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TR-78-A3

Determining TEC Media Alternatives for Field Artillery Individual-Collective Training in the FY 78-83 Period

by

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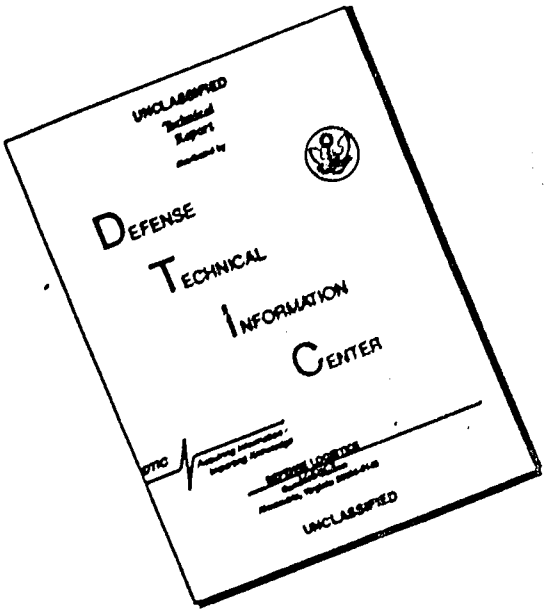

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This report is the second of three, following ARI Technical Report TR-77-A20, "The Effectiveness of Alternative Media in Conjunction with TEC for Improving Performance in MOS Related Tasks."

The emphasis in the Army on a first-battle-win readiness posture demands realism of situational training, active response, and sustaining practice, but with less demand on scarce and costly resources. The research objective was to develop practical procedures, data sources, and a resource management

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20. approach which training supervisors could use to select an optimal delivery system mix for any major individualized-collective training and evaluation program requirement arising in the FY 78-83 period. Although the research has focused on training requirements within the Army Field Artillery School, the results have Army-wide application.

MAJOR FINDINGS

1. A need exists for: (a) closer attention to the characteristics of soldiers; (b) increased realism of delivery system components; (c) selection of techniques less demanding of costly resources; (d) closer integration in the choice of training delivery systems.

2. Life cycle management should include integrating system design with: (a) man-machine interface; (b) personnel selection or job assignment criteria; (c) EPMS/OPMS specialty and skill level structure.

3. Choices among the several training delivery systems potentially available in the FY 78-83 period should consider: (a) broadened exportability to include training delivery systems that can be embedded in a fielded weapon system or which can be accessed from a remote site; (b) established data files containing characteristics, operational status, accessibility, and constraints of training delivery systems.

4. TRADOC goals suggest that it is necessary to: (a) insure that course designers developers possess the skills for selecting, developing and updating media and courseware for a variety of alternative delivery systems; (b) ensure that school system managers can specify procurement requirements as well as monitor and evaluate contractor plans and products; (c) collect and summarize data on training cost effectiveness to include user acceptance throughout the life cycle development of a system.

FOREWORD

This report is the second of three documents resulting from research conducted by the System Development Corporation (SDC) for the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) under contract number DAHC 19-76-C-0027: "The Effectiveness of Alternative Media in Conjunction with TEC for Improving Performance in MOS Related Tasks." Mr. Arthur Marcus, ARI, was the technical contract monitor for the work reported here.

This particular document addresses planning for the utilization of TEC media in the proximal future, FY 78-83. The research was conducted in response to HRN 77-185 sponsored by the US Army Field Artillery School (USAFAS). The first report, ARI TR-77-A20, "The Effectiveness of Alternative Media in Conjunction with TEC for Improving Performance in MOS Related Tasks," was published December 1977.

As background to the development of this effort, the precursors to HRN 77-185 were two previous HRN's: 76-205 initiated by the Combat Army Training Board and an unnumbered HRN initiated in FY 1975 by the US Army Infantry School (USAIS). It was anticipated in FY 1977 that the USAIS could provide necessary support for their HRN; however, changing priorities prevented the Infantry School from providing the required support. However, the USAFAS was acquainted with the research capability of ARI through ARI contributions to the TACFIRE Program and was receptive to the potential value of an HRN which would support computer aided instruction with application to training in artillery weapon systems and thus undertook sponsorship of the effort.

Brigadier General Albert B. Akers, Deputy Commandant of the USAFAS, directed the development of HRN 77-185, which provided USAFAS support. Colonel John S. Crosby (now BG Crosby, Director, Personnel Information Systems, US Army Military Personnel Center) provided guidance, assistance and support for the ARI research effort at the Field Artillery School as Director, Course Development Field Artillery School Brigade. Colonel Crosby's Directorate provided the personnel and logistic support which enabled ARI to accomplish the necessary research for these reports.

A desirable end-product from any research effort is spinoff data which may help to satisfy goals beyond the immediate, stated objectives of a given study. Such is the case in this instance. The Educational Technology and Training Simulation Technical Area has as one objective in its exploratory development program (RDTE category 6.2) the creation of a general model to assist training device developers in evaluating and selecting instructional media on the basis of cost and training effectiveness (see ARI FY 78 Work Program, Project A764, Task A, Work Unit 2). The results reported here will feed directly into this DEMO (device/media optimization) model development effort.

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EXECUTIVE SUMMARY

The current emphasis on a first-battle-win readiness posture demands realism of situational training, active response, and sustaining practice; yet this readiness posture must be less demanding than traditional techniques on costly or scarce resources. Concern for finding the optimum ratio of training systems to resources is evidenced by the variety of delivery systems fielded or in various stages of investigation by USAFAS and other DA/TRADOC groups. The long-range objectives of the current effort are to develop practical procedures, data sources, and a resource management approach for selection or assignment of optimal training delivery system mixes. These delivery systems would be directed toward major individual-collective training and evaluation program requirements in the FY 78-83 period. While this effort is concentrated on training requirements within USAFAS, the results have Army-wide application. The immediate objectives for this phase of the effort were to: (1) identify Army training doctrine and developments affecting resource selection and utilization during FY 78-83; (2) identify USAFAS training support situations for FY 78-83; (3) design a preliminary delivery systems selection model; (4) identify delivery systems available or potentially available to USAFAS; (5) provide a plan for export and evaluation of USAFAS-produced computer-assisted instruction lessons.

Major Findings.

Detailed rationale, implications, and interpretation for findings are in the text and Appendices.

1. A need exists for: (1) closer attention to the characteristics of soldiers; (2) increased realism of delivery system components; (3) selection of techniques less demanding of resources; and (4) choice of training delivery systems more closely integrated with systems for job and mission evaluation.

2. Life-cycle management should integrate system design with: (1) man-machine interface; (2) personnel selection or job assignment criteria; and (3) EPMS/OPMS specialty and skill level structure.

3. The number of training and delivery systems potentially useful through FY 78-83 suggests that: (1) exportability be broadened to include training delivery systems that can be embedded in a fielded weapons system or can be accessed from remote sites; (2) data files be established that contain characteristics, operational status, accessibility, and constraints of training delivery systems.

4. TPADOC goals with respect to responsibilities, manpower utilization, and fiscal justifications suggest the necessity to: (1) ensure that course designers/developers possess the skills for selecting, developing, and updating media and courseware for a variety of alternative delivery systems; (2) ensure that school system managers, technical directors, and resource managers can specify procurement requirements as well as monitor and evaluate contractor plans and products; and (3) collect and summarize data on cost and training effectiveness to include user acceptance, throughout the life-cycle development of a system.

5. Delivery system selection factors. Constraining factors and solution factors were analyzed against five developmental requirements predicted for USAFAS IN FY 78-83:

(1) ITDT Coverage of New or Developmental System.
(2) ITDT Retrofit to Fielded System.
(3) Self-Pacing of MOS Course for Export.
(4) Self-Pacing of MOS Course for School.
(5) Update of Fielded ITDT/MOS Materials.

Implications from this analysis include: (1) Developmental requirements differ enough so that no narrow model dealing solely with trainee, subject matter, and media variables at one decision stage will serve the five situations: (2) The model should integrate the selection of delivery systems for MOS-oriented material, combat literature, training literature, job-support materials, training support materials, and evaluation materials to maximize compatibility and minimize the potential for massive updates. (3) There are significant differences among delivery systems in terms of the efficiency and resource demands in updating of materials.

6. The four consecutive decision stages of a preliminary delivery system's decision model are: (1) State delivery system requirements and preliminary candidates; (2) Select major delivery systems mix for training program; (3) Select delivery systems for specific performance modules and lessons; and (4) Assign alternative delivery systems during training implementation. Each decision stage is designed to produce decision data input to an evolving Individual-Collective Training and Evaluation Plan (ICTEP) providing a technical development and resources management baseline throughout the entire proponency program.

7. An inventory of the specific delivery system resources existing or potentially available for field artillery training in FY 78-83 indicates: (1) A data file should be established of attributes relating to the interaction of delivery system capabilities with characteristics of trainee, subject-matter, and training setting. (2) This data file should be usable within procedural guidelines to be developed for the four decision stages of the preliminary delivery system's selection model.

8. Continued development of the TEC Media Selection methodology and frame of reference is suggested:

(1) Step 1 - USAFAS/ARI Review, Revisions and Concurrence on Approach
(2) Step 2 - Develop Delivery System's Selection Procedures
(3) Step 3 - Pilot Implementation and Formative Evaluation at USAFAS.

9. It is feasible to export USAFAS-produced CAI lessons to Army units via telecommunications access from the unit to a central computer source. Requirements include: (1) physical, computer, and courseware resources; (2) procedures guide and daily usage procedure; (3) student selection; (4) monitor duties; (5) use of automated and manual records; and (6) evaluation guidelines. Procedures, examples, and specific forms have been provided in this report.

SECTION 1. INTRODUCTION

A. BACKGROUND

The overall purpose of the TEC Media applied research program is to determine effective and efficient means of providing exportable training packages to field force units. The Army recognizes for planning that TEC Extension Training Materials (ETM) could employ a full range of alternative delivery systems for individual and collective performance training in units. Indeed, the current emphasis on a first-battle-win readiness posture demands realism of situation and active responses in the training of field forces. The variety and levels of system, job, and mission performance requirements within Field Artillery units and among the combat arms branches requires training and evaluation techniques which are flexible to unit training and work settings, realistic in terms of presentation and active practice capabilities, yet less costly than traditional techniques in resources consumption (ammo, fuel, time, and training support). This broad outlook is evident by methods suggested in FM 21-6 for conducting performance-oriented unit training and in TC 21-5-7 on unit training management. It is also evident in the innovative delivery systems being designed, assessed, and implemented by various DA agencies and service schools. These include computer-mediated training support; simulation devices for training and evaluation in marksmanship/gunnery and fire direction; tactical games, command staff simulation exercises, and two-sided engagement simulations.

Despite these innovative trends, with a few exceptions, past and continuing practice sees TEC exportable training wedded to a narrow range of delivery systems--audiovisual filmstrips for the Beseler Cue-See, printed materials, and audio-directed practice cassettes for use in fixed or portable tape players. This narrow focus perpetuates itself due in part to early decisions to procure and distribute large numbers of a few media devices, pressures upon service schools to convert a range of MOS course objectives to formats

of these devices, available production capabilities of competing contractors, increased service school capabilities to develop materials in these formats, short lead-time decisions causing choices within the available and predictable options, and a consequent tendency to formalize and limit the meaning of "exportable" training in terms of the three familiar TEC "tracks".

The traditional TEC approaches do offer considerable flexibility for individual and small-group use in certain unit training settings. The audiovisual-print-audio practice options can be designed to include realistic practice for certain kinds of job tasks in certain settings. Army studies have also obtained evidence supporting the efficiency and effectiveness of TEC training.[1] A mix of TEC media (e.g., audiovisual, printed worksheets) can be selected for the sensory modalities and symbolic or actual responses most natural to the job cue-response situations. Another approach, more useful in an institutional self-paced course or in an individual learning center, is to make alternative versions of candidate subject-matter modules available in different media. Presumably, given the option to choose, each trainee would choose that option closest to his preferred cognitive-perceptual style; e.g., seeing, hearing, reading, doing. Carried a step farther, given valid and reliable individual difference indices of cognitive-perceptual style available from soldier's records or simple instruments easily administered as part of the training management plan, then a soldier or group of soldiers could be assigned a mix of alternatives appropriate to the profile shown.

There is little sense in considering alternative delivery systems unless there is evidence of the feasibility and utility of their employment in Army training and training development settings. Specifically, there should be evidence that:

- course developers in proponent service schools can develop courseware for the delivery system, and can specify and monitor the design and development requirements if contracted-out

- the training and training management capability is exportable to or accessible from unit training settings
- the training is effective, efficient, and acceptable for unit trainees and job training supervisors

Prior tasks of the current work have looked at one sophisticated alternative delivery system for TEC--Computer Assisted Instruction (CAI). Results, reported in the companion volume to this report (TM-5841/000/00) suggest that CAI is a useful alternative in training Field Artillery personnel. Moreover, USAFAS course developers successfully converted audiovisual TEC lessons to CAI lessons with the same training objectives, input lessons from a school terminal tied to a remote Army service bureau computer, conducted a preliminary evaluation of the CAI lessons consisting of on-line review by subject experts and lesson tryouts with novice Army students, then used the CAI system to make immediate changes to lessons as indicated by the formative evaluations. Computer costs, course developer man-hours, and elapsed time were within expectations. Subject expert and student reaction to the CAI lessons was excellent. USAFAS is now capable of developing their own CAI lessons, checking them, and validating them on-computer. CAI work-projects at the school are continuing. Other ARI-sponsored work has established the feasibility of using tactical system computers in a CAI delivery system mode when they are not in operational use. The CAI training of MOS-related infantryman skills was demonstrated with positive results using a tactical system (DEVTOS) at Ft. Hood MASSTER facility. The feasibility of using CAI as a training vehicle for TACFIRE system operators was initially demonstrated at USAFAS, and evaluation and planned extensions of capability continue.

Similarly, in the area of simulation training, USAFAS is assessing the utility and feasibility for export of an Observed Fire panoramic classroom simulator which permits display realism and selection under control of an operator panel, and allows classroom participants to spot bursts and determine effects.

Also, two Army engagement simulation systems have been developed and their implementation in the Army is nearing completion. SCOPES was implemented Army-wide by USAIS in 1974. ARI subsequently expanded SCOPES into the REALTRAIN system which added the capability to employ artillery support, mines, tanks, and anti-tank weapons during two-sided platoon level exercises. TRADOC and ARI recently concluded a joint effort with USAREUR to implement REALTRAIN in the divisions in Europe. Results and acceptance were excellent.[2]

In sum, delivery system options are plentiful given a broader outlook on exportability, including devices and simulation packages delivered with an Army system or MOS training program, capabilities embedded into the system or job-setting, and telecommunications access to delivery systems remote from the unit location. The primary problem is a workable plan for matching delivery systems methods and media with soldier characteristics and subject-matter characteristics within constraints and capabilities of a given instructional situation.

B. PURPOSE OF THIS PLANNING TASK

In the selection of delivery systems method and media mix oriented to the individual and collective training and evaluation needs of Field Artillery soldiers, jobs, systems, and missions, there is a strong interaction between constraints and solutions. Alternative delivery systems should be viewed as <u>complementary</u> rather than competitive on a number of factors, such as: (1) types and levels of individual-collective competencies in the overall training program and any given performance module; (2) characteristics or preferences of the soldier trainee population; (3) delivery system options for presentation, active response, practice, feedback, and control of the training sequence.

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[1] cf. RPR 75-3, "A Cost Assessment of Army Training Alternatives", ARI, Aug 1975. RR 1188, "Training Individuals in Army Units: Comparative Effectiveness of Selected TEC Lessons and Conventional Methods", ARI, Dec 1975.

[2] Gorman, MG Paul F.. "Engagement Simulation". Proceedings of SALT/NSIA Symposium (Volume IV), Wash., D.C., 22-24 July 1976, pgs. 136-144.

On the other hand, alternative delivery systems are competitive in terms of actual or potential constraints of any given training situation. Constraints of a training or training development situation may include: (1) options permitted within DA/TRADOC regulatory directives or specifications; (2) characteristics and limitations of the work-training setting; (3) requirements for exportable packaging, access, or field utilization; (4) demands upon trainees or training supervisors in field or school; (5) special skills required for courseware development or update; (6) inherent recordkeeping capabilities of the delivery system; (7) efficiency of methods for updating existing courseware; and (8) relative costs of acquisition, operation, maintenance, and courseware development.

In view of the many complementary and competitive delivery system selection factors, the goals of this work are both immediate and long-range. The longer-range goal is to develop practical data sources, decision procedures, and resources management approach that will permit USAFAS training managers to select an optimum delivery system design mix for any major individual-collective training and evaluation program requirement arising in the FY 78-83 period. In view of this goal, the immediate goals of this planning task are to:

- get a realistic fix on the probable types of training development requirements USAFAS will mount in the FY 78-83 period, and the DA regulatory and doctrinal initiatives within which these training developments must operate
- given this framework, to design a compatible delivery systems selection process and identify decision steps, types of decisions, source data, and guidance.

- provide a workplan for followup review, detailing, pilot implementation, and development of these procedures with USAFAS and ARI
- provide a plan for exporting the CAI/TEC package developed by USAFAS to a Field Artillery unit and methods for evaluating the package in the unit setting.

C. ASSUMPTIONS

Assumptions both guiding and emerging from the objectives and approach to the initial planning work reported herein are as follows:

1. The present work should provide a realistic frame of reference for TEC concept planning in the proximal future, FY 78-83. This should receive major emphasis.
2. As a part of problem definition it is essential to identify Army regulatory and doctrinal changes that will impact delivery systems selection and support decisions at USAFAS in the FY 78-83 period.
3. As a part of problem definition it is essential to predict different course design and development situations facing USAFAS training and resource managers in the FY 78-83 period, and to summarize how these situations impact delivery system solutions and constraints.
4. Decisions on the most appropriate delivery system or systems for a training program must take into account a number of factors, including: (1) nature of the work-training setting(s); (2) characteristics of the subject matter; (3) readily available characteristics of trainees; (4) available or potentially available school and unit training resources; (5) utility to USAFAS training supervisors and field artillery unit job-training supervisors; (6) constraints--cost, leadtime, facilities, developer capability and availability, and the applicable Army regulatory directives and specifications.

5. Optimal delivery system decisions should be based on an integrated plan for individual-collective training and evaluation requirements. This can be the outcome of successive decision stages keyed to life-cycle phases of a system or specialty training support program. Decisions should be based upon the appropriate priorities and types of data available in each phase; rather than complex analyses attempting to deal with all variables mechanistically at once, or narrow data on only a few variables.

6. Results of this work should allow creation of a decision plan and procedures for media selection based on desired behavioral changes, and which can be evaluated by mission/job performance and attitudinal measures, as well as relative cost-utility indices.

D. TASK OBJECTIVES

The immediate objectives of the current planning task are to:

1. Identify the DA/TRADOC regulatory initiatives and delivery system initiatives underway having implications for USAFAS and Field Artillery training and evaluation resources utilization in the FY 78-83 period.

2. Identify selection, solution, and constraint factors influencing delivery system decisions. Determine types of training development situations predicted to impact USAFAS during FY 78-83 and contrast these on the delivery system selection, solution, and constraint factors.

3. Determine a rational set of delivery system decision stages within activities and events of a system-job and specialty life-cycle proponency management model. Describe the selection factors, decisions, and types of data appropriate to each stage. Determine the need for an individual-collective training and evaluation plan to make decisions visible, focus development on an integrated set of requirements, and provide rationale for resource demands.

4. Identify types and specific examples of delivery systems for individual-collective training and evaluation which will be available or are potentially available to field artillery units and/or USAFAS during FY 78-83, either from USAFAS or other TRADOC/DA sources.

5. Provide a plan for reviewing, developing, and evaluating with USAFAS and ARI the preliminary delivery systems decision and management control model presented in this report.

6. Provide a plan for the export of USAFAS-produced CAI to a FORSCOM unit, and for the evaluation of CAI training in the unit setting.

The objectives for subsequent work phases are to:

1. Obtain USAFAS/ARI concurrence and revisions to the frame of reference and preliminary delivery systems decision plan contained in this report.

2. Further detail and develop the delivery systems selection procedures, define data sources, and specify products which incorporate Army priorities.

3. Pilot test the application of the delivery systems selection procedures in an appropriate training program development activity at USAFAS; gather data, evaluate the procedure, and revise components in accord with findings.

E. SCOPE AND APPROACH OF CURRENT TASK

The approach to this planning task supported the objectives and assumptions.

Collect and Review Information. During a visit to USAFAS in August 1976, SDC personnel discussed priorities for this task with Training Development and Course Development managers, observed specific delivery systems in use for training and evaluation of fire detection/direction and command-post exercises, and obtained references on specific methods and devices. During the TEC-CAI

conversion period at USAFAS in March 1977, discussed with Course Design, Course Development, and Training Development supervisors delivery systems selection decisions, hand-offs, and problems as experienced by USAFAS; obtained and reviewed regulatory and guidance documentation. In April 1977, at TDI,* discussed and reviewed a number of recent TRADOC initiatives and doctrinal changes in areas of joint TRADOC/DARCOM total systems management, service school life-cycle proponency as user representative of field forces, integration of technical documentation and training (ITDT) specifications; responsibilities and roles of service schools, the TRADOC System Managers, and other TRADOC groups; and delivery system innovations being assessed for future applications.

Identify Army Training Doctrine and Developments Impacting Training Resource Selection and Utilization FY 78-83. In May 1977, information from USAFAS, TDI, and SDC was reviewed to define major development situations applicable to USAFAS during FY 78-83, and to summarize impacts on delivery system constraints and available solutions.

Design Preliminary Delivery Systems Selection Model. During April and May, information from the above two problem definition steps was synthesized into four delivery system decision stages, compatible with events and technical-management products of a total system and MOS life-cycle proponency management model. Decision factors and decision data appropriate to each stage were identified, and the decision described.

Identify Delivery Systems for USAFAS/Field Artillery Individual-Collective Training and Evaluation. Information on training and evaluation resources collected in the earlier steps was summarized as to availability and capabilities, providing a database for future analysis and expansion.

*The Training Developments Institute of Army Training Support Center, TRADOC. Formerly named TMI (Training Management Institute).

Provide a Plan for Further Development and Evaluation. A continuing three-step workplan was defined to permit review, revision, detailing, applying, and evaluating the preliminary delivery systems selection framework set forth in this report.

