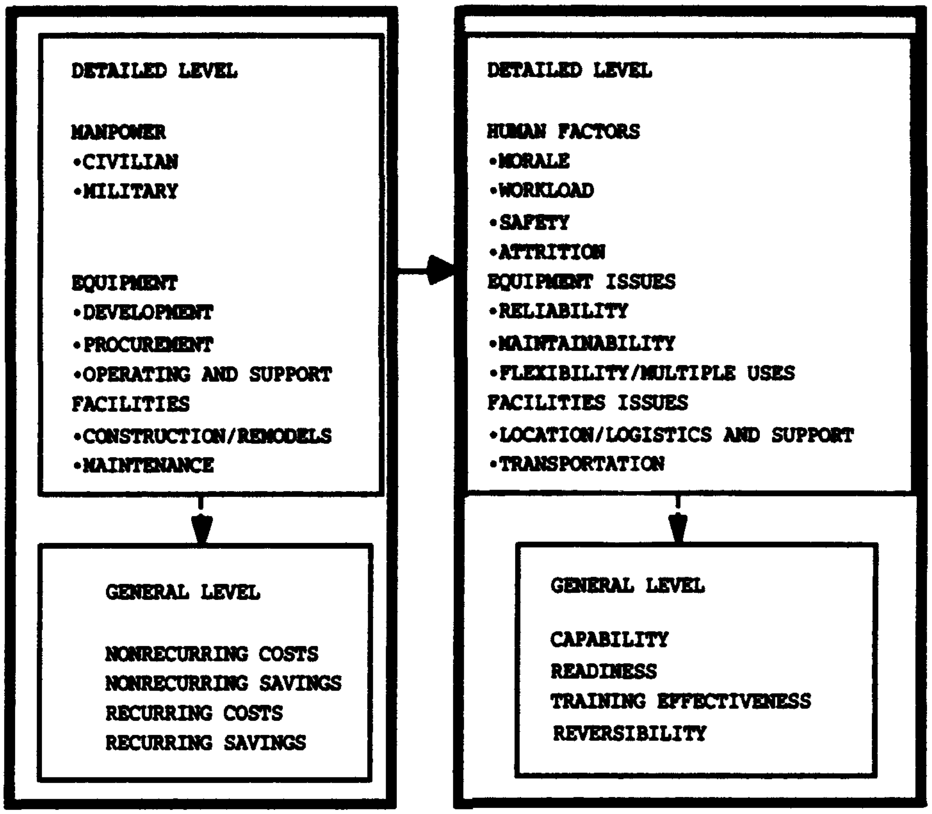

Figure 2.3—Trade-Offs and Risks in Considering Training Changes

manpower, equipment, and facilities. The second level addresses the broader and more general consequences of the change to the Army.

Trade-off analysis begins by identifying the potential qualitative effects that may occur as a result of the specific cost and savings that are generated by the change.

The upper-left box contains the major factors that are considered in the costing method. The upper-right box column is a checklist of potential qualitative considerations that may be important for the training decision. For example, in the manpower area, a potential direct risk in reducing instructor manpower through distributed training is reduced morale if a greater off-duty burden is placed on students. A possible indirect effect of this lower morale is increased attrition in specialties where it is not desired.

At the detailed level in the equipment area, if new training technologies (e.g., simulators and computer-based training) are replacing actual equipment, two important considerations are reliability and flexibility of the new technologies. Reliability is important because potential downtime on the simulator may result in insufficient training or substitutions that are as costly as the original equipment. Flexibility is important because other courses may be able to take advantage of the technologies.

The more general level of the trade-off and risk analysis examines the areas of training effectiveness and soldiers' confidence in their abilities. For example, if training technologies are used extensively to replace training on actual equipment, there may be concerns about the soldiers' ability to operate the actual equipment in combat situations. Determining the effectiveness of substituting technology for actual weapons may require further research and testing.

There are also broader considerations concerning the reversibility of a training decision. For example, implementing an Army-wide teletraining system requires a large up-front investment in a technology, and associated equipment, that is changing very rapidly, in terms of both cost and capabilities. If the Army purchases current teletraining equipment, it may be outdated by the time it is fully operational. Investing in current teletraining equipment and capabilities must be weighed against the incremental training effectiveness of this current technology compared with other methods and against the large and difficult-to-reverse investment decision.

Case Studies of Training Changes

The job and cost analysis methods described in this section have been applied in several selected specialized skill training programs. The remainder of this document describes the application of the methods for assessing the potential role of distributed training in conducting advanced individual training of cannon fire direction specialists (MOS 13E10 AIT).

3. Options for Training Cannon Fire Direction Specialists

This section presents our analysis of training options for the MOS 13E10 AIT course. We first describe how MOS 13E10 AIT is currently conducted, covering course characteristics, content, and instructional philosophy. Next, we apply our job analysis methodology to identify alternatives to reorganize the MOS 13E10 AIT POI, consistent with principles of distributed training and expanded use of training aids, devices, simulators, and simulations. The three alternative POIs we develop are the basis for the cost analysis presented in Section 4.

Selection of MOS 13E10 AIT Course for Case Study

We chose to examine the MOS 13E10 AIT course because of its potential suitability for expanded use of training technologies, possibly as part of a distributed training strategy that also seeks to reduce the length of resident training. As our MOS analysis indicates, cannon fire direction specialists need costly and extensive training in cognitive tasks.[1] The training also involves extensive use of equipment. While more aggressive use of training technologies in the schoolhouse and at home station could prove less costly than current resident training emphasizing platform instruction and practical exercise, a balance must be established between efficiency and effectiveness. Thus, our analysis sought to determine potential benefits of training technologies while retaining sufficient resident and hands-on training to produce qualified graduates who are confident when performing cannon fire direction tasks.

Description of MOS 13E10 AIT

The MOS 13E10 AIT course is for enlisted artillerymen who will serve in fire direction or operations sections of field artillery cannon units. Its primary purpose is to prepare soldiers to perform skill-level one duties conducted in field artillery fire direction centers. Soldiers attend this course on completion of basic training. Attendance and successful performance qualifies the graduate in military occupational specialty 13E.

[1]See Winkler, Kirin, and Uebersax (1992).

Currently, MOS 13E10 AIT is a seven-week course. It was offered 24 times in FY 91 to a total of 750 students. Optimum class size is 40 students. In addition to the active Army students that attend the course, reservists and guardsmen are also sent to the course by their units. After force reductions, the Army projects a reduction in the number of total students to 686 students for FY 93. Training is conducted at the U.S. Army Field Artillery School, Fort Sill, Oklahoma.

Duties of MOS 13E10 Specialists

The MOS 13E10 soldier is one of the critical members of the "gunnery team," serving typically as a member of a platoon FDC. The principal focus of the MOS 13E10 AIT course is on tasks conducted in the FDC supporting fire missions, including communications, tactics, and operation of fire direction systems. The following discussion briefly describes the key duties of MOS 13E10 specialists.

FDC Operations. In conducting FDC operations, the MOS 13E10 specialist reads grid maps, receives and plots forward observers' target data, and determines and announces firing chart data. He prepares the FDC's backup computer system (BUCS) for operation, enters data, and computes firing data using the BUCS.[2]

Operations. The MOS 13E10 soldier performs other duties in the operations section, including recording fire mission data; maintaining ammunition status and situation maps; compiling target lists; and preparing situation, target, and fire capability overlays.

Communications. The skill-level one cannon fire direction specialist is responsible for the installation and preventive maintenance checks and services (PMCS) of communications equipment. He lays field wire and installs telephones, radios, and antennas. He also monitors radio transmissions and transmits and receives radio messages.

Vehicle and Generator Operation. Another category of tasks includes vehicle and generator operation and PMCS. The MOS 13E10 soldier loads equipment, transports personnel and materiel in vehicles, and operates and services generators.

Unit Defense. Finally, MOS 13E10 specialists are also responsible for defensive duties, which include constructing fortifications, bunkers, and weapons

[2]In a separate "fast-track" course, selected soldiers perform some database construction, mission processing, and registrations tasks on the FDC's main battery computer system (BCS).

emplacements. They also perform security guard, listening post, and outpost duties.

MOS 13E10 AIT Instructional Characteristics

The MOS 13E10 AIT course provides students with instruction and practical exercise on skill-level one cannon fire direction specialist tasks. The aim of this instruction is to train each soldier to perform the wide variety of day-to-day tasks in his duty description. The majority of the technical instruction is provided in a traditional platform format. Students sit at desks in classrooms with a ratio of 1 instructor per 20 students for conference and demonstration instruction, and a ratio of 1 instructor per 6 students for practical exercises with "hardware oriented" equipment (PE 1).

The practical exercises take up three-fourths of the academic instruction and involve mainly the use of small handheld equipment items that perform similar functions to equipment found in an advanced math class. The graphical firing table (GFT) is similar to a slide rule and the BUCS is a modified handheld calculator. These are used while working through a manual of paper-and-pencil, practical exercises. The emphasis on practical exercises underscores the difficulty of training highly cognitive, computational tasks. The first-time fail rates for several of these training events has hovered above 20 percent. The manual gunnery computational skills are difficult to maintain without extensive practice. Students frequently forget what they learned in these earlier training segments. The remaining practical exercise tasks involve other hands-on practice with maps and various items of communications equipment. Generally, students work alone rather than in groups.

The bulk of the training is provided by the Gunnery Department and in lesser degrees by the Communications/Electronics Department and the Target Acquisition Department (map reading). When training schedules permit, the Gunnery Department offers an integrated command post exercise (CPX) for 13E10 and 13F soldiers. The CPX provides realistic, field-oriented training to augment academic instruction. The CPX setup includes a control station and six "cells" representing six 13E FDCs. Each cell resembles the interior of an FDC and contains the necessary equipment. Students demonstrate their acquired skills while their performance is monitored by instructors. The Gunnery Department's segment of training culminates in live-fire practice (dry fire) and a live-fire exercise.

Analytical Issues

Current MOS 13E10 AIT instructional philosophy, course characteristics, and use of training resources provide the framework for the analysis. The course is currently taught entirely in-residence. The course would appear to be a good candidate for reorganization because of its emphasis on cognitive tasks and high cost of training. Given the actual duties of first-term MOS 13E soldiers, some tasks currently trained in-residence might best be trained in units. Other tasks might need to be added to the resident POI. At the same time, however, specific analysis is needed to determine how much training may actually need to be conducted in-residence given key course objectives. Equally important for our analysis, MOS 13E10 AIT appears to be a good candidate for expanded use of training technologies. The highly cognitive, computational skills required for the FDC and operations section duties are difficult to train and maintain. Increased use of interactive training technologies could improve training effectiveness for resident and nonresident training, but analysis is needed to determine possible costs and benefits. The following job analysis helps to clarify these issues.

Analytical Method

As described in Section 2, the MOS 13E10 job analysis involves four steps:

- Select tasks for analysis
- Collect measures of task attributes
- Use factor analysis to identify dimensions and groups of tasks within them
- Develop alternative POIs.

Below we describe the measures used in the job analysis and how we conducted the statistical analysis. Analytical results and description of alternative POIs follow next.

In order to cast the widest net for tasks to be considered in our job analysis, we focused on the universe of skill-level one and skill-level two tasks (SL1–2) for MOS 13E. These tasks were identified using the Fort Sill Master Critical Task List (June 1991), the MOS 13E10 Soldier's Manual (September 1985), the MOS 13E10 POI (March 1989), and the AOSP cannon fire direction specialist incumbent and supervisor surveys (1987).

We then obtained three measures of on-the-job task performance from the AOSP cannon fire direction specialist surveys and seven measures of task characteristics from SMEs at Fort Sill. The final dataset consisted of 201 tasks.

The 10 measures used in our analyses are listed in Table 3.1. The mean values and standard deviations (SDs) are the average values for these measures across all tasks included in our analyses. The range of values for each measure is also provided. Each of the measures is described in more detail below.

AOSP Measures

Job Incumbent Ratings. The 1987 AOSP field survey of MOS 13E10 soldiers contained data from incumbents who rated their own *Frequency of Performance* of 601 MOS 13E tasks in SL1–4. We focused attention on the subset of tasks included in SL1–2.

The following criteria were used to identify the appropriate MOS 13E10 respondents from the total of 445 incumbents who completed the *Frequency of Performance* survey. To be included in the analysis, survey respondents needed to indicate that they were at SL1 in a TOE unit with 13E as primary MOS, and at one of the following fire direction duty positions: Assistant Chief Fire Direction Computer, Assistant Fire Control NCO, Chart Operator, Chief Fire Direction Computer, Fire Direction Computer, Fire Direction Specialist, Fire Direction Specialist Radio Telephone Operator, Radio Telephone Operator, or Senior Fire Direction Specialist. These criteria yielded a total of 137 (30.8 percent) respondents whose data were used for the two frequency measures described below.

Table 3.1

Measures Used in the Analysis

Source	Range	Mean	SD
AOSP measures			
Job incumbents			
Percentage of incumbents who report doing task	0–100	59.11	15.09
Number of times per year done	0–480	116.40	38.04
Supervisor			
Training emphasis	1–6	3.73	0.44
SME ratings			
Location	0–2	1.69	0.33
Prerequisite	0–1	0.47	0.25
Immediacy	0–1	0.38	0.26
Interactivity	0–1	0.24	0.28
Reasoning	0–1	0.09	0.15
Transferability	0–1	0.26	0.39
Equipment	0–1	0.60	0.43

Percentage of Incumbents Who Report Doing Task. The AOSP questionnaire for job incumbents asks cannon fire direction specialists to indicate whether they are called upon to perform a given task. The percentage of soldiers who report doing a task can range from 0 to 100 percent. The value for this measure shown in Table 3.1 is the average value across tasks included in our job analysis.

Number of Times per Year Done. Job incumbents' ratings of how often they perform a particular task were converted from a 7-point "relative time spent" (RTS) scale to the estimated Absolute Frequency (AF) of performance in number of times performed per year (0–480). The RTS-to-AF conversion is part of the AOSP Comprehensive Occupational Data Analysis Programs (CODAPs).[3] Combined with other measures, the percentage of MOS 13E10 soldiers called upon to do a task and the frequency with which the task is performed can be useful indicators of whether a task or group of tasks should be included for resident or nonresident training.

Job Supervisor Ratings. The 1987 AOSP surveys of MOS 13E10 soldiers also collected data from MOS 13E10 supervisors, who rated the same 601 SL1–4 tasks on *training emphasis* for SL1 cannon fire direction specialists. We used responses from all of the 40 supervisors to whom the survey was administered. They listed their primary MOS as 13E and their pay grade/rank as E-6 SSG/SP6. Most respondents (98 percent) had one or more years of experience with MOS 13E, were in TOE units (93 percent), and were from field artillery units (90 percent). For analytic purposes, we calculated the mean training emphasis rating of the 40 supervisors for each of the SL1–2 tasks included in our analysis.

Training Emphasis. Supervisors' ratings of training emphasis were each rated on a 7-point scale with 1 meaning "cannot evaluate" and anchored from 2 ("no training required for SL1") to 7 ("high training emphasis for SL1"). We transformed the AOSP 7-point scale to a 6-point scale by treating "cannot evaluate" as missing data and subtracting a value of 1 from each level. These ratings were then aggregated to obtain the average of the supervisors' ratings on each measure. Supervisor ratings that indicate a training emphasis for MOS 13E10 soldiers help to identify critical tasks for training at SL1 and perhaps for AIT at Fort Sill.

To summarize, these first three measures were generated from the most recently fielded job incumbent and job supervisor AOSP surveys. The data collected

[3]The RTS-to-AF conversion and rationale for its use for critical task selection are discussed in several papers by the U.S. Army Personnel Integration Command. For a summary see Goldberg, n.d.

reflect the insights and performance experience of MOS 13E10 soldiers and their supervisors, in MOS 13E TOE units, on MOS 13E10 job-related tasks.

Subject Matter Expert Ratings

The next group of measures included in our job analysis addresses additional attributes of tasks relevant to training organization and delivery. The seven measures described below were developed at RAND and collected from a group of course instructors at the Field Artillery Center. The conversions of the SME ratings to numerical values are also given for each rating.

Location. Tasks are rated according to *where* they are performed in typical units under full-standard (nonpractice) conditions.

0 = Garrison. The task is performed in a garrison setting.

1 = Both. The task is performed in the field and in garrison.

2 = Field. The task is performed in the field (including ranges and maneuver areas).

The location of task performance may play a role in determining where these tasks are trained. For example, some tasks performed in the field may be better trained in the unit rather than in-residence because of improved access to training opportunities.

Prerequisite. This category describes how much the *ability* to perform the task is *prerequisite* to the ability to perform other tasks done by soldiers of the same skill level.

0 = Specific. The task is unique and does not generalize to other tasks. Thus, a "specific" task is an isolate among tasks in terms of its performance requirements.

1 = General. The task has broad application for this grade, in that it is required as part of more specific tasks. If soldiers do not know how to do this task, there are other tasks that they cannot possibly do.

The identification of generic building block tasks whose mastery is prerequisite to successful performance of other tasks can provide information for the sequencing of training.

Immediacy. Tasks are rated on this dimension according to how much lead time is available for preparation to perform the task, prior to it being demanded to full standard.

0 = Low Immediacy. Time exists to prepare to perform this task (ranging from several hours to months, depending on the task). In a nonemergency situation, there is little or no pressure to rush preparation. Even in a combat situation, the use of reference material can be expected.

1 = High Immediacy. The job requires this task to be done either at any time or on a regular basis. Task accomplishment is very time and situation sensitive. When needed, these tasks must be done correctly without consulting reference or training material.

Tasks that need to be performed right away, such as those central to processing fire missions, may be designated for resident training because of readiness considerations.

Interactivity. Tasks are classified according to how they are performed within the context of group efforts or unit missions. They may be viewed as completely individual and requiring no interaction, or as part of a team effort in which collaboration is the key to success.

0 = Limited Interactivity. In these tasks, people work individually, even if they work toward a common goal. Tasks that form part of an interactive task are rated "0" if labor is divided according to specialization and does not require close synchronization; i.e., some people do some things while other people do other things. The results of these individual tasks are joined at some point to produce the unit product.

1 = Cooperative. These tasks require ongoing interaction by members of a unit. Success for the individual task is impossible to define outside the context of the unit. Roles may be well defined, or fluid collaboration may be necessary.

The key to rating these tasks is defining the outcome of the specific task and then deciding whether the task can be achieved by one individual. Knowing whether a task is performed interactively or individually is relevant to decisions about *how* and *where* to train a task (e.g., in a small group, classroom setting).

Reasoning. Each task is rated according to the amount of judgment required to complete it.

0 = Rote. These tasks require motor skills (manipulation of equipment), memorization of a sequence of steps, or the use of a checklist or similar job aid, and no more in-depth analysis, for completion.

1 = Cognitive. These tasks require that the performer understand the underlying conditions and rationale for the task before applying professional judgment and experience to complete it. It is difficult to define such tasks without first defining a situation or context in which they will be performed.

The distinction between cognitive and rote (procedural) tasks is helpful for decisions about *how* to train. Tasks that require on-line judgment may call for simulation and diagnostic feedback such as provided in intelligent tutoring systems. Rote tasks may prove especially suitable for repetitive drill and practice.

Transferability. This category describes how similar tasks are to civilian or military tasks.

0 = Military. Intensive, specialized, military training is required to accomplish this task.

1 = Civilian. A soldier placed in a civilian situation can accomplish a similar task with minimal orientation. Conversely, a civilian placed in a military unit can accomplish this task with minimal orientation.

Tasks are given a "civilian" rating when comparable tasks are also found in civilian work. Military tasks are so rated because they have little civilian transferability. Tasks identified as specific to the military require specialized training in branch schools and/or units. In contrast, tasks that are not unique to the military may be open to other training options in civilian education and training settings.

Equipment. Tasks are rated on whether or not they require the use or manipulation of equipment for successful completion.

0 = No Equipment.

1 = Equipment.

The essence of the task must require the use of equipment or manipulation of a device to be rated "1." Equipment that could possibly assist in accomplishing a task (e.g., binoculars for terrain observation) should not cause the task to be rated as requiring equipment. Further, a "look up in a table" type of task requiring a chart or book is not considered an equipment task. Tasks requiring equipment are ones for which device-based training approaches might be expanded or developed.

Factor Analysis and Task Rankings

Method of Analysis. We used factor analysis (e.g., Harman, 1976) to uncover a small set of general dimensions of MOS 13E10 tasks. We structured the data in Table 3.1 as a rectangular array and calculated correlations between each pair of measures. Listwise deletion was used in constructing the correlation matrix. This resulted in 201 tasks with complete data on the 10 measurements. We then used the principal component analysis method to reduce the dimensionality of the original 10 measurements. We further considered only factor dimensions with eigenvalues of at least 1.0. The factors were rotated according to the varimax criterion, for easier interpretation of the factor loadings on the 10 measures.

To aid our interpretation of each factor dimension, we considered only measures with the strongest loadings (≥ 0.50 or ≤ -0.50).[4] These conventional cutoff values served to reduce the number of defining measures for a factor from 10 to only those with at least 25 percent of the total variance accounted for by the factor.

Calculation of Factor Scores. We next use the factor analysis results to calculate scores for each task on each dimension. Again we considered only the variables with positive loadings ≥ 0.50 and those with negative loadings ≤ -0.50. The composite factor scores were computed following a unit weighting strategy, which consisted of three steps. First, we converted the values on each measure to standard scores (z-scores). Next, we multiplied the z-score of each defining measure by 1 or –1 according to the positive or negative loading on the factor. Finally, we took the average of these products to generate the composite factor score. The factor score values were then used to rank order all of the tasks on each of the dimensions.

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[4] A variable's "loading" on a factor is the correlation between the variable and the factor. This loading will fall within a range of 1.00 (perfect positive correlation) to –1.00 (perfect negative correlation).

Factor Analysis Results

The analysis yielded four dimensions of fire direction specialist tasks: *Frequent MOS 13E10 Tasks*, *Urgent Combat Tasks*, *Equipment Tasks*, and *Interactive Tasks*. Table 3.2 provides the eigenvalues and percentage of the total variance accounted for by each factor. The loadings for the measures that meet the defining criteria on each dimension are provided in Table 3.3.

Our interpretations of each of the four MOS 13E10 task dimensions are based on each factor's defining measures and the tasks ranked "high" and "low" on each dimension. Tables 3.4–3.7 summarize the task rankings, using the 15 highest and lowest ranking tasks on each dimension for illustration. The complete rankings of all 201 tasks on each dimension are given in Appendix Tables A.1–A.4.

Table 3.2

General Dimensions of MOS 13E10 Tasks

Factor	Name	Eigenvalue	Percentage of Total Variance Accounted for
1	Frequent MOS 13E10 tasks	3.35	24.9
2	Urgent combat tasks	1.92	21.6
3	Equipment tasks	1.27	17.1
4	Interactive tasks	1.12	12.9

NOTE: Total amount of variance accounted for is 76.5.

Table 3.3

Results of Factor Analysis

Measure	Frequent MOS 13E10 Tasks	Urgent Combat Tasks	Equipment Tasks	Interactive Tasks
Percentage of MOS 13E10 soldiers doing task	0.89			
Number of times per year done	0.68		0.61	
Training emphasis	0.89			
Location: field		0.68		
Prerequisite		0.52	-0.52	
Immediacy		0.75		
Transferability		-0.79		
Equipment			0.85	
Interactivity				0.65
Reasoning				0.86

NOTE: Only the defining measures that loaded high (above + 0.50) or low (below -0.50) on each of the four solution factors are shown.

Frequent MOS 13E10 Tasks (Factor 1)

Factor 1 (accounting for 24.9 percent of the combined variance) is defined by three measures shown in Table 3.3: (1) percentage of cannon fire direction specialists who report doing a task, (2) training emphasis, and (3) number of times per year the task is done.

We interpret this factor as indicating *Frequent MOS 13E10 tasks*, because the defining measures show a high proportion of cannon fire direction specialists report performing these tasks and performing them frequently. The tasks also are rated as having a high training emphasis by the supervisors of MOS 13E10 soldiers. This factor thus appears to point to the "key duties" in MOS 13E10 in need of training.

To illustrate, Table 3.4 lists the 15 highest and lowest tasks based on the factor scores on this dimension. The tasks in the highest factor score include, for example, determining the grid coordinates of a point on a military map and processing fire unit data and weapon location using BUCS. In contrast, the bottom-ranked tasks include processing an aerial observer mission and conducting a fire mission into a secondary zone.

Urgent Combat Tasks (Factor 2)

Factor 2 (accounting for 21.6 percent of the combined variance) is defined by four measures: (1) transferability, (2) immediacy, (3) location (field), and (4) prerequisite (ability). Note that the first defining measure has a *negative* loading on Factor 2. This indicates tasks that *are not transferable* to similar civilian tasks (i.e., are military in nature). We characterize this general dimension as representing *urgent combat tasks*. This dimension identifies military tasks that must be performed immediately in the field and that are precursors for other tasks. The defining measures denote an essential characteristic of urgency for the MOS 13E10 soldier. These tasks may require resident training.

Table 3.5 provides a listing of the 15 highest and lowest ranking tasks on this dimension. The highest ranking tasks include tasks essential to the fire mission; e.g., construct an emergency fire chart, plot targets, and determine and announce chart data. At the bottom of the ranking are a number of tasks involving maintenance of communications equipment.

Table 3.4

Tasks with Highest and Lowest Ranking on Factor 1: Frequent MOS 13E10 Tasks

Rank	Title	Factor Score
Highest ranking tasks		
1	Send radio message	1.819
2	Determine the grid coordinates of a point on a military map using the military grid	1.525
3	Install and operate telephone set TA-312/PT	1.499
4	Process fire unit data and weapon location using the backup computer system (BUCS)	1.462
5	Process ammunition data using the backup computer system (BUCS)	1.374
6	Identify terrain features on a map	1.364
7	Install antenna group OE-254/GRC (team method)	1.341
8	Process an area fire mission using the backup computer system (BUCS)	1.329
9	Process observer data using the backup computer system (BUCS)	1.321
10	Operate AN/VRC-46 radio set (AN/VRC-12 series)	1.317
11	Prepare/operate tactical FM radio set	1.293
12	Initialize the backup computer system (BUCS) and verify files	1.219
13	Enter map modification data into the backup computer system (BUCS)	1.207
14	Process target/known point data using the backup computer system (BUCS)	1.197
15	Process computer MET information using BUCS	1.195
Lowest ranking tasks		
187	Determine and announce fire commands for prearranged fires	–1.196
188	Compute firing data manually for toxic chemical projectile	–1.458
189	Determine firing data for an HOB correction for shell ICM (M444 and M449 series)	–1.490
190	Determine firing data for shell rap using the GFT	–1.523
191	Determine location/altitude of HB/MPI by computing polar plot data	–1.542
192	Determine the HB/MPI location by graphic intersection	–1.547
193	Process an aerial observer mission (ranging rounds)	–1.551
194	Determine location/altitude of HB/MPI by computing grid-coordinated altitude	–1.554
195	Determine and announce fire commands for a RAAM/ADAM mission	–1.570
196	Determine firing data for shell copperhead	–1.578
197	Determine and announce fire commands for a copperhead mission	–1.584
198	Determine a GFT setting and GFT deflection correction from an HB/MPI radar registration	–1.637
199	Determine GFT settings for 6400 mils (eight-directional MET)	
200	Conduct a fire mission into a secondary zone (zone-to-zone transformation)	–1.776
201	Determine firing data for shell RAAM/ADAM using the GFT	–1.820

Table 3.5

Tasks with Highest and Lowest Ranking on Factor 2: Urgent Combat Tasks

Rank	Title	Factor Score
Highest ranking tasks		
1	Construct an emergency firing chart	1.337
2	Plot targets and determine and announce chart data (manual)	1.185
3	Process an area fire mission using the battery computer system (BCS)	1.179
4	Process hasty fire mission (hip shoot)	1.130
5	Compute and announce site, angle of site, and vertical angles	1.057
6	Compute firing data for fire-for-effect (FFE) mission	0.978
7	Receive/record data for HB/MPI registration from observation posts 01/02	0.947
8	Determine data to orient observers for an HB/MPI (or radar HB/MPI) registration	0.947
9	Compute firing data for battalion mass radar adjust mission	0.935
10	Process an immediate suppression mission	0.929
11	Process an area fire mission using the backup computer system (BUCS)	0.832
12	Receive corrections from forward observer during fire mission	0.813
13	Locate target by grid coordinates	0.802
14	Construct firing chart based on map spot	0.795
15	Prepare a surveyed firing chart	0.795
Lowest ranking tasks		
187	Position vehicle-mounted/skid-mounted generator	–1.650
188	Off load/load generator from/onto carrier	–1.675
189	Perform operator's PMCS on SB-22 pt switchboards	–1.693
190	Perform preventive maintenance checks and services (PMCS) on gasoline engine driven generator set	–1.693
191	Record generator deficiencies (DA form 2404)	–1.693
192	Perform operator's PMCS/routine checks on telephone set TA-312/pt	–1.717
193	Perform operator's preventive maintenance checks and services on antenna RC-292	–1.717
194	Perform vehicle preventative maintenance checks and services (PMCS)	–1.717
195	Perform operators PMCS on AN/VRC-12 series radio	–1.845
196	Perform operator's PMCS on AN/VRC-160/AN/VRC-54/AN/VRC-53/AN/GRC-125 radio sets	–1.845
197	Perform operator's PMCS on AN/VRC-46 radio set	–1.845
198	Perform operator's PMCS on radio set AN/PRC-77 or AN/PRC-25 (RC)	–1.845
199	Perform operator's PMCS on AN/VRC-48 radio set	–1.845
200	Perform operator's PMCS on AN/VRC-49 radio set	–1.845
201	Perform operator's PMCS on AN/VIC-1	–1.869

Equipment Tasks (Factor 3)

Factor 3 (accounting for 17.1 percent of the combined variance) has three defining measures: (1) requires equipment, (2) number of times per year the task is done, and (3) prerequisite to others. Note that the third defining measure loads negatively on this factor. This means that the dimension is identifying tasks that generally are *not* building blocks for others. Altogether, this general dimension seems to point to routine *equipment tasks*. Compared with other tasks, these may be more suitable for nonresident training or use of TADSS when this may be applicable.

Table 3.6 shows that tasks ranking highest on this dimension cover installation, operation, and maintenance of vehicles, communications, and fire direction center computer equipment. In contrast, the tasks at the bottom of this dimension include complex cognitive gunnery computation tasks. These may be especially suitable for interactive technologies such as computer-based training.

Interactive Tasks (Factor 4)

Factor 4 (accounting for 12.9 percent of the combined variance) is defined by two measures: (1) reasoning and (2) interactivity. This general dimension appears to identify interactive tasks. Tasks requiring reasoning are cognitive by their very nature, whereas interactive tasks require the soldier to cognitively monitor the behavior of others. The teaching of such tasks might require group interaction.

Table 3.7 illustrates the tasks identified by this dimension. The highest ranking tasks include, for example, processing simultaneous fire missions and installing antennas. In contrast, tasks that rank lowest on this dimension may be performed by an individual (e.g., perform operator's preventive maintenance checks and services).

Developing Alternative POIs for MOS 13E10 AIT

Each of the four dimensions helps determine the training requirements of MOS 13E10 soldiers. Factor 1 identifies the core tasks performed most frequently by cannon fire direction specialists. These tasks have a high training emphasis. Factor 1 provides the initial identification of tasks to be considered for training. It gives little insight, however, into alternative mechanisms for organizing and delivering training, such as which tasks are necessary for resident and nonresident training. However, since Factor 2 measures "urgent combat skills," this job dimension may indicate the tasks with highest priority for resident

Table 3.6

Tasks with Highest and Lowest Ranking on Factor 3: Equipment Tasks

Rank	Title	Factor Score
Highest ranking tasks		
1	Perform vehicle preventive maintenance checks and services (PMCS)	1.358
2	Perform preventive maintenance checks and services (PMCS) on gasoline engine driven generator set	1.284
3	Off load/load generator from/onto carrier	1.247
4	Install antenna group OE-254/GRC (team method)	1.233
5	Shutdown the battery computer system (BCS)	1.233
6	Position vehicle-mounted/skid-mounted generator	1.211
7	Perform operator's PMCS on AN/VRC-46 radio set	1.145
8	Perform operator's preventive maintenance checks and services on antenna group OE-254	1.131
9	Perform operator's PMCS/routine checks on telephone set TA-312/PT	1.113
10	Install a generator set	1.087
11	Install RC-292 antenna	1.086
12	Install radio set control group AN/GRA-39	1.032
13	Record generator deficiencies (DA form 2404)	1.029
14	Assist in destruction of communications security equipment/material to prevent enemy use	1.026
15	Transmit shot to forward observer during fire mission	1.005
Lowest ranking tasks		
187	Determine and announce fire commands for prearranged fires	–1.196
188	Compute firing data manually for smoke projectile	–1.216
189	Compute and announce site, angle of site, and vertical angles	–1.236
190	Compute firing data manually for white phosphorus (wp) projectile	–1.244
191	Determine position corrections by solution of a concurrent MET message	–1.255
192	Determine and announce firing data for an HB/MPI radar registration	–1.270
193	Plot targets, determine, and announce chart data (manual)	–1.287
194	Plot the HB/MPI (or radar HB/MPI) location by grid coordinates	–1.306
195	Construct firing chart based on map spot	–1.319
196	Update a GFT setting and GFT deflection correction by solution of a subsequent MET message	–1.341
197	Determine the HB/MPI (or radar HB/MPI) location by plotting polar coordinates	–1.348
198	Determine data to orient observers for an HB/MPI (or radar HB/MPI) registration	–1.383
199	Determine a GFT setting and GFT deflection correction from an HB/MPI radar registration	–1.403
200	Determine location/altitude of HB/MPI by computing polar plot data	–1.452
201	Construct an Emergency Firing Chart	–1.481

Table 3.7

Tasks with Highest and Lowest Ranking on Factor 4: Interactive Tasks

Rank	Title	Factor Score
Highest ranking tasks		
1	Process simultaneous fire missions	3.710
2	Off load/load generator from/onto carrier	2.693
3	Assist in destruction of communications security equipment/material to prevent enemy use	2.384
4	Install RC-292 antenna	2.384
5	Install antenna group OE-254/GRC (team method)	2.384
6	Convert a computerized fire mission in progress to manual backup procedures	2.338
7	Transfer a GFT setting to nonregistering batteries	2.029
8	Process hasty fire mission (hip shoot)	2.029
9	Position vehicle-mounted/skid-mounted generator	2.029
10	Transfer a GFT setting and deflection correction from an offset registration	1.983
11	Hand off a mission	1.721
12	Conduct a fire mission into a secondary zone (zone-to-zone transformation)	1.366
13	Prepare and transmit messages to observer (manual)	1.366
14	Process an immediate suppression mission	1.366
15	Maintain ammunition status reports/records	1.320
Lowest ranking tasks		
187	Perform operator's PMCS on AN/VRC-12 series radio	–0.716
188	Perform operator's PMCS on AN/VRC-160/AN/VRC-54/AN/VRC-53/AN/GRC-125 radio sets	–0.716
189	Perform operator's PMCS on AN/VIC-1 intercommunication equipment	–0.716
190	Perform operator's PMCS on AN/VRC-46 radio set	–0.716
191	Perform operator's PMCS on radio set AN/PRC-77 or AN/ PRC-25 (RC)	–0.716
192	Perform operator's preventive maintenance checks and services on antenna RC-292	–0.716
193	Perform operator's preventive maintenance checks and services on antenna group OE-254	–0.716
194	Perform operator's PMCS on radio set control group AN/GRA-39	–0.716
195	Perform operator's PMCS on SB-22 pt switchboards	–0.716
196	Perform operator's PMCS on AN/VRC-48 radio set	–0.716
197	Perform operator's PMCS on AN/VRC-49 radio set	–0.716
198	Connect/disconnect generator to/from operating equipment	–0.716
199	Perform preventive maintenance checks and services (PMCS) on gasoline engine driven generator set	–0.716
200	Record generator deficiencies (DA form 2404)	–0.716
201	Adjust generator output/voltage/frequency	–0.716

training. Factor 3, in contrast, may identify candidates for nonresident training because these tasks are frequently performed "equipment skills," whereas

Factor 4 identifies candidates for interactive training. Moreover, both of these dimensions call attention to possible training technologies (e.g., training devices for equipment skills and interactive technologies for hard-to-train cognitive tasks).

Based on such logic, we developed a number of decision rules for using task rankings to suggest possible changes in the organization and delivery of MOS 13E10 AIT. On the basis of factor score rankings, we sought to: (a) identify tasks to be trained and those to be eliminated; (b) determine where and when tasks might be trained; and (c) indicate how different groups of tasks might be trained with alternative training technologies. The development of these rules was guided by the additional goals to suggest changes in training organization and delivery while remaining true to the principal course training objectives of preparing new MOS 13E recruits to serve as SL1 cannon fire direction specialists.

Identifying Training Content

Tasks that rank highest on the dimensions characterizing MOS 13E10 tasks are potential candidates for training. According to our analysis, these would include the tasks performed most frequently by MOS 13E10 soldiers (Factor 1), and the urgent combat tasks (Factor 2).[5] Tasks that are less important for SL1 training are those with "low" rankings on these two dimensions (e.g., conduct a fire mission in a secondary zone).[6] These possible criteria for identifying potential tasks for MOS 13E10 AIT are shown in Table 3.8.

Table 3.8

Decision Rules for Identifying Tasks for MOS 13E10 AIT

	Dimensions			
Training Content	F1	F2	F3	F4
Include	high			
Include		high		
Eliminate	low	low		

NOTE: Job Dimensions:
F1 = Frequent MOS 13E10 tasks
F2 = Urgent combat tasks
F3 = Equipment tasks
F4 = Interactive tasks.

[5] A general rule for identifying the high-scoring tasks on a dimension could be to set a cutoff that requires the task's factor score to be within the top (bottom) third of the distribution of scores on the dimension.

[6] On Factors 3 and 4, however, tasks at both extremes of the distribution appear suitable for training, as these factors distinguish equipment versus cognitive tasks and interactive versus individual tasks, respectively.

Determining the Location and Timing of Training

Next we seek to determine location and timing of training, i.e., whether tasks should be taught in-residence or in field units, post-AIT. The selection of tasks for resident training was guided by the key course objectives to train soldiers on critical skill-level one 13E MOS-specific skills and the dimensions of the MOS 13E10 soldier's job identified in our analysis. We gave most important consideration to the schoolhouse mandate to ensure that the graduated soldier is ready to contribute effectively in his specialty, especially in the performance of combat-urgent tasks.

Our analyses suggest a "minimum essential" set of tasks for resident instruction would consist of tasks that are performed frequently or are combat urgent for MOS 13E10 soldiers. Remaining tasks could be considered for post-AIT nonresident training or a subsequent course. These could include equipment (e.g., involving PMCS of some communications gear) or interactive tasks (e.g., antenna installation). Table 3.9 provides some possible decision rules to aid decisions about "where and when" to train.

Identifying Alternative Media

Training developers begin with hypotheses that certain methods of instruction are preferable to others for training certain tasks. Although these decisions may seem straightforward, they are not. For example, there is a common practice of selecting training methods based upon "proven" approaches. Such an approach, however, may overlook some potentially more cost-effective methods. Moreover, although the training developer may wish to consider a variety of instructional methods and technologies, no hard rules exist for assigning tasks to

Table 3.9

Decision Rules for Suggesting Tasks for Resident and Nonresident Training

	Dimensions			
Training Location	F1	F2	F3	F4
Resident	high	high		
Nonresident		low	high	
Nonresident		low		high
Nonresident	high	low		

NOTE: Job Dimensions:
F1 = Frequent MOS 13E10 tasks
F2 = Urgent combat tasks
F3 = Equipment tasks
F4 = Interactive tasks.

specific methods, media, and technologies, nor are these routinely tested for efficiency and effectiveness. Our job and cost analyses can provide some insights.

The statistical analysis has identified general dimensions of the cannon fire direction specialist's tasks relevant to training. The current POI shows the current method of training. Alternative approaches and technologies employing similar instructional principles can be linked to tasks and subsequently screened according to costs. Table 3.10 provides some initial criteria.

These criteria suggest that tasks emphasizing cognitive skills might be trained using such tools as computer-based training (CBT), interactive videodisc (IVD), or simulators. Such methods could substitute for existing approaches for conducting resident training. The specific choice would be made considering the costs and effectiveness of the alternative training technologies. Further, equipment-related tasks currently trained using "hands-on" instruction might, in selected instances, be trained more cost-effectively using training devices.

Implications of Analysis for the MOS 13E10 AIT POI

The final step of our job analysis develops alternative POIs that incorporate alternative approaches to training. Our goal was to suggest ways to conduct MOS 13E10 AIT more efficiently by better aligning the course with job requirements and expanding the use of training technologies. To accomplish this, we examined the current POI in light of our analysis. We reviewed the tasks contained in the POI with respect to training priorities established in our analysis. Tasks in the current POI that did not fit the criteria for inclusion for resident training were considered for elimination from training or for nonresident training in units. We also carefully considered other tasks (including

Table 3.10

Decision Rules for Suggesting Alternative Training Strategies

	Dimensions			
Methods of Training	F1	F2	F3	F4
CBT, IVD, simulators			low	
Training devices			high	

NOTE: Job Dimensions:
F1 = Frequent MOS 13E10 tasks
F2 = Urgent combat tasks
F3 = Equipment tasks
F4 = Interactive tasks.

skill-level two tasks) not currently trained in-residence if our analysis indicated they fulfilled criteria for inclusion for the resident course.