Provide a Plan for Export and Evaluation of CAI in a FORSCOM Unit. A plan was generated containing requirements for exporting and evaluating USAFAS-produced CAI in an Army field unit setting (Ft. Hood).

F. ORGANIZATION OF REPORT

- Executive Summary
- Section 1 - provides the background, purpose, assumptions, objectives, and approach for the current and longer-range goals.
- Section 2 - summarizes a number of DA regulatory and doctrinal initiatives, as well as resource development trends, to suggest the external context within which USAFAS delivery systems decisions will be made during FY 78-83.
- Section 3 - identifies primary selection, solution, and constraint factors influencing delivery system decisions. Postulates five training program development situations predicted to impact USAFAS during FY 78-83 and contrasts each situation with respect to the decision factors.
- Section 4 - depicts a rational delivery systems selection process as a related series of decisions based upon the activities, available data, and interim products for each phase of an overall system and MOS life-cycle management model. Summarizes the types of delivery system decisions and decision data appropriate to each stage. Highlights the importance of evolving a baseline Individual-Collective Training and Evaluation Plan (ICTEP) as a basis for integrated management of technical developments.

- Section 5 - identifies generic and specific delivery systems for training and evaluation as available or potentially available to field units and/or USAFAS in FY 78-83. Summarizes capabilities and constraints.

- Section 6 - provides a plan for exporting CAI as a turnkey operation from USAFAS to an Army unit and for evaluating CAI packages in the unit setting.

- Section 7 - summarizes conclusions and recommendations.

- Appendices - provide examples, abbreviations, and references.

SECTION 2. TRAINING AND EVALUATION RESOURCES UTILIZATION CONTEXT FY 78-83

Part of the problem facing USAFAS in the FY 78-83 period is the rapid evolution of DA trends and doctrine in the acquisition of systems, integrating combat developer and training developer inputs during system acquisition, changing responsibilities among TRADOC organizations, interfaces with field forces and procuring commands, and the multitude of delivery system options either available for individual-collective training and evaluation or in various stages of development by DA groups (service schools, ARI, ATSC, PM ARTADS, PM TRADE/TRADER, etc.). The purpose of this section is to summarize a number of DA trends and initiatives to provide the context within which USAFAS/Field Artillery unit training resource selection, design, and utilization decisions will be made in the FY 78-83 period.

A. FIRST-BATTLE-WIN READINESS

The 1973 Arab/Israeli war has greatly impacted on the way the Army intends to fight the next war. The lethality of modern weapons dictates a briefer, more violent warfare than ever before. Once hostilities begin, there will be little time to prepare for combat. To attain battle success, the Army is striving to field the best possible weapons, tactics and techniques, and soldiers trained to employ them. A number of system test cases (e.g., LAW, TOW, DRAGON, tanks) attest to system performance gaps between the designed, expected performance of a system and the actual operational effectiveness of a current system manned by its soldier users. This shortfall in weapons capability represents a loss of the resources invested in the weapon system. To ensure being ready to win in advance, Army units must in peacetime acquire and sustain a high degree of job proficiency and combat readiness in applying and maintaining their systems. Ways must be found to make more effective and efficient use of training time and work-training settings in order to achieve the goal of sustained weapons system and job proficiency. In the past, Army unit training and evaluation has relied upon use of operational equipment, live

fire exercises, and large tactical maneuvers in the field. Dramatic rises in costs of ammo, fuel, spare parts, and new materiel combined with maneuver area restrictions due to weapons lethality have curtailed this type of training. Realism is also a problem. Live fire exercises permit realism in maneuvers, but no troops shoot back. Tactical field exercises use opposing forces, but not live ammo.

In sum, to optimize battlefield effectiveness by improving individual and unit proficiency, the Army during FY 78-83 will seek training delivery and support systems which: (1) allow high fidelity simulation of modern weapons and modern battlefield environments; (2) are less constrained by safety and less demanding of operational resources (ammo, fuel, parts, range-training areas); and (3) allow unit commanders to more effectively utilize time and personnel available for training.

B. INCREASED NUMBERS, AUTOMATION AND COMPLEXITY OF SYSTEMS

Forty-four major systems will enter the Army inventory between FY 77 and FY 85. Included in this timetable through FY 81 are USAFAS combat and training proponency for fielding TACFIRE and Battery Computer System (BCS) with ECOM (FY 76-77), the XM-204 with ARMCOM (FY 78), SP ARTY M107/110/109/109A Total System with ARMCOM and TARCOM (FY 79), and Towed ARTY with ARMCOM (FY 81).

Artillery sensors, weaponry, guidance, communications, and tactical command-control systems at all levels of field organization from the Forward Observers through DivArty Fire Direction Centers are employing advanced technology with evolutionary plans for increasing levels of automation, miniaturization, system compatibility among echelons, and interoperability with joint-force systems such as TAC and German Artillery. Examples of battlefield subsystems include a variety of implanted and mobile sensors, laser sensors and direction-finders, laser-guided and heat seeking weapons, portable digital communication and graphic display devices, and computer-based information processing at

Bn FDC/DivArty FDC levels which permit information access from fire support elements. Virtually every new weapons system fielded in the future will include microprocessors and automated test gear to semi-automate operational and maintenance functions. This increased automation will continue during the FY 78-83 period to impact technical and tactical warfare doctrine, system and mission performance standards, and the training requirements for those individual soldiers or teams who must employ and maintain Army systems.

With sufficient foresight, much of the automation planned for operational functions can also be adapted to support the training, practice, and evaluation needed to acquire and sustain proficiency in systems use or maintenance. Recent applications of Army tactical computers at Ft. Hood and at USAFAS (TACFIRE) are demonstrating how operational Army computers and communications devices can be adapted to support system user training or MOS-related refresher training during periods when operations functions are of secondary importance. Similarly, a series of truck, tank and heavy engineer equipment simulators are being developed to simulate equipment functions and serve as substitutes for actual equipment. A family of full crew interactive simulators is projected for fielding with the new battle tank (XM-1) and the Mechanized Infantry Combat Vehicle with TOW Bushmaster Armored Turret (MICV-TBAT). The trend to build into Army systems the capability to support the training and evaluation of user-maintenance teams once the system is fielded--called Embedded Training (ET)--can be expected to continue in the FY 78-83 period. This is because: (1) it is realistic to train users at their job duty positions and devices; and (2) the primary equipment costs and certain software costs for training support may already be invested in acquiring the operational system.

C. SOLDIER CHARACTERISTICS, TURBULENCE, AND RETENTION

The military manpower is now costing more than 50 percent of the defense budget. Some of this expense is in high training costs, due in part to the complexity of modern weapons mentioned above, but a principal cost is due to

rapid turnover. In today's Army an annual 50 percent turnover rate or 3 to 6 months in a duty assignment is not unusual. Less than 15 percent of the enlisted ranks are reenlisting, perhaps due to what they see as a real or potential diminishing value of the military career--fringe benefits, permanence, retention of awarded grades until retirement, and retirement benefits. Officer end-strength retention is also showing a problem trend between 1976 and 1977; for example, among Captains with an average of 8 years of service. A recent congressional study notes that the Army and Marines are falling short in recruiting and reserve forces are greatly understrength under the all-volunteer military force. Reasoning for the dramatic increase of ethnic minorities in the Army ranges from the increasing number who are mentally and physically qualified to an "economic conscription" caused by the near-double civilian unemployment rate of minority males. The net effect of all this is a continual entry-level or retraining load and management burden of large magnitude for Army schools and units.

Solutions are not straightforward. Existing trends, and alternatives under consideration, portend any of the following for the FY 78-83 period: (1) revised policies on conscription; (2) revised recruiting and job assignment policies; (3) use of more women in non-combat jobs; (4) tighter initial screening to reduce turnover; (5) closer examination of educational and aptitude standards actually required for service jobs; (6) changes in job rotation practices to favor job competence; (7) job design as part of fielded system and unit organizational design; (8) MOS revisions, or specialty shred-outs more closely related to actual unit jobs; (9) greater focus on the soldier's job competence as the basis for career progress; and (10) work-training programs as the preferred and primary Army instructional situation.

Within these larger solutions, the implications for a training delivery systems selection model appear to be as follows:

- Close attention to job design, including MOS combinations or specialty shred-outs, early in a system or MOS proponency program based upon the anticipated density and abilities of the personnel subsystem pool.
- Priority to training settings and delivery systems which are clearly job-related and allow realistic cues and responses.
- Priority to soldier self-pacing for mastery of individual skills.
- Consider requirements for skills acquisition, evaluation, and sustaining practice in selecting a delivery systems mix.
- Provide alternative delivery systems for the same objectives, where feasible and warranted by training density.
- Simplify the combined pictorial-verbal intelligibility and comprehension burden on trainees by appropriate media selection and care in materials development. Ensure that validation and user testing confirms intelligibility and comprehension.

D. TOTAL SYSTEM MANAGEMENT

In the Army system acquisition process, the personnel subsystem, logistics support, and training support has traditionally been playing catch-up with the materiel system. This has become evident numerous times in operational tests that compared an Army system's expected performance effectiveness against its actual effectiveness when employed by unit users, typically showing a wide performance gap (e.g., DRAGON, tanks). Schools and units have had to operate under a continual "train-up" priority in an attempt to close gaps.

The Total Systems initiative, as exemplified by AR 1000-2 (23 December 1976 draft) says that training, personnel, and logistics support subsystems of a total Army materiel system will be integrated by joint TRADOC/DARCOM effort with the acquisition life-cycle for the operations and maintenance equipment of new and developmental Army systems. The general concept, interfaces, and

resources impact is shown in Figure 2-1. TRADOC is chartered to ensure that the training and personnel subsystem is fielded along with the total weapon system at OT-II. Further, TRADOC combat development decisions must be integrated with training development decisions--an important difference between the TRADOC approach and several other U.S. and foreign training commands. The goal is an integrated logistics support package. The maintenance burden implications for most systems will include automated test gear, simplified training, and simplified technical manuals and job-aids.

Table 2-1 shows how AR 1000-2 will impact the association of training development activities with parallel system acquisition events of the Life-Cycle System Management Model (LCSMM). One goal is an attempt to cut the lead-time for fielding and total life-cycle system costs. The impact of this is that the old Low-Rate Initial Production (LRIP) and associated DT/OT-III LCSMM events preceding a production decision will now be considered non-essential and will not be conducted unless specifically approved by ASARC. The burden is now shifted to earlier operational tests:

> "Operational tests will be conducted in a truly tactical environment, making use of field maintenance, training, manuals, countermeasures, etc. A complete integrated logistic support package and training package must be procured early enough to prepare for and demonstrate during DT/OT-II the adequacy of the training and logistic support packages." (AR 1000-2 draft.)

The implication of this for job support packages including training support materials is that draft synoptic outlines of technical manual critical task lists and preliminary drafts of critical task sequences must be available for input to DT/OT-I. The validated tech manuals and training support package including any prototype simulators must be available for DT/OT-II and related government composite package verification tests.

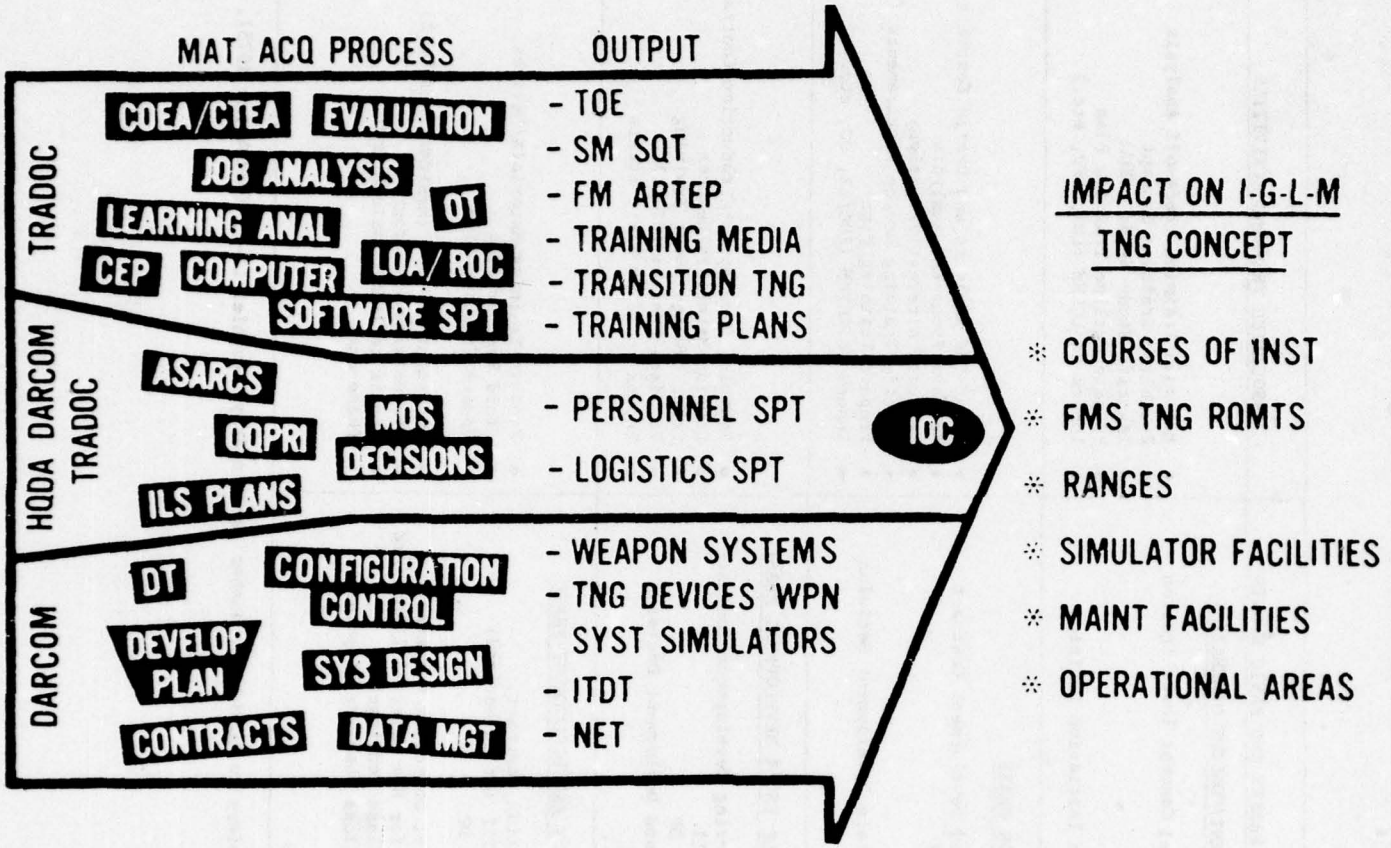

Figure 2-1. General Impact of AR 1000-2 Draft on Total Systems Development

Table 2-1. General Relationship of Training Activities to LCSMM Basic Events

EVENT * #	LCSMM PHASES AND BASIC EVENTS	ASSOCIATED TRAINING ACTIVITIES
	REQUIREMENT/CONCEPT GENERATION	
1	Materiel Concept Investigation	• Materiel/Training Trade-off Analysis
2	LOA	• Establish Training Concept
8	CFP	• Identify Study Needs (MOA)
9	ODP	• Prepare Outline Training Plan
14	Program Initiation Decision	• Inputs to LCSMM (LOA, CFP, etc.)
	VALIDATION PHASE	
16	Advanced Development Contract	• Front-End Analysis and Design Contract
21-22	DT/OT I	• Perform Front-End Analysis
31	ROC/LR	• Evaluate Alternative Designs
33	DP	• Specify Training Device Requirements (TDR)
37/42	Full-Scale Development Decision	• Prepare Training Plan
		• Inputs to LCSMM (ROC/LR, DP, etc.)
	FULL-SCALE ENG'R DEVELOPMENT PHASE	
45	Engineering Development Contract	• Training Development/Production Contract
51-52	DT/OT II	• Develop Materials/Devices
60	Update DP	• Start New Equipment Training
64/71	Prod. and Deployment Decision	• Validate Program (OT II)
		• Inputs to LCSMM Basic Events
	PRODUCTION AND DEPLOYMENT PHASE	
72	Production Contract	• Produce Training Materials/Devices
78-79	DT/OT III (if authorized)	• Field Test Program
82	Update DP	• Update Training Plan
105	IOC	
111	Materiel Objective Achieved	• Implement Program (Resident and Unit)
117	Reqt. for New Materiel Identified	• Evaluate/Revise Program
118	Type Class Contingency	• Inputs to LCSMM Basic Events
119	Type Class Obsolete/Disposal	• Phase-out

Event # refers to LCMM event number used in Army Pamphlet 11-25 (dated May 1975).

E. INTEGRATED TECHNICAL DOCUMENTATION AND TRAINING (ITDT)[1]

This is a recent Army process and product initiative designed to ensure that technical manuals, job aids, and training for system operators and maintenance personnel are engineered as a total job support package for delivery to user commands with the fielded materiel system. Performance of the total weapons system is maximized by ITDT products directed at the novice acquiring and sustaining those individual/crew operator skills and maintenance skills most critical to apprentice and journeyman job duties wherever the system, its personnel subsystem, and unit are located. Draft AR 1000-2 makes ITDT coverage an integral feature of all major new developmental systems; no system will be permitted to enter OT-II without it. Also, the provision of ITDT coverage for selected fielded systems is being accelerated. A joint DARCOM/TRADOC ITDT Working Committee has nominated candidate developmental systems for ITDT coverage in the FY 76-79 period and candidate fielded systems for ITDT in the FY 77-81 period.

Figure 2-2 shows how ITDT activities relate to the equipment acquisition events and logistics analysis inputs in a typical system procurement action. This ITDT process generally parallels the instructional systems development (ISD) process of system job/task analysis, training program design, and instructional program development/validation as guided by TRADOC Pamphlet 350-30. For ITDT, however, the process is modified to provide for the concurrent and integrated development of both technical documentation (simplifying <u>what</u> to do) and training (teaching <u>how</u> to do and providing supportive performance practice with the job materials). Thus, the front-end data collection and analysis is geared to serve both documentation and training development needs; the selection of tasks for training is conditioned by the highly illustrated, simple to read information which will be available in the technical documentation for on-the-job use; and the training is designed to reinforce and supplement the job performance steps presented in the technical manuals.

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[1] TRADOC/DARCOM, "Technical Documentation and Training Acquisition Handbook". Revised 9 May 1977.

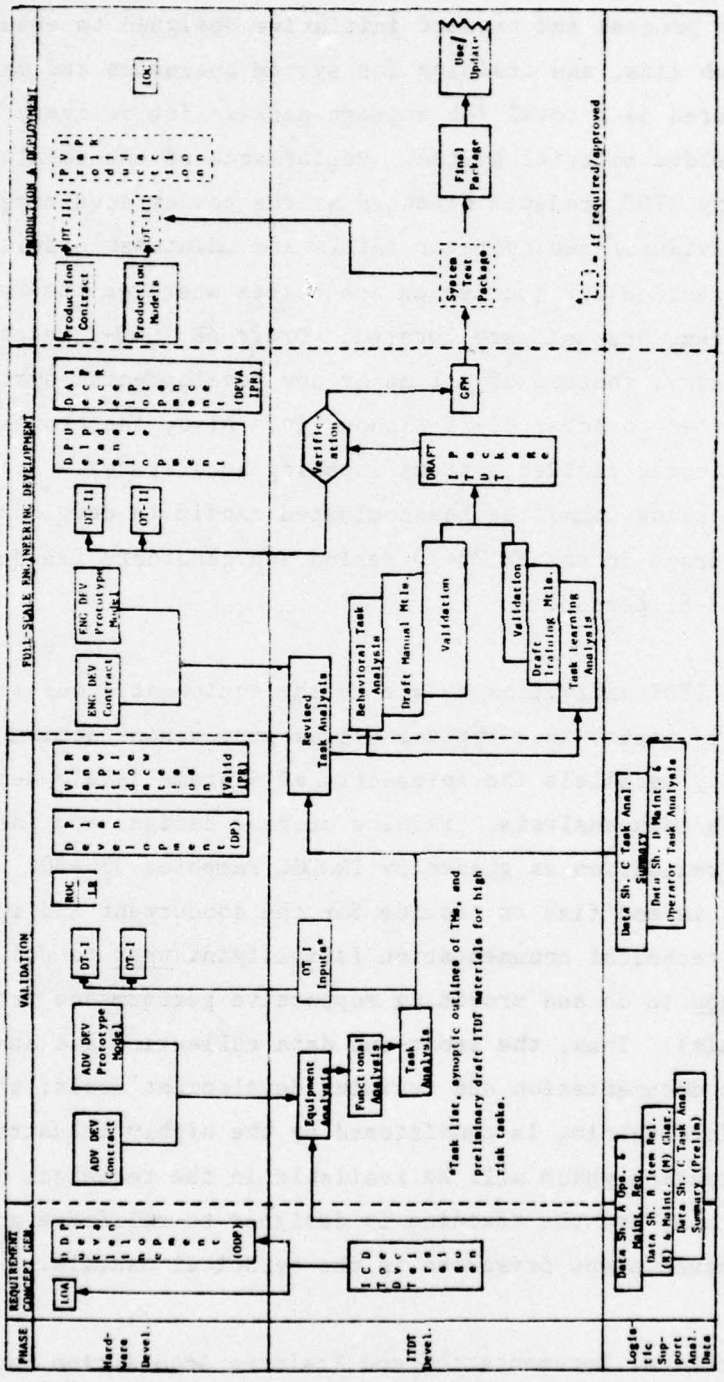

Figure 2-2. ITDT Development in an LCSMM Context

The Army is attempting to put "teeth" into the ITDT process and product requirements by preparing ITDT military specifications covering front-end analysis, operator manuals, three levels of maintenance manuals (organizational, direct, and general support), and supportive extension training products. A draft set of ITDT Mil Specs are undergoing revisions for near-term (FY 77-78) procurement actions, based upon lessons learned from such existing ITDT demonstration projects as Tank Turrets, Wheeled Vehicles, and TACFIRE. Current work is underway on a more comprehensive revision to the specifications for use in the post-78 period. The Army has sponsored parallel preparation of a Technical Documentation and Training Acquisition Handbook to facilitate the joint work of materiel developers and training developers charged with implementing ITDT within the Army total systems life-cycle management model. This document has undergone two revisions based upon joint DARCOM/TRADOC review inputs since distribution of a first draft on 28 January 1977. Also, as part of the TRADOC Staff and Faculty Development Program, TDI is sponsoring the preparation of workshops to target the special ITDT awareness needs of service school senior managers, interface responsibilities of DARCOM Program Managers and TRADOC System Managers, and implementation skills for mid-managers and their technical specialists.