After reviewing course content, we turned our attention to training methods. Given the emphasis on cognitive and equipment-oriented tasks, we sought to recommend a "maximum reasonable" substitution of training technology for current methods of instruction. The substitutions recognize the need for at least some "hands on" training and field training exercises.

This approach for suggesting alternative POIs was accomplished in three steps:

1. Based on the current POI, define "minimum essential" tasks for resident training and tasks for elimination or distribution to units
2. "Add-in" other essential tasks for resident training that are not in the current POI
3. Define options for expanding the use of training technologies in the POI created in the previous step.

The 13 March 89 MOS 13E10 AIT POI used as the "baseline" and the alternative POIs we developed are shown in Appendix Tables B.1–B.5. For each POI, we show the training events, class hour designations, and total hours of instruction.

Potential for Changes in Content and Length of Resident Training

Current POI. Our initial finding is that 80 percent of the instructional hours in the current resident POI address core job requirements of first-term cannon fire direction specialists. We reach this judgment by isolating tasks suggested by our analysis as frequently performed or combat urgent for skill-level one soldiers. Our analysis indicates that such tasks have high training emphasis and must be performed immediately on assignment to a unit. Currently, such tasks encompass 200 of 250 instructional hours, including such training events as

- Map reading
- Communications training events
- Firing charts, basic firing data, and operations of the FDC
- Precision registrations and special missions
- Backup Computer System training.

Because proficiency in such tasks is required to ensure the combat readiness and effectiveness of artillery units, such tasks should be included for resident training for cannon fire direction specialists.

For example, a core set of communications events was retained in-residence (with some modification) to provide MOS 13E10 soldiers with a set of *generic* skills essential for communication skill readiness to

- Operate in a radiotelephone net and encode and decode messages
- Authenticate, encrypt, and decrypt coordinates
- List the preventive and remedial electronic counter-countermeasures
- Submit an MIJI report
- Prepare, operate, and maintain FM radios (medium power AN/VRC-12 series radios)
- Construct and install antennas (antenna group OE-254)
- Prepare and operate radio control group AN/GRA-39 equipment
- Prepare and operate communication security equipment.

Tasks for Training in Units. Our analysis suggested tasks for which individual training could occur in unit settings. Such tasks include the following characteristics:

- Occur frequently either in field or garrison
- Are not combat urgent
- Are equipment-related or involve repetitive procedures.

These criteria are similar to the "easy *versus* hard" and "tasks *versus* high-value skills" dimensions that have been suggested for choosing between AIT and OJT (Wild and Orvis, 1993).

For cannon fire direction specialists, such tasks generally involve installation and maintenance (and some operation) of communications equipment, generators, and vehicles. In addition, they include some interactive tasks (e.g., off load/load generator from/onto carrier, install RC-292 antenna, operate intercommunication set AN/VIC-1). Such frequently performed procedural tasks, specific to equipment assigned to units, may best be trained among intact crews in units.

Based on such reasoning, we identified 18 hours of resident instruction (7 percent of current POI hours) that could be conducted in units:

- 16 hours of communications training
- 2 hours meteorological messages training using BUCS.

The communications training distributed to units includes training on some interactive tasks and training on some types of radios and antennas not included in the resident, generic-skill training for this equipment.

Eliminated Tasks. Our analysis further suggested that over 10 percent of course material could be considered for simple elimination from the current POI. This could include

- 25 hours skill-level two meteorological messages training
- 6 hours of land navigation
- 1 hour extra orientation.

Our analysis suggested that current meteorological message training may not be required. These tasks tend to be performed infrequently by SL1 soldiers and were given low training emphasis by these soldiers' supervisors. The land navigation tasks, according to the task analysis results, do not seem as central to job requirements as, say, fire chart construction or manual gunnery computations. An hour of initial gunnery orientation was also eliminated, based on the advice of SMEs.

In sum, our initial examination of the MOS 13E10 AIT POI identified 18 class hours for training in units, 32 class hours for elimination from the current POI, and a trimmer MOS 13E10 AIT POI comprising 200 class hours of resident instruction. The specific alternative POI is found in Appendix Table B.2.

Tasks Added to Resident Training. Our analysis also identified tasks not currently in the POI that fit the "minimum essential" criteria for inclusion for resident training. Such tasks are combat urgent or frequently performed by MOS 13E10 soldiers; they are often prerequisite to other tasks. Most of these were Battery Computer System tasks, currently designated as SL2, which are included in a separate MOS 13E10 "fast-track" course. The statistical analysis, however, showed that these tasks are in fact performed frequently by SL1 soldiers, receive high training emphasis from supervisors, and appear otherwise similar to other MOS 13E10 tasks in the fire direction center.

Thus as part of our development of alternative POIs, we identified 29 new class hours of BCS (or Lightweight Computer Unit—LCU) instruction from the "fast-track" course for resident training. The 29 new class hours produce an "Add-In POI" with a total of 229 class hours. Even with these additional tasks, however, we reduce the 13 March 89 POI by 21 hours (or 8 percent). This second alternative POI is provided in Appendix Table B.3.

Potential for Expanded Use of Training Technologies

We next turned our attention to potential applications of training technologies in the MOS 13E10 POI. For the purpose of this case study, we used the "Add-In POI" and developed a third alternative, varying the technologies used to conduct the training.

Computer-Based Training. By the application of the principles discussed earlier, we selected CBT as an alternative method for conducting a portion of existing practical exercises. We chose CBT because evidence from research in cognitive science and education psychology supports its use for such hard-to-train, cognitive tasks as those required of cannon fire direction specialists. Moreover, evidence suggests that CBT can improve instructional efficiency and reduce training time by one-third. The evidence is drawn from older empirical studies of computer-aided instruction (CAI)[7] and more recent studies examining intelligent-tutoring and interactive-videodisc systems.[8]

The tasks identified as candidates for CBT were the frequently performed or combat-urgent tasks in the POI with a cognitive component (i.e., low on Factor 3). In principle, this could include all training of gunnery computations and BCS/LCU tasks, and CEOI communications tasks. In practice, however, CBT would substitute for practical exercises while leaving initial platform instructions and preexam drills intact.

We estimate that CBT could be used for 70 hours (almost half of 157 practical exercise hours and nearly a third of all instructional hours). The training affected would include the following:

- Construction of firing charts
- Determination of chart data
- Basic firing data
- Determination of site, angle of site

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[7]For example, see the reviews by Fletcher (1990) and Park, Perez, and Seidel (1987) and a recent overview of CAI and the emerging new technologies for use in education by Lewis (1992).

[8]For example, Fischer, Lemke, Mastaglio, and Morch (1990) describe applications with the computer tutor as a "critic or coach"; Newman (1991) employs an "apprenticeship training model" to ITS design; Towne and Munro (1991) employ "simulation-based instruction" to train technical skills; Winkler and Polich (1990) report the effectiveness of interactive videodisc in Army communications training.

- Operation of the FDC (selected fire missions)
- Precision registrations
- Special missions
- Introduction to the BCS/LCU
- Database construction
- Mission processing and registrations
- CEOI communications.

Initially, we assume this substitution could be accomplished on a one-for-one basis where 1 CBT hour = 1 PE hour. Thus, the alternative "CBT POI" of 229 POI hours is equal in length to the "Add-In POI." The detailed list of events and hours and methods of instruction in this alternative "CBT POI" is found in Appendix Table B.4.

Given improvements in training efficiency suggested in the literature, we will also consider an additional CBT POI that reduces the length of the course from 229 to 205.7 hours based on the assumption that CBT can train one-third faster. This additional alternative POI is shown in Appendix Table B.5.

Conclusions

The job analysis demonstrates the potential for reducing the length of resident training and expanding the use of training technology (specifically, CBT). Up to 20 percent of the existing POI might not need to be trained in-residence. However, the potential to reduce the length of this course is limited and likely to be less than indicated because other tasks not currently trained may need to be added in (e.g., "SL2" tasks that are performed by SL1 soldiers). But despite the inclusion of new resident training, the analysis produced a "net savings" of 21 hours in a course shortened from 250 hours to 229 hours. Thus, the maximum potential for reducing course length in MOS 13E10 AIT is approximately 8 percent.

In addition, our analysis demonstrates the potential for CBT to train hard-to-train, complex cognitive tasks performed by cannon fire direction specialists. CBT could be used for nearly half of the practical exercise hours while preserving "hands-on" experience. Over all instructional hours, the "maximum reasonable" use of CBT in MOS 13E10 AIT appears to be approximately 31 percent. Moreover, CBT might increase training efficiency by reducing training time by as much as one-third in the practical exercises in which it is used.

Thus, the results of the job analysis suggest three major alternative POIs for the MOS 13E10 AIT for further analysis: a "shortened" course that eliminates hours of instruction without admitting new candidates for resident instruction, an "Add-In" course that eliminates tasks while admitting others that meet resident training criteria, and a POI that incorporates CBT. The next section examines the cost of these alternatives.

4. Cost of Training Options

In this section, we use the methodology described in Section 2 to analyze and compare the costs of alternative MOS 13E10 AIT programs.

We limit our analysis in two important ways. First, we use a static course baseline to identify resource and cost changes. We examine the operation of the MOS 13E10 AIT course for a single year, FY 93, and measure the differences in resources and costs generated by the three alternatives. The second way we limit the analysis is by calculating the cost effects as though all trainees are members of the Active Component (USA). The Reserve Component (USAR) and the National Guard (ARNG) operate under a number of training constraints, including limited training time, facilities, and equipment and conflicts with the trainees' civilian occupations. Because these constraints could negate any cost savings from small reductions in training time, we did not assume that any of the alternatives would necessarily create a savings from decreased USAR and ARNG time on active duty for training.

Analytic Steps

Our analysis focuses on changes in savings and costs that result from implementing alternative training strategies. The most important step in the analysis is to thoroughly define the current MOS 13E10 AIT course and the proposed alternatives.

Definition and Specification of the Changes in MOS 13E10 AIT

Current Course. The "Program of Instruction (POI) for MOS 13E10 Cannon Fire Direction Specialist," dated 13 March 1989, provided much of the information necessary for defining the baseline. The POI designates a minimum class size of 20 students, with 40 students the optimal (and maximum) number. For FY 93, the Army Program for Individual Training (ARPRINT) forecasts a total of 686 students attending the course.[1] This student population includes active, reserve,

[1] The Army Training Requirements and Resources System (ATRRS) is an automated information system that provides input to training management information for the schools and training centers. A major product of ATRRS is the ARPRINT, which provides officer and enlisted training requirements, objectives, and programs for the Army.

and National Guard personnel. This number of students will require approximately 17 iterations during FY 93 if each class contains the maximum 40 students. The course is seven weeks long and students are taught in-residence at Fort Sill. Active Army students attend the course as their AIT assignment immediately following Basic Training (BT) and are on Temporary Duty (TDY) status. Reservists and guardsmen are sent to the course by their units, also on TDY status.

Of the seven-week total, 6.25 weeks (250 hours) are designated as academic or instructional hours. An additional 30 hours are reserved for administrative time, including processing the students' and commandant's time and open time. Another 24 hours of physical fitness training are not included in the totals. The Gunnery Department manages the MOS 13E10 AIT course and conducts 76.0 percent of the training (based on POI academic hours). The Target Acquisition Department conducts 5.6 percent of the training, and the Communications/ Electronics Department conducts 18.4 percent.

The training departments' choices of instructional methods (e.g., conference, demonstration, practical exercises) are extremely important because these methods eventually drive manpower, equipment, and facilities requirements. Practical exercises are the dominant method used in the MOS 13E10 AIT course and represent almost 75 percent of all academic hours. These methods of instruction have predetermined student groupings and instructor manpower requirements.[2] The end result of combining the method of instruction and the predetermined student groupings is the instructor contact hour (ICH). Course manpower requirements are determined largely by the ICH computation. There are a total of 712.7 ICHs for one iteration of the MOS 13E10 AIT course, according to the 13 March 1989 POI.[3] Table 4.1 shows the current distribution of ICHs among the training departments.

Proposed Alternatives to the MOS 13E10 AIT 13 March 89 POI. Using the job analysis results described in Section 3, we developed three alternative POIs: the "Shortened POI," the "Add-In POI," and the "CBT POI." However, there is a multitude of ways to implement these alternatives, and the selection of implementation options can have a profound effect on costs. To illustrate the

[2]TRADOC Regulation No. 351-1, The Training Requirements Analysis System (TRAS). TRAS integrates the training development and implementation process with resources (personnel, construction, training equipment, ammunition, etc.). TRAS prescribes the size of student groups and the number of instructors per group based on the method of instruction.

[3]This number is actually the result of an error in the calculation of the ICHs, in which 11.6 ICHs of map reading (event AN10AH) were counted twice. The correct number of ICHs is 701.1. However, since 712.7 was the official number of ICHs used in costing this version of the POI, we used this number in all of our calculations involving ICHs.

Table 4.1

Departmental Instructional Methods and Instructor Contact Hour Summary for MOS 13E10 AIT 13 March 1989 POI

Method of Instruction	Gunnery ICHs	Target Acquisition ICHs	Communications/ Electronics ICHs	Total ICHs
Conference	25.5	2.4	4.8	32.7
Demonstration	0.0	0.0	1.0	1.0
Practical exercises	406.5	50.0	149.0	605.5
TV	0.0	0.0	0.5	0.5
Exams	55.0	2.0	16.0	73.0
Total	487.0	54.4	171.3	712.7

NOTE: These are the ICHs for *one* course iteration. To determine the ICHs required during any fiscal year, each cell must be multiplied by the number of iterations held in that fiscal year.

importance of implementation options (and of cost assumptions), we analyze each of the three alternatives using two sets of implementation and cost assumptions. Table 4.2 summarizes the alternatives and assumptions we consider in this analysis.

The "Shortened POI" alternative eliminates 50 academic hours (two weeks) of the original course POI. Among 50 hours dropped from the POI were 16 hours of general communications and 27 hours of meteorological messages. This change reduces the POI from 250 academic hours to 200, and the ICHs from 712.7 to 540.8. Table 4.3 lists the hours reduced in this alternative.

The "Add-In" POI starts with the "Shortened POI" and adds 29 hours of SL1 BCS/LCU events now taught in the "Fast-Track" option. The "Add-In" POI results in a total of 229 academic hours with an increase (over the "Shortened POI") of 71 ICHs, for a total of 611.8 ICHs. Table 4.4 summarizes the training events added to the POI.

Table 4.2

MOS 13E10 AIT Course Alternatives

Alternative	High-Cost Assumptions	Low-Cost Assumptions	Total
Shortened POI	X	X	2
Add-In POI	X	X	2
CBT POI	X	X	2
Total	3	3	6

Table 4.3

Events Reduced in the "Shortened POI" Alternative

Department	Event	Hours Reduced
Gunnery	Orientation	1.0
Gunnery	Concurrent MET	8.0
Gunnery	Subsequent MET	8.0
Gunnery	MET Practical Exercise	6.0
Gunnery	BUCS MET	2.0
Gunnery	Examinations	3.0
TAD	Map Reading, Part I	4.0
TAD	Map Reading, Part II	2.0
CED	Medium Power Radio Sets	2.0
CED	Intercommunication Set AN/VIC-1	2.0
CED	PMCS on Radio Set AN/VRC-46	2.0
CED	Antennas	1.0
CED	Examination and Critique	1.0
CED	Prepare and Operate a SINCGARS	8.0

NOTE: TAD: Target Acquisition Department, CED: Communications/Electronics Department, met: meteorology.

Table 4.4

Events Added in the "Add-In POI"

Department	Event Added	Hours Added
Gunnery	Introduction to the Lightweight Computer Unit (LCU)	2.0
Gunnery	LCU Database Construction	10.0
Gunnery	LCU Mission Processing and Registrations	12.0
Gunnery	LCU Practical Exercises	4.0
Gunnery	Exam	1.0

NOTE: Four hours of LCU Practical Exercises and one hour of exam are new, not included in the "Fast-Track" POI.

The "CBT POI" is the same as the "Add-In POI," except that it converts 70 hours of PE (practical exercises) to CBT and 11 hours of PE to conference. The number of academic hours is unchanged at 229, but, because CBT and conference instruction require fewer instructors than PE, the total ICHs are reduced from 611.8 to 532.8.

Assumptions and Alternative Scenarios. We need to be very clear about our assumptions and make them explicit to clarify the extent and limits of our analysis. We have already mentioned two important assumptions in our description of the alternatives. First, we are assuming that a static analysis will suffice for screening these alternatives. Second, we are limiting our analysis by calculating costs as if all trainees are members of the Active Component.

For this MOS 13E10 example, we organize our analysis using two different sets of assumptions about implementation options, development costs, and training efficiency. We will conduct the analysis once using an original set of assumptions involving high costs and then again using new assumptions involving lower costs.

Original Assumptions. As shown in Table 4.5, in our set of original assumptions for delivery activities, we make five key assumptions. First, we assume that converting from PE to CBT will not cause students to learn faster, so there will be no savings in instructional time. Second, we assume that for eliminated events, if the soldier needs to acquire that skill, he will learn it in the units through on-the-job training (OJT). This leads to the assumptions that the units, since they will not be conducting any additional formal platform training, will have no need for additional instructors, and that since the soldiers will be practicing on the equipment already assigned to the unit, there will be no need for additional equipment.[4] And we assume that the changes in training location and methods will not cause any change in the rates at which students fail training events.

For the training development activity area under the original assumptions, we do not use TRADOC's estimated time values (ETV). The current ETV assume a static time period to develop a particular type of product. For example, to develop a computer-based training product requires 49 developer man-days.

Table 4.5

Original Assumptions

Training Activity	Location	Assumption
Delivery	School	No time savings for CBT
	Units	OJT for eliminated events
	Units	No additional instructors
	Units	Existing equipment sufficient
	School	Will not cause a change in fail rates
Development	School	Flat rate development
	School	All CBT/conference/exam development costs allocated to MOS 13E10 AIT
	School/Unit	LCU software development excluded
Support	School	No reduction in civilian workload or costs

[4]As described in the previous section, units would assume responsibility for approximately 18 hours of communications and MET message training. For the purpose of this analysis, we assume that this training is feasible and can be accomplished using existing resources. This assumption appears reasonable, especially since almost half (8 hours) of this training is in SINCGARS, which the Army plans to teach in the units to all concerned personnel. However, to the degree this assumption is incorrect, and additional manpower, equipment, or facilities are required to accomplish this training, the potential for reducing course length and cost savings attributable to these changes will be diminished.

That one product may be one hour or five hours in duration; yet the man-days requirement remains the same. For our original assumptions, we dissect development products into hourly increments and assign a flat dollar rate per hour for each type of product.[5] For example, a one-hour class costs $7,000 to develop and a two-hour class costs $14,000 to develop. With the original assumptions, we track each new product by hour rather than simply by product. We also assume that all costs for CBT, conference, and exam development should be charged to the MOS 13E10 course. And we assume that since LCU software will be developed for the purpose of deploying the LCU in the field, the development costs should not be charged to MOS 13E10.

For the support activity area, we make one important assumption. We assume that the changes will cause no significant reduction in civilian workload, so the number and distribution of civilians employed will not change, and there will be no reduction in civilian costs.

New Assumptions. The new assumptions modify one assumption about cost, one about efficiency, and one about implementation (see Table 4.6).

With respect to training delivery, we now assume that there will be a 33 percent time savings with CBT; that is, a lesson that took three hours to learn with PE1 can be learned in two hours with CBT. For the training development activity area, we now use TRADOC's estimated time values for media development.[6] We now assume that these current time values that estimate the man-hours by training product are accurate predictors of the manpower required to develop and sustain the new training products.

In the support activity area, the new assumption is that there will be a reduction in civilian workload and costs. Some civilian tasks will not be replaced by other

Table 4.6

New Assumptions

Training Activity	Location	Assumption
Delivery	School	33 percent time savings with CBT
Development	School	TRADOC estimated time values
Support	School/Host	Reduction in civilian workload and costs

[5]To develop these rates, we conducted a simple survey of various training development firms, and our flat rates represent the median values we collected. See Way-Smith (1993) for details.

[6]These time values were developed in the 1980s and may not accurately reflect current development requirements. These standards are currently being revised. However, these values are what the Army now uses to resource training development, and we use them to serve as a benchmark for establishing a lower boundary on training development costs.

tasks; so the civilians performing the eliminated tasks will be transferred to excess capacity and removed from Army employment, with a resulting one-time separation cost and a recurring savings in civilian pay and benefits.

Importance of These Assumptions. The training resource analysis method examines the effects of training changes in the context of the entire Army and not just TRADOC and its schools. Removing training events from the POI results in immediate cost savings for the schools. Events that need not be trained in the unit (e.g., SL2 MET messages) represent a pure savings with no offsetting costs to the unit. However, units will have to do some communications training currently done in the school. If, as we assume, the training can best be done by OJT, there will be no need for additional dollar outlays. In this case the unit can expect a result consisting of some mix of three outcomes: The unit may be able to integrate the new lessons into its current OJT (particularly in the case of SINCGARS training); the unit may have some degree of resource "slack" (i.e., trainers' and trainees' time is not a binding constraint) that it can apply to the new lessons; or the soldier may end up being less trained than he is currently.

The two sets of estimates for development costs result in large differences in the costing of the alternatives. Development is an important cost driver, and changes in development affect both costs and savings. This is because there are two types of development costs to be considered. *Initial* costs are the one-time expenses of developing a new training event. Once the training event is in place, it incurs a *sustaining* development cost, which is an ongoing expense for maintenance on the event. The annual ongoing development costs to keep all events up to date amount to about half of the initial cost to develop the event. Thus, removing an event from the POI reduces the sustaining development costs; changing an event or adding one to the POI results in both initial and sustaining development costs. The higher development costs really are, the greater will be the initial and sustaining development costs for new products, but these will be offset by the greater value of the savings from eliminated events.

For both development and civilian support, the degree to which savings estimates will be realized depends upon implementation decisions, which in turn will depend largely upon conditions at USAFAS and Fort Sill. If developers and civilians have some "slack" in their organizations, then a savings in development or support may be translated into dollars through a reduction in the number of developers or civilians. However, if developers' and civilians' time is a binding constraint, and remains so after the changes, then there is no "slack," and the Army's best use of the savings would be in development or civilians: That is, keep the same people but have them do other tasks they do not have time to do now. For both sets of assumptions, the savings represent not the dollars that will be returned to the Army but rather the estimated value of the time that will be saved by the changes.

Activity Analysis

Next we examine how implementing the alternatives would affect ongoing training activities. We focus principally on the CBT POI, compared with the current course, in the following discussion because this alternative incorporates the changes included in the other activities. We used the same procedures to analyze the cost effects of the other alternatives, i.e., the "Shortened" POI and "Add-In" POI.

The activity analysis identifies the principal delivery, development, and support activities that produce the current MOS 13E10 AIT course, and it examines how these activities would change and which organizations would be affected as a result of implementing the proposed alternatives. The activity analysis requires a comprehensive understanding of the overall functions and organizations of the school and how they affect a particular course. This is critical because if activities are omitted, they will not be included in the resource or cost analysis phases of the method. In short, the activity analysis is an organizational analysis for the affected course. The activity analysis uses balance sheets to determine which activities change, how they change, for whom they change, and when they change.

Once we have completed the balance sheets for each major activity area, we summarize these balance sheets, and we make initial estimates as to whether these activity changes are one-time or recurring types of changes. Table 4.7 lists activity and workload changes for the CBT POI with the original assumptions. Table 4.8 summarizes the activity and workload changes for the CBT POI with the new assumptions. Both tables show specific activity and workload changes in the stubs of the table. The most significant activity changes are indicated in the columns. Note also that Table 4.7 shows product development in hours, to which flat-rate per-hour development costs are applied, while in Table 4.8 development is shown in products, which are then costed using TRADOC's estimated time values.

As can be seen in the tables, significant changes in activities and workload in training delivery, development, and support occur under both sets of assumptions. In either case, one-time changes occur in training development, as new products are developed to support CBT for resident and printed materials

Table 4.7

Activity and Workload Changes for CBT POI Under Original Assumptions

Activity/Workload Changes	Type of Activity: One-Time Transition	Type of Activity: Recurring
DELIVERY		
Installation course length (–21 hours)		X
Student load reductions (–7.2 man-years)		X
School annual ICH change (–3085.3 ICHs)		X
Gunnery (–926.1)		
TAD (–795.8)		
CED (–1363.4)		
DEVELOPMENT		
New product development (+93.6 hours)	X	
Computer-based hours (+70)	X	
Printed hours (+23.6)	X	
Development sustainment		
Conference hours (+11.6)		X
Computer-based hours (+70)		X
Practical exercises hours (–99.6)		X
Exam hours (–3)		X

Table 4.8

Activity and Workload Changes for CBT POI Under New Assumptions

Activity/Workload Changes	Type of Activity: One-Time Transition	Type of Activity: Recurring
DELIVERY		
Installation course length (–44.3 hours)		X
Student load reductions (–15.1 man-years)		X
School annual ICH change (–3884.5 ICHs)		X
Gunnery (–1646.4)		
TAD (–795.8)		
CED (–1442.3)		
DEVELOPMENT		
New product development (33 products)		
Computer-based products (+15)	X	
Printed products (+18)	X	
Development sustainment		
Conference products (–1)		X
Computer-based products (+15)		X
Practical exercises (–26)		X
Exam products (–1)		X
SUPPORT		
USAFAS	X	X
Fort Sill	X	X

for nonresident instruction. One-time changes in training delivery are also required as course length is reduced.

Recurring changes in activities are also called for under each set of assumptions profiled above in Tables 4.5 and 4.6. The most important differences derive from the assumptions regarding savings in training time attributable to CBT and the amount of support required for CBT courseware.

Resource Analysis

The summaries of activity changes serve as the foundation for identifying the associated resource changes. The resource analysis step of the method produces the specific manpower, equipment, and facilities changes that result from implementing the alternative. To identify these changes, we proceed as we did with the activity analysis—using the balance sheet to record the specific changes and then summarizing these changes.

Table 4.9 lists the types of changes generated in implementing the CBT POI, using the original assumptions. Most of the entries under "Basis for Estimate of Cost or Savings" are the same numbers noted under "Activity Workload Changes" on the balance sheets. These entries form the basis of the calculation in net changes in cost. The right-hand columns of the table indicate whether the cost or savings from the changes will occur only during the transition phase (nonrecurring) or will occur annually (recurring).

Table 4.10 is the catalogue of cost-causing changes for the new assumptions. Changes in civilian support manpower are now included as a direct result of the

Table 4.9

CBT POI Catalogue of Cost-Causing Changes: Original Assumptions

Type of Change	Basis for Estimate of Cost or Savings	Type of Cost	
		Nonrecurring	Recurring
ACTIVITIES			
School delivery	–3085.3 ICHs (–7.2 load)		X
New product development	+93.6 hours	X	
Development sustainment	–21 hours		X

NOTE: Civilian support manpower is not costed because of the original assumption that the reduction in course length would not relieve support workload. Military manpower is not included because changes to the POI will have no effect on total Army military manpower costs unless they are translated into a change in end-strength. See Way-Smith (1993) for further discussion of this issue.

Table 4.10

CBT POI Catalogue of Cost-Causing Changes: New Assumptions

Type of Change	Basis for Estimate of Cost or Savings	Type of Cost Nonrecurring	Type of Cost Recurring
ACTIVITIES			
School delivery	–3884.5 ICHs (–15.1 load)		X
New product development	+33 products	X	
Development sustainment	–13 products		X
School training support	–3884.5 ICHs (–15.1 load)	X	X
Host training support	–15.1 student load	X	X
MANPOWER			
Civilians		X	X
New training products	+33 products	X	X
Sustainment of products	–46 products	X	X

change. As in Tables 4.7 and 4.8, the original assumptions show product development in hours, while the new assumptions show development with products as the unit of measure.

Cost Results

Table 4.11 presents the cost results of the CBT POI, using the original assumptions. Savings are shown in parentheses. The nonrecurring costs for this option are the costs of new training product development, which we estimate at approximately $1,018,000. The savings are also development-related, resulting from a reduction in the maintenance of existing training products. If the assumptions about the costs of development are correct, the initial cost of implementing the change is about seven times the amount of the annual savings.

Table 4.12 lists the cost changes for the CBT POI, using the new assumptions. The transition (nonrecurring) costs under this set of assumptions are significantly lower than those under the original assumptions, dropping from approximately

Table 4.11

Results of Original Assumptions of CBT POI Option

	Costs
NONRECURRING	
New training products	$1,018,000
RECURRING (SAVINGS)	
Training product maintenance	($148,000)

Table 4.12

Results of New Assumptions of CBT POI Option

Costs	
NONRECURRING	
Civilian personnel costs	
Separations	$54,000
New training products	$265,000
Total costs	$319,000
RECURRING (SAVINGS)	
Civilian pay and allowances	($114,000)
Training product maintenance	($53,000)
Total savings	($167,000)

$1,018,000 to $319,000. This change is due primarily to the lower costs of training development based on estimated time values. If development costs are lower than previously estimated, then savings from a reduction in development will also be lower, and estimated savings from development drop from approximately $148,000 to $53,000. Total recurring savings are augmented, however, by the addition of savings in civilian costs. Altogether, we estimate the annual recurring savings will be $167,000, using these assumptions.

Before we compare the cost results for all of the alternatives, we need to consider the implications of the options for military manpower. Table 4.13 compares the military manpower results for two sets of assumptions. The figures show the number of military man-years that could be taken from instruction and applied to other assignments. Although these figures do not represent cost savings unless they are applied to reductions in end-strength, they do represent increases in the efficiency with which military manpower is deployed.

Table 4.13

Military Manpower Results: Original and New Assumptions

	Transfers to Other Organizations	
	Assumptions	
Type of Manpower	Original	New
Instructors	3	5
Student years	7	15
Total	10	20

Savings and Cost Results for All Alternative POIs

The final step of our analysis places the costs in context. This requires comparing the alternatives, "sizing the costs and savings," and identifying the trade-offs.

Comparisons of the Alternatives

We first compare the costs and savings associated with each of the major alternatives examined in our analyses. Table 4.14 lists the savings and costs for all alternatives, using the two sets of assumptions. All of these figures were derived through the procedure described for the CBT POI on the preceding pages.

Figure 4.1 shows the various break-even points for both the original and new assumptions.

Under either set of assumptions, the "Shortened POI" can provide an immediate payback, assuming that the course realistically can be scaled back to this level. In designing POIs, the training developer should align training with job requirements while placing the highest resident training priorities on the tasks central to job performance in the subsequent duty assignment. The "Shortened POI" provides an extreme example of how this can be accomplished to provide immediate and substantial returns (breaking even in about four months even in the worst case). But even in the circumstance when tasks are "added in" to the POI, cost savings of $84,000 to $117,000 can be achieved within a year, as a smaller number of "high-priority" tasks replace a larger number of tasks that may be less suitable for resident training.

Table 4.14

Comparisons of Alternatives: Original and New Assumptions

Costs/Savings	Shortened POI	Add-In POI	CBT POI
Original assumptions			
Nonrecurring Costs	$0	$296,000	$1,018,000
Recurring (Savings)	($283,000)	($117,000)	($148,000)
New assumptions			
Nonrecurring Costs	$54,000	$139,000	$319,000
Recurring (Savings)	($187,000)	($84,000)	($167,000)

NOTE: Current dollars rounded to thousands.

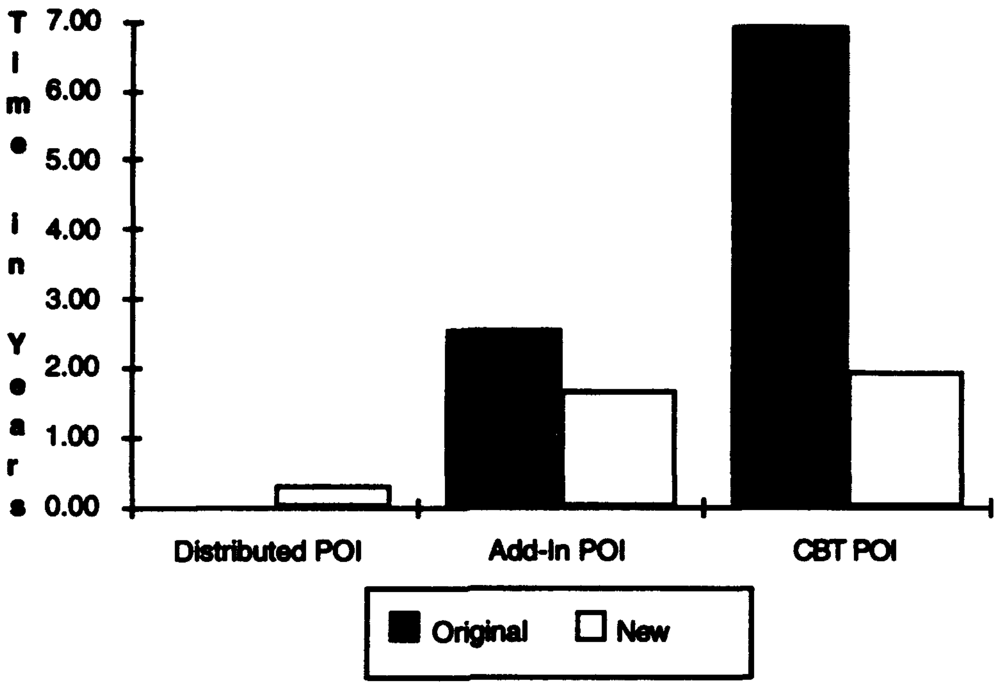

Figure 4.1—Break-Even Analysis

The cost analysis of the CBT options also supports the value of incorporating CBT in the MOS 13E10 AIT POI, assuming that the break-even range is reasonable in terms of obsolescence of equipment or courseware. If the CBT can be developed and implemented under the original assumptions, then the investment should break even in seven years. The new assumptions suggest a shorter break-even period of about two years. The difference in estimated savings is attributable in large part to the estimated cost of courseware development (flat dollar rates versus ETVs), which overcomes compensating savings attributable to improvements in training efficiency and lowered support requirements. We suspect the higher development and support costs are more accurate and thus the longer break-even period may be more realistic.[7]

[7]During the decision to invest in CBT, however, other considerations should also be weighed, such as its exportability, e.g., to maintain skills in units, and the potential to improve the quality of training for hard-to-train tasks with high failure rates and substantial learning decay.

Sizing the Costs and Savings

The largest savings that can be realized is with the "Shortened POI": $283,000 (and no cost) if the original assumptions are correct, $187,000 under the new assumptions. Under both sets of assumptions the CBT POI has higher costs and higher savings than the "Add-In POI." If the original assumptions are correct, adopting the "Shortened POI" can save about 4 percent of USAFAS' FY 92 OMA (Operation and Maintenance, Army) budget. Figure 4.2 shows the potential savings in relation to the USAFAS OMA budget.

However, not all of this potential savings can be freely transferred to other budget priorities. A large part of the potential savings is in development, and this represents an "opportunity savings": The time developers save from the MOS 13E10 AIT course can be devoted to developing training products for other courses. The dollar value is just an attempt to estimate the value of that time.

Trade-Offs

There is one important qualitative trade-off that needs to be considered in the analysis. Some of the events being removed from the POI will not be needed in the soldier's first duty assignment. However, others train skills that are needed by the unit. For these events, the soldier will have received some generic skill training in the school, but the unit will need to provide the specific training. The unit may be able to include this training as part of ongoing OJT. That this is not

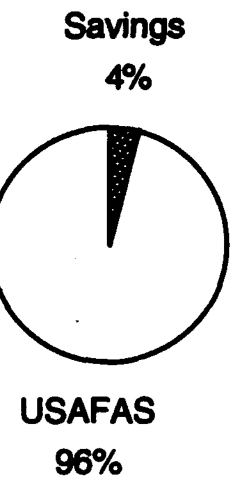

Figure 4.2—Savings in Relation to USAFAS' FY 92 OMA Budget

unreasonable is evidenced by the Army's plan to teach SINCGARS to users in the units. But if resources do not exist, the unit will not be able to absorb this additional training without either sacrificing other activities or acquiring additional resources. This effect is offset to the degree that the changes in the POI will improve the soldier's training (e.g., by incorporating urgent combat BCS/LCU training now done by units).

5. Conclusions and Implications

To cope with declining resources and budgets, the Army is reviewing its customary methods of training individual skills, with the goal of finding ways to train more efficiently. New training concepts and strategies have been proposed as a means for reducing training costs and increasing training efficiency, but further analysis is needed to refine specific concepts to ensure that they reduce costs and prove feasible in practice. The goal of our research effort is to develop and apply new tools for linking new training concepts with specific individual training programs and for analyzing the effects of training changes on Army individual training costs. To this end, we have developed an analytic method that analyzes military occupational specialties, selects training programs for in-depth study, analyzes job duties, suggests training options, and assesses cost and resource implications of training changes.

This document details the results of applying our training and cost analysis methods in a specialized skill training course—MOS 13E10 AIT. The analysis considers changes in training content, timing, location, and technologies consistent with strategies that seek to reduce the length of resident training and expand the use of training technologies. We draw three general conclusions from our analysis.

Training Programs Can Be Better Aligned with Job Requirements

Despite continuing pressures to rationalize the content of training courses, there is still room for improvement. Our analysis shows that MOS 13E10 AIT contains about 50 hours of material that could be considered for elimination from resident training. Some of this material covers tasks that our analysis suggests are not generally performed by skill-level one soldiers. Some of this material may further lend itself to training in units, possibly in lieu of other individual training that belongs more properly in-residence.

Other training programs presumably also contain material that is not as closely tied to job requirements as other tasks in the program of instruction. As part of the continuing effort to reduce training costs and improve operating efficiency, training managers should review existing training programs to ensure close alignment of training programs and job requirements. A formal method for analyzing training requirements, such as that described in this report, can provide objective information for determining the tasks that need training and which of these need to be trained in-residence.

A broad and objective review of training programs, aimed at "scrubbing" training courses to better align training programs with job requirements and resident training priorities, could free a respectable amount of resources. These could be used to reduce training costs or to provide necessary training that is not currently resourced.

The Potential to Reduce Course Length Is Limited but Savings Are Possible

Through systematic consideration of the job duties of cannon fire direction specialists, in conjunction with key MOS 13E10 training objectives, we find that respectable savings can accrue as course length is reduced—from $187,000 to $283,000 per year almost immediately in the most severe case.[1] The possibility of achieving such savings is diminished, however, by potential claims on the training time that may be made available.

For example, if tasks suggested by our analysis as fulfilling the criteria for resident training (but not currently trained in-residence) were added to the curricula, then the net reduction in course length falls from a maximum of 50 hours to a maximum of 21 hours (about 8 percent of the current course). This reduces the potential savings by over half, to $84,000–$117,000 per year within two or three years. Thus, it is possible here (and may be possible elsewhere) to effect realignments of course content while lowering training costs if new material can take the place of other, more resource-intense material with lower priority for resident training.

CBT Can Save Costs While Improving Training Efficiency

Our analysis confirmed that MOS 13E10 AIT is a good candidate for expanded use of CBT. The course currently does not use CBT. Our analysis showed that CBT could be used in nearly half of the tasks for which "hands-on" practical exercises are now used (principally gunnery computation and LCU tasks). Under both sets of assumptions in our analysis, the introduction of CBT in MOS

[1]This assumes that no additional costs are incurred as units absorb some of this training. Actual savings are likely to be smaller if increased training burden across the Army is considered.

13E10 AIT can provide cost savings. Under one set of assumptions, CBT could save up to $167,000 per year after two years. Alternatively, even in the worst case, CBT could provide annual recurring savings of $148,000 after seven years and after a three-times-greater initial outlay.

Moreover, CBT can reduce the need for training manpower and improve the quality and standardization of training. The key uncertainty governing the payback period is the cost of developing and sustaining the CBT courseware. But given that the operation of the battery echelon FDC and the technical support of timely, accurate fire missions for maneuver forces will continue to be the principal battlefield requirement, even a long break-even time should save the Artillery School and the Army sufficient costs and resources to make the investment worthwhile.