F. LIFE-CYCLE SYSTEM AND JOB SPECIALTY PROPONENCY OF SERVICE SCHOOLS

Service schools are being designated responsible as user representatives for the integrity of a system and its personnel and training subsystems throughout the system life-cycle, from inception to obsolescence. Thus, the USAFAS is proponent for TACFIRE and BCS, and will be proponent for XM-204, SP Arty Total System, and Towed Arty in FY 78-81. This life-cycle proponency responsibility includes MOS proficiency of the personnel subsystem from Army entry-to-exit, maintenance of field forces job proficiency, and overall responsibility for weapons system performance effectiveness. Key aspects of the service school proponency role as user representative include: (1) focus on forces in the field; (2) provide individual training; (3) provide collective training; (4) centralize responsibility in a TRADOC Systems Manager.

1. Focus on Field Forces

The service schools are not viewed as ends in themselves. They must contribute to field forces individual job task and collective mission proficiency by supporting training conducted where the Army systems and jobs are. The goal is about 90 percent unit training and 10 percent institutional.[2] The key to school system technical proponency will be a well done job/duty positional analysis (job analysis) for the main operations and maintenance functions of each weapons system for which the school is proponent. The most critical individual and collective personnel subsystem tasks representing the hard-core of soldier jobs are selected for training. These tasks must be allocated to a training setting and delivery system for acquiring initial competency and sustaining proficiency, considering that there is an increasing need to deliver training and evaluation away from the school. Decisions on the specific specialties, skill levels and jobs to be trained, including choice of training settings and delivery systems rationale will be identified by the user representative in the Individual-Collective Training Plan (ICTP). This becomes the proponent school's game plan for field unit support from which other developments proceed.

2. Individual Training Oriented to Soldier and Job

Individual training is that which is conducted for the soldier to give him the skills and knowledges he needs to do his job. Job-based training will be of the highest priority, recognizing that the soldier's central identification is his job and that individual job competence is prerequisite to collective mission competence. For an Army Weapons or tactical system, jobs include rifleman, grenadier, scout, radio operator, gunner, and artillery control console operator--not the soldier's primary MOS. Individual job training performance standards should be assessed by Skill Qualification Tests (SQT) to determine the

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[2]Gorman, MG Paul F. "The Army Training System." TRADOC Video Tape #777-0461 dated 17 January 1977.

skill level at which the soldier is qualified on critical tasks. The SQT and Job-Book are intended to provide the soldier and his job supervisor with a guide for individual job-oriented training progress and training needs.

3. Collective Training Oriented to System and Mission Effectiveness

Collective training refers to the developing in a group of soldiers, a crew, squad, platoon, and higher levels, those interdependencies and teamwork necessary for effective team performance. The Army Training and Evaluation Program (ARTEP) has been developed to contain mission-essential and performance oriented collective training standards as guidance for unit commanders. The ARTEP highlights the critical tasks which a unit must be able to perform at various collective levels from squad to Division or Force to be successful and survive in battle.

4. Important Role of the TRADOC System Manager (TSM)

A TSM for total system management at the proponent school will be appointed concurrent with a DARCOM Program Manager (PM), preferably early in the system requirements and concept definition phase. Figure 2-3 shows the general role of the proponent school TSMs. As currently understood, the TSM will interface with the school commandant and will have tasking authority which cuts across school resources. His responsibilities include ensuring the critical combat developer's interface with training/course developers in the school, coordination with DARCOM PMs and TRADOC Systems Support Officer (TRASSO) at Ft. Monroe, and representing the system to DCSOPERS and others on Capitol Hill. Thirty TSMs[3] have been identified from MILPERCEN to represent major (24) and non-major (6) developmental systems. Each TSM will have a project staff consisting of an officer for personnel, for training, and for logistics, and a secretary.

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[3]Burdeshaw, BG William. "Army Total Systems Management." Presentation at C. R. I. Sr. Managers Course, Hampton, Va. 20 April 1977.

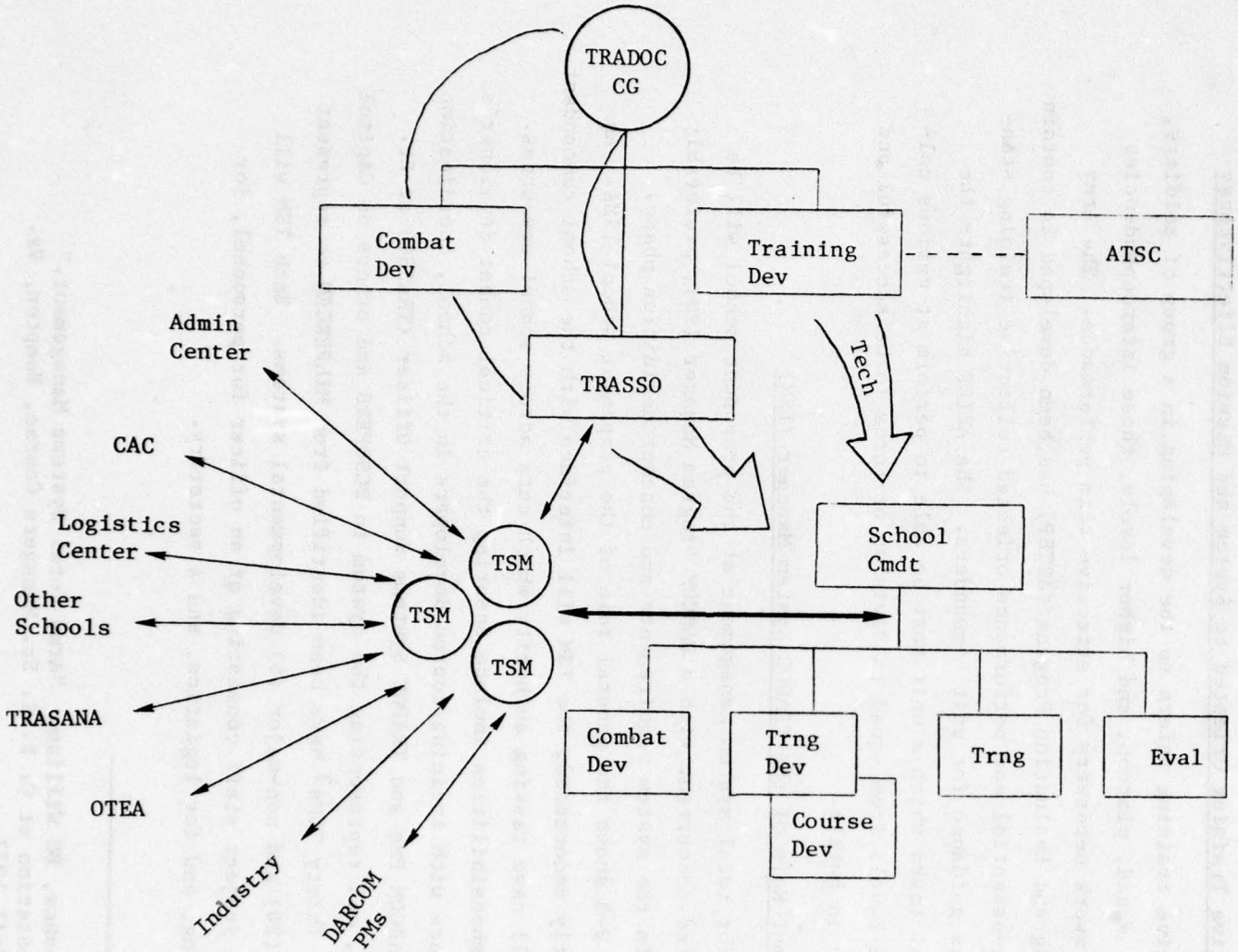

Figure 2-3. Total System Integration Role of TRADOC System Managers

G. VOLUME OF POTENTIALLY USEFUL TRAINING-EVALUATION RESOURCES

A potential problem faced in selecting an appropriate mix of delivery systems is the sheer volume of method-media innovations either fielded, nearing exportable form, or in various phases of exploratory development. Part of the problem is simply awareness of the options. Table 2-2 provides a partial list of the kinds of delivery systems potentially available for packaged export, remote access, integration into systems, or usable at USAFAS for training and evaluation in the FY 78-83 period.

The capabilities and constraints of these delivery systems do vary and will require tradeoff considerations for any given instructional situation. These considerations are summarized in Section 5 of this report.

H. MUTUAL RESPONSIBILITIES FOR TRAINING AND EVALUATION

The changing roles of Army organizations will impact on how and where training resources are selected and utilized in the upcoming five years. Commander, TRADOC will provide policy and guidance for the development, implementation, and evaluation of individual and collective training to meet training needs Army-wide.

1. Field Forces

The responsibility for conducting and managing individual and collective training and administering individual-collective evaluations will primarily reside close to field force jobs and systems (active and reserve), at unit battalion levels and lower. This will be true whether the unit is in-garrison, a local training area, or a major training area. FM 21-6 and TC 21-5-7 provide guidance.

2. Army Service Schools

Service schools, including resident TRADOC System Manager(s), will provide a system, job, and MOS proponency function as user representative of field forces. The responsibility for designing, developing,

Table 2-2. Summary of Training and Evaluation Resources

1. SQT and ARTEP program materials.
2. Combat and Training Literature (FM 100-5, How-to-Fight Manuals, Commanders Manuals, Soldiers Manuals, FM 21-6, TC 21-5-7, Job Books).
3. Army Correspondence Course Program materials.
4. TEC program and Self-Pacing program materials (audiovisual, print, audio).
5. Existing FMs, TMs, and job-aids.
6. Tech manuals, job-aids, and training materials from ITDT programs.
7. Television (CCTV, mobile units, field playback devices, field TVT devices, regional production units).
8. Manual Command/Tactical Exercises (SAND TABLE, board games, TEWTS, CPX Simulation Facility at USAFAS).
9. Computer-Mediated Training Support:
   - Tactical systems Embedded Training (PLANIT)
   - Schools CAI/CMI support systems (ABACUS, PLANIT)
   - Command maneuver and tactical exercises (CAMMS and CATTA; Ft. Leavenworth)
   - Computer-based CPX support (Inter-Data at USAFAS)
10. Training Devices and Simulators:
    - Observed Fire Panoramic Simulator (at USAFAS)
    - Mini-Range Trainer (at USAFAS)
    - Subcaliber Devices
    - Devices and targets from Marksmanship/Gunnery Laser Devices (MAGLADS) program
    - Helicopter Flight Simulators
11. Engagement Simulations permitting two sided exercises:
    - Squad Combat Operations Exercise Simulated (SCOPES)
    - REALTRAIN (permits artillery, tanks, mines, antitank weapons to exercise)
    - Multiple Integrated Laser Engagement System (MILES)
12. Information Storage, Retrieval, Transmission
    - Training Developments Information System (TDIS)
    - Micrographics
    - Videodisk
    - Satellite Transmission

evaluating, and updating of exportable individual-collective training and evaluation methods will reside primarily in the schools. This includes the front-end analysis required to select tasks, training settings, and delivery systems. Schools will also implement training appropriate for conduct at the service school, and individual training courses for implementation in Army Training Centers.

3. Army Training Centers

ATCs will implement training courses provided by service schools and provide subject matter experts to assist service school training development programs as required.

4. Army Training Support Center

ATSC will serve as conduit for access by schools, units and soldiers to all forms of materials produced under the Army TEC, Correspondence Course, Combat Literature, and Training Literature programs. The responsibility for reviewing, integrating, packaging, production, distribution, and inventory control of exportable packages originating in service schools will reside primarily in ATSC. ATSC support will also include a centralized repository of combined arms common-job-task data, as well as centralized record keeping on training evaluation (SQT, ARTEP) results for feedback to unit commanders and support of DA DCSPER and MILPERCEN qualitative personnel management needs.

5. TRADOC Training Developments Institute

TDI will provide a TRADOC Staff and Faculty Program to develop and sustain knowledges and skills in managing, developing, implementing, and evaluating self-paced performance training for all members of service schools, training centers, etc., and will support service school course development missions with resources of the TRADOC Self-Paced Instruction and ITDT programs.

6. Army Training Board

Responsible for monitoring and providing feedback to proponent schools, ATSC, and TDI on the effectiveness and efficiency of fielded training support systems. Responsible for developing and implementing training management systems for active and reserve field forces.

These roles are being further defined in TRADOC Reg. 350-100-1 Analysis, Development and Evaluation of Individual Training (to be published).

I. SCHOOL RESPONSIBILITIES FOR RESOURCES MANAGEMENT

Presently, and in the foreseeable future, the service schools' most needed and costly resource will be people--particularly officer end-strength and civilian full-time spaces. From a resources management standpoint, the general goals for institutional courses will be to: (1) maintain or increase student loads and course frequency; (2) achieve more student/fewer instructor ratios; (3) reduce overall training time; and (4) reduce instructor contact hours (ICH). To achieve this, more decentralized and less instructor-intensive course design-development priorities will be favored; specifically:

exportable, system/job-embedded, or remote access job training
self-pacing of institutional courses

Figure 2-4 shows the kinds of positive results that USAFAS has achieved from self-pacing of the 82C Survey course--more students input and the course conducted oftener, with both ICH and number of instructors down. Similarly, after redeveloping the ADO Advanced Course at Ft. Bliss, student loads increased by 62 percent, course length was reduced by 19 percent, and ICH went down 11 percent.[4] The incentive to service schools is that the savings from lower ICH can be used to divert manpower to other product workload requirements.

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[4]Thurman, BG M. "Resource Management at TRADOC", Handout and Videotape 909-777-0464-B, TRADOC, DCSRM, 15 March 1977.

	INPUT	FREQ	ONE TIME ICH	INSTR
1. FY76	1636	27	1930	58
2. INITIAL FY77	2259	32	2187	78
3. FY77 REVISED (SELF PACE)	2553	50	685	38

Figure 2-4. Payoff From Self-Pacing 82C Survey Course at USAFAS

Figure 2-5 shows the service school organization design model[5] currently advanced by DCSRM, TRADOC as "School Model 76." Local variations on this model include: Ft. Knox, where the "design" components of the Individual-Collective Training Divisions are moved into the Course Development Division; Ft. Sill, where design and various development activities are merged into another Directorate, Course Developments; and, Ft. Benjamin Harrison with a matrix design for ad-hoc flexibility.

During FY 78-83, the need to integrate training and evaluation analysis, design, and delivery system selection activities in a "baseline-to-design" Individual-Collective Training and Evaluation Plan (ICTEP) for system/MOS life-cycle proponency is predicted to increase. This implies: (1) focus on the TRADOC System Manager(s) for cross-organization integration and decision-making; (2) focus on the Resource Manager for utilizing manpower skills flexibly; (3) coordination efficiencies through less fractionated organization design.

[5] Thurman, BG M. "School Model 76". Handout and videotape 777-0463, TRADOC DCSRM, 31 Jan 77.

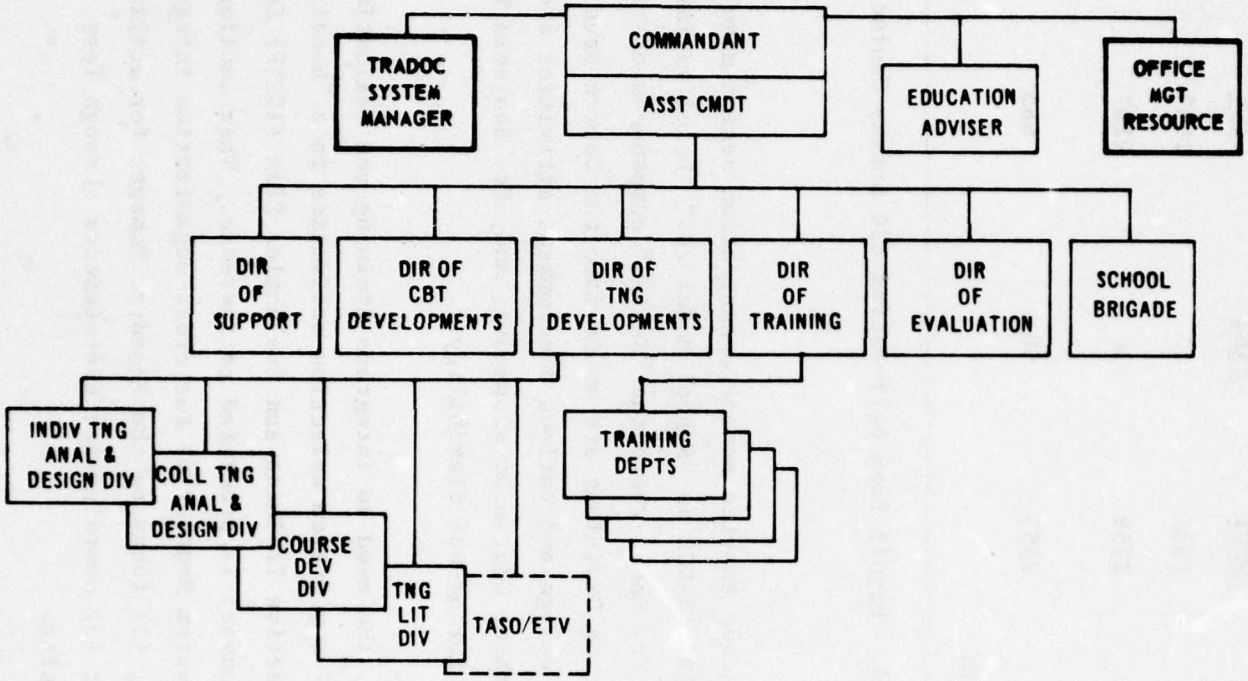

Figure 2-5. System and Resource Managers in School Model-76

SECTION 3: USAFAS TRAINING SUPPORT SITUATIONS FY 78-83

Section 2 described evolving DA/TRADOC regulatory initiatives, guidance, and delivery system trends as the external context influencing training and evaluation resources utilization during FY 78-83.

This section first identifies the various factors that can influence decisions on the optimal delivery systems (method-media mix) for a training program. For any given program development requirement, the realistic solutions and constraints will vary. Several instructional development situations postulated as likely USAFAS requirements for FY 78-83 are described and contrasted in terms of impacts on delivery systems selection factors.

A. FACTORS INFLUENCING DELIVERY SYSTEM DECISIONS

Instructional delivery systems (method-media and media mix) determine how the training is to be presented to the trainee and how the student is to respond. Examples of delivery systems include the instructor or job-training supervisor, books, films, slides, recordings, videotape, computer terminals, simulator devices, and engagement simulations. The selection of delivery system configurations is based primarily upon the type of situational presentations, symbolic or actual responses, and feedback specified for each training module and for successive levels of performance modules within a training program; together with considerations on characteristics of the soldier users. This results in a candidate list which is subject to further scruitiny based upon a number of potential constraints including cost-effectiveness.

Figure 3-1 summarizes the delivery systems selection problem in terms of the factors which can influence decisions on a realistic optimum delivery system configuration for a training program. The "Selection Factors" are the student characteristics and subject-matter characteristics which would be of primary concern, all other things being equal. The "Solution Factors" are those

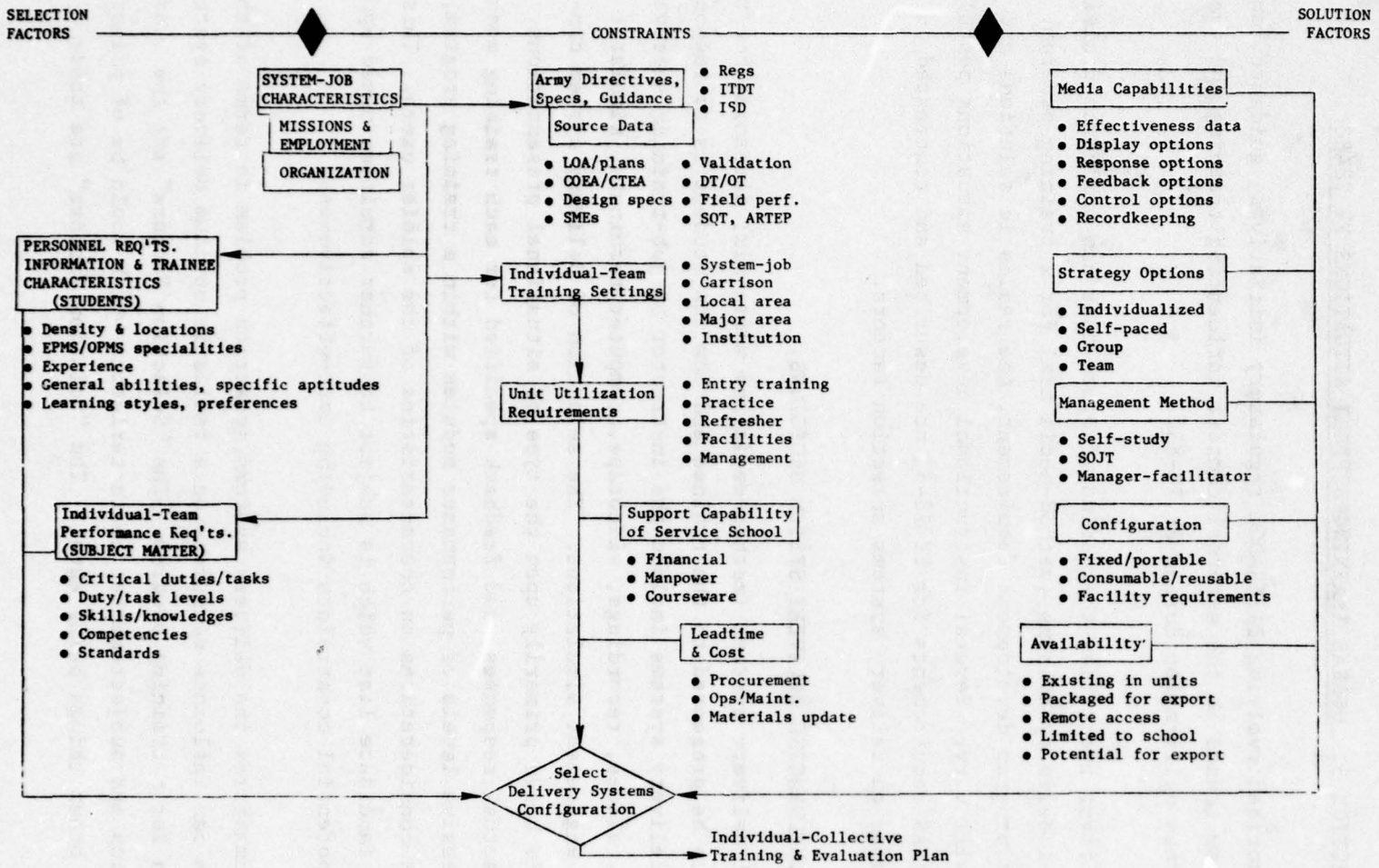

Figure 3-1. Delivery System Selection, Constraint, and Solution Factors

method-media attributes which, ideally, would be matched as closely as possible to requirements of the selection factors to arrive at an optimal delivery system decision. Realistically, however, the "Constraint" factors shown indicate the actual or potential limitations that will condition any decision based solely on student, subject matter, and delivery system considerations.