Appendix

A. 13E Task Rankings

Table A.1

Factor 1: Frequent 13E10 Tasks

Rank	Title	Factor Score
1	Send radio message	1.8185
2	Determine the grid coordinates of a point on a military map using the military grid	1.5248
3	Install and operate telephone set TA-312/PT	1.4990
4	Process fire unit data and weapon location using the backup computer system (BUCS)	1.4622
5	Process ammunition data using the backup computer system (BUCS)	1.3742
6	Identify terrain features on a map	1.3640
7	Install antenna group OE-254/GRC (team method)	1.3406
8	Process an area fire mission using the backup computer system (BUCS)	1.3292
9	Process observer data using the backup computer system (BUCS)	1.3213
10	Operate AN/VRC-46 radio set (AN/VRC-12 series)	1.3173
11	Prepare/operate tactical FM radio set	1.2933
12	Initialize the backup computer system (BUCS) and verify files	1.2192
13	Enter map modification data into the backup computer system (BUCS)	1.2068
14	Process target/known point data using the backup computer system (BUCS)	1.1968
15	Process computer met information using BUCS	1.1953
16	Convert computer met information using BUCS	1.1886
17	Shutdown the battery computer system (BCS)	1.1838
18	Locate target by grid coordinates	1.1565
19	Identify topographical symbols on a military map	1.1435
20	Determine the elevation of a point on the ground using a map	1.1396
21	Process ballistic met information using BUCS	1.1332
22	Connect/disconnect generator to/from operating equipment	1.0965
23	Record a data base	1.0731
24	Initialize the battery computer system (BCS) and construct and record a data base	1.0658
25	Record generator deficiencies (DA form 2404)	1.0576
26	Process battery computer system (BCS) piece information using the BCS; PIECES message	0.9946

Rank	Title	Factor Score
27	Process fire unit information using the AFU; update message of the battery computer system (BCS)	0.9931
28	Process muzzle velocity data and store muzzle velocity variations (MVVS) in the BUCS	0.9884
29	Load and update a previously recorded data base using the battery computer system (BCS)	0.9692
30	Perform preventive maintenance checks and services (PMCS) on gasoline engine driven generator set	0.9449
31	Maintain fire direction records	0.9272
32	Establish and close an FM radiotelephone net	0.9210
33	Process map modification information using the SPRT; map message of the BCS	0.9168
34	Update registration corrections for BUCS using BCS data	0.9102
35	Process a precision registration using the backup computer system (BUCS)	0.9086
36	Prepare a surveyed firing chart	0.8614
37	Process fire unit ammunition information using the AFU; BAMOUP message of the BCS	0.8564
38	Process plain text information using the SYS; PTM message of the battery computer system	0.8431
39	Install radio set control group AN/GRA-39	0.8395
40	Operate an FM radio set using AN/GRA-39	0.8049
41	Process an area fire mission using the battery computer system tem (BCS)	0.7940
42	Process an illumination mission using BUCS	0.7885
43	Process target/known point information using FM; RFAF message of the battery computer system (BCS)	0.7724
44	Perform operator's preventive maintenance checks and services on antenna group OE-25	0.7649
45	Maintain ammunition status reports/records	0.7642
46	Announce fire commands utilizing data from BUCS	0.7538
47	Prepare/operate communications security equipment TSEC/KY-57 with FM radio sets	0.7489
48	Install a generator set	0.7480
49	Measure distance on a map	0.7262
50	Offload/load generator from/onto carrier	0.6999
51	Plot target locations/unit information on firing charts	0.6754
52	Adjust generator output/voltage/frequency	0.6630
53	Process a radar registration using BUCS	0.6594
54	Process observer information using the FM; OBCO message of the battery computer system (BCS)	0.6448
55	Perform operator's PMCS/routine checks on telephone set TA-312/PT	0.6436
56	Perform field-expedient repairs on generator	0.6019
57	Determine magnetic Azimuth using M2 compass	0.5881
58	Perform operator's PMCS on AN/VRC-46 radio set	0.5743
59	Convert azimuths	0.5736

Rank	Title	Factor Score
60	Update registration corrections with met data using BUCS	0.5676
61	Determine azimuths using a protractor and compute back-azimuths	0.5645
62	Process meteorological information using the MET; CM message of the battery computer system (BCS)	0.5608
63	Process a time-on-target (TOT) fire mission	0.5605
64	Resynchronize the battery computer system (BCS)	0.5478
65	Update registration corrections with survey data using BUCS	0.5362
66	Process a high burst/mean point of impact (HB/MPI) registration using the BUCS	0.5331
67	Plot targets, determine, and announce chart data (manual)	0.5284
68	Operate radio set AN/VRC-64/AN/GRC-160	0.5251
69	Take corrective action on error and warning messages using the battery computer system (BCS)	0.4980
70	Install RC-292 antenna	0.4889
71	Perform diagnostic tests using the diagnostic test summary of the battery computer system (BCS)	0.4667
72	Replot targets as directed and determine and announce grid location	0.4664
73	Navigate from one point to another point (dismounted)	0.4494
74	Construct firing chart based on map spot	0.4207
75	Compute firing data for fire-for-effect(FFE) mission	0.4179
76	Locate an unknown point on a map or on the ground by resection	0.4164
77	Compose/address/transmit messages on BCS	0.4161
78	Determine location on ground by terrain association	0.4108
79	Determine/announce fire commands utilizing data obtained from battery computer system (BCS)	0.4061
80	Process an illumination fire mission	0.3990
81	Process information using the BCS; COMD message format	0.3676
82	Process precision registration using the battery computer system (BCS)	0.3088
83	Process a fire plan using the battery computer system (BCS)	0.3019
84	Assist in destruction of communications security equipment/material to prevent enemy use	0.2992
85	Orient map using compass	0.2986
86	Execute a priority fire mission	0.2949
87	Position vehicle mounted/skid-mounted generator	0.2751
88	Transmit shot to forward observer during fire mission	0.2731
89	Perform operator's PMCS on radio set control group AN/GRA-39	0.2651
90	Establish a priority fire mission	0.2591
91	Receive corrections from forward observer during fire mission	0.2225
92	Display/act on received messages using BCS	0.2060

Rank	Title	Factor Score
93	Process replot using the battery computer system (BCS)	0.1894
94	Construct an emergency firing chart	0.1755
95	Determine basic firing data for an HE projectile with a GFT/GFT fan (fuze quick, time, and VT)	0.1708
96	Process simultaneous fire mission using BCS	0.1651
97	Determine basic firing data for an HE projectile with a GFT (high angle)	0.1466
98	Update a priority fire mission or assign a target number as a known point using the FM	0.1414
99	Update registration corrections using met information	0.1177
100	Compute and announce site, angle of site, and vertical angles	0.1097
101	Initiate/process check firing and cancel check firing using the battery computer system (BCS)	0.0997
102	Manually authenticate messages received and transmitted using the battery computer system (BCS)	0.0950
103	Operate intercommunications set AN/VIC-1 on a tracked vehicle (includes FM radio)	0.0761
104	Calculate muzzle velocity variation information using the BCS/MVV message format	0.0658
105	Post/update map-spotted firing chart	0.0654
106	Process mask information using the AFU; MASK message of the battery computer system (BCS)	0.0375
107	Determine direction using field-expedient methods	0.0357
108	Process restricted fire area information using the SPRT; GEOM message of the BCS	0.0308
109	Initiate/process check firing and cancel check firing using the battery computer system (BCS)	0.0255
110	Construct a field expedient antenna for tactical FM radio	0.0187
111	Update registration corrections using survey information	0.0128
112	Perform operator's PMCS on TSEC/KY-57 communications security equipment	0.0111
113	Manually authenticate messages received and transmitted using the battery computer system (BCS)	-0.0227
114	Process an immediate suppression mission	-0.0482
115	Encode and decode CEOI messages using KTC 600 tactical operations code	-0.0488
116	Process/update final protective fire (FPF) mission using BCS	-0.0502
117	Recognize electronic countermeasures (ECM) and implement electronic counter-countermeasures (ECCM)	-0.0708
118	Determine basic firing data for an HE projectile with a GFT setting applied (GFT or GFT fan)	-0.0979
119	Construct a GFT setting and apply deflection corrections to a GFT/GFT fan	-0.1029
120	Process high burst/mean point of impact (HB/MPI) registration using the BCS	-0.1069

Rank	Title	Factor Score
121	Prepare and transmit messages to observer (manual)	-0.1297
122	Transmit muzzle velocity information using the AFU; MV message of the battery computer system (BCS)	-0.1321
123	Plot targets on firing chart from hasty fire plan	-0.1650
124	Purge battery computer system (BCS) memory	-0.1874
125	Perform operator's PMCS on radio set AN/PRC-77 or AN/PRC-25 (RC)	-0.2154
126	Process simultaneous fire missions	-0.2276
127	Determine and apply low-angle GFT settings and deflection corrections to graphical equipment	-0.2482
128	Prepare/submit operators MIJI report	-0.2485
129	Use the KTC 1400 numeral cipher/authentication system	-0.2600
130	Determine chart data using manual backup procedures	-0.2736
131	Perform operator's preventive maintenance checks and services on antenna RC-292	-0.2980
132	Transfer from a map-spotted firing chart to a surveyed firing chart	-0.3633
133	Calculate data for a GFT setting	-0.3686
134	Determine position corrections by solution of a concurrent met message	-0.4391
135	Perform operator's PMCS on AN/VIC-1 intercommunication equipment	-0.4513
136	Determine and announce fire commands for a quick smoke mission	-0.4674
137	Prepare consolidated target list/map overlay used in plotting/recording procedures	-0.4729
138	Convert a computerized fire mission in progress to manual backup procedures	-0.4800
139	Determine and announce fire commands for illumination missions	-0.4800
140	Determine and announce fire commands for an immediate smoke mission	-0.4845
141	Update a GFT setting and GFT deflection correction by solution of a subsequent met message	-0.5341
142	Process hasty fire mission (hip shoot)	-0.5358
143	Hand off a mission	-0.5650
144	Determine/announce firing data using special corrections	-0.5651
145	Perform operators PMCS on AN/VRC-12 series radio	-0.5834
146	Process preplanned copperhead fire mission using BCS	-0.6027
147	Display a GFT setting using the FM; GFT message format	-0.6673
148	Perform operator's PMCS on AN/VRC-160/ AN/VRC-54/AN/VRC-53/AN/GRC-125 radio sets	-0.6842
149	Determine corrections for a nonstandard weight projectile	-0.6898
150	Process aerial observer mission using BCS	-0.6998
151	Determine and announce fire commands for a mass fire mission	-0.7075
152	Process firefinder fire mission using BCS	-0.7128

Rank	Title	Factor Score
153	Plot the HB/MPI (or radar HB/MPI) location by grid coordinates	-0.7269
154	Compute firing data for battalion mass radar adjust mission	-0.7481
155	Perform vehicle preventative maintenance checks and services (PMCS)	-0.7519
156	Determine firing data for shell ICM (M444 and M449 series) using the ICM scale on the GFT	-0.7928
157	Process artillery target intelligence information using the battery computer system (BCS)	-0.7957
158	Process an illumination fire mission (1 gun, 2 gun range and lateral spread, and coord. illumination)	-0.8286
159	Determine and announce fire commands for prearranged fires	-0.8482
160	Determine the HB/MPI (or radar HB/MPI) location by plotting polar coordinates	-0.8580
161	Determine and announce replot data (fuze time)	-0.8731
162	Compute firing data manually for white phosphorus (WP) projectile	-0.9068
163	Compute data manually for firing final protective fires	-0.9089
164	Determine and apply position/special corrections with an M10/M17 plotting board	-0.9400
165	Determine and announce replot data (fuze quick and VT)	-0.9429
166	Receive/record data for HB/MPI registration from observation posts 01/02	-0.9686
167	Compute firing data manually for smoke projectile	-0.9729
168	Process fire commands for copperhead/target of opportunity with BCS	-0.9841
169	Compute firing data manually for radar registration	-0.9888
170	Determine and announce firing data for an HB/MPI radar registration	-1.0133
171	Deny a fire mission using the battery computer system (BCS)	-1.0179
172	Locate observer by trilateration or resection using the battery computer system (BCS)	-1.0269
173	Determine the data for a two-plot GFT setting by solving a met to a met check gage point	-1.1199
174	Determine firing data by solution of a met to a target	-1.1303
175	Determine data to orient observers for an HB/MPI (or radar HB/MPI) registration	-1.1887
176	Determine and announce fire commands for a zone and sweep mission	-1.2168
177	Perform operator's PMCS on AN/VRC-49 radio set	-1.2181
178	Determine firing data for shell DPICM using the GFT	-1.2392
179	Transfer a GFT setting and deflection correction from an offset registration	-1.2500
180	Determine adjusted firing data from a second lot registration	-1.2724

Rank	Title	Factor Score
181	Determine firing data for an HOB correction for shell DPICM	-1.2919
182	Install/prepare SB-22 PT switchboards	-1.3065
183	Determine piece displacement using hasty traverse procedures	-1.3136
184	Perform operator's PMCS on AN/VRC-48 radio set	-1.3192
185	Transfer a GFT setting to non-registering batteries	-1.3761
186	Determine and announce fire commands for a rap mission	-1.4258
187	Perform operator's PMCS on SB-22 PT switchboards	-1.4547
188	Compute firing data manually for toxic chemical projectile	-1.4575
189	Determine firing data for an HOB correction for shell ICM (M444 and M449 series)	-1.4897
190	Determine firing data for shell rap using the GFT	-1.5233
191	Determine location/altitude of HB/MPI by computing polar plot data	-1.5416
192	Determine the HB/MPI location by graphic intersection	-1.5473
193	Process an aerial observer mission (ranging rounds)	-1.5510
194	Determine location/altitude of HB/MPI by computing grid-coordinated altitude	-1.5538
195	Determine and announce fire commands for a RAAM/ADAM mission	-1.5702
196	Determine firing data for shell copperhead	-1.5781
197	Determine and announce fire commands for a copperhead mission	-1.5839
198	Determine a GFT setting and GFT deflection correction from an HB/MPI radar registration	-1.6365
199	Determine GFT settings for 6400 mils (eight-directional MET)	
200	Conduct a fire mission into a secondary zone (zone to zone transformation)	-1.7763
201	Determine firing data for shell RAAM/ADAM using the GFT	-1.8199

Table A.2

Factor 2: Urgent Combat Tasks

Rank	Title	Factor score
1	Construct an emergency firing chart	1.3365
2	Plot targets, determine, and announce chart data (manual)	1.1845
3	Process an area fire mission using the battery computer system (BCS)	1.1786
4	Process hasty fire mission (hip shoot)	1.1299
5	Compute and announce site, angle of site, and vertical angles	1.0568
6	Compute firing data for fire-for-effect (FFE) mission	0.9778
7	Receive/record data for HB/MPI registration from observation posts 01/02	0.9468
8	Determine data to orient observers for an HB/MPI (or radar HB/MPI) registration	0.9468
9	Compute firing data for battalion mass radar adjust mission	0.9350
10	Process an immediate suppression mission	0.9292
11	Process an area fire mission using the backup computer system (BUCS)	0.8317
12	Receive corrections from forward observer during fire mission	0.8133
13	Locate target by grid coordinates	0.8015
14	Construct firing chart based on map spot	0.7947
15	Prepare a surveyed firing chart	0.7947
16	Determine and apply low-angle GFT settings and deflection corrections to graphical equipment	0.7889
17	Determine and announce fire commands for a mass fire mission	0.7889
18	Determine and announce fire commands for prearranged fires	0.7889
19	Compute firing data manually for white phosphorus (wp) projectile	0.7830
20	Determine and announce fire commands for an immediate smoke mission	0.7830
21	Establish a priority fire mission	0.7830
22	Execute a priority fire mission	0.7771
23	Process simultaneous fire mission using BCS	0.7771
24	Update a GFT setting and GFT deflection correction by solution of a subsequent met message	0.7519
25	Determine firing data for an HOB correction for shell DPICM	0.7402
26	Determine firing data for shell DPICM using the GFT	0.7402
27	Hand off a mission	0.7343

Rank	Title	Factor Score
28	Process fire commands for copperhead/target of opportunity with BCS	0.7343
29	Process/update final protective fire (FPF) mission using BCS	0.7343
30	Recognize electronic countermeasures (ECM) and implement electronic counter-countermeasures (ECCM)	0.6309
31	Construct a GFT setting and apply deflection corrections to a GFT/GFT fan	0.5940
32	Determine basic firing data for an he projectile with a GFT/GFT fan (fuze quick, time, and VT)	0.5881
33	Determine basic firing data for an he projectile with a GFT (high angle)	0.5881
34	Determine basic firing data for an he projectile with a GFT setting applied (GFT or GFT fan)	0.5881
35	Compute firing data manually for smoke projectile	0.5881
36	Process an illumination fire mission (1 gun, 2 gun range and lateral spread, and coord. illumination)	0.5881
37	Determine and announce fire commands for a quick smoke mission	0.5881
38	Determine and announce fire commands for a zone and sweep mission	0.5881
39	Determine firing data for shell ICM (M444 and M449 series) using the ICM scale on the GFT	0.5822
40	Determine/announce fire commands utilizing data obtained from battery computer system (BCS)	0.5822
41	Initiate/process check firing and cancel check firing using the battery computer system (BCS)	0.5822
42	Initiate/process check firing and cancel check firing using the battery computer system (BCS)	0.5822
43	Update a priority fire mission or assign a target number as a known point using the FM	0.5822
44	Determine the HB/MPI (or radar HB/MPI) location by plotting polar coordinates	0.5512
45	Plot the HB/MPI (or radar HB/MPI) location by grid coordinates	0.5512
46	Determine position corrections by solution of a concurrent met message	0.5512
47	Determine and announce firing data for an HB/MPI radar registration	0.5512
48	Determine a GFT setting and GFT deflection correction from an HB/MPI radar registration	0.5512
49	Determine location/altitude of HB/MPI by computing polar plot data	0.5512
50	Determine the HB/MPI location by graphic intersection	0.5512
51	Determine chart data using manual backup procedures	0.5453
52	Determine firing data for shell rap using the GFT	0.5453
53	Determine and announce fire commands for illumination missions	0.5453
54	Determine and announce fire commands for a rap mission	0.5453

Rank	Title	Factor Score
55	Determine firing data for an HOB correction for shell ICM (M444 and M449 series)	0.5394
56	Determine/announce firing data using special corrections	0.5394
57	Maintain ammunition status reports/records	0.4791
58	Prepare and transmit messages to observer (manual)	0.4605
59	Display/act on received messages using BCS	0.4605
60	Announce fire commands utilizing data from BUCS	0.4302
61	Post/update map-spotted firing chart	0.3933
62	Transfer from a map-spotted firing chart to a surveyed firing chart	0.3933
63	Determine corrections for a nonstandard weight projectile	0.3933
64	Plot targets on firing chart from hasty fire plan	0.3874
65	Compute data manually for firing final protective fires	0.3874
66	Process simultaneous fire missions	0.3815
67	Determine the data for a two-plot GFT setting by solving a met to a met check gage point	0.3504
68	Determine adjusted firing data from a second lot registration	0.3504
69	Transfer a GFT setting and deflection correction from an offset registration	0.3504
70	Determine and announce fire commands for a copperhead mission	0.3504
71	Determine and announce fire commands for a RAAM/ADAM mission	0.3504
72	Determine and announce replot data (fuze quick and VT)	0.3504
73	Determine and announce replot data (fuze time)	0.3504
74	Determine GFT settings for 6	0.3504
75	Determine location/altitude of HB/MPI by computing grid-coordinated altitude	0.3504
76	Update registration corrections with met data using BUCS	0.3504
77	Update registration corrections with survey data using BUCS	0.3504
78	Locate observer by trilateration or resection using the battery computer system (BCS)	0.3504
79	Determine firing data for shell copperhead	0.3446
80	Process a fire plan using the battery computer system (BCS)	0.3446
81	Process a time-on-target (TOT) fire mission	0.3446
82	Process an illumination fire mission	0.3446
83	Process firefinder fire mission using BCS	0.3387
84	Process aerial observer mission using BCS	0.3387
85	Take corrective action on error and warning messages using the battery computer system (BCS)	0.3085
86	Navigate from one point to another point (dismounted)	0.3029
87	Prepare/operate tactical FM radio set	0.3027

Rank	Title	Factor Score
88	Process fire unit data and weapon location using the backup computer system (BUCS)	0.2412
89	Replot targets as directed and determine and announce grid location	0.2228
90	Transmit shot to forward observer during fire mission	0.2111
91	Plot target locations/unit information on firing charts	0.1925
92	Process map modification information using the SPRT; map message of the BCS	0.1925
93	Process fire unit information using the AFU; update message of the battery computer system (BCS)	0.1925
94	Process battery computer system (BCS) piece information using the BCS; pieces message	0.1925
95	Process fire unit ammunition information using the AFU; BAMOUP message of the BCS	0.1925
96	Process meteorological information using the MET; CM message of the battery computer system (BCS)	0.1925
97	Process observer information using the FM; OBCO message of the battery computer system (BCS)	0.1925
98	Process target/known point information using FM; RFAF message of the battery computer system (BCS)	0.1925
99	Deny a fire mission using the battery computer system (BCS)	0.1925
100	Encode and decode CEOI messages using KTC 600 tactical operations code	0.1925
101	Determine the grid coordinates of a point on a military map using the military grid R	0.1809
102	Transfer a GFT setting to non-registering batteries	0.1497
103	Determine firing data for shell RAAM/ADAM using the GFT	0.1497
104	Update registration corrections using met information	0.1497
105	Update registration corrections using survey information	0.1497
106	Process artillery target intelligence information using the battery computer system (BCS)	0.1497
107	Process preplanned copperhead fire mission using BCS	0.1497
108	Process an aerial observer mission (ranging rounds)	0.1438
109	Initialize the backup computer system (BUCS) and verify files	0.1323
110	Initialize the battery computer system (BCS) and construct and record a data base	0.1262
111	Manually authenticate messages received and transmitted using the battery computer system (BCS)	0.0892
112	Manually authenticate messages received and transmitted using the battery computer system (BCS)	0.0892
113	Compose/address/transmit messages on BCS	0.0708
114	Maintain fire direction records	0.0649
115	Determine piece displacement using hasty traverse procedures	0.0405

Rank	Title	Factor Score
116	Process observer data using the backup computer system (BUCS)	0.0405
117	Process an illumination mission using BUCS	0.0405
118	Use the KTC 1400 numeral cipher/authentication system	0.0405
119	Compute firing data manually for toxic chemical projectile	-0.0023
120	Compute firing data manually for radar registration	-0.0023
121	Calculate muzzle velocity variation information using the BCS/MVV message format	-0.0023
122	Process information using the BCS; COMD message format	-0.0023
123	Determine firing data by solution of a met to a target	-0.0510
124	Process high burst/mean point of impact (HB/MPI) registration using the BCS	-0.0510
125	Process precision registration using the battery computer system (BCS)	-0.0510
126	Display a GFT setting using the FM; GFT message format	-0.0510
127	Install and operate telephone set TA-312/PT	-0.0685
128	Process ammunition data using the backup computer system (BUCS)	-0.0871
129	Process target/known point data using the backup computer system (BUCS)	-0.0871
130	Process ballistic met information using BUCS	-0.0871
131	Process computer met information using BUCS	-0.0871
132	Determine location on ground by terrain association	-0.0927
133	Determine direction using field-expedient methods	-0.0986
134	Construct a field expedient antenna for tactical FM radio	-0.1055
135	Load and update a previously recorded data base using the battery computer system (BCS)	-0.1233
136	Determine and apply position/special corrections with an M10/M17 plotting board	-0.1544
137	Process muzzle velocity data and store muzzle velocity variations (MVVs) in the BUCS	-0.1544
138	Update registration corrections for BUCS using BCS data	-0.1544
139	Process a high burst/mean point of impact (HB/MPI) registration using the BUCS	-0.1544
140	Process a precision registration using the backup computer system (BUCS)	-0.1544
141	Process a radar registration using BUCS	-0.1544
142	Convert a computerized fire mission in progress to manual backup procedures	-0.1544
143	Determine magnetic Azimuth using M2 compass	-0.1717
144	Process mask information using the AFU; MASK message of the battery computer system (BCS)	-0.1972
145	Process restricted fire area information using the SPRT; GEOM message of the BCS	-0.1972
146	Conduct a fire mission into a secondary zone (zone to zone transformation)	-0.2031

Rank	Title	Factor Score
147	Transmit muzzle velocity information using the AFU; MV message of the battery computer system (BCS)	-0.2031
148	Calculate data for a GFT setting	-0.2031
149	Prepare/operate communications security equipment TSEC/KY-57 with FM radio sets	-0.2091
150	Enter map modification data into the backup computer system (BUCS)	-0.2147
151	Perform field-expedient repairs on generator	-0.2448
152	Assist in destruction of communications security equipment/material to prevent enemy use	-0.2470
153	Convert computer met information using BUCS	-0.2820
154	Identify terrain features on a map	-0.2876
155	Prepare consolidated target list/map overlay used in plotting/recording procedures	-0.3065
156	Operate an FM radio set using AN/GRA-39	-0.3481
157	Process replot using the battery computer system (BCS)	-0.3551
158	Determine the elevation of a point on the ground using a map	-0.3968
159	Orient map using compass	-0.3968
160	Operate intercommunications set AN/VIC-1 on a tracked vehicle (includes FM radio)	-0.3970
161	Operate AN/VRC-46 radio set (AN/VRC-12 series)	-0.4515
162	Operate radio set AN/VRC-64/AN/GRC-160	-0.4622
163	Process plain text information using the SYS; PTM message of the battery computer system (BCS)	-0.4885
164	Prepare/submit operators MIJI report	-0.5559
165	Convert azimuths	-0.5976
166	Identify topographical symbols on a military map	-0.6161
167	Determine azimuths using a protractor and compute back-azimuths	-0.6404
168	Send radio message	-0.6581
169	Resynchronize the battery computer system (BCS)	-0.6650
170	Perfom diagnostic tests using the diagnostic test summary of the battery computer system (BCS)	-0.7078
171	Install RC-292 antenna	-0.7135
172	Install antenna group OE-254/GRC (team method)	-0.7135
173	Adjust generator output/voltage/frequency	-0.7496
174	Locate an unknown point on a map or on the ground by resection	-0.7924
175	Measure distance on a map	-0.7983
176	Record a data base	-0.8169
177	Install/prepare SB-22 pt switchboards	-0.8352
178	Purge battery computer system (BCS) memory	-0.8900
179	Connect/disconnect generator to/from operating equipment	-0.9017
180	Shutdown the battery computer system (BCS)	-1.1941
181	Establish and close an FM radiotelephone net	-1.2614
182	Install a generator set	-1.3401
182	Install radio set control group AN/GRA-39	-1.4921

Rank	Title	Factor Score
184	Perform operator's preventive maintenance checks and services on antenna group OE-254	-1.5166
185	Perform operator's PMCS on TSEC/KY-57 communications security equipment	-1.6442
186	Perform operator's PMCS on radio set control group AN/GRA-39	-1.6442
187	Position vehicle mounted/skid-mounted generator	-1.6500
188	Offload/load generator from/onto carrier	-1.6745
189	Perform operator's PMCS on SB-22 pt switchboards	-1.6929
190	Perform preventive maintenance checks and services (PMCS) on gasoline engine driven generator set	-1.6929
191	Record generator deficiencies (DA form 2404)	-1.6929
192	Perform operator's PMCS/routine checks on telephone set TA-312/pt	-1.7173
193	Perform operator's preventive maintenance checks and services on antenna RC-292	-1.7173
194	Perform vehicle preventative maintenance checks and services (PMCS)	-1.7173
195	Perform operators PMCS on AN/VRC-12 series radio	-1.8449
196	Perform operator's PMCS on AN/VRC-160/ AN/VRC-54/AN/VRC-53/AN/GRC-125 radio sets	-1.8449
197	Perform operator's PMCS on AN/VRC-46 radio set	-1.8449
198	Perform operator's PMCS on radio set AN/PRC-77 OR AN/PRC-25 (RC)	-1.8449
199	Perform operator's PMCS on AN/VRC-48 radio set	-1.8449
200	Perform operator's PMCS on AN/VRC-49 radio set	-1.8449
201	Perform operator's PMCS on AN/VIC-1	-1.8694

Table A.3

Factor 3: Equipment Tasks

Rank	Title	Factor score
1	Perform vehicle preventive maintenance checks and services (PMCS)	1.3578
2	Perform preventive maintenance checks and services (PMCS) on gasoline engine driven generator set	1.2837
3	Offload/load generator from/onto carrier	1.2469
4	Install antenna group OE-254/GRC (team method)	1.2325
5	Shutdown the battery computer system (BCS)	1.2325
6	Position vehicle mounted/skid-mounted generator	1.2105
7	Perform operator's PMCS on AN/VRC-46 radio set	1.1451
8	Perform operator's preventive maintenance checks and services on antenna group OE-254	1.1314
9	Perform operator's PMCS/routine checks on telephone set TA-312/PT	1.1127
10	Install a Generator Set	1.0865
11	Install RC-292 antenna	1.0857
12	Install radio set control group AN/GRA-39	1.0321
13	Record generator deficiencies (DA form 2404)	1.0287
14	Assist in destruction of communications security equipment/material to prevent enemy use	1.0259
15	Transmit shot to forward observer during fire mission	1.0047
16	Perform operators PMCS on AN/VRC-12 series radio	0.9507
17	Purge battery computer system (BCS) memory	0.9365
18	Record a data base	0.9348
19	Perform operator's PMCS on AN/VIC-1 intercommunication equipment	0.9317
20	Perform operator's PMCS on radio set AN/PRC-77 or AN/ PRC-25 (RC)	0.9133
21	Enter map modification data into the backup computer system (BUCS)	0.9056
22	Connect/disconnect generator to/from operating equipment	0.8987
23	Process ammunition data using the backup computer system (BUCS)	0.8958
24	Perform operator's preventive maintenance checks and services on antenna RC-292	0.8567
25	Perform operator's PMCS on radio set control group AN/GRA-39	0.8548
26	Perform operator's PMCS on AN/VRC-160/ AN/VRC-54/AN/VRC-53/AN/GRC-125 radio sets	0.8538
27	Process precision registration using the battery computer system (BCS)	0.8500
28	Process replot using the battery computer system (BCS)	0.8397

Rank	Title	Factor Score
29	Perform operator's PMCS on AN/VRC-48 radio set	0.8053
30	Process fire unit information using the AFU; update message of the battery computer system (BCS)	0.8019
31	Perform operator's PMCS on AN/VRC-49 radio set	0.7980
32	Process observer data using the backup computer system (BUCS)	0.7980
33	Establish and close an FM radiotelephone net	0.7972
34	Process computer met information using BUCS	0.7928
35	Process information using the BCS; COMD message format	0.7847
36	Convert computer met information using BUCS	0.7838
37	Adjust generator output/voltage/frequency	0.7754
38	Process battery computer system (BCS) piece information using the BCS; pieces message	0.7712
39	Process map modification information using the SPRT; map message of the BCS	0.7579
40	Process fire unit ammunition information using the AFU; BAMOUP message of the BCS	0.7385
41	Process ballistic met information using BUCS	0.7236
42	Determine/announce fire commands utilizing data obtained from battery computer system (BCS)	0.7221
43	Update a priority fire mission or assign a target number as a known point using the FM	0.7213
44	Perform operator's PMCS on TSEC/KY-57 communications security equipment	0.7194
45	Process target/known point information using FM; RFAF message of the battery computer system (BCS)	0.7117
46	Process fire unit data and weapon location using the backup computer system (BUCS)	0.7114
47	Transmit muzzle velocity information using the AFU; MV message of the battery computer system (BCS)	0.7037
48	Process target/known point data using the backup computer system (BUCS)	0.6988
49	Process plain text information using the SYS; PTM message of the battery computer system (BCS)	0.6922
50	Process observer information using the FM; OBCO message of the battery computer system (BCS)	0.6863
51	Process a fire plan using the battery computer system (BCS)	0.6846
52	Process meteorological information using the MET; CM message of the battery computer system (BCS)	0.6656
53	Process high burst/mean point of impact (HB/MPI) registration using the BCS	0.6613
54	Process muzzle velocity data and store muzzle velocity variations (MVVs) in the BUCS	0.6342
55	Resynchronize the battery computer system (BCS)	0.6241
56	Process a precision registration using the backup computer system (BUCS)	0.6222
57	Process a radar registration using BUCS	0.6006
58	Update registration corrections for BUCS using BCS data	0.5995

Rank	Title	Factor Score
59	Display a GFT setting using the FM; GFT message format	0.5794
60	Process/update final protective fire (FPF) mission using BCS	0.5781
61	Execute a priority fire mission	0.5513
62	Process aerial observer mission using BCS	0.5419
63	Perform operator's PMCS on SB-22 pt switchboards	0.5412
64	Process an illumination mission using BUCS	0.5274
65	Send radio message	0.5261
66	Process mask information using the AFU; MASK message of the battery computer system (BCS)	0.5176
67	Process simultaneous fire missions	0.5134
68	Calculate data for a GFT setting	0.5025
69	Load and update a previously recorded data base using the battery computer system (BCS)	0.5017
70	Process an illumination fire mission	0.4985
71	Process simultaneous fire mission using BCS	0.4943
72	Compose/address/transmit messages on BCS	0.4877
73	Take corrective action on error and warning messages using the battery computer system (BCS)	0.4833
74	Process a time-on-target (TOT) fire mission	0.4831
75	Announce fire commands utilizing data from BUCS	0.4780
76	Process a high burst/mean point of impact (HB/MPI) registration using the BUCS	0.4718
77	Process restricted fire area information using the SPRT; GEOM message of the BCS	0.4506
78	Perform field-expedient repairs on generator	0.4480
79	Process preplanned copperhead fire mission using BCS	0.4472
80	Display/act on received messages using BCS	0.4347
81	Initiate/process check firing and cancel check firing using the battery computer system (BCS)	0.4275
82	Process an immediate suppression mission	0.4172
83	Calculate muzzle velocity variation information using the BCS/MVV message format	0.4163
84	Process firefinder fire mission using BCS	0.4057
85	Update registration corrections using met information	0.3621
86	Initiate/process check firing and cancel check firing using the battery computer system (BCS)	0.3610
87	Process an area fire mission using the backup computer system (BUCS)	0.3443
88	Determine magnetic Azimuth using M2 compass	0.3342
89	Install/prepare SB-22 pt switchboards	0.3340
90	Operate radio set AN/VRC-64/AN/GRC-160	0.3337
91	Perfom diagnostic tests using the diagnostic test summary of the battery computer system (BCS)	0.3213
92	Establish a priority fire mission	0.3048
93	Construct a field expedient antenna for tactical FM radio	0.2725
94	Update registration corrections using survey information	0.2646
95	Prepare/submit operators MIJI report	0.2580

Rank	Title	Factor Score
96	Install and operate telephone set TA-312/PT	0.2465
97	Locate target by grid coordinates	0.2140
98	Update registration corrections with met data using BUCS	0.2130
99	Process an area fire mission using the battery computer system (BCS)	0.2128
100	Manually authenticate messages received and transmitted using the battery computer system (BCS)	0.2102
101	Update registration corrections with survey data using BUCS	0.2021
102	Operate an FM radio set using AN/GRA-39	0.1958
103	Manually authenticate messages received and transmitted using the battery computer system (BCS)	0.1860
104	Process artillery target intelligence information using the battery computer system (BCS)	0.1796
105	Convert a computerized fire mission in progress to manual backup procedures	0.1749
106	Prepare/operate communications security equipment TSEC/KY-57 with FM radio sets	0.1646
107	Receive corrections from forward observer during fire mission	0.1585
108	Initialize the backup computer system (BUCS) and verify files	0.1546
109	Hand off a mission	0.1489
110	Process an aerial observer mission (ranging rounds)	0.0412
111	Prepare and transmit messages to observer (manual)	-0.0063
112	Process fire commands for copperhead/target of opportunity with BCS	-0.0072
113	Deny a fire mission using the battery computer system (BCS)	-0.0161
114	Operate AN/VRC-46 radio set (AN/VRC-12 series)	-0.0226
115	Initialize the battery computer system (BCS) and construct and record a data base	-0.0366
116	Determine/announce firing data using special corrections	-0.0764
117	Operate intercommunications set AN/VIC-1 on a tracked vehicle (includes FM radio)	-0.0992
118	Prepare/operate tactical FM radio set	-0.1006
119	Locate observer by trilateration or resection using the battery computer system (BCS)	-0.1126
120	Measure distance on a map	-0.1491
121	Plot target locations/unit information on firing charts	-0.1693
122	Determine the grid coordinates of a point on a military map using the military grid R	-0.2019
123	Maintain ammunition status reports/records	-0.2142
124	Determine azimuths using a protractor and compute back-azimuths	-0.2540
125	Process hasty fire mission (hip shoot)	-0.2604
126	Compute firing data for fire-for-effect(FFE) mission	-0.2707

Rank	Title	Factor Score
127	Use the KTC 1400 numeral cipher/authentication system	-0.2844
128	Maintain fire direction records	-0.3329
129	Determine the elevation of a point on the ground using a map	-0.4197
130	Determine direction using field-expedient methods	-0.4202
131	Process an illumination fire mission (1 gun, 2 gun range and lateral spread, and coord. illumination)	-0.4319
132	Compute firing data for battalion mass radar adjust mission	-0.4321
133	Convert azimuths	-0.4351
134	Identify terrain features on a map	-0.4424
135	Recognize electronic countermeasures (ECM) and implement electronic counter-countermeasures (ECCM)	-0.4710
136	Locate an unknown point on a map or on the ground by resection	-0.4761
137	Encode and decode CEOI messages using KTC 600 tactical operations code	-0.4978
138	Identify topographical symbols on a military map	-0.5009
139	Receive/record data for HB/MPI registration from observation posts 01/02	-0.5043
140	Conduct a fire mission into a secondary zone (zone to zone transformation)	-0.5481
141	Determine and apply position/special corrections with an M10/M17 plotting board	-0.5543
142	Determine firing data by solution of a met to a target	-0.5544
143	Orient map using compass	-0.5591
144	Determine chart data using manual backup procedures	-0.5707
145	Determine location on ground by terrain association	-0.6194
146	Replot targets as directed and determine and announce grid location	-0.6525
147	Plot targets on firing chart from hasty fire plan	-0.6852
148	Prepare consolidated target list/map overlay used in plotting/recording procedures	-0.6981
149	Compute data manually for firing final protective fires	-0.7069
150	Determine firing data for shell ICM (M444 and M449 series) using the ICM scale on the GFT	-0.7222
151	Determine basic firing data for an he projectile with a GFT/GFT fan (fuze quick, time, and VT)	-0.7412
152	Transfer a GFT setting to non-registering batteries	-0.7425
153	Determine and announce fire commands for illumination missions	-0.7621
154	Determine piece displacement using hasty traverse procedures	-0.7652
155	Determine basic firing data for an he projectile with a GFT (high angle)	-0.7750
156	Determine basic firing data for an he projectile with a GFT setting applied (GFT or GFT fan)	-0.8382
157	Determine and announce fire commands for an immediate smoke mission	-0.8465

Rank	Title	Factor Score
158	Compute firing data manually for radar registration	-0.8478
159	Determine and announce replot data (fuze quick and VT)	-0.8509
160	Determine and announce replot data (fuze time)	-0.8516
161	Determine firing data for shell copperhead	-0.8838
162	Determine and announce fire commands for a quick smoke mission	-0.9008
163	Post/update map-spotted firing chart	-0.9008
164	Determine firing data for shell DPICM using the GFT	-0.9262
165	Determine adjusted firing data from a second lot registration	-0.9689
166	Determine and announce fire commands for a zone and sweep mission	-0.9706
167	Navigate from one point to another point (dismounted)	-0.9789
168	Determine firing data for an HOB correction for shell ICM (M444 and M449 series)	-0.9836
169	Compute firing data manually for toxic chemical projectile	-0.9936
170	Determine and announce fire commands for a mass fire mission	-0.9937
171	Transfer a GFT setting and deflection correction from an offset registration	-1.0015
172	Determine firing data for shell rap using the GFT	-1.0188
173	Transfer from a map-spotted firing chart to a surveyed firing chart	-1.0364
174	Construct a GFT setting and apply deflection corrections to a GFT/GFT fan	-1.0412
175	Determine corrections for a nonstandard weight projectile	-1.0712
176	Determine firing data for shell RAAM/ADAM using the GFT	-1.0748
177	Determine firing data for an HOB correction for shell DPICM	-1.1018
178	Determine and announce fire commands for a RAAM/ADAM mission	-1.1021
179	Determine and announce fire commands for a copperhead mission	-1.1063
180	Determine the data for a two-plot GFT setting by solving a met to a met check gage point	-1.1187
181	Determine and apply low-angle GFT settings and deflection corrections to graphical equipment	-1.1205
182	Determine and announce fire commands for a rap mission	-1.1228
183	Determine the HB/MPI location by graphic intersection	-1.1530
184	Determine location/altitude of HB/MPI by computing grid-coordinated altitude	-1.1541
185	Determine GFT settings for 6400 mils (eight-directional met)	-1.1645
186	Prepare a surveyed firing chart	-1.1808
187	Determine and announce fire commands for prearranged fires	-1.1965
188	Compute firing data manually for smoke projectile	-1.2163

Rank	Title	Factor Score
189	Compute and announce site, angle of site, and vertical angles	-1.2360
190	Compute firing data manually for white phosphorus (wp) projectile	-1.2443
191	Determine position corrections by solution of a concurrent met message	-1.2547
192	Determine and announce firing data for an HB/MPI radar registration	-1.2698
193	Plot targets, determine, and announce chart data (manual)	-1.2871
194	Plot the HB/MPI (or radar HB/MPI) location by grid coordinates	-1.3061
195	Construct firing chart based on map spot	-1.3189
196	Update a GFT setting and GFT deflection correction by solution of a subsequent met message	-1.3409
197	Determine the HB/MPI (or radar HB/MPI) location by plotting polar coordinates	-1.3481
198	Determine data to orient observers for an HB/MPI (or radar HB/MPI) registration	-1.3830
199	Determine a GFT setting and GFT deflection correction from an HB/MPI radar registration	-1.4026
200	Determine location/altitude of HB/MPI by computing polar plot data	-1.4516
201	Construct an Emergency Firing Chart	-1.4805

Table A.4

Factor 4: Interactive Tasks

Rank	Title	Factor score
1	Process simultaneous fire missions	3.7103
2	Offload/load generator from/onto carrier	2.6925
3	Assist in destruction of communications security equipment/material to prevent enemy use	2.3840
4	Install RC-292 antenna	2.3840
5	Install antenna group OE-254/GRC (team method)	2.3840
6	Convert a computerized fire mission in progress to manual backup procedures	2.3378
7	Transfer a GFT setting to non-registering batteries	2.0293
8	Process hasty fire mission (hip shoot)	2.0293
9	Position vehicle mounted/skid-mounted generator	2.0293
10	Transfer a GFT setting and deflection correction from an offset registration	1.9832
11	Hand off a mission	1.7209
12	Conduct a fire mission into a secondary zone (zone to zone transformation)	1.3662
13	Prepare and transmit messages to observer (manual)	1.3662
14	Process an immediate suppression mission	1.3662
15	Maintain ammunition status reports/records	1.3200
16	Process an aerial observer mission (ranging rounds)	1.0577
17	Receive/record data for HB/MPI registration from observation posts 01/02	1.0577
18	Determine and announce fire commands for a mass fire mission	1.0116
19	Determine and announce fire commands for prearranged fires	1.0116
20	Determine and announce fire commands for a zone and sweep mission	1.0116
21	Install a generator set	1.0116
22	Prepare consolidated target list/map overlay used in plotting/recording procedures	0.9654
23	Compose/address/transmit messages on BCS	0.9654
24	Navigate from one point to another point (dismounted)	0.9654
25	Recognize electronic countermeasures (ECM) and implement electronic counter-countermeasures (ECCM)	0.9654
26	Process an illumination fire mission (1 gun, 2 gun range and lateral spread, and coord. illumination)	0.7031
27	Transmit shot to forward observer during fire mission	0.7031
28	Receive corrections from forward observer during fire mission	0.7031
29	Determine adjusted firing data from a second lot registration	0.6569