Several of the constraint factors shown in Figure 3-1 warrant brief mention. There is a major interaction between the selection of individual-team training settings and the selection of delivery systems. The capabilities and/or cost of a particular type of delivery system may be a deciding factor in the training setting selection process; similarly, the training setting may dictate the appropriateness of a particular type of delivery system. Together, an optimal selection of settings and configuration of delivery systems should provide the most effective and efficient training to those who require the training and at the point in time when the training is most needed by the trainees.

The Army/TRADOC regulations and directives chosen to guide a particular training program development activity will serve to define requirements and constrain such factors as potential training settings and candidate delivery systems. For example, AR 1000-2, ITDT Mil Specs, and the Cost-Training Effectiveness Analysis (CTEA) methods in TRADOC Reg 11-8 and TRADOC Pams 11-10 or 11-78 will provide more specific constraints on delivery systems than the general guidance of the ISD volumes (TRADOC Pam 350-30).

The available source data and existing training materials will be a major influence on candidate delivery systems when self-pacing or retrofitting training for a system or specialty already fielded, as compared to the data and existing materials available for input to a new system or specialty training program development.

B. USAFAS SITUATIONAL RESOURCE SELECTION PROBLEMS

Types of development requirements predicted for USAFAS during FY 78-83 are as follows:

Situation

1 - ITDT Coverage of New or Developmental System
2 - ITDT Retrofit to Fielded System
3 - Self-Pacing of MOS Course for Export
4 - Self-Pacing of MOS Course for Institution
5 - Update of Fielded ITDT/MOS Materials

The following paragraphs summarize the implications of each of these requirements on several selection, solution, and constraint factors shown above in Figure 3-1.

1. ITDT Coverage of New or Developmental System

   a. Situation

      USAFAS is designated within the DA total systems management initiative as responsible for the life-cycle proponency of personnel, logistics, and training support including Integrated Technical Documentation and Training (ITDT) coverage for several Army Systems (the Tactical Fire Direction System (TACFIRE), Battery Computer System (BCS), or XM-204.)

   b. Selection Factor Impacts

      Trainee Characteristics. Job design and personnel requirements information--jobs, density and location, EPMS/OPMS plans, manning plans for test and fielding--should be an outcome of personnel subsystem design during the system concept/requirements phase. The front-end analysis phase should obtain data on soldier intelligibility-comprehension requirements for use as design criteria, with trainee profile and performance data obtained from

developmental validation, verification, and DT/OT-II. Job incumbent profile, job performance, training acceptance, and SQT/ARTEP feedback data is obtained after the system is fielded, jobs are manned, and training is implemented.

Individual-Collective Tasks. The main focus for the ITDT job-aid and training support package will be critical operator/crew and maintenance tasks from novice through Skill Levels 1 and 2, apprentice and journeyman. Technical manuals will focus on critical job tasks at all skill levels selected.

c. Constraint Factor Impacts

Primary Regulatory Directives: AR 1000-2 (26 Dec 76), AR 1000-1; ITDT draft Mil Specs for front-end analysis, operator manuals, maintenance manuals, and training materials; TRADOC Reg 350-100-1 (13 Apr 77 working draft); TRADOC Reg 11-8 and TRADOC Pam 11-10 on CTEA; Army Technical Documentation and Training Acquisition Handbook (9 May 77 revision).

Primary Source Data. System operating concept documents, system design specifications, engineering data, system planning and management data, logistics support analysis data, organizational and manning plans, test plans, system design personnel, and combat developer-training developer subject experts.

Training Setting. The goal is to field a complete operator/crew and maintenance job-support package including initial and sustaining training to be available with the fielded system and unit, whatever the location. The primary training setting is the system and job-duty location, or suitable unit self-study areas.

Lead Time and Costs. Lead time for new developmental system ITDT coverage will parallel the overall system acquisition cycle. ITDT

will be relatively well funded, based partly upon lessons learned in current ITDT demonstration projects (Tank Turrets, Wheeled Vehicles, TACFIRE, BCS). Funding will include contracted work for materiel system development and production. It may also include contracted work for front-end analysis, training design, development of training simulation devices, and development of the technical manual and training support packages.

School Support Capability. The proponent school will be responsible for providing combat developer, training developer, course design-development, and evaluation inputs throughout the system life-cycle. USAFAS developers may be required to integrate overall EPMS/OPMS specialty plans with the system and job-duty focus of ITDT coverage. The focal points for coordinating external and internal management of needs and resources will be the TRADOC System Manager (TSM) and Resource Manager at USAFAS. Since one of the goals of AR 1000-2 is to reduce overall life cycle system costs, USAFAS combat and training developers with the TSM may need to provide a mini-COEA/CTEA (TRADOC Reg 11-8) as initial justification for major training development requirements in the concept/requirements generation phase. Then, based upon DT/OT-I results, expansion of the COEA or CTEA may be required before proceeding into production--especially where expensive training simulation devices are concerned.* Assistance for COEA/CTEA preparation can be obtained from TRASANA (TRADOC Systems Analysis Activity). Since ITDT may be contracted-out, USAFAS should be prepared to state requirements for training analysis and design, characteristics of trainees, delivery system criteria,

* Appendix A-3 provides an example of a CTEA (Cost and Training Effective Analysis) for an advanced TACFIRE training system for which USAFAS is proponent.

and product evaluation standards. The methods-media and manpower skills to review and revise ITDT products should exist at USAFAS.

d. Delivery System Solution Impacts

The delivery system under ITDT coverage is the entire job-support package to be fielded with the system. The components of this package are shown in Table 3-1.** Requirements include: (1) Technical Documentation (operator and maintenance manuals) suitable for use by all system personnel, novice to experienced; (2) Training Support Package consisting of job performance guides and a mix of extension training delivery systems, including various training management materials, to permit acquiring and practicing skills needed in applying the technical documentation to critical job tasks. Eligible extension training material (ETM) options include the three primary TEC media tracks, as well as simulation devices, tactical simulations, and computer-mediated training support as appropriate for the object system. The primary eligible training methods are SOJT or self-paced study and practice. Delivery system decisions for ITDT should be integrated and compatible with decisions for object system MOS courses, Soldiers Manuals, SQTs, and ARTEP.

2. ITDT Retrofit to a Fielded System

a. Situation

USAFAS is designated by DA on a selective basis to provide ITDT coverage for a system already fielded; for example, SP ARTY Total System (M107/110/109/109A), and TOWED ARTY systems. The

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**From DARCOM/TRADOC, "Technical Documentation and Training Acquisition Handbook," (draft) revised 9 May 1977.

Table 3-1. Typical ITDT Package Contents

DOCUMENTATION

- Maintenance Manuals (JPM format)*
  - Volume I: Reference Data and Installation Instructions
  - Volume II: Scheduled Maintenance
  - Volume III: Troubleshooting
  - Volume IV: Corrective Maintenance

  or ("new look" format)*
  - TM 9-xxx-xxx-20: Organizational Maintenance
  - TM 9-xxx-xxx-30: Direct Support Maintenance
  - TM 9-xxx-xxx-40: General Support Maintenance
- Operators Manual ("new look" format)
  - Chapter 1: Introduction
  - Chapter 2: Operating Instructions
  - Chapter 3: Maintenance Instructions
  - Chapter 4: Maintenance of Auxiliary Equipment
  - Chapter 5: Ammunition

TRAINING

- Training Management Guide (TMG)
- Student Guide (SG)
- Job Performance Guide (JPG)
- Lesson Administrative Instructions (LAI)
- Student Lesson Sheets (SLS)
- ETM Media Materials (Options)
  - Track 1: Audio Visual
  - Track 2: Written
  - Track 3: Audio
  - Other: (CAI, simulation devices, etc.)

*Manuals will use either JPM or "new look" format, depending on specific system application.

main focus is on integrating technical manuals, job aids, and exportable training into a total system job-support package at an appropriate intelligibility level for the job incumbents.

b. Selection Factor Impacts

Trainee Characteristics. This should include personnel data, performance data, and attitudes of actual job incumbents from Army files, SIDPERS data base, job survey and interview with unit training NCOs. This will permit evaluating problems to determine if solutions should target trainees (e.g., materials intelligibility) or other factors such as system hardware, personnel selection, or unit organizational effectiveness.

Individual-Collective Tasks. Same as for Situation 1, critical operator/crew and maintenance tasks. This may or may not include redoing the front-end job task analysis depending upon an assessment of existing job and performance problems and effectiveness of existing training and technical manuals.

c. Constraint Factor Impacts

Primary Regulatory Directives. Same as for Situation 1, ITDT coverage of new developmental systems. However, the start point in the ITDT retrofit process (front-end analysis, materials design, or development) will depend upon an assessment of the adequacy of existing job-training products.

Primary Source Data. Technical publications for the existing system, modification instructions, unsatisfactory condition reports, maintenance bulletins, job surveys of job incumbents and their supervisors, existing unit job-aids and training (e.g., SQT, ARTEP) and combat-training literature (FMs, Soldiers Manuals, etc.).

Training Setting. Same as for Situation 1, the fielded system and unit, whatever the location.

Leadtime and Costs. Leadtime and funding will depend upon the number of ITDT phases to be performed in the retrofit process, the types of technical documentation and training support to be produced, and the impacts on existing manuals and MOS training and evaluation materials. This will also influence what portion of the work is done at USAFAS or contracted-out. Funding estimates for ITDT retrofit of specific Field Artillery System range from 1.5 million to 5 million dollars.[1]

School Support Capability. Same as described for Situation 1. However, a primary USAFAS problem will be to determine how ITDT changes will influence existing MOS courses, Soldiers Manuals, SQTs, and ARTEP and either assure contractor integration or schedule in-house development changes.

d. Delivery System Solution Impacts

Delivery system impacts are the same as discussed for Situation 1. However, efficiency should dictate a close assessment of the existing technical manuals, training packages/devices, and evaluation methods for possible use or adaptation before imposing new development requirements. For example, the primary solution may be redoing the technical manuals in ITDT-specified formats such that they are shown by government verification and developmental/operational tests to meet intelligibility-comprehension requirements for successful task performance. Existing TEC packages, job-aids, and training devices may be sufficient given the ITDT student guide and training management guide. The creation of new manuals, aids, and training materials will create revision requirements to existing SQTs, Soldiers Manuals, TEC, and ARTEP. The tasks, conditions, and standards may also be changed if the retrofit requires a new front-end job task analysis.

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[1] "Record of ITDT Working Committee Meeting, 22-24 September 1976 at Hq TRADOC". Training Management Institute, Ft Eustis, VA. 27 September 1976.

3. Self-Pacing of MOS Course for Export to Units

a. Situation

USAFAS developers are designated responsible for preparing all or portions of an existing MOS school course for self-paced, individual jobs proficiency training for export to and use in field artillery unit job settings or learning center. Recent examples include USAFAS responsibility for preparing exportable packages for branch-unique tasks of the combined arms Operations/Intelligence NCO course, and export of TEC lessons for MOS 13E Skill Levels 1 and 2. Each field artillery battalion is programmed to receive some 400 TEC lessons that will provide self-paced, self-study MOS training and cover many of the job tasks performed in a battalion.

b. Selection Factor Impacts

Trainee Characteristics. Exportable packages are produced for an identifiable pool of existing or potential MOS/job incumbents. The EPMS/OPMS specialty skill level duties and tasks for unit-level job training will normally be specified in the USAFAS-produced Individual Training Plan or Commander's Manual for the MOS. For the selected MOS skill levels, approximate central value, range, and dispersal on AQB/ACB subtest scores, length of service, rank/grade, prior training, years of civilian education, and time in duty position may be available from unit or central DA data files.

Individual-Collective Tasks. Job duties and tasks in the MOS Individual Training Plan, Soldiers Manuals, SQTs, ARTEP and supportive job-task analysis data will be primary sources of critical tasks, conditions, and standards. Tasks allocated

in the Commander's Manual to unit SOJT or self-study, including compatible Soldiers Manual and SQTs for the selected MOS skill levels are the candidate tasks for unit exportable packages.

c. Constraint Factor Impacts

Primary Regulatory Directives. TRADOC Reg 350-100-1 (draft),* TC 351-3 (being revised), AR 611-3 on job-task analysis, SQT Developers Handbook, TC 21-5-3, TC 21-5-7, FM 21-6, and TRADOC Pam 350-30 (ISD). The applicable portions of these directives and guidance will depend upon assessments and decisions on whether or not self-pacing requires redoing the front-end job task analysis.

Primary Source Data. Field feedback data, including job surveys and CODAP (Computerized Occupational Data Analysis Program) outputs. Unit performance data on live-fire, FTXs, CPXs, SQT, and ARTEPS from unit, FORSCOM division, or ATSC data files. Individual Training Plan, Army Subject Schedules/POIs, Soldier's Manuals and Commander's Manual. Existing technical manuals, combat manuals, and job materials-aids.

Training Setting. Per TRADOC Reg 350-100-1 (draft) the candidate training settings for exportable, self-paced job training are garrison, local, and major training areas normally at battalion levels or lower. A self-study training module may be designed for the job site, a unit learning center, barracks, home, etc. An SOJT module is designed for the unit, and training areas/ facilities to which the unit has direct access.

*"Analysis, Development and Evaluation of Individual Training"

Leadtime and Costs. This will vary with the urgency and the magnitude of the analysis, design, and development efforts required. The Individual Training Plan should provide the basis for estimating and allocating school and external support requirements. Funding may range anywhere from one-quarter million to several million dollars for a given exportable course requirement.

School Support Capability. USAFAS training, design, and course developers have the access to subject-experts and skills required for the training, analysis, course design, and course development activities needed for TEC and other self-pacing programs including computer-assisted instruction (CAI). Whether or not USAFAS has sufficient manpower to handle all aspects of analysis, design, development, packaging, and production within funding and time constraints will determine how the work is accomplished: (1) entirely in-house; (2) a joint Army-contractor team at USAFAS; (3) packaging and production contracted-out; or (4) the entire development process contracted-out.

d. Delivery System Solution Factors

The exportable courses will be multi-media, the mix selected as appropriate for the job-tasks being trained and the trainees. Eligible media will include: audio visual, audio only, programmed text, printed pictorials, job-aids, or a combination of these -- all materials which can be packaged and exported to units from a central source such as ATSC. Also, unit television trainers (TVT) allow units to make their own tapes or to use those made by the TASO at Ft. Sill. Student Study Guides, Student Workbooks, and Correspondence Courses are also available for export from Ft. Sill

or ATSC. Computer-Assisted/Managed instruction is also a candidate for access by units, given that units are equipped with one or more interactive terminals, terminal printers, and phone connections to an Army centralized computer facility such as the Edgewood Arsenal UNIVAC 1108.* USAFAS personnel can develop, validate, and update CAI lessons. With the TACFIRE system, the delivery system for computer-assisted operator training and practice is embedded in the system for export when the system is fielded. Other potentially exportable delivery systems include tactical simulation games (TEWTS) and two-sided engagement simulations such as REALTRAIN and, in the future, MILES. Presently, the Observed Fire Panoramic Classroom Simulator at USAFAS shows potential for export to garrison-post training settings having the required facilities and user skills.

With all these existing or potential exportable packages, unit training management materials are essential. The management plan and procedures for a given course should be specifically tailored to the form of training (SOJT, independent self-study), the training setting (job or system, learning center, garrison-local-major training areas) and the particular materials and delivery systems used.

*** See Section 6 of report for further details on unit remote usage.**

4. Self-Pacing of MOS Course for Institutional Use

a. Situation

USAFAS developers are designated responsible for preparing all or portions of an existing or projected MOS school course for self-paced individual training. There may be a requirement to export the course to another Army Training Center. A recent example is the USAFAS self-pacing of the 82C Survey course. Future priorities could include FADAC maintenance and operation, Fire Support Team (FIST) operation, Pershing repair, SR-56 operation, and Artillery Officer Basic Course.

b. Selection Factor Impacts

Trainee Characteristics. Same as Situation 3, except that this could be focused more on Senior NCOs (e.g., skill levels 5-9) and Officer Basic/Advanced OPMS levels.

Individual-Collective Tasks. Same as Situation 3, except that NCO leadership, training, training management and new or specialized skills where USAFAS offers unique capabilities such as use of automated maintenance gear or specialized intercultural language learning, may be the main focus. Similarly, officer platoon leader, organizational effectiveness, and CPX tactical decision-making training may be best for the school situation.

c. Constraint Factor Impacts

Primary Regulatory Directives. Same as Situation 3.

Primary Source Data. Same as Situation 3

Training Setting. Facilities of USAFAS and/or an Army Training Center.

Leadtime and Costs. Same as Situation 3, except that funding may be applied to accomplish the work entirely within USAFAS. Examples where such work has been contracted-out include work at the Ft. Eustis Transportation School to develop three self-paced technical courses for helicopter maintenance and three for water craft technicians; the 440 thousand dollar contract including a soldier validation of learning requirement.

School Support Capability. Same as Situation 3, except that the broader range of usable delivery systems in USAFAS and Army Training Centers and concommitant need for materials development and update may place a burden for more flexible skills on USAFAS course designers and developers. It may also become more taxing on the USAFAS training resource managers to identify appropriate manpower skills across the school and combine them into the teams required for a particular development (e.g., combining scenario development and training management skills for the Fire Control Simulator BT-33 with skills needed for development of other media). Support of the Ft. Sill TASO is available.

d. Delivery System Solution Impacts

Eligible delivery systems include all of those listed for Situation 3, plus the other training and evaluation resources available at USAFAS such as the Fire Control Simulator BT-33, Artillery Direct Fire Trainer, M31 Field Artillery Trainer, CPX simulation facility, language learning centers, and both mobile and classroom television facilities. The co-located TASO may be able to design and produce relatively simple mock-ups,

simulations, and training devices which are low-cost, require little research and development, can utilize OMAP-8 funds, and require short leadtime. If the USAFAS self-paced course is also intended for export to an Army Training Center, this may influence the candidate delivery systems.

5. Update of Fielded ITDT/MOS Packages

a. Situation

Once fielded, ITDT and MOS materials will undergo continuing evaluation to ensure continuing adequacy with respect to user needs. Field users, combat developers, or evaluators may determine that technical or tactical doctrine is no longer appropriate and must be adjusted. A new technological development in systems or jobs changes performance requirements. Inconsistencies are found between the field documentation and the training support package. Any of these situations can cause a requirement to update fielded manuals (combat, technical, training) and/or the training and evaluation materials.

b. Selection Factor Impacts

Trainee Characteristics. No impact in particular, unless changing characteristics or capabilities of the job trainee pool are the cause for update; for example, materials once intelligible to the job incumbents are no longer so, or the ability levels of job incumbents have increased to the point where the materials are too didactic.

Individual-Collective Tasks. Prior front-end job task analysis data must be assessed to determine the required changes in individual skills, team interactions, tools, references, standards, etc.,

caused by the changes. A clear, accessible audit trail of tasks, subtasks, and task hierarchy or relationships will ease identifying change impacts. This is currently a manual data and configuration control operation in service schools. Implementation of the Training Development Information System (TDIS) by Training Developments Institute (TDI) and ATSC in the near future may provide automated remote access assistance to USAFAS for this problem.

c. Constraint Factor Impacts

Primary Regulatory Directives. FM 100-5, TRADOC Reg 350-100-1, Chapters 7 and 8 (draft), AR611-3 on job task analysis, and all others referenced for Situations 1 through 4 as appropriate to the update change requirements.

Primary Source Data. Questionnaire replies or change requests input from field users to Army Training Board, ATSC, or the proponent school, USAFAS. Configuration management and change control inputs designed for the object system. Field and force test reports. Activities and findings from the USAFAS Director of Evaluation. Individual/Collective Training Plans.

Training Setting. Any of those mentioned for Situations 1-4, as appropriate to the change requirement.

Leadtime and Costs. It is highly desirable to minimize the costs and maximize the efficiency associated with determining requirements for updating and providing the follow-up changes to units. There are significant variations in update efficiency and costs among the various media.

School Support Capability. A major problem in updating documentation and training materials is in locating all the areas in which the change must be reflected. As a rule, any deficiency which requires a change in the fielded materials should also be reflected in appropriate intermediate products to provide currency of the data base audit trail. The delivery system and supporting material decisions recorded on an expanded job-duty task matrix and maintained as part of the Individual/ Collective Training Plan will materially assist this effort.

d. Delivery System Solution Impacts

Delivery system decisions should consider the storage media permitting efficient and least costly updates. For example, the cost of only the studio production portion of a normal TV tape at USAFAS has been estimated at $300/minute.* Conversely, a CAI system such as PLATO which is in use by USAFAS, contains an interactive compiler such that changes input to computer-stored lessons from the keyboard are made instantaneously and can immediately be administered for checking or to students. Similarly, it is more efficient for USAFAS to update slides for a Singer Caramate than to update audio-filmstrips for the Beseler Cue-See device.

In some cases it may make sense to have a training delivery system separate from the course developer's updating system to make update of manuals and training materials more efficient. For example, script production is normally carried out as part of the development process for a variety of delivery systems -- audiovisual, audio-only, slides, technical and combat manuals,

*personal communication at USAFAS

videotapes, simulator positions, etc. This printed material could be input and formatted as part of the development process using an efficient computer-based text editor, such as that recently used and accessible from USAFAS on the UNIVAC 1108 at Edgewood Arsenal. Stored in this form, update is immediate and not costly. Listings can be rapidly produced to serve as narration scripts for visual and/or audio productions, or for simulation exercise player inputs.

SECTION 4. PRELIMINARY DELIVERY SYSTEMS SELECTION PROCESS

Section 3 identified the primary selection, solution, and constraint factors influencing delivery system decisions for a training program and contrasted several instructional development situations predicted for USAFAS during FY 78-83 on these decision factors.

This section first suggests criteria to guide the design and subsequent evaluation of a delivery system selection process useful to USAFAS during FY 78-83. Then, a delivery system selection process is presented that takes into account the decision factors identified in Section 3 in a sequence of four decision stages keyed to the events and products of a materiel system and/or MOS life-cycle proponency timeline. The kinds of delivery system decisions appropriate to source data available at successive events is indicated. How the successive decision stages build upon each other and serve as input to an evolving Individual-Collective Training and Evaluation Plan is shown.

A. CRITERIA FOR EVALUATION OF PROCESS

Based upon the frame of reference provided in earlier sections, the nine criteria described below have guided the design of a preliminary delivery systems selection model for the USAFAS training support situations anticipated during FY 78-83. Given a suitable data collection plan, these criteria may also be applied in evaluating the utility and outcomes of applying the process during subsequent developmental work suggested in Section 6.

1. Method Useful to USAFAS Training Programs Development

For the delivery system process to be useful to USAFAS, it should be compatible with existing ISD guidance and practice at USAFAS but--more important for the FY 78-83 period--should be attuned to changing roles and responsibilities of TRADOC/DA groups, trends in delivery system developments, and Army regulatory directives and guidance emerging

for FY 78-83. These directives and guidance include: ITDT process and Mil Specs; AR 1000-2 (draft), TRADOC Reg 350-100-1 (draft), TC 351-3 (under revision); TC 21-5-7 and FM 21-6 for unit training; and the methods of TRADOC Pam 71-10 (with TRADOC Reg 11-8 and TRADOC Pam 71-8) currently suggested as the authoritative guide in the planning, conduct, and review of TRADOC cost and training effectiveness analyses (CTEA). These initiatives have received emphasis in the framework already provided by Sections 2 and 3 of this report. The delivery system decision process described in this section builds upon this framework.

2. Takes Into Account Readily Available Characteristics of Trainees

The delivery system selection process should make use of that available data on trainees which is useful to successive decisions on delivery systems within the phases and events of an overall USAFAS system/MOS life-cycle proponency responsibility. Depending on the phase, the trainee characteristics data considered should be available from such sources as: (1) DA/DCSPER; MILPERCEN, and SIDPERS data files; (2) instruments administered during validation, verification, developmental-operational tests, user field tests, or training implementation; (3) school or unit personnel records; and (4) job training survey data obtained from job incumbents and their supervisors.

3. Considers Capabilities and Constraints of Job-Training Settings

There is a strong interaction between selection of training setting and choice or configuration of delivery systems for training and evaluation. The delivery system selection model should take into account the resources and constraints of the various eligible training settings: (1) in system-on job; (2) garrison, local, and major training areas; (3) unit learning center; and (4) other unit area, barracks, or home. It should also take into account the resources and constraints of Army

training institutions (USAFAS, training/education centers, NCO academics, post installation schools, Reserve and National Guard schools, etc.).*

4. Considers Characteristics of Individual-Collective Job Duties and Tasks

Behavioral performance requirements for progressive levels of individual, group, and collective team skills define the training subject matter and must be a prime selection factor in making delivery system decisions. Once critical tasks have been selected for training, selecting or configuring an optimal delivery systems mix should consider such job-duty task characteristics as: (1) realistic situational cues and responses; (2) tools, equipment, and references employed; (3) skill and competency groupings of tasks by job duty; (4) duty and task performance measures and standards; (5) logical training progression for individual, group, and team behaviors; and (6) requirements for skill acquisition and sustaining practice.

5. Takes Into Account Job Training Resources Existing in Units and School

The delivery system selection process for a training and evaluation program should utilize or adapt to the maximum extent possible, consistent with other problems or requirements, those delivery systems and training support materials already existing in the selected job-training settings--system or job, unit area, and/or school. For example, SQTs, ARTEP, soldier manuals, combat literature, job manuals and job-aids, TEC packages, training literature, correspondence courses, TV videotapes, standard briefing aids (maps, charts, overlays, vu-graphs), and actual equipment or mockups that may be available in unit training settings.

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* See TRADOC Reg 350-100-1 (March 1977 draft). Those eligible training settings are not in direct correspondence to the settings suggested in the ISD model, TRADOC Pam 350-30.

6. Takes Into Account Potentially Exportable School and TRADOC Resources

The delivery system selection process for a training and evaluation program should consider supplementing or replacing existing unit resources with those considered more effective for the settings, levels of training objectives, and practice requirements emerging from needs and job-duty analyses. Candidates for export or unit access may include tactical games, system-embedded trainers (devices/software), and battle engagement simulations.

7. Outputs of Process Useful to USAFAS Developers

The delivery systems selection process should result in decisions which can be supported by USAFAS developers and operations training supervisors. "Support" includes access to development facilities and the manpower skills required to develop and update training materials for unit exportable or accessible training. Support may require the ability to specify delivery system, design, and development requirements including product standards for contracted SOW/procurement packages; then to monitor work progress and evaluate products.

8. Delivery System Products for USAFAS are Usable by Units

The delivery systems process should result in decisions usable by unit training supervisors. This implies that delivery systems and training materials, whether exported to or remotely accessed by units, should include training management guides for students and for job supervisors or training NCOs which proceduralize training management. Further, these guides should be appropriate to the training settings chosen for the delivery systems. The adequacy of these guides and procedures should be assessed during large-group validation, operational testing, and after field or school implementation.

9. Delivery System Products Result in Effective, Efficient, Acceptable Training

The selected delivery systems and support packages resulting from development should result in effective trainee individual job-duty and collective mission proficiency as evidenced by packaged performance tests, SQT (written, hands-on, certification components) and ARTEPs. Efficiency should be evidenced by data gathered during validation, operational tests, and implementation usage in school and field, such as: time to mastery, trainee loads and frequency, number of supervisors/instructors, supervisor/student ratios, and instructor contact hours. Acceptance of the training media and methods should be evidenced by attitude questionnaires administered to subject experts, trainees, and training supervisors during development and implementation usage.

B. PRELIMINARY DECISION PROCESS AND PRODUCTS

The delivery systems selection process described below incorporates the frame of reference provided in Sections 2 and 3, and is intended to satisfy the design criteria described above.

Figure 4-1* shows a system and training development program life-cycle, highlighting four primary delivery system decision stages with associated inputs and technical or management products. Key orientation to Figure 4-1 is as follows:

- The major phases of system development including developmental-operational tests are labeled at the top, with concurrent training development phases directly underneath. The phases shown are compatible with the Army Life Cycle System Management Model (LCSMM) and emerging Total Systems Management directives (AR 1000-2 impact) in that: (1) combat developer, training developer, and materiel

*Figure 4-1, an apron foldout on page 4-17, can be extended to assist reader orientation.

developer inputs are integrated in the events; (2) Low-Rate Initial Production preceding production decision is eliminated; and (3) DT/OT-III or other type of user field test is shown as an ASARC option, to lower the life-cycle system costs and expedite fielding of the system.

- The training development phases, activities, and products are generally compatible with ITDT, ISD, and TEC procurement guidance suitable both for a system-job duty orientation and an EPMS/OPMS specialty focus.

- The process activities and products show outputs of the initial requirements and front-end analysis events driving: first, the design requirements for combat, MOS, and mission/task evaluation materials (How-to-Fight manuals, ARTEP, SQTs, Soldier's Manuals, Commander's Manual) and; second, the design of technical manuals, job-aids, and training support methods, media and materials. This is to encourage the "crosswalk" integration of individual-collective task and mission performance requirements with training and evaluation developments, including the compatible selection of delivery systems for evaluation and training.

- Four delivery system decision stages are highlighted to show the types of decisions that are appropriate to each stage, based upon the available data, work activities, and interim products of each system or training development phase.

- An Individual/Collective Training and Evaluation Plan (ICTEP) is shown as an evolving product for management of technical developments throughout the system and/or MOS training propency life-cycle. It identifies the specific MOS, skill levels, and jobs (operator/crew, maintenance, unit support) to be trained as well as delivery system

decisions. Such a plan is to be produced by the proponent school or TRADOC system manager representing field users. It becomes the training proponency game-plan and should summarize job, task, setting, trainee, and delivery systems' decisions and data against which time, financial, and manpower resources for development are allocated and audited.*

1. Stage 1 - State Delivery System Requirements and Preliminary Candidates

Process: Initially a requirement for system, job, or MOS needs is generated by field forces, combat developers, Army testing agencies, or other sources. TRADOC/DARCOM combat, training, and materiel developers work together to determine system operations and hardware functional design, employment concept, maintenance and logistic support concept, personnel subsystem information and requirements, and training support concept. Personnel subsystem concept should result in decisions on: (1) jobs and duty positions; (2) job locations and density; (3) relation of system-job duties to EPMS/OPMS specialty skill-level structure; (4) manning transition requirements from testing to IOC and subsequent deployment; (5) determining needs for new specialty shred-outs or cross-training; and (6) determining the major Army doctrine, directives, and specifications governing developments. From this, training needs and requirements are generated.

Data Sources: DCSPER, MILPERCEN, and SIDPERS data banks as well as data from Army testing agencies and job surveys are used to generate personnel subsystem requirements information, or QQPRI (Quantitative and Qualitative Personnel Requirements Information) to guide training program requirements, initial selection of candidate delivery systems, and subsequent front-end analysis work.

Delivery System Decisions. The major emphasis at this stage is to use personnel requirements information data and training requirements to

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*Joint TRADOC/DARCOM Letter, "Integrated Technical Documentation and Training (ITDT) for Development Systems," (April 1977 (Draft). TRADOC Reg 350-100-1, "Development, Implementation and Evaluation of Individual Training," March 1977 (Draft).

arrive at a training concept covering needs, settings, loads, frequency, delivery systems, and anticipated results. For delivery systems, the major goal is to state constraints and performance expectations, and make preliminary decisions on candidates. Examples of requirements statements include the following:

- "All delivery systems must be available, or readily exportable, to field units with no special impacts upon operational equipment."
- "Training delivery systems and SQT/ARTEP delivery systems must be compatible and realistic for combat performance requirements."
- "The training program and delivery systems used must reduce the overall life-cycle cost of the proponent school training program."
- "Training approaches and devices shall be designed for a combined pictorial-verbal intelligibility and comprehension level of grade school."
- "Training approaches and devices shall be compatible with ITDT Mil Specs and the DA Technical Documentation and Training Acquisition Handbook."

Such statements serve as constraints or specifications within which initial delivery system categories are selected; for example, exportable audiovisual and print, as well as system-embedded hardware or software simulation techniques may be candidates for the requirements stated above. Assessment of supporting technology for the candidate delivery systems against constraints and requirements may reveal a need for further development; as with a major training device. This, in turn, may require that a preliminary Cost and Training Effectiveness Analysis (CTEA) be performed to assess tradeoffs and provide decision rationale for the Individual/Collective Training and Evaluation Plan.

Outputs: Initial decisions on jobs, MOS, manning, and other personnel subsystem requirements, as well as the training concept and candidate delivery systems are entered into a draft Individual/Collective Training and Evaluation Plan (ICTEP). This states preliminary requirements and is an important start on integrating system, job, MOS, evaluation, and training requirements. For a system acquisition program, the ICTEP also serves as an Outline Training Development Plan for input to the Outline Development Plan (ODP) for the materiel system.

2. Stage 2 - Select Major Delivery Systems Mix for Training Program

Process: The development of combat and technical documentation, MOS-oriented training literature, associated evaluation materials, and supportive training should be based on a common foundation of precisely defined individual-collective job performance requirements data. These data are developed through a process commonly referred to as a front-end analysis (FEA).* FEA entails systematic data collection, analysis, and decision making to provide the basic data and associated documentation and training delivery system decisions needed for designing and developing manuals, job-aids, evaluation, and training materials as an integrated package. Analysis of operator and staff tactical mission functions as well as equipment-oriented operator/crew and maintenance functions results in matrices associating job tasks with duty positions and with equipment. Task data worksheets are then prepared for individual and collective job tasks. These are then analyzed to identify task competencies, select representative competencies and critical task sequences, and prepare a consolidated list of competencies for each job. The resulting matrix associating critical individual-collective competencies with job duty positions can then drive critical task selection for Commander's Manuals, ARTEPs, SQTs, and Soldier's Manuals--as well as providing input to Stage-2 delivery system decisions.

*In a major acquisition, FEA will progress concurrently with system concept validation, following an Army program initiation decision and appointment of a DARCOM Program Manager (PM) and TRADOC System Manager (TSM).

Source Data: The primary source data for delivery system decisions at this stage will include: (1) results of functional, task, and competency analyses from above; (2) experiential data or aptitude-ability data for personnel participating in DT/OT-I; (2) performance results of DT/OT-I; (3) existing training and evaluation resources; (4) any results from feasibility and cost assessments of training device requirements; and (5) requirements stated in the draft ICTEP from Stage 1.

Delivery System Decisions: The matrix associating individual-collective performance competencies with job duties, the selection of critical training tasks, and other source data noted above is used to decide on the major types of devices and materials for the program job, training, and evaluation requirements. Two critical factors for this decision are: (1) initial selection of work-training settings in the Stage-1 ICTEP; and (2) the levels of individual-collective competencies to be trained; e.g., individual equipment skills, individual tactical skills, operator-supervisor coordination, operator-external coordination, command staff, etc., resulting from front-end analysis.

Stage-2 decisions result in two candidate lists: existing delivery systems selected, and selection of potentially available delivery systems requiring development. For example, the existing materials could include tools, test gear, FMs, combat literature, and TEC packets. The developmental delivery systems might include simplified and intelligible technical manuals, computer-mediated training support, and command or engagement simulations.

Outputs: The Stage 2 decisions on delivery systems, with supporting rationale for the overall mix selected for the training program, is used to detail the Individual/Collective Training and Evaluation Plan (ICTEP) in Stage 1. This may include data resulting from a mini-CTEA or full CTEA (TRADOC Reg 11-8) conducted during this phase. At this point, the ICTEP becomes a baseline record of technical decisions with supporting justification to: (1) ensure integration of component products and standards; (2) gauge

estimates of school and external resources required (time, manpower, money, facilities); and (3) provide an audit trail for change control or upward reporting. It also provides TRADOC input to the materiel system Development Plan (DP).

Appendix A-1 contains an example of the selection rationale supporting a delivery systems mix for the TACFIRE advanced training program at USAFAS. Appendix A-3 is an example of a mini-CTEA generated in support of the proposed mix.

3. Stage 3 - Configure Delivery Systems for Specific Performance Modules and Lessons

Design Process: This training design phase utilizes outputs of the front-end analysis and, in fact, may be an unbroken part of FEA leading up to development decisions for a particular program. For a system acquisition, documentation and training design-development will parallel the materiel system Engineering Development phase leading up to DT/OT-II. First, behavioral task analysis details the individual-collective tasks selected during FEA into subtasks. The responses required to achieve the behavioral competency of each subtask, and the situational cues that guide the response are identified. Together, this data indicates the primary sensory modalities and active responses required by the collection of tasks defining each job duty. The outcomes of behavioral task analysis lead directly to development of storyboards for draft technical manuals and to preparation of job performance measures (tests and standards). Criterion and enabling training objectives derived from the task-subtask sequences are prepared. These objectives are then grouped into lessons and sequenced into performance modules. The result is a matrix associating training performance modules and lessons with job-duty positions.* Another important

*Page A-21 shows an example of a matrix associating tactical system duty positions at several echelon levels with a number of performance modules for three functional areas (formats, equipment, and procedures). It served as a baseline for the CTEA estimates also contained in Appendix A-3.

decision finalized at this stage is the training setting for each performance module. Current guidance suggests candidate settings as: (1) system-embedded, (2) SOJT; (3) self-study; (4) garrison, local, or major training areas; and (4) institutional.

Source Data: The task data, performance measures, lessons list, job duty/performance module matrix, and training setting decisions from the design process are the primary data influencing Stage-3 delivery system decisions. Another source is the soldier profile and performance data obtained from DT/OT-I (for training associated with system procurement) and used to update the ICTEP based upon the results of DT/OT-I. Job survey data including CODAP, Army data files (e.g., GT and ACB subtest data), and Army field evaluation and user support agencies (e.g., Army Training Board, MASSTER) may be useful sources of soldier data prior to actual data obtained during small-group and large-group validation.

Delivery System Decisions: The Stage 3 focus is to select the specific type and mix of delivery systems for each performance module. This is based on the individual-collective training and evaluation requirements of the module, the training setting, and available soldier data that is useful. Similarly, the specific method-media for each lesson is selected. Both the performance module and lesson level decisions must consider the requirement for demonstration, situational displays, active responses, drill, evaluation, and sustaining practice. These considerations will usually lead to compatibility of methods-media mix for lessons within a performance module.

Another consideration at this stage is the feasibility and desirability of providing alternative delivery systems for the same training objectives. This may be desirable if there is evidence that trainee abilities, cognitive-perceptual style, or preferences will vary substantially. However, such evidence may not be available until after large-group validation, verification, or DT/OT-II. Training setting, cost, and other constraints may limit feasibility.

Design Outputs: The primary Stage-3 outputs driving development activities are the task data, performance measures, lessons list, job-duty/performance module matrix, and Lesson Design Approach (LDA) documents. Each LDA specifies exactly how the learning objectives for that lesson will be achieved. The LDA will typically include:

- Lesson Identification: title and number.
- Lesson Relationship: relationship to other lessons.
- Lesson Strategy: how the lesson will be developed (an overview of the lesson stating what the soldier will be taught, lesson prerequisites, sequence for achieving each learning objective, instructional method, and presentation media).
- Lesson Outline: topic headings and training objectives supported by each.
- Pre and Post Test: recommended tests for validating/verifying the lesson and measuring student attainment of learning objectives.
- Administrative Requirements: needed to support the lesson (equipment, materials, etc.)
- Utilization Rationale: how lesson design fits with normal unit work/training cycles and with soldier progression.

Examples of LDAs for audiovisual and CAI lessons are shown in Appendix A-2.

Development Process: Based on the defined LDAs and the overall performance module requirements, the training and evaluation materials supporting the entire system-job/MOS performance package are prepared for the selected delivery system(s)

The training and evaluation management guides (student guide, training supervisor guide, lesson administrative instructions, test administration booklets, progress charts, etc.) are very important to utilizing the media. This will be especially true if alternative methods-media for the same objectives are selected and configured for trainee preference or assignment.

The training and evaluation materials are then validated in a sequential manner through tests involving successively larger groups of soldiers representative of the target population--leading up to government verification and/or DT/OT-II for system oriented products. During these stages, data is gathered on training effectiveness, efficiency, costs, management utilization, and acceptance by trainees and training supervisors. In addition, experiential questionnaires, observational records, and other instruments assessing preference or learning style may be administered as part of the training management sequence.

Development Decision and Outputs: Based upon validation, verification, and/or DT/OT-II results--including the trainee characteristics data mentioned above--decisions are finalized for the optimal mix, assignment, and utilization of delivery systems. Training management plans are revised in accordance with these decisions. This leads to another update and detailing of the ICTEP baseline plan in accordance with developmental acceptance requirements, and prior to production and fielding of the total system/MOS support package.

4. Stage 4 - Assign Alternatives During Implementation

Process: Once the system/MOS support package is implemented in the training setting, training and evaluation are conducted in accordance with management plans tailored to the training settings and delivery system methods--media mix. The burden for effective utilization should be carried by a designed combination of student guide, supervisor guide, and management

instructions within the media materials--for example, self-evaluation sheets with prescriptive assignments; or assignment of alternative activities based upon automated module pretest and post test records in a computer-based mode. The total training and evaluation job support package, including delivery system and management methods, should contain procedures for obtaining and recording data on the success of training in support of individual jobs and collective missions.

Source Data: This will include all questionnaires, forms, logs, automated records, videotape records, supervisor reports, training NCO reports, SQT data, Job Book records, and ARTEP records specified for the Individual-Collective Training and Evaluation Plan in Stage 3; and implemented in accordance with the training management methods discussed above.

Delivery System Decisions: Stage 4 delivery system decisions deal primarily with assignment or choice among training activities and resources, in accordance with the management plan for the training setting and delivery systems. This may be a trainee choice based upon a performance summary and the options available, a controlled assignment based upon monitored records, or some combination. A second decision is on the effectiveness and user acceptance of the delivery system for supporting job and mission performance.

Output: The primary output is field usage and effectiveness data. This may include surveys of job incumbents and job trainees, job supervisors, and training NCOs; unit SQT, CPX, FTX, and ARTEP results; and results of major combined arms exercises or contingency missions. The proponent school Director of Evaluation, aided by other Army test agencies and Army Training Board, should assess such data to determine impacts on the Individual-Collective Training and Evaluation Plan.