Rank	Title	Factor Score
30	Determine firing data by solution of a met to a target	0.6569
31	Determine data to orient observers for an HB/MPI (or radar HB/MPI) registration	0.6569
32	Install and operate telephone set TA-312/PT	0.6569
33	Determine the data for a two-plot GFT setting by solving a met to a met check gage point	0.6107
34	Identify topographical symbols on a military map	0.6107
35	Identify terrain features on a map	0.6107
36	Measure distance on a map	0.6107
37	Perform field-expedient repairs on generator	0.6107
38	Locate target by grid coordinates	0.6107
39	Compute firing data manually for smoke projectile	0.3484
40	Compute firing data manually for white phosphorus (wp) projectile	0.3484
41	Compute firing data manually for toxic chemical projectile	0.3484
42	Compute firing data manually for radar registration	0.3484
43	Compute data manually for firing final protective fires	0.3484
44	Compute firing data for battalion mass radar adjust mission	0.3484
45	Determine and announce firing data for an HB/MPI radar registration	0.3484
46	Process a high burst/mean point of impact (HB/MPI) registration using the BUCS	0.3484
47	Process a precision registration using the backup computer system (BUCS)	0.3484
48	Process a radar registration using BUCS	0.3484
49	Process an area fire mission using the backup computer system (BUCS)	0.3484
50	Process an illumination mission using BUCS	0.3484
51	Process firefinder fire mission using BCS	0.3484
52	Send radio message	0.3484
53	Operate intercommunications set AN/VIC-1 on a tracked vehicle (includes FM radio)	0.3484
54	Establish and close an FM radiotelephone net	0.3484
55	Initiate/process check firing and cancel check firing using the battery computer system (BCS)	0.3023
56	Initiate/process check firing and cancel check firing using the battery computer system (BCS)	0.3023
57	Construct a field expedient antenna for tactical FM radio	0.3023
58	Determine chart data using manual backup procedures	0.3023
59	Determine and announce replot data (fuze quick and VT)	0.3023
60	Determine and announce replot data (fuze time)	0.3023
61	Determine and apply position/special corrections with an M10/M17 plotting board	0.3023
62	Determine GFT settings for 6400 mils (eight-directional met)	0.3023
63	Process simultaneous fire mission using BCS	0.3023

Rank	Title	Factor Score
64	Determine piece displacement using hasty traverse procedures	0.3023
65	Determine firing data for shell ICM (M444 and M449 series) using the ICM scale on the GFT	-0.0062
66	Determine and announce fire commands for a copperhead mission	-0.0062
67	Determine and announce fire commands for illumination missions	-0.0062
68	Determine and announce fire commands for a RAAM/ADAM mission	-0.0062
69	Determine and announce fire commands for an immediate smoke mission	-0.0062
70	Determine and announce fire commands for a rap mission	-0.0062
71	Determine and announce fire commands for a quick smoke mission	-0.0062
72	Determine/announce fire commands utilizing data obtained from battery computer system (BCS)	-0.0062
73	Announce fire commands utilizing data from BUCS	-0.0062
74	Resynchronize the battery computer system (BCS)	-0.0062
75	Manually authenticate messages received and transmitted using the battery computer system (BCS)	-0.0062
76	Manually authenticate messages received and transmitted using the battery computer system (BCS)	-0.0062
77	Transmit muzzle velocity information using the AFU; MV message of the battery computer system (BCS)	-0.0062
78	Establish a priority fire mission	-0.0062
79	Process aerial observer mission using BCS	-0.0062
80	Prepare/operate tactical FM radio set	-0.0062
81	Prepare/operate communications security equipment TSEC/KY-57 with FM radio sets	-0.0062
82	Operate AN/VRC-46 radio set (AN/VRC-12 series)	-0.0062
83	Operate radio set AN/VRC-64/AN/GRC-160	-0.0062
84	Prepare/submit operators MIJI report	-0.0062
85	Operate an FM radio set using AN/GRA-39	-0.0062
86	Plot targets on firing chart from hasty fire plan	-0.0524
87	Construct a GFT setting and apply deflection corrections to a GFT/GFT fan	-0.0524
88	Compute and announce site, angle of site, and vertical angles	-0.0524
89	Determine position corrections by solution of a concurrent met message	-0.0524
90	Update a GFT setting and GFT deflection correction by solution of a subsequent met message	-0.0524
91	Determine location/altitude of HB/MPI by computing grid-coordinated altitude	-0.0524
92	Determine location/altitude of HB/MPI by computing polar plot data	-0.0524
93	Initialize the backup computer system (BUCS) and verify files	-0.0524

Rank	Title	Factor Score
94	Load and update a previously recorded data base using the battery computer system (BCS)	-0.0524
95	Process plain text information using the SYS; PTM message of the battery computer system (BCS)	-0.0524
96	Perfom diagnostic tests using the diagnostic test summary of the battery computer system (BCS)	-0.0524
97	Determine the grid coordinates of a point on a military map using the military grid R	-0.0524
98	Determine magnetic Azimuth using M2 compass	-0.0524
99	Determine azimuths using a protractor and compute back-azimuths	-0.0524
100	Install/prepare SB-22 pt switchboards	-0.0524
101	Perform vehicle preventative maintenance checks and services (PMCS)	-0.0524
102	Construct an emergency firing chart	-0.0524
103	Take corrective action on error and warning messages using the battery computer system (BCS)	-0.0524
104	Deny a fire mission using the battery computer system (BCS)	-0.0524
105	Determine direction using field-expedient methods	-0.0524
106	Determine location on ground by terrain association	-0.0524
107	Update registration corrections with met data using BUCS	-0.2722
108	Construct firing chart based on map spot	-0.3609
109	Post/update map-spotted firing chart	-0.3609
110	Maintain fire direction records	-0.3609
111	Replot targets as directed and determine and announce grid location	-0.3609
112	Determine a GFT setting and GFT deflection correction from an HB/MPI radar registration	-0.3609
113	Update registration corrections for BUCS using BCS data	-0.3609
114	Process high burst/mean point of impact (HB/MPI) registration using the BCS	-0.3609
115	Process precision registration using the battery computer system (BCS)	-0.3609
116	Locate observer by trilateration or resection using the battery computer system (BCS)	-0.3609
117	Process an area fire mission using the battery computer system (BCS)	-0.3609
118	Update a priority fire mission or assign a target number as a known point using the FM	-0.3609
119	Process fire commands for copperhead/target of opportunity with BCS	-0.3609
120	Display/act on received messages using BCS	-0.3609
121	Process/update final protective fire (FPF) mission using BCS	-0.3609
122	Process preplanned copperhead fire mission using BCS	-0.3609
123	Use the KTC 1400 numeral cipher/authentication system	-0.3609

Rank	Title	Factor Score
124	Plot targets, determine, and announce chart data (manual)	-0.3609
125	Determine basic firing data for an he projectile with a GFT/GFT fan (fuze quick, time, and VT)	-0.3609
126	Determine basic firing data for an he projectile with a GFT (high angle)	-0.3609
127	Determine basic firing data for an he projectile with a GFT setting applied (GFT or GFT fan)	-0.3609
128	Compute firing data for fire-for-effect(FFE) mission	-0.3609
129	Determine firing data for an HOB correction for shell DPICM	-0.3609
130	Determine firing data for an HOB correction for shell ICM (M444 and M449 series)	-0.3609
131	Determine firing data for shell RAAM/ADAM using the GFT	-0.3609
132	Determine firing data for shell copperhead	-0.3609
133	Determine firing data for shell rap using the GFT	-0.3609
134	Determine firing data for shell DPICM using the GFT	-0.3609
135	Determine/announce firing data using special corrections	-0.3609
136	Calculate data for a GFT setting	-0.3609
137	Encode and decode CEOI messages using KTC 600 tactical operations code	-0.3609
138	Prepare a surveyed firing chart	-0.7155
139	Transfer from a map-spotted firing chart to a surveyed firing chart	-0.7155
140	Plot target locations/unit information on firing charts	-0.7155
141	Determine the HB/MPI (or radar HB/MPI) location by plotting polar coordinates	-0.7155
142	Plot the HB/MPI (or radar HB/MPI) location by grid coordinates	-0.7155
143	Determine and apply low-angle GFT settings and deflection corrections to graphical equipment	-0.7155
144	Determine corrections for a nonstandard weight projectile	-0.7155
145	Determine the HB/MPI location by graphic intersection	-0.7155
146	Enter map modification data into the backup computer system (BUCS)	-0.7155
147	Process fire unit data and weapon location using the backup computer system (BUCS)	-0.7155
148	Process ammunition data using the backup computer system (BUCS)	-0.7155
149	Process observer data using the backup computer system (BUCS)	-0.7155
150	Process target/known point data using the backup computer system (BUCS)	-0.7155
151	Process ballistic met information using BUCS	-0.7155
152	Process computer met information using BUCS	-0.7155
153	Convert computer met information using BUCS	-0.7155

Rank	Title	Factor Score
154	Process muzzle velocity data and store muzzle velocity variations (MVVs) in the BUCS	-0.7155
155	Update registration corrections with survey data using BUCS	-0.7155
156	Initialize the battery computer system (BCS) and construct and record a data base	-0.7155
157	Shutdown the battery computer system (BCS)	-0.7155
158	Purge battery computer system (BCS) memory	-0.7155
159	Process map modification information using the SPRT; map message of the BCS	-0.7155
160	Process fire unit information using the AFU; update message of the battery computer system (BCS)	-0.7155
161	Process battery computer system (BCS) piece information using the BCS; pieces message	-0.7155
162	Process fire unit ammunition information using the AFU; BAMOUP message of the BCS	-0.7155
163	Process mask information using the AFU; MASK message of the battery computer system (BCS)	-0.7155
164	Process meteorological information using the MET; CM message of the battery computer system (BCS)	-0.7155
165	Process observer information using the FM; OBCO message of the battery computer system (BCS)	-0.7155
166	Process target/known point information using FM; RFAF message of the battery computer system (BCS)	-0.7155
167	Process restricted fire area information using the SPRT; GEOM message of the BCS	-0.7155
168	Calculate muzzle velocity variation information using the BCS/MVV message format	-0.7155
169	Record a data base	-0.7155
170	Process replot using the battery computer system (BCS)	-0.7155
171	Update registration corrections using met information	-0.7155
172	Update registration corrections using survey information	-0.7155
173	Display a GFT setting using the FM; GFT message format	-0.7155
174	Process artillery target intelligence information using the battery computer system (BCS)	-0.7155
175	Process a fire plan using the battery computer system (BCS)	-0.7155
176	Process a time-on-target (TOT) fire mission	-0.7155
177	Process an illumination fire mission	-0.7155
178	Process information using the BCS; COMD message format	-0.7155
179	Execute a priority fire mission	-0.7155
180	Determine the elevation of a point on the ground using a map	-0.7155
181	Convert azimuths	-0.7155
182	Orient map using compass	-0.7155
183	Locate an unknown point on a map or on the ground by resection	-0.7155
184	Install radio set control group AN/GRA-39	-0.7155

Rank	Title	Factor Score
185	Perform operator's PMCS/routine checks on telephone set TA-312/PT	-0.7155
186	Perform operator's PMCS on TSEC/KY-57 communications security equipment	-0.7155
187	Perform operators PMCS on AN/VRC-12 series radio	-0.7155
188	Perform operator's PMCS on AN/VRC-160/ AN/VRC-54/AN/VRC-53/AN/GRC-125 radio sets	-0.7155
189	Perform operator's PMCS on AN/VIC-1 intercommunication equipment	-0.7155
190	Perform operator's PMCS on AN/VRC-46 radio set	-0.7155
191	Perform operator's PMCS on radio set AN/PRC-77 or AN/PRC-25 (RC)	-0.7155
192	Perform operator's preventive maintenance checks and services on antenna RC-292	-0.7155
193	Perform operator's preventive maintenance checks and services on antenna group OE-254	-0.7155
194	Perform operator's PMCS on radio set control group AN/GRA-39	-0.7155
195	Perform operator's PMCS on SB-22 pt switchboards	-0.7155
196	Perform operator's PMCS on AN/VRC-48 radio set	-0.7155
197	Perform operator's PMCS on AN/VRC-49 radio set	-0.7155
198	Connect/disconnect generator to/from operating equipment	-0.7155
199	Perform preventive maintenance checks and services (PMCS) on gasoline engine driven generator set	-0.7155
200	Record generator deficiencies (DA form 2404)	-0.7155
201	Adjust generator output/voltage/frequency	-0.7155

B. Current and Alternative POIs for MOS 13E AIT

The following tables summarize the alternative programs of instruction we analyzed for this case study. The tables cover the baseline (current) POI, the "Shortened POI," the "Add-In POI," and two CBT POI (the latter of which includes the assumption that CBT can shorten training time). Each of the tables show the training events included in the POI, the number of academic hours allocated to each event by type of instruction, and the number of instructor contact hours.

Type of instruction is coded as follows:

Conference	=	Employs directed discussion, instructor controlled
Demo	=	Use of an actual situation or portrayal to show and explain procedure
PE1	=	Performance oriented exercise with actual equipment
PE2	=	Practical application outside the classroom, but not involving actual equipment
PE3	=	Exercises in the classroom not involving equipment
EXAM1	=	Hardware oriented performance
EXAM2	=	Written test
CBT	=	Computer-based training
TV	=	Television/video.

Table B.1

13E Baseline Case

POI	Event name	Conference	Demo	PE 1	PE 2	PE 3	TV	Exam 1	Exam 3	Total POI	Total ICHs
GD10AA	Summary Orientation	2.0								2.0	0.0
GD10AC	Construction of Firing Charts	1.0		7.0						8.0	22.0
GD10AE	Determination of Chart Data	1.0		7.0						8.0	22.0
GD10AM	Firing Chart Drill	1.0		3.0						4.0	10.0
GD1001	Examination							2.0		2.0	6.0
GD10AI	Extract Data from the TFT					2.0				2.0	4.0
GD10AK	Basic Firing Data	1.0		5.0						6.0	16.0
GD10AQ	Determination of VI, VA, SITE, and Angle of Site	4.0		4.0						8.0	16.0
GD1002	Examination							2.0		2.0	6.0
GD10AT	Operation of the FDC	1.0		7.0						8.0	22.0
GD10BG	Operations of the FDC (Practical Exercise)			6.0						6.0	18.0
GD1003	Examination							2.0		2.0	6.0
GD10AZ	Precision Fire	1.0		7.0						8.0	22.0
GD10BU	High Burst/MPI Registration	2.0		6.0						8.0	20.0
GD10BZ	Registrations Practical Exercise			4.0						4.0	12.0
GD1004	Examination							2.0		2.0	6.0
GD10CO	Concurrent Met	2.0				6.0				8.0	8.0
GD10CV	Subsequent Met	2.0		4.0		2.0				8.0	16.0
GD10BH	Met Practical Exercise			6.0						6.0	18.0
GD1005	Examination								3.0	3.0	3.0
GD10AN	Illumination Firing Data	1.0		2.0						3.0	7.0
GD10HB	White Phosphorus	0.5		2.5						3.0	8.0
GD10DU	High Angle Firing Data	0.5		1.5						2.0	5.0
GD10LN	DP ICM Firing Data (M483A)	1.0		3.0						4.0	10.0
GD10BI	Special Missions Practical Exercise			4.0						4.0	12.0
GD1006	Examination							2.0		2.0	6.0
GD10JI	Introduction and Initialization of BUCS	1.0								1.0	1.0
GD10JD	BUCS Data Base Construction	1.0		7.0						8.0	22.0
GD10JR	BUCS MET	0.5		1.5						2.0	5.0
GD10JA	BUCS Mission Processing	1.0		7.0						8.0	22.0
GD10JK	BUCS Registrations	2.0		6.0						8.0	20.0
GD10JS	BUCS Special Situations	1.0		7.0						8.0	22.0
GD10JQ	BUCS Practical Exercises			8.0						8.0	24.0
GD1007	BUCS Examination							4.0		4.0	12.0
GD10JX	Live Fire Practice (Dry Fire)			8.0						8.0	24.0
GD10SM	Live Fire Exercise			8.0						8.0	24.0
GD1008	End of Course Comprehensive Test							3.0	1.0	4.0	10.0
*GD10PI	Introduction to the Battery Computer System (BCS)	*1.0		*1.0							
*GD10PD	BCS Database Construction	*3.0		*7.0							
*GD10PA	BCS Mission Processing and Registrations	*4.0		*8.0							
AN10AG	Map Reading, Part I	1.3				6.7				8.0	28.1
AN10AH	Map Reading, Part II	1.1				2.9				4.0	24.3
AN1001	Examination and Critique								2.0	2.0	2.0
CC10BM	Radiotelephone Procedure	0.5				2.5				3.0	5.5
CC10OJ	CEOI	1.0				7.0				8.0	15.0
CC10OD	Medium Power Radio Sets			2.0						2.0	10.0
CC10BA	Low Power Radio Sets			2.0						2.0	10.0
CC10BB	Radio Set Control Group AN/GRA-39			2.0						2.0	10.0
CC10AA	Intercommunication Set AN/VIC-1			2.0						2.0	10.0
CC10PM	PMCS on Radio Set AN/VRC-46	0.5		1.0		0.5				2.0	6.5
CC10CM	Electronic Warfare	0.5				1.0	0.5			2.0	3.0
CC10VV	Communication Security Equipment TSEC/KY-57	0.5		3.5						4.0	18.0
CC10OE	Antennas	0.5	0.5		2.0					3.0	11.5
CC10AG	Applied Communications Procedures	0.3			1.7	2.0				4.0	12.8
CC1001	Examination and Critique							3.0	1.0	4.0	16.0
CC10SA	Prepare and Operate a SINCGARS	1.0		7.0						8.0	43.0
TOTAL		34.7	0.5	151.0	3.7	32.6	0.5	20.0	7.0	250.0	712.7