In summary, four decision stages have been defined for selecting, configuring, and managing the assignment of training and evaluation delivery systems. These decision stages are:

Stage 1 - State Delivery System Requirements and Preliminary Candidates

Stage 2 - Select Major Delivery Systems Mix for Training Program

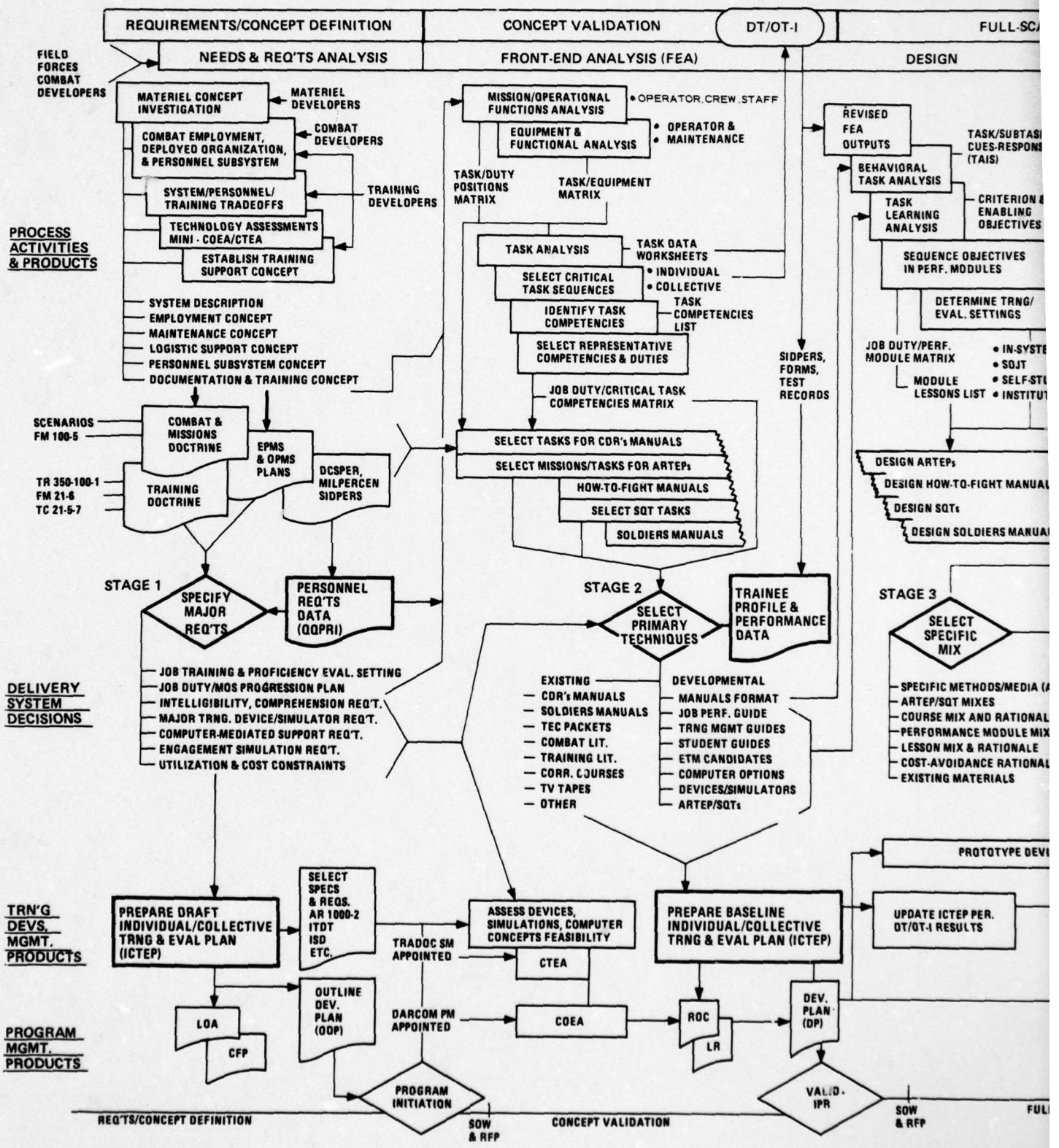
Stage 3 - Configure Delivery Systems for Specific Performance Modules and Lessons

Stage 4 - Assign Alternatives During Implementation

The Individual/Collective Training and Evaluation Plan (ICTEP) is considered a key tool for integrating technical requirements, developments, and school resources in an overall system and/or MOS proponency responsibility to field users.

Significant also are the management plans and procedures for resources utilization and data collection during the conduct of training. These plans must be tailored to the work-training setting, users, level of training objectives (individual, group, team, system), training resources, and data collection requirements of the training setting. Training management procedures are an essential part of the total delivery system configuration process.

SYSTEM DEVELOPMENT PHASES &



T PHASES & TRAINING DEVELOPMENT PHASES

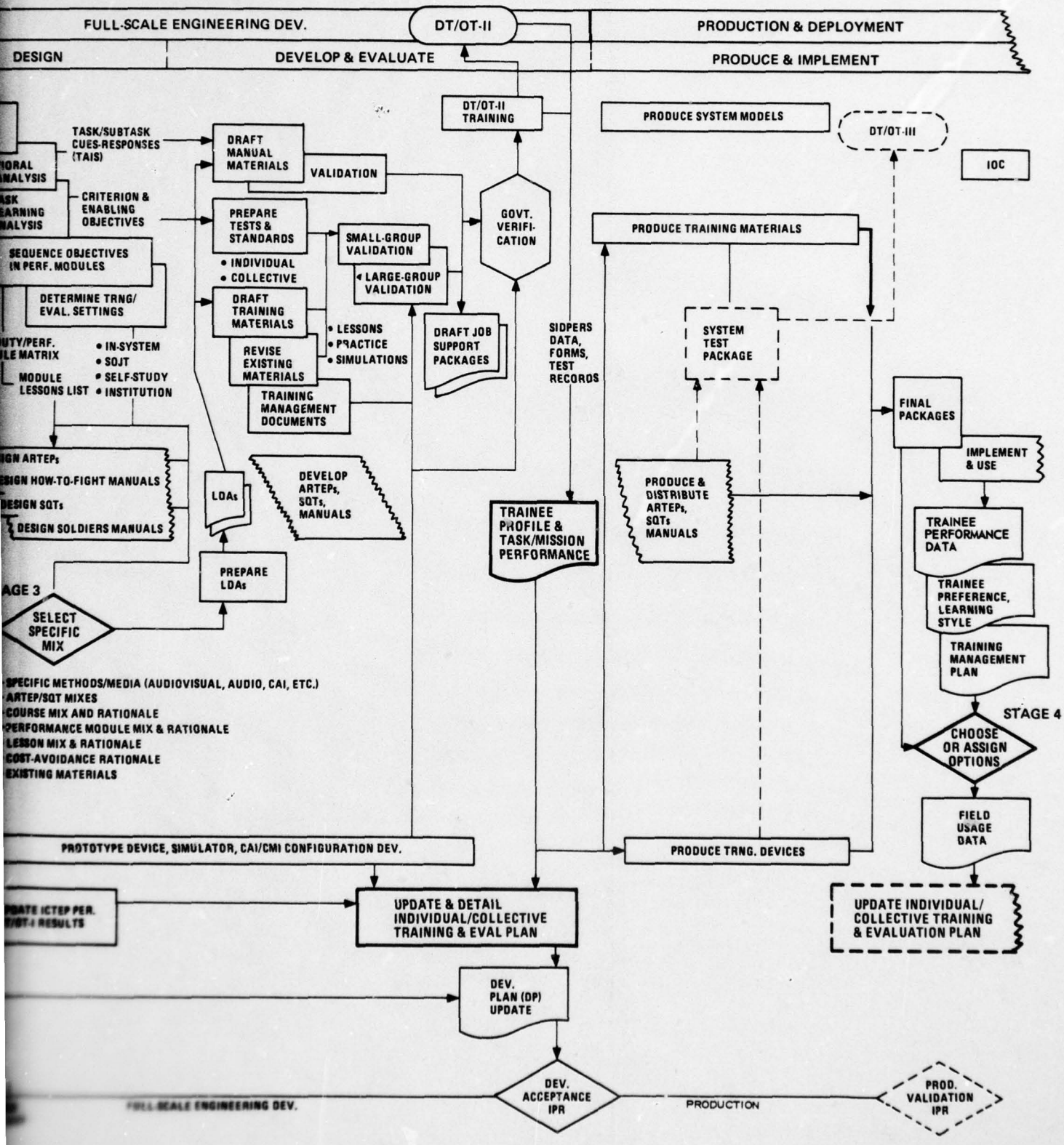


Figure 4-1. Relationship of Delivery System Decision Stages to Life-Cycle Proponency Process and Products

SECTION 5. CHARACTERISTICS OF CANDIDATE DELIVERY SYSTEMS

Sections 3 and 4 have identified the primary trainee and subject or job-duty task selection factors and the constraint factors bearing on delivery system decisions. The third component is the solution factors--characteristics of methods-media and specific delivery system configurations for field artillery training

This section identifies various generic and specific types of delivery systems currently available or potentially available for USAFAS/unit file artillery training in FY 78-83, sumarizing certain characteristics useful for support of individual-collective training and evaluation.

A. BASIC DELIVERY SYSTEM CHARACTERISTICS

A delivery system, as considered herein, is any method containing plans and procedures for the presentations, responses, feedback, and management of individual, group, or collective team training and evaluation. Thus, delivery system components include presentation and response media (e.g., job manuals-aids, job equipment and tools, devices and materials for training display and response) as well as training management guides appropriate to the method, materials, and setting.

Delivery system methods and media are of special interest in the training acquisition process due to their implications for the production, distribution, delivery, storage, and updating of training program materials as well as their impact on the cost and effectiveness of the program. In some cases, the delivery system may include the capabilities for building and updating the training materials (as with the PLANIT computer-assisted instruction system); in other cases, such as TEC audiovisual, the production and update capabilities stand separate from the primary delivery system (Beseler Cue-See and audio filmstrips).

Delivery system methods may be categorized using various classification schemes. These include where the instruction is to be presented (classroom, study carrel, home, or work environment); how it is to be presented (lecture, seminar, demonstration, or practical exercise); what the student is to do (listen, read, observe, respond, or perform); the mode of presentation (group or individual); the nature of student participation (interactive or passive); the manner of student progression (lock-step or self-paced); and how the instructional sequence is to be managed (instructor, student, or media managed). TRADOC Reg 350-100-1 (March 1977 draft) suggests and defines three forms or methods of individual job training: (1) structured on-the-job training (SOJT); (2) independent self-study; and (3) institutional training. FM 21-6 and TC 21-5-7 offer a variety of methods useful for individual proficiency and collective mission training, keyed to (G)arrison - (L)ocal - (M)ajor training area facilities.

Delivery system media are the means used to present instructional and situational practice information to the student, and for the student to make symbolic or actual responses. As in the case with instructional methods, instructional media can be classified and described in multiple ways. One such classification and listing of representative media is shown in Table 5-1. A summary description of each of these media, containing a synopsis of advantages and limitations, is presented in Appendix B.

Often, methods and media capabilities of any specific delivery system are closely interdependent. For example, the USAFAS Fire Control Simulator BT-33 and the Observed Fire Trainer (OFT), M31 Field Artillery Trainer, or TACFIRE computer-mediated embedded training system each represent a total delivery system configuration of media and method.

Table 5-1. Representative Instructional Media

Instructor with Standard Aids

1. Instructor/Training Supervisor
2. Charts and Display Boards
3. Overhead Transparencies

Printed Materials

1. Standard Printed Materials
2. Programmed Instruction Texts
3. Microform

Audio Visual

1. Audio Tapes
2. Slides and Sound-Slides
3. Filmstrips and Sound-Filmstrips
4. Motion Pictures and Sound Motion Pictures
5. Television and Video Recordings

Training Devices and Simulators

1. Teaching Machines
2. Models and Mock-Ups
3. Hardware Simulator-Trainers
4. Actual Objects

Computer Mediated Training Support

1. Computer Managed Instruction (CMI)
2. Computer Assisted Instruction (CAI)
3. Computer-Based Team Training

More detailed summaries of generic media characteristics (attributes) can be generated. These provide a summary data base against which requirements of subject-matter/job-task characteristics and trainee characteristics can be compared in the initial screening of media candidates. Figure 5-1, an apron foldout on page 5-7, illustrates a summary rating on attributes of various media types.

Figure 5-1 is a Training Techniques Selection Matrix defined by SDC for the first-stage selection of decentralized training techniques for a tactical weapons command/control system. The matrix details the capability of various generic training media techniques to satisfy any given set of display, response, and strategy parameters of command-control system training requirements. The top partitioning of the parameters into the display, response, and strategy capabilities of training media techniques are intended to be maximally compatible with behavioral statements of functions, tasks, or training objectives which specify the training condition (display), trainee behavior (response), and the type of instructional interaction (strategy) required. The display, response, and strategy parameters used in this matrix reflect careful consideration of the functional skill and knowledge training requirements for each of five levels of command-control training requirements.[1]

The training media techniques listed on the left-hand side of the selection matrix fall broadly into four categories: (1) audiovisual media typically associated with classroom-group or individual instructional carrel usage, omitting those media which are multiples or special cases, such as multichannel TV, dial-access audio, and language labs; (2) hardware-oriented techniques, such as actual gear or dedicated simulator-trainer hardware; (3) methods

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[1] the media techniques, and the media parameters at the top of Figure 5-1 are defined in: Bennik, F., Fallentine, B., Mower, R. Joint Surveillance System Training Requirements Analysis Study: Volume I - Study Analyses (Appendices G & H), SDC TM-5588/000/00, 31 October 1975.

that merge computer software support with other forms of group or individual training media, such as computer-managed instruction (CMI); and (4) combined hardware/software techniques which use operational consoles for individual positional training and for interaction training among console positions internal and external to the command-control center.

Ratings within the matrix cells of Figure 5-1 are intended to indicate the relative suitability of each training media technique to meet each display, response, and strategy parameter listed across the top. The ratings are defined as follows:

Blank - Training technique is not suitable.

1 - Training technique is clearly suitable.

2 - Suitable only with special response device or other modification.

3 - Suitable only with instructor control for individual or group training (i.e., there is no response acceptance and evaluation capability inherent in the generic media technique).

The strategy "interaction" parameter is intended to show the extent to which a training technique contains integrated response control of successive presentations. In addition to the primary rating above, the following encoding is used:

X - Contains integrated response control of presentation.

Y - Presentation can be controlled by separate and specialized response subsystem.

Z - Presentation is not controllable by response without an instructor to obtain and evaluate responses.

It is evident that these ratings are primarily qualitative distinctions with respect to the capabilities of the training media techniques defined generically in Appendix B to meet display, response acceptance and evaluation, and group or individual interaction training requirements. The human instructor is neither

TRAINING TECHNIQUES SELECTION MATRIX

	TRAINING TASK CHARACTERISTICS / TRAINING MEDIA TECHNIQUES	DISPLAY PRESENTATION PARAMETERS																RESPONSE PARAMETERS											
		VISUAL											AUDITORY			TACTILE		VERBAL/SYMBOLIC					PERFORMANCE						
																			SPECIFIC RECALL										
		ALPHANUMERICS	SPECIAL SYMBOLS	2-D SITUATIONAL	3-D REPRESENTATION	STATIC	DYNAMIC	POINT OR VECTOR MOTION	DATE PATTERN MOTION	RATE/DISTANCE CHANGES	OBJECT/GROUND CONTRAST	COLOR CUE	SIGNAL CUE	TONE DISCRIMINATION	SPEECH COMPREHENSION	SIZE/SHAPE CUES	POSITIONAL CUES	CHOICE SELECTION	WRITTEN	PICTORIAL	ORAL	COMPOSED/CREATED	INDICATION	MANIPULATION	READ/INTERPRET	LISTEN/INTERPRET	VOICE COMPOSITION	SITUATION EVALUATION	
I	OVERHEAD TRANSPARENCIES	1	1	1	1	1		1	3	3	1	1																	
	AUDIO TAPES												1	1	1			2			1	1				1	1		
	SLIDES	1	1	1	1 1	1		1	2	1	1	1						2											
	SOUND SLIDES	1	1	1	1 1	1		1	2	1	1	1	1	1	1			2											
	FILMSTRIPS	1	1	1	1 1	1		1	1	1	1	1						2											
	SOUND FILMSTRIPS	1	1	1	1 1	1		1	1	1	1	1	1	1	1			2											
	MOTION PICTURES	1	1	1	1 1	1		1	3	3	3	3																	
	SOUND MOTION PICTURES	1	1	1	1 1	1		1	1	1	1	1	1	1	1			2											
	MICROFORM	1	1	1	1	1		1	1	1	1	1						2											
	TEACHING MACHINES	1	1	1	1	1		1	2	1	1	1	1	1	1			1	1				1		1	1		1	1
	VIDEO RECORDING	1	1	1	1 1	1		1	1	1	1	1	1	1	1			2					2	2	2	2			
	LIVE TELEVISION	1	1	1	1 1	1		1	1	1	1	1	1	1	1			2			2		2		2	2	2		
	SLOW SCAN T.V.	1	1	1	1 1	1		1		1	1	1	1	1	1			2					2						
	PRINTED MATERIAL	1	1	1	1	1		1		1	1	1						1	1				1						
	PROGRAMMED TEXT	1	1	1	1	1		1		1	1	1						1	1	1		1	1		1			1	1
	PAPER SIMULATIONS	1	1	1	1	1		1		1		1						1	1				1		1			1	1
	CHARTS	1	1	1	1	1		1		1	1	1	3					1	1	1	3		1		1				
	DISPLAY BOARDS	1	1	1	1	1		1		1	1	1	3										1		1				
II	MODELS/MOCKUPS	1	1	1	1 1	1		1	2	2	1	1	1	1	1	1	1						1	1					
	HARDWARE SIMULATOR-TRAINERS	1	1	1	1 1	1	1	1	1	1	1	1	2	2	2	1	1	1	2		3	2	1	1	1	1	1	1	1
	ACTUAL OBJECTS	1	1	1	1 1	1	1	1	1	1	1	1	1	1	1	1	1						1	1	1	1	1	1	1
III	OFF-CONSOLE CMI	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	3	3
	ON-CONSOLE CMI	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1			1	2	2	1	2		1	1
IV	ON-CONSOLE CAI	1	1	2	2	1	1	2			2	2	2	2	2			1	1			1	2	2	1	2		1	1
	ON-CONSOLE CAI & SIMULATION	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1		3	1	1	1	1	2	2	1	1
	CONSOLE-GENERATED SIM TARGETS & ECM	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1						1	1	1	1	1	1	1
	ON-CONSOLE EW SIMULATION EXERCISE	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1				1	1	1	1	1	1	1	1	1
	ON-CONSOLE LIVE EW EXERCISE	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1						1	1	1	1	1	1	1

ATRIX

FORMANCE				STRATEGY PARAMETERS: FEEDBACK					INTERACTION: PACING		SEQUENCING					CONSOLE MODE		SUPPORT MODE					
LISTEN/INTERPRET	VOICE COMPOSITION	SITUATION EVALUATION	DECIDE ACTION	INFORMATIVE	EVALUATIVE	CORRECTIVE	FREQ. IMMEDIATE	FREQ. DELAYED	LEARNER-PACED	PROGRAM-PACED	LINEAR	RESPONSE BRANCHING	HISTORY BRANCHING	REPETITIVE PRACTICE	LEARNER-CONTROLLED	INDEPENDENT	NETTED	INSTRUCTOR-FACILITATOR	INSTRUCTIONAL MONITOR	SIMULATION TEAM	EQUIPMENT OPERATOR	TRAINEE STANDALONE	
				3	3	3	3			3	3	Z	Z	Z				1					OVERHEAD TRANSPARENCIES
1	1			1	2	3	2	3	Y	1	1	2		1	1			1				1	AUDIO TAPES
				1	2	3		3	1	1	1	Z	Z	Z	Y	1		1				1	SLIDES
				1	2	3	2	3	1	1	1	Z	Z	Z	Y	1		1				1	SOUND SLIDES
				1				3	1	1		Z	Z	Z	1							1	FILMSTRIP
				1	2		3		1	1	1	Z	Z	Z	1							1	SOUND FILMSTRIP
				1	3			3		1	1							1					MOTION PICTURES
				1	3			3		1	1							1					SOUND MOTION PICTURES
				1	2	2	2		1		1	Y			1	1						1	MICROFORM
1		1	1	1	1	2	1		1	2	1	1		2	2	1						1	TEACHING MACHINES
2				1	2	2	2	3	Y		1	Y			Y	1		1	1			1	VIDEO RECORDING/PLAYBACK
2	2			1	2	3	3	3	Y	1	1	3						1			1		LIVE TELEVISION
				1	2	3	3	3	Y	1	1	3						1			1		SLOW SCAN TELEVISION
				1	1		1	1	1		1				1	1						1	PRINTED MATERIAL
		1	1		1	1	1		1		1	1		1	1	1						1	PROGRAMMED TEXT
		1	1	1	1	3	1	3	1		1	1			1	1			1			1	PAPER SIMULATION
				3	3	3	3			3	3	Z	Z	Z				1					CHARTS
				3	3	3	3			3	3	Z	Z	Z				1					DISPLAY BOARDS
				3	3	3	3		1	1	1	Z	Z	Z	2	1		1				1	MODELS/MOCKUPS
1	1	1	1	1	1	3	1		1	1	1	1	2	2	2	1	2		1			1	HARDWARE SIMULATOR-TRAINERS
1	1	1	1	1	1	2	1		1	3	1	Z	Z	3	1	1	1	1				1	ACTUAL OBJECTS
3	3	3	3		1,	1		3	1	3	1			3		1			1		1	1	OFF-CONSOLE CMI
2		1	1		1	1	1		1	1	1	1	1	1		1					1	1	ON-CONSOLE CMI
2		1	1		1	1	1		1	3	1	1	1	1	1	1					1	1	ON-CONSOLE CAI
2	2	1	1		1	1	1		1	1	1	1	1	1	1	1	2				1	1	ON-CONSOLE CAI & SIMULATION
1	1	1	1		3	3	2	3		1	1			1	1	1	1			1	1	1	CONSOLE-GENERATED SIM TARGETS & ECM
1	1	1	1		3	3	2	3		1	1						1		1	1	1		ON-CONSOLE EW SIMULATION EXERCISE
1	1	1	1		3	3	2	3		1	1						1	1		1	1		ON-CONSOLE LIVE EW EXERCISE

KEY

BLANK = NOT SUITABLE

1 = SUITABLE
2 = SUITABLE WITH SPECIAL MODIFICATIONS OR DEVICE
3 = SUITABLE ONLY UNDER INSTRUCTOR CONTROL FOR INDIVIDUALS OR GROUPS (NO RESPONCE CAPABILITY INHERENT IN MEDIA)
X = CONTAINS INTEGRATED RESPONSE CONTROL OF PRESENTATION
Y = PRESENTATION CAN BE CONTROLLED BY SEPARATE RESPONSE SYSTEMS
Z = PRESENTATION NOT CONTROLLED BY RESPONSE

(Page 5-8 blank)

2

Figure 5-1. Training Techniques Selection Matrix

assumed essential or unessential to the use of each technique. Rather, the strategy parameter of usage "mode" shows the minimal personnel support required for use of the media technique. Fine-grained distinctions in the capabilities ratings were not made among the media techniques, except where differentiation resulted in differences in capability ratings within matrix cells or where there was a clear differentiation of technique available in the operational setting.

B. SPECIFIC FIELD ARTILLERY DELIVERY SYSTEMS

Representative media attributes (Figure 5-1 and Appendix B) can be useful to get an early fix on the match of requirements for an instructional situation with the capabilities of media to arrive at the prime media candidates for a delivery system. This is especially true when lead time is sufficient to consider the design of new delivery systems, or the selection and re-configuration of existing media into a delivery system. Problems with this approach alone are twofold:

- rarely do specific existing or prototype delivery system candidates fit entirely the generic characteristics.
- a variety of constraints usually have an overriding influence; as was discussed for five instructional development situations in Section 3 and summarized in Figure 3-1.