* Fast Track training events not included in the baseline case POI

Table B.2

Shortened POI

POI	Event name	Change	Conference	Demo	PE 1	PE 2	PE 3	TV	Exam 1	Exam 2	Total POI	Total [illegible]
AN10AG	Map Reading, Part I	KEEP POI / ELIM	1.0				3.0				4.0	7.0
AN10AH	Map Reading, Part II	KEEP POI / ELIM	1.0				1.0				2.0	3.0
AN1001	Examination and Critique	KEEP POI								2.0	2.0	2.0
GD10AA	Gunnery Orientation	KEEP POI / ELIM	1.0								1.0	0.0
GD10AC	Construction of Firing Charts	KEEP POI	1.0		7.0						8.0	22.0
GD10AE	Determination of Chart Data	KEEP POI	1.0		7.0						8.0	22.0
GD10AM	Firing Chart Drill	KEEP POI	1.0		3.0						4.0	10.0
GD1001	Examination	KEEP POI							2.0		2.0	6.0
GD10AI	Extract Data from the TFT	KEEP POI					2.0				2.0	4.0
GD10AK	Basic Firing Data	KEEP POI	1.0		5.0						6.0	16.0
GD10AQ	Determination of VI, VA, SITE, and Angle of Site	KEEP POI	4.0		4.0						8.0	16.0
GD1002	Examination	KEEP POI							2.0		2.0	6.0
GD10AT	Operation of the FDC (Record low-angle area & FFE missions w/fuze Quick, Time & VT)	KEEP POI	1.0		7.0						8.0	22.0
GD10BG	Operations of the FDC (Practical Exercise)	KEEP POI			6.0						6.0	18.0
GD1003	Examination (Record of fire for low-angle)	KEEP POI							2.0		2.0	6.0
GD10AZ	Precision Fire	KEEP POI	1.0		7.0						8.0	22.0
GD10BU	High Burst/MPI Registration	KEEP POI	2.0		6.0						8.0	20.0
GD10BZ	Registrations Practical Exercise	KEEP POI			4.0						4.0	12.0
GD1004	Examination	KEEP POI							2.0		2.0	6.0
GD10AN	Illumination Firing Data	KEEP POI	1.0		2.0						3.0	7.0
GD10HB	White Phosphorus	KEEP POI	0.5		2.5						3.0	8.0
GD10DU	High Angle Firing Data	KEEP POI	0.5		1.5						2.0	5.0
GD10LN	DP ICM Firing Data (M483A)	KEEP POI	1.0		3.0						4.0	10.0
GD10BI	Special Missions Practical Exercise	KEEP POI			4.0						4.0	12.0
GD1006	Examination	KEEP POI							2.0		2.0	6.0
GD10JI	Introduction and Initialization of BUCS	KEEP POI	1.0								1.0	1.0
GD10JD	BUCS Data Base Construction	KEEP POI	1.0		7.0						8.0	22.0
GD10JA	BUCS Mission Processing	KEEP POI	1.0		7.0						8.0	22.0
GD10JK	BUCS Registrations	KEEP POI	2.0		6.0						8.0	20.0
GD10JS	BUCS Special Situations	KEEP POI	1.0		7.0						8.0	22.0
GD10JQ	BUCS Practical Exercises	KEEP POI			8.0						8.0	24.0
GD1007	BUCS Examination	KEEP POI							4.0		4.0	12.0
GD10JX	Live Fire Practice (Dry Fire)	KEEP POI			8.0						8.0	24.0
GD10BM	Live Fire Exercise	KEEP POI			8.0						8.0	24.0
GD1008	End of Course Comprehensive Test	KEEP POI							3.0	1.0	4.0	10.0
*GD10PI	Introduction to the LCU Battery Computer System (LCU)**	FAST TRACK										
*GD10PD	LCU Database Construction	FAST TRACK										
*GD10PA	LCU Mission Processing and Registrations	FAST TRACK										
GD10CO	Concurrent Met	ELIMINATE										
GD10CV	Subsequent Met	ELIMINATE										
GD10BH	Met Practical Exercise	ELIMINATE										
GD1005	Examination	ELIMINATE										
GD10JR	BUCS MET	ELIMINATE										
CC10BM	Radiotelephone Procedure	KEEP POI	0.5				2.5				3.0	5.5
CC10OJ	CEOI (113-573-4006)	KEEP POI	1.0				7.0				8.0	15.0
CC10OD	Medium Power Radio Sets (includes FMCS)	KEEP/DISTRIBUTE			2.0						2.0	10.0
CC10BA	Low Power Radio Sets	DISTRIBUTE UNIT										
CC10BB	Radio Set Control Group AN/GRA-39	KEEP POI			2.0						2.0	10.0
CC10AA	Intercommunication Set AN/VIC-1	DISTRIBUTE UNIT										
CC10PM	FMCS on Radio Set AN/VRC-46	KEEP IN CC10OD										
CC10CM	Electronic Warfare	KEEP POI	0.5				1.0	0.5			2.0	3.0
CC10VV	Communication Security Equipment TSEC/KY-57	KEEP POI	0.5		3.5						4.0	18.0
CC10OE	Antennas (Group OE-254)	KEEP/DISTRIBUTE	0.5	0.5		1.0					2.0	6.5
CC10AG	Applied Communications Procedures (113-573-7017)	KEEP POI	0.3			1.7	2.0				4.0	12.8
CC1001	Examination and Critique	KEEP/DISTRIBUTE							2.0	1.0	3.0	11.0
CC10SA	Prepare and Operate a SINCGARS	DISTRIBUTE UNIT										
TOTAL			27.3	0.5	127.5		18.5	0.5	19.0	4.0	200.0	540.8

* Fast Track training events not included in the baseline case POI

Table B.3

Add-in POI

POI	Event name	Change	Conference	Demo	PE 1	PE 2	PE 3	TV	Exam 1	Exam 2	Total POI	Total ICHs
AN10AG	Map Reading, Part I	KEEP POI / ELIM	1.0				3.0				4.0	7.0
AN10AH	Map Reading, Part II	KEEP POI / ELIM	1.0				1.0				2.0	3.0
AN1001	Examination and Critique	KEEP POI								2.0	2.0	2.0
GD10AA	Gunnery Orientation	KEEP POI / ELIM	1.0								1.0	0.0
GD10AC	Construction of Firing Charts	KEEP POI	1.0		7.0						8.0	22.0
GD10AE	Determination of Chart Data	KEEP POI	1.0		7.0						8.0	22.0
GD10AM	Firing Chart Drill	KEEP POI	1.0		3.0						4.0	10.0
GD1001	Examination	KEEP POI							2.0		2.0	6.0
GD10AI	Extract Data from the TFT	KEEP POI					2.0				2.0	4.0
GD10AK	Basic Firing Data	KEEP POI	1.0		5.0						6.0	16.0
GD10AQ	Determination of VI, VA, SITE, and Angle of Site	KEEP POI	4.0		4.0						8.0	16.0
GD1002	Examination	KEEP POI							2.0		2.0	6.0
GD10AT	Operation of the FDC (Record low-angle area & FFE missions using Quick, Time & VT)	KEEP POI	1.0		7.0						8.0	22.0
GD10BG	Operations of the FDC (Practical Exercise)	KEEP POI			6.0						6.0	18.0
GD1003	Examination (Record of fire for low-angle)	KEEP POI							2.0		2.0	6.0
GD10AZ	Precision Fire	KEEP POI	1.0		7.0						8.0	22.0
GD10BU	High Burst/MPI Registration	KEEP POI	2.0		6.0						8.0	20.0
GD10BZ	Registrations Practical Exercise	KEEP POI			4.0						4.0	12.0
GD1004	Examination	KEEP POI							2.0		2.0	6.0
GD10AN	Illumination Firing Data [illegible], -1121	KEEP POI	1.0		2.0						3.0	7.0
GD10HB	White Phosphorus [illegible]-1132	KEEP POI	0.5		2.5						3.0	8.0
GD10DU	High Angle Firing Data [illegible]-1162	KEEP POI	0.5		1.5						2.0	5.0
GD10LN	DP ICM Firing Data (M483A) [illegible]	KEEP POI	1.0		3.0						4.0	10.0
GD10BI	Special Missions Practical Exercise	KEEP POI			4.0						4.0	12.0
GD1006	Examination	KEEP POI							2.0		2.0	6.0
GD10JI	Introduction and Initialization of BUCS	KEEP POI	1.0								1.0	1.0
GD10JD	BUCS Data Base Construction	KEEP POI	1.0		7.0						8.0	22.0
GD10JA	BUCS Mission Processing	KEEP POI	1.0		7.0						8.0	22.0
GD10JK	BUCS Registrations	KEEP POI	2.0		6.0						8.0	20.0
GD10JS	BUCS Special Situations	KEEP POI	1.0		7.0						8.0	22.0
GD10JQ	BUCS Practical Exercises	KEEP POI			8.0						8.0	24.0
GD1007	BUCS Examination	KEEP POI							4.0		4.0	12.0
*GD10PI	Introduction to the LCU Battery Computer System (LCU)	*ADD TO POI	1.0		1.0						2.0	4.0
*GD10PD	LCU Database Construction	ADD TO POI	3.0		7.0						10.0	24.0
*GD10PA	LCU Mission Processing and Registrations	ADD TO POI	4.0		8.0						12.0	28.0
*NEW	LCU Practical Exercises	ADD TO POI			4.0						4.0	12.0
GD10JX	Live Fire Practice (Dry Fire)	KEEP POI			8.0						8.0	24.0
GD10BM	Live Fire Exercise	KEEP POI			8.0						8.0	24.0
GD1008	End of Course Comprehensive Test	KEEP POI							4.0	1.0	5.0	13.0
GD10CO	Concurrent Met ([illegible]-1700)	ELIMINATE									0.0	
GD10CV	Subsequent Met ([illegible]-1701)	ELIMINATE									0.0	
GD10BH	Met Practical Exercise	ELIMINATE									0.0	
GD1005	Examination	ELIMINATE									0.0	
GD10JR	BUCS MET	ELIMINATE									0.0	
CC10BM	Radiotelephone Procedure	KEEP POI	0.5				2.5				3.0	5.5
CC10OJ	CEOI (113-573-[illegible])	KEEP POI	1.0				7.0				8.0	15.0
CC10OD	Medium Power Radio Sets (includes PMCS)	KEEP/DISTRIBUTE			2.0						2.0	10.0
CC10BA	Low Power Radio Sets	DISTRIBUTE UNIT										
CC10BB	Radio Set Control Group AN/GRA-39	KEEP POI			2.0						2.0	10.0
CC10AA	Intercommunication Set AN/VIC-1	DISTRIBUTE UNIT										
CC10PM	PMCS on Radio Set AN/VRC-46	KEEP IN CC10OD										
CC10CM	Electronic Warfare	KEEP POI	0.5			1.0	1.0	0.5			2.0	3.0
CC10VV	Communication Security Equipment TSEC/KY-57	KEEP POI	0.5		3.5						4.0	18.0
CC10OE	Antennas (Group OE-254)	KEEP/DISTRIBUTE	0.5	0.5		1.0					2.0	6.5
CC10AG	Applied Communications Procedures (113-573-7017)	KEEP POI	0.3			1.7	2.0				4.0	12.8
CC1001	Examination and Critique	KEEP/DISTRIBUTE							2.0	1.0	3.0	11.0
CC10BA	Prepare and Operate a SINCGARS	DISTRIBUTE UNIT										
TOTAL			35.3	0.5	147.5	3.7	18.5	0.5	20.0	4.0	229.0	611.8

* Fast Track training events not included in the baseline case POI

Table B.4

CBT POI

POI	Event name	Change	Conference	CBT	Demo	PE 1	PE 2	PE 3	TV	Exam 1	Exam 2	Total POI	Total IOHs
AN10AG	Map Reading, Part I	KEEP POI/ELIM	4.0									4.0	4.0
AN10AH	Map Reading, Part II	KEEP POI/ELIM	2.0									2.0	2.0
AN1001	Examination and Critique	KEEP POI									2.0	2.0	2.0
GD10AA	Gunnery Orientation	KEEP POI/ELIM	1.0									1.0	0.0
GD10AC	Construction of Firing Charts	KEEP POI	2.0	6.0								8.0	14.0
GD10AE	Determination of Chart Data	KEEP POI	2.0	6.0								8.0	14.0
GD10AM	Firing Chart Drill	KEEP POI	1.0			3.0						4.0	10.0
GD1001	Examination	KEEP POI								2.0		2.0	6.0
GD10AI	Extract Data from the TFT	KEEP POI	2.0									2.0	2.0
GD10AK	Basic Firing Data	KEEP POI	2.0	4.0								6.0	10.0
GD10AQ	Determination of VI, VA, SITE, and Angle of Site	KEEP POI	4.0	4.0								8.0	12.0
GD1002	Examination	KEEP POI								2.0		2.0	6.0
GD10AT	Operation of the FDC (Record low angle area & FFE missions w/fuze Quick, Time & VT)	KEEP POI	2.0	6.0								8.0	14.0
GD10BG	Operations of the FDC (Practical Exercise)	KEEP POI				6.0						6.0	18.0
GD1003	Examination (RECORD OF FIRE FOR LOW-ANGLE)	KEEP POI								2.0		2.0	6.0
GD10AZ	Precision Fire	KEEP POI	2.0	6.0								8.0	14.0
GD10BU	High Burst/MPI Registration	KEEP POI	2.0	6.0								8.0	14.0
GD10BZ	Registrations Practical Exercise*	KEEP POI				4.0						4.0	12.0
GD1004	Examination	KEEP POI								2.0		2.0	6.0
GD10AN	Illumination Firing Data 061-300-2206, -1121	KEEP POI	1.0	2.0								3.0	5.0
GD10HB	White Phosphorus 061-300-1122	KEEP POI	0.5	2.5								3.0	5.5
GD10DU	High Angle Firing Data 061-300-1102	KEEP POI	0.5	1.5								2.0	3.5
GD10LN	DP ICM Firing Data (M483A) 061-300-2206, -2201	KEEP POI	1.0	3.0								4.0	7.0
GD10BI	Special Missions Practical Exercise	KEEP POI				4.0						4.0	12.0
GD1006	Examination	KEEP POI								2.0		2.0	6.0
GD10JI	Introduction and Initialization of BUCS	KEEP POI	1.0									1.0	1.0
GD10JD	BUCS Data Base Construction	KEEP POI	1.0			7.0						8.0	22.0
GD10JA	BUCS Mission Processing	KEEP POI	1.0			7.0						8.0	22.0
GD10JK	BUCS Registrations	KEEP POI	2.0			6.0						8.0	20.0
GD10JS	BUCS Special Situations	KEEP POI	1.0			7.0						8.0	22.0
GD10JQ	BUCS Practical Exercises	KEEP POI				8.0						8.0	24.0
GD1007	BUCS Examination	KEEP POI								4.0		4.0	12.0
*GD10PI	Introduction to the LCU Battery Computer System (LCU)	ADD TO POI	1.0	1.0								2.0	3.0
*GD10PD	LCU Database Construction	ADD TO POI	3.0	7.0								10.0	17.0
*GD10PA	LCU Mission Processing and Registrations	ADD TO POI	4.0	8.0								12.0	20.0
*NEW	LCU Practical Exercises	ADD TO POI				4.0						4.0	12.0
GD10JX	Live Fire Practice (Dry Fire)	KEEP POI				8.0						8.0	24.0
GD10BM	Live Fire Exercise	KEEP POI				8.0						8.0	24.0
GD1008	End of Course Comprehensive Test	KEEP POI								4.0	1.0	5.0	13.0
GD10CO	Concurrent Met (061-300-1700)	ELIMINATE											
GD10CV	Subsequent Met (061-300-1701)	ELIMINATE											
GD10BH	Met Practical Exercise	ELIMINATE											
GD1005	Examination	ELIMINATE											
GD10JR	BUCS MET	ELIMINATE											
CC10BM	Radiotelephone Procedure	KEEP POI	0.5					2.5				3.0	5.5
CC10OJ	CEOI (113-573-4008)	KEEP POI	1.0	7.0								8.0	15.0
CC10OD	Medium Power Radio Sets (includes FMCS)	KEEP/DISTRIBUTE				2.0						2.0	10.0
CC10BA	Low Power Radio Sets	DISTRIBUTE UNIT											
CC10BB	Radio Set Control Group AN/GRA-39	KEEP POI				2.0						2.0	10.0
CC10AA	Intercommunication Set AN/VIC-1	DISTRIBUTE UNIT											
CC10PM	FMCS on Radio Set AN/VRC-46	KEEP IN CC10OD											
CC10CM	Electronic Warfare	KEEP POI	0.5					1.0	0.5			2.0	3.0
CC10WV	Communication Security Equipment TSEC/KY-57	KEEP POI	0.5			3.5						4.0	18.0
CC10OE	Antennas (Group OE-254)	KEEP/DISTRIBUTE	0.5		0.5		1.0					2.0	6.5
CC10AG	Applied Communications Procedures (113-573-7017)	KEEP POI	0.3				1.7	2.0				4.0	12.8
CC1001	Examination and Critique	KEEP/DISTRIBUTE								2.0	1.0	3.0	11.0
CC10BA	Prepare and Operate a SINCGARS	DISTRIBUTE UNIT											
TOTAL			46.3	70.0	0.5	79.5	2.7	5.5	0.5	20.0	4.0	229.0	532.8

* Fast Track training events not included in the baseline case POI

Table B.5

CBT POI with Efficiency Assumption

POI	Event name	Change	Conference	CBT	Demo	PE 1	PE 2	PE 3	TV	Exam 1	Exam 3	Total POI	Total ICHs
AN10AG	Map Reading, Part I	KEEP POI / ELIM	4.0									4.0	4.0
AN10AH	Map Reading, Part II	KEEP POI / ELIM	2.0									2.0	2.0
AN1001	Examination and Critique	KEEP POI									2.0	2.0	2.0
GD10AA	Summary Orientation	KEEP POI / ELIM	1.0									1.0	0.0
GD10AC	Construction of Firing Charts	KEEP POI	2.0	4.0								6.0	10.0
GD10AE	Determination of Chart Data	KEEP POI	2.0	4.0								6.0	10.0
GD10AM	Firing Chart Drill	KEEP POI	1.0			3.0						4.0	10.0
GD1001	Examination	KEEP POI								2.0		2.0	6.0
GD10AI	Extract Data from the TFT	KEEP POI	2.0									2.0	2.0
GD10AK	Basic Firing Data	KEEP POI	2.0	2.7								4.7	7.4
GD10AQ	Determination of VI, VA, SITE, and Angle of Site	KEEP POI	4.0	2.7								6.7	9.4
GD1002	Examination	KEEP POI								2.0		2.0	6.0
GD10AT	Operation of the FDC (Record low angle area & FFE missions using Quick, Time & VT)	KEEP POI	2.0	4.0								6.0	10.0
GD10BG	Operations of the FDC (Practical Exercise)	KEEP POI				6.0						6.0	18.0
GD1003	Examination (RECORD OF FIRE FOR LOW-ANGLE)	KEEP POI								2.0		2.0	6.0
GD10AZ	Precision Fire	KEEP POI	2.0	4.0								6.0	10.0
GD10BU	High Burst/MPI Registration	KEEP POI	2.0	4.0								6.0	10.0
GD10BZ	Registrations Practical Exercise	KEEP POI				4.0						4.0	12.0
GD1004	Examination	KEEP POI								2.0		2.0	6.0
GD10AN	Illumination Firing Data 061-000-2200, -1121	KEEP POI	1.0	1.5								2.5	4.0
GD10HB	White Phosphorus 061-000-1122	KEEP POI	0.5	1.6								2.1	3.7
GD10DU	High Angle Firing Data 061-000-1102	KEEP POI	0.5	1.0								1.5	2.5
GD10LN	DP ICM Firing Data (M483A) 061-000-0000, -0001	KEEP POI	1.0	2.0								3.0	5.0
GD10BI	Special Missions Practical Exercise	KEEP POI				4.0						4.0	12.0
GD1006	Examination	KEEP POI								2.0		2.0	6.0
GD10JI	Introduction and Initialization of BUCS	KEEP POI	1.0									1.0	1.0
GD10JD	BUCS Data Base Construction	KEEP POI	1.0			7.0						8.0	22.0
GD10JA	BUCS Mission Processing	KEEP POI	1.0			7.0						8.0	22.0
GD10JK	BUCS Registrations	KEEP POI	2.0			6.0						8.0	20.0
GD10JS	BUCS Special Situations	KEEP POI	1.0			7.0						8.0	22.0
GD10JQ	BUCS Practical Exercises	KEEP POI				8.0						8.0	24.0
GD1007	BUCS Examination	KEEP POI								4.0		4.0	12.0
*GD10PI	Introduction to the LCU Battery Computer System (LCU)	ADD TO POI	1.0	1.0								2.0	3.0
*GD10PD	LCU Database Construction	ADD TO POI	3.0	4.5								7.5	12.0
*GD10PA	LCU Mission Processing and Registrations	ADD TO POI	4.0	5.0								9.0	14.0
*NEW	LCU Practical Exercises	ADD TO POI				4.0						4.0	12.0
GD10JX	Live Fire Practice (Dry Fire)	KEEP POI				8.0						8.0	24.0
GD10SM	Live Fire Exercise	KEEP POI				8.0						8.0	24.0
GD1008	End of Course Comprehensive Test	KEEP POI								4.0	1.0	5.0	13.0
GD10CO	Concurrent Met (061-000-1700)	ELIMINATE											
GD10CV	Subsequent Met (061-000-1701)	ELIMINATE											
GD10BH	Met Practical Exercise	ELIMINATE											
GD1005	Examination	ELIMINATE											
GD10JR	BUCS MET	ELIMINATE											
CC10BM	Radiotelephone Procedure	KEEP POI	0.5					2.5				3.0	5.5
CC10OJ	CEOI (113-573-4000)	KEEP POI	1.0	4.7								5.7	10.4
CC10OD	Medium Power Radio Sets (includes PMCS)	KEEP/DISTRIBUTE				2.0						2.0	10.0
CC10BA	Low Power Radio Sets	DISTRIBUTE UNIT											
CC10BB	Radio Set Control Group AN/GRA-39	KEEP POI				2.0						2.0	10.0
CC10AA	Intercommunication Set AN/VIC-1	DISTRIBUTE UNIT											
CC10PM	PMCS on Radio Set AN/VRC-46	KEEP IN CC10OD											
CC10CM	Electronic Warfare	KEEP POI	0.5					1.0	0.5			2.0	3.0
CC10VV	Communication Security Equipment TSEC/KY-57	KEEP POI	0.5			3.5						4.0	18.0
CC10OE	Antennas (Group OE-254)	KEEP/DISTRIBUTE	0.5		0.5		1.0					2.0	6.5
CC10AG	Applied Communications Procedures (113-573-7017)	KEEP POI	0.3				1.7	2.0				4.0	12.8
CC1001	Examination and Critique	KEEP/DISTRIBUTE								2.0	1.0	3.0	11.0
CC10SA	Prepare and Operate a SINCGARS	DISTRIBUTE UNIT											
TOTAL			46.3	46.7	0.5	79.5	2.7	5.5	0.5	20.0	4.0	205.7	498.2

* Fast Track training events not included in the baseline case POI

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