Therefore, a focus on the specific existing and potentially available resources for field artillery training and evaluation in the FY 78-83 period is also essential. These resources are summarized in Table 5-2 on the next two pages.

Table 5-2. Field Artillery Training Resources Summary

Delivery System	FY 78-83 Availability				Usage Mode			
	Unit & USAFAS	Unit Only	USAFAS – ATC Only	External Source	Job-System	Self-Study	Group Facility	Team Area
1. SQTs	X			ATSC		X	X	
2. ARTEPs		X		ATSC	X			X
3. Combat literature	X			ATSC	X	X	X	
4. Training literature	X			ATSC	X	X	X	
5. Correspondence Course materials	X			ATSC		X		
6. Ops/Intell Job Trng packets	X			ATSC	X	X		
7. Existing FMs, TMs, job-aids		X			X			
8. Actual gear (system, test, tools)		X			X			
9. Standard class aids/graphics	X						X	
10. Standard operations charts/maps	X				X		X	
11. TEC materials: audiovisual	X			ATSC		X	X	
audio-practice	X			ATSC	X	X		
print	X			ATSC	X	X		
12. ITDT manuals & trng packets/devices	FY 77-83			TRADOC/DARCOM	X	X		X
13. Closed-Circuit television (CCTV)			X				X	
14. Mobile television van			X		X			X
15. Videotape playback units	X			TASO		X	X	
16. Television Trainer (TVT)	X			TASO	X			X
17. Language Lab devices & carrels			X			X	X	
18. M31 Field Artillery Trainer	present		X					X
19. Fire Control Simulator BT-33	FY 80-83		X	TRADER			X	
20. Observed Fire Trainer (OFT)	FY 79-80		X	TRADER			X	

Table 5-2. Field Artillery Training Resources Summary (Cont.)

Delivery System	FY 78-83 Availability				Usage Mode			
	Unit & USAFAS	Unit Only	USAFAS-ATC Only	External Source	Job-System	Self-Study	Group Facility	Team Area
21. Arty Direct Fire Trainer (ADFT)	FY 77-78		X	Div/Bde/TASO				X
22. Marksmanship/Gunnery Laser Devices (MAGLADS)	FY 78-83			TRADER/TRADE	X			X
23. In-System Crew Ops Simulators	FY 80-83			TRADER/TRADE	X			X
24. TACFIRE Embedded Training	FY 81-83		X	ARTADS	X	X		
25. TACFIRE Tactical Training System	FY 81-83		FY 79	ARTADS	X	X		X
26. PLANIT CAI/CMI	FY 77-78		X	ARI		X		
27. CPX Simulation Facility with Computer Support (Interdata)			X	USAFAS				X
28. Computer Maneuver & Tactical Exercises (CAMMS, CATTS)				USACGSC				X
29. Manual Tactical Exercises (Sand Table, board games, TEWTS)		X						X
30. Squad Combat Ops Exercise (SCOPES)		X		CATB/ARI				X
31. REALTRAIN Engagement Simulation		USAREUR		TRADOC/ARI				X
32. Multi-Integrated Laser Eng. (MILES)	post-FY 80			TRADOC				X
33. Microform	X			ATSC/TASO	X	X		
34. Micrographics	post-FY 80			ATSC	X	X		
35. Training Developments Info. System (TDIS)			FY 78-80	TDI	X			
36. Videodisk transmit/playback	post-FY 80				X	X	X	
37. Satellite transmission (STAR)	post-FY 80				X	X	X	

Table 5-2 showed a partial listing of those delivery systems projected to be available for field artillery training at unit/USAFAS locations in FY 78-83. "Available" here means either currently existing in units, exportable from a central source, capable of remote-access by units or USAFAS from a central source, or procurable for system-site installation. The availability locations checked include:

- Unit and USAFAS
- Unit only--Bn/Bde/Div Garrison, Local, or Major areas
- USAFAS or Army Training Centers only
- Potential access/acquisition from external source (TRADOC, ARI, DARCOM)

The general usage mode is also indicated.

NOTE: An "X" in Table 5-2 "Availability" columns means that there is a present capability at the location shown.

Figures 5-2a and 5-2b illustrates how the specific delivery systems listed in Table 5-2 above could be compared on characteristics. Figure 5-2a shows comparative display presentation and response attributes of TEC, CAI, and mixes thereof. Figure 5-2b shows similar comparisons on training strategy attributes.

The blank area in Figure 5-2b shows that the matrix could be expanded to include more matching parameters. For example:

1. Suitability for Trainee Characteristics

   a. Trainee general mental ability (low, medium, high GT)

   b. Trainee specific aptitudes (ACB/AQB indices)

      - verbal (comprehension, reasoning)
      - arithmetic reasoning

① MEDIA ATTRIBUTES / DELIVERY SYSTEM • TEC • CAI • MIXED	DISPLAY PRESENTATION CAPABILITIES																RESPONSE CAPABILITIES ②											
	VISUAL											AUDITORY			TACTILE		VERBAL/SYMBOLIC					PERFORMANCE						
																		SPECIFIC RECALL										
	ALPHANUMERICS	SPECIAL SYMBOLS	2D GRAPHICS	3D REPRESENTATION	STATIC DISPLAYS	DYNAMIC SIMULATION	POINT OR VECTOR MOTION	PATTERN MOTION	TIME/DISTANCE MOTION	OBJECT/GROUND CONTRAST	COLOR CUE	SIGNAL CUE	SIMULTANEOUS TONES	SPEECH	SIZE SHAPE CUES	POSITIONAL CUES	CHOICE SELECTION	ALPHANUMERIC	PICTORIAL	ORAL	COMPOSED CREATED	INDICATION	MANIPULATION	READ/INTERPRET	LISTEN/INTERPRET	VOICE COMPOSITION	SITUATION EVALUATION	DECIDE/SPECIFY ACTION
AUDIOVISUAL (BESSLER CUE SEE)	x	x	x	x	x		x	x	x	x	x	x	x	x														
AUDIOVISUAL (SOUND SLIDE)	x	x	x	x	x		x			x	x	x	x	x														
AUDIO CASSETTE AND EXERCISE MATERIALS	x	x	x	x	x						x	x	x	x								x	x		x			
PLATO	x	x	x	x	x		x			x	x											x						
PLANIT STANDALONE (CRT/KEYBOARD)	x	x			x	x											x	x			x	x		x			x	x
PLANIT WITH PICTORIAL HANDOUTS	x	x	x	x	x	x											x	x			x	x		x			x	x
PLANIT WITH BESSLER CUE SEE	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x			x	x		x	x		x	x
PLANIT WITH AUDIO-DIRECTED EXERCISE	x	x			x	x						x	x	x								x	x		x			

SEE STRATEGY ATTRIBUTES

① DISPLAY AND RESPONSE MEDIA ATTRIBUTES ARE DEFINED IN BENNIK, MOWER, FALLENTINE (1975)

② CAPABILITIES CHECKED FOR RESPONSE ASSUME NO INSTRUCTOR

Figure 5-2a. Display and Response Attributes of Selected TEC/CAI Treatments

③ MEDIA ATTRIBUTES / DELIVERY SYSTEM • TEC • CAI • MIXES	STRATEGY CHARACTERISTICS																								
	FEEDBACK										INTERACTION ④														
									FREQ		PACING		SEQUENCING								MODE		
	INFORMATIVE	EVALUATIVE	CORRECTIVE	SUMMARY	IMMEDIATE	DELAYED	LEARNER-PACED	PROGRAM-PACED	LINEAR	ADAPTIVE ENTRY TEST	RESPONSE BRANCHING	HISTORY BRANCHING	REPETITIVE PRACTICE	LEARNER-CONTROLLED	INDIVIDUAL	SMALL-GROUP	NETTED INDIVIDUALS
AUDIOVISUAL (BESSLER CUE SEE)	x					x	x		x						x	x	
AUDIOVISUAL (SOUND-SLIDE)	x					x	x		x						x	x	
AUDIO CASSETTE AND EXERCISE MATERIALS	x				x		x	x	x				x		x	x	
PI TEXT		x	x		x		x		x	x	x				x		
PLANIT STANDALONE (CRT/KEYBOARD)		x	x	x	x		x	x		x	x	x	x	x	x		
PLANIT WITH PICTORIAL HANDOUTS		x	x	x	x		x	x		x	x	x	x	x	x		
PLANIT WITH BESSLER CUE SEE		x	x	x	x		x	x		x	x	x	x	x	x	x	
PLANIT WITH AUDIO-DIRECTED PRACTICE		x	x	x	x		x	x		x	x	x	x	x	x	x	

③ MEDIA STRATEGY ATTRIBUTES ARE A FUNCTION BOTH OF THE MEDIA DEVICE AND THE COURSEWARE THEY ARE DEFINED IN BENNIK MOWER FALLETTIE (1975)

④ FEEDBACK AND INTERACTION CAPABILITIES CHECKED ASSUME TC INSTRUCTOR

Figure 5-2b. Strategy Attributes of Selected TEC/CAI Treatments

- mechanical
- pattern analysis (spatial)
- clerical speed (dexterity)
- radio code skill
- shop mechanic
- information (automotive, electronics, general)
- classification inventory (leadership, self-confidence)

c. Trainee interests--from shop mechanic, information, and classification subtests.

2. Various Constraints; e.g.

a. Relative cost rankings--acquisition, operation, maintenance, courseware development, courseware update.

b. Setting, logistical, personnel support requirements--such as those shown in Section 3 (Figure 3-1).

In sum, these or other specific Field Artillery delivery system data descriptions will need further work. This work is suggested in the development plan, Appendix E.

SECTION 6. EXPORTING THE CAI/TEC PACKAGE TO FIELD UNITS

A. INTRODUCTION

This section describes the methodology for exporting the Observed Fire CAI/TEC package developed by the USAFAS to the field and to an operational FORSCOM unit (e.g., Fort Hood, Texas).

The procedures and resources required are based upon the recent experience at USAFAS reported in the final report.[1] The computer used was the UNIVAC 1108 computer at Edgewood Arsenal, Maryland. If another computer is used, the procedures for accessing the computer and PLANIT may vary somewhat but will be generally applicable. The resources required and internal PLANIT procedures would be the same.

It is assumed that CAI lessons will be executed as they are presently constructed and any changes required would be effected through the U.S. Army Research Institute. Arrangements for use of the system are effected also through the U.S. Army Research Institute (Mr. James Baker, Mr. Arthur Marcus, or Mr. John Larson).

This section is organized to follow the logical progression of obtaining and running the system in a "normal" progression. The order in which the procedures are presented in this section versus the order in which they are executed in running students will probably vary depending upon the time and circumstances of student execution.

The resources and procedures required for implementing the program are covered in the paragraphs that follow. Specific arrangements, e.g., telephone number and account number to use, are arranged by the individuals listed above.

---

[1] Hoyt, W., Bennik, F., Butler, A. "The Effectiveness of Alternative Media in Conjunction with TEC for Improving Performance in MOS-Related Tasks: Final Report". SDC TM-5841/000/01, 5 June 1977.

B. RESOURCES REQUIRED

The resources required for unit implementation include physical resources, computer resources, courseware resources, procedures guide, appropriate students, training records, and training monitor.

1. Physical Resources

a. ADDS Consul 880 (If different console is used, check character set compatibility with courseware and PLANIT.)

b. Telephone (one per console)

c. Telephone modem (one per console)

d. Leased telephone line (one per console)

e. Printer (one per console)

f. Paper for printer (20 roles recommended initially)

g. Power source (outlets - three hole or adapter required)

(1) One for each console

(2) One for each printer

(3) Lighting as necessary

h. Tables, chairs, and workspace (as required)

A typical arrangement is shown in Figure 6-1. Printer should not be visible by the student if used during student runs.

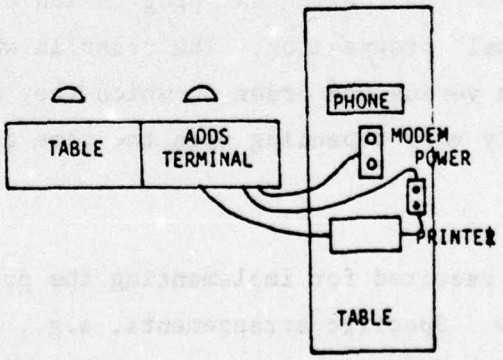


Figure 6-1. Typical Console Arrangement

2. Computer Resources

a. PLANIT CAI system on-line on UNIVAC 1108.

b. Telephone number(s) to access computer

3. Courseware Resources

The CAI, TEXT, and TEC courseware listed under separate headings below cover the same objectives. The TEXT lessons are based upon CAI and CAI is based upon TEC. TEXT and CAI are listed to show the course materials developed on Observed Fire.

a. CAI

The following PLANIT CAI lessons (permanent files) should be on-line on the UNIVAC 1108:

PLANIT Lesson Name	Title
DOD1*	Determination of Direction
DODTA*	Pretest
DODTB*	Post test
TL2*	Target Location: Polar Plot Method and Grid Coordinates Method
TLTA*	Pretest
TLTB*	Post test
TL3*	Locate a Target by Shift from a Known Point
TATL3*	Pretest
TBTL3*	Post test
CFF	The Call for Fire
CFFTA	Pretest
CFFTB	Post test
BCA	Area Fire Mission (Bracketing and Creeping Methods) Part I
BCATA	Pretest
BCATB	Post test
BCB	Area Fire Mission (Bracketing and Creeping Methods) Part II
BCBTA	Pretest
BCBTB	Post test
OFTA*	Observed Fire Module Pretest
OFTB*	Observed Fire Module Post-test

*Off-line course exhibits, available from ARI, are required for the asterisked items.

Lesson listings are available from ARI and are useful in identifying any problem areas which may occur.

The above CAI lessons reflect current tactical doctrine.

b. Text Presentation (Optional)

The following TEXT MATERIAL on Observed Fire, in paper and pencil format, are available from the U.S. Army Research Institute.

Lesson 1. Determination of Direction

Lesson 2. Target Location - Polar Plot Method and Grid Coordinates Method

Lesson 3. Locate Target by Shift from a Known Point

Lesson 4. Call for Fire

Lesson 5. Area Fire Missions: Adjustment of Field Artillery Fire by the Bracketing and Creeping Methods, Part I

Lesson 6. Area Fire Missions: Adjustment of Field Artillery Fire by the Bracketing and Creeping Methods, Part II

The above TEXT lessons reflect current tactical doctrine.

c. TEC Lessons (Optional)

The following are the currently available TEC lessons on Observed Fire.

TEC Lesson No.	Title
#949-061-0001-F	Determination of Direction
#949-061-0002-F	Target Location: Polar Plot Method and Grid Coordinates Method
#949-061-0003-F	Locate a Target by Shift from a Known Point
#949-061-0004-F	The Call for Fire
#949-061-0005-F	The Adjustment of Field Artillery Fire by the Bracketing and Creeping Methods, Part I
#949-061-0006-F	The Adjustment of Field Artillery Fire by the Bracketing and Creeping Methods, Part II

The TEC lessons will be updated by USAFAS, as part of their normal update cycle, to reflect current tactical doctrine.

4. Procedures Guide Required

Procedures are required to turn on the equipment, access the computer, execute lessons, obtain student records, and sign off the system. These are normally executed in the following order.

(1) Connect console to computer.
(2) Declare job to executive system.
(3) Access PLANIT.
(4) ADDLOG student names.
(5) Retrieve and execute CAI Lesson as a student.
(6) Retrieve and execute CAI lesson as an author.
(7) Obtain student records.
(8) Sign off PLANIT.
(9) Sign off computer.

These nine procedural items are detailed in Appendix C-1. Special procedures in Appendix C-1 are Items (A) (in the box on the first page of Appendix C-1) and Items (B) and (C) (at the end of Appendix C-1) as follows:

(A) Correct keying errors before computer entry.
(B) Restore PLANIT (to reliable operating status)
(C) Obtain Table of Contents

Keying errors can occur anytime, either when getting on line or during lesson execution.

Item (B) in Appendix C-1 shows the procedure to use when it is necessary to restore the PLANIT system. This will become evident when lesson execution becomes abnormal, e.g., error messages appear or branching

does not execute properly. It is wise also to restore PLANIT frequently, e.g., daily or every other day to clean out the student record files and other files which may have accumulated after system use. The restore procedure normally follows Item (2) , Declare job to executive system, and is followed by Item (3) , Access PLANIT.

Item (C) shows the steps for listing the table of contents to show what lessons are available for access by students or authors, Items (5) or (6)

5. Student Requirements

The series of lessons are applicable to all soldiers in the combat arms. There is a prerequisite, however, that the individual has had Land Navigation (map reading) and can read a military map.

It is suggested that the Questionnaire(S), Appendix C-2, be filled out by the student to determine that the prerequisite has been met.

6. Records Requirements

The PLANIT CAI system maintains its own records. These are as follows:

a. Student Interaction Record, Figure 6-2. This record is produced automatically as the student progresses through the course, if the printer is on. Everything displayed on the screen or input (responses) via the console is recorded. This record is optional.

b. PLANIT Student Record, Figure 6-3a and 6-3b. These are obtained at the end of the student runs (end of each day) by console action as given in Item (7) , Appendix C-1. The test record, Figure 6-3a, shows the item responses for a student (S2) on the specified test (in this case, lesson name CFFTB). The

```
                    **TARGET LOCATION**

THE OBJECTIVE OF THIS TEST IS TO EVLAUATE YOUR ABILITY TO:

    1. LOCATE A TARGET BY POLAR PLOT WHEN THE TARGET-REFERENCE POINT
       IS KNOWN

    2. LOCATE A TARGET BY POLAR PLOT BY ESTIMATING DATA FROM A MAP

    3. LOCATE A TARGET BY GRID COORDINATES BY ESTIMATING DATA
       FROM A MAP

                        (TYPE 'GO' TO CONTINUE)

*
GO

SUCCESSFUL COMPLETION OF THIS TEST INDICATES THAT YOU ALREADY
POSSESS THE NECESSARY SKILLS TO LOCATE TARGETS BY THE POLAR
PLOT METHOD AND THE GRID COORDINATE METHOD, AND WILL NOT HAVE
TO TAKE THE LESSON ON **TARGET LOCATION.**
DO YOU HAVE A PENCIL, PAPER, AND THE TARGET LOCATION TEST HANDOUT?
IF NOT, GET THEM FROM THE MONITOR. WHEN YOU ARE READY,

                        (TYPE 'GO' TO CONTINUE)

*
GO

THE INFORMATION TO LOCATE A TARGET BY THE  POLAR PLOT METHOD  IS
SHOWN IN FIGURE 1, OF THE HANDOUT. DIRECTION TO THE KNOWN REFERENCE
POINT (HILLTOP 610) IS 315 DEGREES. THE ESTIMATED ANGLE FROM
HILLTOP 610 TO THE TARGET IS 10 DEGREES. THE ESTIMATED DISTANCE
TO THE TARGET IS 3000 METERS, AND THE VERTICAL SHIFT TO THE
TARGET IS +10 METERS.
STUDY FIGURE 1.
                        (TYPE 'GO' TO CONTINUE)

*
GO

THE RELATIVE LOCATION OF THE OBSERVER,REFERENCE POINT AND TARGET,
ALONG WITH THE KNOWN INFORMATION, IS SHOWN IN FIGURE 1. WHEN
LOCATING THIS TARGET BY THE POLAR PLOT METHOD, WHAT TWO ELEMENTS
OF TARGET LOCATION MUST BE SENT TO THE FIRING UNIT? TYPE THE
LETTER CORRESPONDING TO YOUR ANSWER. (A,B,C, OR D)

                    A.  DISTANCE AND RANGE
                    B.  DIRECTION AND DISTANCE
                    C.  DISTANCE AND TARGET TYPE
                    D.  ELEVATION AND DISTANCE

*
B
```

Figure 6-2. Student Interaction Record

```
DATE   0/0/1                                                STUDENT HISTORY
LESSON NAME  CFFTB,  STUDENT NAME S2
  FRAME    TYPE    TIME      NEUTRAL     ANSWER     LABEL
                   MIN/      RIGHT+        TAG
                   SEC       WRONG-
START                                                0/0/1      0.00
   1.00      Q     63.63        0          A       CFFPOST
   2.00      Q     63.60        0          A       SIT
   3.00      Q     63.63        -          -       E1
   4.00      Q     63.63        +          A       E2
   5.00      Q     63.63        +          A       E3
   6.00      Q     63.58        +          A       E4
   7.00      Q     63.60        +          B
   8.00      Q     63.61        +          B
START                                                0/0/1      0.00
NUMBER RIGHT    5
NUMBER WRONG    1
NUMBER ENTRIES    8
NUMBER TIME-OUTS    0
TOTAL TIME    512.11
```

Figure 6.3a. PLANIT Student Record-Tests

```
N
DATE   0/0/1                                                    STUDENT HISTORY
LESSON NAME   CFF,  STUDENT NAME S2
  FRAME   TYPE   TIME    NEUTRAL   ANSWER   LABEL
                 MIN/    RIGHT+    TAG
                 SEC     WRONG-
START                                        0/0/1      0.00
   1.00     Q    63.59      0         A
   2.00     Q    63.58      0         A
   3.00     Q    63.58      0         A
   4.00     Q    63.63      0         A
   5.00     Q    63.58      -         -
   4.00     Q    63.63      0         A
   5.00     Q    63.58      +         A
   6.00     Q    63.59      0         A
   7.00     M    63.62      +         B
   8.00     Q    63.60      0         A
   9.00     Q    63.63      +         +
  10.00     Q    63.63      +         A
  11.00     Q    63.59      0         A
  12.00     M    63.62      +         C
  13.00     Q    63.58      0         A        E1
  14.00     Q    63.63      +         +
  15.00     Q    63.59      +         A
  16.00     Q    63.61      0         A
  17.00     Q    63.61      +         A
  18.00     M    63.59      +         C
  19.00     Q    63.59      -         -
  20.00     Q    63.60      0         A
  21.00     M    63.63      +         C
  22.00     Q    63.60      0         A
  23.00     Q    63.63      0         A
  24.00     Q    63.61      +         A
  25.00     Q    63.59      0         A
  26.00     Q    63.60      0         A
  27.00     M    63.63      +         C
  28.00     Q    63.59      0         A
  29.00     M    63.60      +         B
  30.00     Q    63.61      0         A
  31.00     Q    63.62      0         A
  32.00     M    63.63      +         B
  33.00     M    63.59      +         A
  34.00     M    63.58      +         C
  35.00     D    63.63      0
  36.00     Q    63.58      0         A
  37.00     M    63.62      -         B
  37.00     M    63.62      +         C
  38.00     Q    63.63      +         A
  39.00     M    63.63      +         B
  40.00     M    63.60      +         C
  41.00     M    63.59      +         D
  42.00     M    63.60      +         A
  43.00     Q    63.60      0         A
  44.00     Q    63.62      0         A
  45.00     Q    63.60      0         A
  46.00     Q    63.59      0         A
NUMBER RIGHT   22
NUMBER WRONG   3
NUMBER ENTRIES   49
NUMBER TIME-OUTS   0
TOTAL TIME   3136.27
```

Figure 6-3b. PLANIT Student Record-Lesson Execution

lesson execution record, Figure 6-3b, shows the keyed responses made by a student (S2) during lesson execution (in this case, lesson CFF).

Figures 6-3a and 6-3b shows the complete HISTORY student record format, obtained by keying-in "N" in response to the PLANIT prompt, SUMMARY ONLY (Y/N) ?, shown as item (7) in Appendix C-1. The response "Y" would produce only the header data and summary information at the bottom of the record.

Student and lesson performance is automatically recorded and scored during lesson execution in accordance with the criteria (decision frames) established for each lesson and text. If the student passes, he will automatically go on to the next PLANIT lesson programmed; e.g., if he passes the DODTA pretest he will be branched to the next pretest, TLTA. Once the student starts INTRO, then he should be able to progress through the lessons automatically as directed by the computer.

c. Monitor's Observation Log

The monitor's observation log shown in Appendix C-3 is filled in by the monitor to maintain a log of individual student progress, difficulties encountered, system down times, and other data considered appropriate for evaluation.

The monitor's log provides a place to record individual lesson times and other experience data which may be required or desired for evaluation. Computer times are not available for individual lessons, but are available at the end of a run when signing off the UNIVAC 1108, Step (9) in Appendix C-1. The

example in Figure 6-4 shows an elapsed time of 31 minutes for the run; i.e., start 17:56, stop 18:28.

```
@ FIN
  RUNID: BENNIK   ACCT: 8556N0F1501T   PROJECT: TECMEDIA
     STOP PLANIT
  TIME:   TOTAL: 00:02:18.806
          CPU:   00:00:04.254        I/O:  00:01:51.986
          CC/ER: 00:00:22.566       WAIT:  00:28:18.642
  IMAGES READ:   108        PAGES:  9
  START:   17:56:51 FEB 24,1977     FIN:   18:27:33:FEB 24,1977
```

Figure 6-4. End-of-Run Accounting Data

d. CAI Attitude Questionnaires

The CAI Student Attitude Questionnaire shown in Appendix C-4 is the one used by USAFAS for student runs at Fort Sill to measure student reaction to CAI and to determine problem areas in validating lesson materials.

There are also two attitude questionnaires on-computer as PLANIT lessons, as follows:

PREQ	Pre attitudinal questionnaire
POSTQ	Post attitudinal questionnaire

PREQ and POSTQ are answered on-line and automated records kept the same way as any other PLANIT lesson. Listings of the two questionnaires can be obtained from the U.S. Army Research Institute.

7. Monitor Requirements

The CAI system, once the student is on line, is designed to run by itself. The minimum requirements for a monitor is to turn on and access the system, be available (on call) in case the student runs into problems, to obtain student PLANIT student records at the end of the session, and to turn off the system. This suggests monitor familiarity and practice with the procedural items contained in Appendix C-1. The monitor may also keep a monitor's log of student activities, indicating the times started and stopped for each lesson or series of lessons.

The student interaction record, if the printer is on, is an easy method of determining student progress without disturbing the student.

C. PROCEDURES

The procedures are quite simple. When the student arrives, he fills out his Questionnaire(S) (Appendix C-2). During this time (or prior) the monitor gets on-computer by carrying out items (1) through (5) in Appendix C-1. The first lesson obtained for a new student is INTRO. The computer will guide him through INTRO and the series of six Observed Fire lessons, first administering the pretest and then the lesson and post test if the pretest is failed. If the student must leave at any time, he types "<FINISHED" (Figure 6-5), and when he returns and signs on for that lesson, he will be automatically started where he left off. The off-line course exhibits will be required for those lessons designated by an asterisk (*) in paragraph B, 3, a., page 6-3.

When the student has completed the lessons (or at the end of the day) student records are obtained, as shown in item (7) in Appendix C-1, and items (8) and (9) to sign-off are carried out.

When you see	Type (exactly as spaced)
LOG IN OR END	(Your name - example Smith) then press the NEW LINE key
ENTER COMMAND	GET INTRO - then press the NEW LINE key
IDENTITY YOURSELF	(Your name - example Smith) then press the NEW LINE key
When you take a break	<FINISHED - then press the NEW LINE key

Figure 6-5. Console Instructions

The student attitude questionnaire is administered either off-line or on-line. If on-line, the PLANIT Lesson PREQ is taken after INTRO. These can be obtained through the GET command in item (5), Appendix C-1, or can be programmed for automatic execution by USAFAS or the U.S. Army Research Institute.

The Observed Fire module pre- and post tests, OFTA and OFTB, are also available, should it be desired to administer these as a group rather than individually as is currently programmed. OFTA and OFTB are the combined alternate forms of the individual pre- and post tests for the six lessons.

D. EVALUATION

The evaluation covers two areas: (1) do students learn as evidenced by their post test scores, and (2) are the lessons and the CAI media acceptable to the students.

The answer to the first question is determined by the test scores of the students, i.e., do they get through the course. Feedback on the post test(s) provide this answer, i.e., the student passed or failed.

The answer to the second question is determined by the responses to the attitude questionnaire, whether administered on-line (PREQ and POSTQ) or administered in hard copy (Appendix C-4).

Other considerations include time required to take the lessons and tests, and costs. Telephone costs and computer costs can be obtained from the U.S. Army Research Institute.

The monitor's logs (Appendix C-3) should also be analyzed in terms of problem areas, computer down time and other factors which may be of interest in evaluating CAI in a field setting.

SECTION 7: CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

1. *A number of Army trends and initiatives will be influencing field artillery training resources utilization during FY 78-83.* These include: (1) the prime need for field forces to acquire and maintain a battle-readiness posture; (2) designated USAFAS job, mission, and MOS training proponency for several new developmental and fielded systems in FY 78-83; (3) characteristics and turbulence of Army job incumbents impacting on training loads and resources; (4) impacts of AR 1000-2 on integration of USAFAS combat and training developers, joint TRADOC/DARCOM responsibilities, and reduction of system life-cycle costs; (5) impacts of Integrated Technical Documentation and Training (ITDT) requirements; (6) the volume of existing or potentially available training and evaluation resources among units, USAFAS, and TRADOC/DARCOM sources; (7) changing roles and responsibilities among TRADOC groups, including the new role of TRADOC System Manager; and (8) goals and implications for USAFAS internal resources allocation and management.

2. *USAFAS proponency for supporting the acquisition and maintenance of proficiency in field forces will occur during a period when weapons system complexity is increasing and less than optimum capabilities are predicted for trainees or job incumbents.* This implies a need for: (1) closer attention to the characteristics of soldiers in selecting delivery systems, and in the development and validation of job-support and training packages; (2) increased realism of delivery system situational displays, responses, and practice for all training settings; (3) selection of techniques less demanding of scarce or costly resources; and (4) closer integration in the choice of delivery systems for individual and collective training with those selected for job and mission evaluation.

3. *USAFAS life-cycle proponency for system jobs and MOS structure implies an earlier and more influential role of the school TRADOC System Managers to minimize operational test performance gaps and life-cycle costs in ways other than "train-up."* These include (1) integrating system design with job design, human engineering the man-machine interface, and specifying personnel selection or job assignment criteria; and (2) integrating system job-duty design with the EPMS/OPMS specialty and skill level structure.

4. *There are many existing, developmental, and new delivery systems potentially useful in FY 78-83.* This suggests that: (1) the notion of exportability be broadened to include individual-collective delivery systems for training and evaluation that can be embedded in a fielded system, delivered with a system, or provide remote access by units to central training and job data sources via telecommunications; (2) data files should be established at USAFAS or central locations enabling developers to determine characteristics, operational status, accessibility, and constraints of training and evaluation delivery systems.

5. *TRADOC goals with respect to responsibilities, manpower utilization, and fiscal justifications in the upcoming period were summarized.* They suggest: (1) ensuring that course designers-developers possess the flexible skills needed to select, develop, and update media and courseware for a variety of alternative delivery systems; (2) ensuring that school system managers, technical directors, and resource managers can specify requirements for procurement packages, monitor work in progress, and evaluate contractor plans and products; and (3) collecting and summarizing data on training effectiveness, efficiency, utility, acceptance, and costs during validations, developmental-operational testing, and user implementation to determine benefits and savings.

6. Delivery system *selection factors* include personnel subystem (trainee and incumbent) characteristics, and individual-collective performance levels and requirements. *Constraining factors* include regulatory directives, available source data, work-training settings, unit usage demands, support capability of USAFAS, leadtime, and costs (acquisition, operations, and maintenance-update). Delivery system *solution factors* include media capability and training strategy options, training management methods, logistical requirements, and availability. *These factors were analyzed against five developmental requirements predicted for USAFAS in FY 78-83: ITDT Coverage of New or Developmental System; ITDT Retrofit to Fielded System; Self-Pacing of MOS Course for Export; Self-Pacing of MOS Course for School; and Update of Fielded ITDT/MOS Materials.* Implications from this comparison include: (1) developmental requirements differ enough so that no narrow model dealing solely with trainee, subject matter, and media variables at one decision stage will serve the five situations; (2) the model should integrate the selection of delivery systems for MOS-oriented material, combat literature, training literature, job-support materials, training support materials, and evaluation materials to maximize compatibility and minimize the potential for massive updates; and (3) there are significant differences among delivery systems in terms of the efficiency and resource demands in updating of materials.

7. *A preliminary delivery system's decision model was prepared to satisfy nine design and potential evaluation criteria. The model incorporates decision stages keyed to the events, available data, and interim products of a total system and MOS developmental proponency life-cycle.* The four consecutive decision stages are: (1) State Delivery System Requirements and Preliminary Candidates: (2) Select Major Delivery Systems Mix for Training Program; (3) Select Delivery Systems for Specific Performance Modules and Lessons; and (4) Assign Alternative Delivery Systems During

Training Implementation. The types of decision rules and available data on trainees, performance requirements, delivery systems, and constraints will vary for each stage.

The model is designed to ensure a close and progressive relationship between SQT standards and ARTEP standards, as well as compatibility of delivery system's selection for training and evaluation. Each decision stage is designed to produce decision data for input to an evolving Individual/Collective Training and Evaluation Plan (ICTEP) providing a technical development and resources management baseline throughout the entire proponency program.

8. *Representative media capabilities were compiled and an inventory of the specific delivery system resources existing or potentially available for field artillery training in FY 78-83 was prepared.* This indicates: (1) a data file of specific field artillery delivery system attributes should be established, those attributes relating to the interaction of delivery system capabilities with trainee, subject-matter, and training setting characteristics; (2) this data file should be usable within procedural guidelines to be developed for the four decision stages of the preliminary delivery system's selection model.

9. *Continued development of the TEC Media Selection methodology and frame of reference advanced in this report is suggested, consisting of three steps and associated tasks:* (1) Step 1 - USAFAS/ARI Review, Revisions and Concurrence on Approach; (2) Step 2 - Develop Delivery System's Selection Procedures; and (3) Step 3 - Pilot Implementation and Formative Evaluation at USAFAS.

10. Results reported in the companion volume ARI TR-77-A20 and work on this task indicate that it is feasible to export USAFAS-produced CAI lessons to Army units via telecommunications access from the unit to a central computer source. Requirements include: (1) physical resources, computer resources, and courseware resources; (2) procedures guide and daily usage procedure; (3) student selection; (4) monitor duties; (5) use of automated and manual records; and (6) evaluation guidelines. Procedures, examples, and specific forms have been provided in this report.

B. RECOMMENDATIONS

The preliminary delivery system decision model presented in Section 3, 4, and 5 has attempted to provide a framework that brings together trends and influences into a coherent frame of reference for decision-making in the FY 78-83 period. These trends and influences include: findings and approaches of Aptitude-Treatment-Interaction (ATI)research; Instructional Systems Development (ISD) guidance; evolving Integrated Technical Documentation and Training (ITDT) guidance; Cost and Training Effectiveness Analysis (CTEA) approaches; joint TRADOC/DARCOM Management of Total Systems Development proponency (AR 1000-2); MOS-oriented and system or job-oriented Army directives; characteristics of soldier populations; field artillery delivery system options; and the levels and types of field artillery performance requirements.

The following recommendations are provided for consideration by USAFAS:

1. Assess whether assumptions (Section 1, part C) and conclusions are reasonable, and how these should influence subsequent work on delivery systems methodology.

2. Assess accuracy of the initiatives, directives, trends, and implications cited in Section 2, as well as the decision factors and USAFAS situational development implications presented in Section 3.

3. Determine whether the subsequent work focus should be on one or a combination of the four decision stages in the overall model; i.e., (1) State Delivery Systems Requirements and Preliminary Candidates; (2) Select Major Delivery Systems Mix for Training Program; (3) Select Delivery Systems for Specific Performance Modules and Lessons; and (4) Assign Alternative Delivery Systems during Training Implementation. Each of the stages has different implications on data requirements and sources, decision goals, decision procedures, and decision outcomes.

4. Assess which trainee data is available, and how it is gathered and used in any or all of the four decision stages. Useful trainee data will vary depending on the decision purpose. Potential sources include: data banks (DCSPER, MILPERCEN, SIDPERS); ACB/AQB aptitude subtest scores; general mental abilities (GT); experiential questionnaires administered to soldiers; specialized individual difference measures; cognitive-perceptual style instruments or derived indices from other sources; attitudinal inventories; and observed trainee preference among alternatives provided in the training setting. Observed preferences can be correlated with other data items to determine what, if any, stable relationships exist.

5. The above recommendations should be given early consideration during Step 1 of the developmental workplan provided in Appendix E to better focus Step 2 of the workplan.

6. The above recommendations should be given consideration in planning field data collection on CAI/TEC/Test exportable packages, using implementation procedures given in Section 6 and Appendix C. Appropriate data collection can provide data useful to the delivery systems model and data files suggested in this report.

7. It is apparent that the FY 78-83 projections and preliminary solutions given in this report have implications for several directorates within USAFAS (e.g., Training Developments and Directorate of Evaluation). It is also recommended that reactions and inputs of other service schools and groups (e.g., TDI, ATSC, TRADOC DCST, ARTADS) be solicited.

APPENDIX A

EXAMPLES OF DELIVERY SYSTEMS SELECTION RATIONALE FOR AN INDIVIDUAL-COLLECTIVE TRAINING PLAN

A-1: SELECTION RATIONALE FOR TRAINING PROGRAM

A-2: SELECTION RATIONALE FOR SPECIFIC LESSONS

A-3: COST-AVOIDANCE ESTIMATES SUPPORTING DELIVERY SYSTEMS

These examples illustrate the types of supporting rationale for delivery systems selection considered appropriate outcomes of the front-end analysis and preliminary design phases of a major service school system, job-duty, and MOS life-cycle proponency program. The examples are actual products generated in support of the USAFAS TACFIRE Advanced Training Program and Individual-Collective Training Plan in which SDC participated as subcontractor under prime guidance of Litton Data Systems and USAFAS. This program included a requirement for Integrated Technical Documentation and Training (ITDT) coverage. Appendices A-1 and A-2 are from information in Litton Document MS 77298-2, dated 24 February 1977. Appendix A-3 is a Cost and Training Effectiveness Analysis (CTEA) supporting the delivery systems selection, generated by a USAFAS/Litton team and reported in: Individual-Collective Training Plan for TACFIRE, HQ TRADOC, October 1976.

These examples supplement information in Section 4 of this report.

A-1: SELECTION RATIONALE FOR TRAINING PROGRAM

Media Selection for TACFIRE Training
(Litton Document 148000-901)

1. PURPOSE

The purpose of this document is to provide the general requirements and rationale for the selection of media for each lesson segment (Lesson Design Approach document) within the TACFIRE Advanced Training Program.

2. PRIMARY CONSIDERATIONS

A key element of Phase 1 of the TACFIRE Advanced Training Program was the selection of the appropriate delivery systems/media for presentation of the individualized, self-paced training materials. Three primary considerations have been levied on the selection of media:

a. All media must be available, or readily exportable, to the field units with a minimum or no introduction of special devices or equipment unique to TACFIRE training.

b. The training program and the media used must reduce the overall life cycle cost of the resident/school training program.

c. The media selections must be consistent with the overall TACFIRE training requirements.

Analysis of knowledge and skills to be taught as part of the TACFIRE Advanced Training Program has resulted in the selection of specific media to accomplish the program objectives. The following discussion provides the rationale for media selection in the TACFIRE Advanced Training Program.

3. EVALUATION FACTORS

In the selection of any medium for individualized instruction, there is a strong interaction between constraints and solutions. No single approach is selected based on only one or two factors. Every selection results from an evaluation of numerous factors such as:

a. Characteristics of the student population
b. Characteristics of the subject matter
c. Features of the work environment
d. Characteristics of the training environment

e. Ability to apply training materials in the field, as well as the school
f. Cost constraints
g. Time constraints

4. MEDIA CATEGORIES

While there are numerous different kinds of instructional media, certain media are popular because of their flexibility in meeting the considerations posed by the above factors. These media fall into the following basic categories:

a. Printed text
b. Audio-visual
c. Simulation
d. Audio only
e. Person-to-person (platform and tutorial)

5. MEDIA/DEVICE TYPES

The instructional media and devices considered for use in the TACFIRE Advanced Training Program were as follows:

a. Printed Text
   (1) Programmed text
   (2) Job Performance Manuals/Job Performance Guides (JPM/JPG)
   (3) Technical Manuals/Field Manuals (TMs/FMs)
   (4) Job aids

b. Audio-visual
   (1) Video tape
   (2) Video disc
   (3) Sound slide
   (4) Motion picture
   (5) 35mm film strip and sound
   (6) Beseler Cue/See

c. Simulation
   (1) Computer Assisted Instruction (CAI)/Computer Mediated Practice
   (2) System Simulation

d. Audio only
   (1) Portable audio cassette players

e. Person-to-Person
   (1) Platform instruction
   (2) One-to-one tutorial

6. MEDIA SELECTIONS

The extreme importance and emphasis on availability of the selected media in the field has greatly influenced the selection process. This is particularly true in the audio-visual category. The Beseler Cue/See was selected to satisfy the audio-visual requirements primarily due to its availability in the field. The U. S. Army's Training Extension Course (TEC) program has programmed approximately eight Beseler Cue/See machines for every field army battalion. This selection makes machines available to the TACFIRE units and also ensures compatibility of TACFIRE with the Army's TEC program. Many of the audio-visual lessons could be converted to other media such as video disc, video tape, or other audio-visual media as they become available in the field.

Similarly, the in-unit field training considerations, as well as resident school cost and scheduling considerations, lead away from the selection of platform instruction for TACFIRE specific training. There appears to be no need in TACFIRE for audio-only training materials.

The major media selected for TACFIRE training are the following:

a. Programmed Text
b. JPMs/JPGs (TMs already exist for use in place of JPGs)
c. Job Aids
d. Audio-visual (Beseler Cue/See)
e. CAI/Computer Mediated Practice
f. System Simulation

7. EFFECTIVENESS/RATIONALE

The effectiveness/rationale of the individual media selections is discussed in the following paragraphs:

a. Programmed Text

The programmed text traditionally has been the workhorse of individualized instruction. It is low cost, highly portable, and can be used to teach a wide variety of skills and knowledges. In the TACFIRE program, a large part of the training involves the use of formats to enter data into the system and to receive output data from the system. Data is entered, altered, and deleted using these formats. The TACFIRE format is a moderately complex geometric configuration (similar to a punched card format) which contains mnemonic codes indicating the proper location for data entries.

The programmed text is an ideal method for providing practice in data entry short of actually putting the student at the system equipment. With the format printed on the page, the student can record his answers right on the printed format and then compare this answer to the printed confirmation on the next page. One of the few drawbacks associated with the use of the programmed text is that the student must be able to read the text. In cases where the content contains new terms and concepts, the program may exceed some students' reading levels. Lessons containing new verbal content will be taught using an audio-visual approach rather than the programmed text to take advantage of the students' greater listening vocabulary.

b. JPM/JPG (TM)

Job Performance Manuals and Job Performance Guides are an effective medium to employ when teaching the soldier specific operations and procedures which are performed on equipment. The use of the JPM/JPG requires access to the equipment while performing the steps. An important instructional advantage of this approach is that the soldier is in contact with the real world environment rather than an artificial representation of the real world, and he is able to practice the actual operations to be performed. This practice may be on the system during actual field operation or on the system equipment with simulation software to simulate actual field operation.

From a cost standpoint, original production and reproduction of the JPM/JPG is comparable to a programmed text. In this program, the JPM/JPG is used in two different ways. In some lessons, it is used as the primary training vehicle and guides the soldier through a sequence of steps.

The second application of the JPM is as an elaborate Job Aid. When the soldier is taught the use of formats in TACFIRE, the programmed text is used to present a graduated series of exercises on filling in formats. To complete the exercise requires the use of a JPM which contains a definition of the different mnemonics contained in the format and conditions for making entries into the format fields. This enables the soldier to acquire technical competence with a wide range of formats without the necessity of memorizing the large number of terms and conditions.

In the case of the TACFIRE system, detailed TMs already exist. The TACFIRE system operation and the organizational maintenance concepts make extensive use of computer programming and special hardware design to assist in fault detection, fault isolation and overall system operation. For this reason, the existing TMs contain all the information which would normally be contained in the JPGs for a system of this type. Therefore, the TMs will be used to satisfy the TACFIRE system operational and organizational maintenance JPG requirements.

c. Job Aids

The use of job aids is an effective and economical addition to the training materials. A job aid can effectively reduce the training time, enhance job proficiency and reduce latency times by serving as a memory cue (i.e., checklist) or by eliminating the need for memorization (i.e., data lists, typical data identification or allowable limits, format location keys). The TACFIRE requirements lend themselves to the use of decals, plasticized cards, small pocket booklets as quick reference aids to the performance of the job.

d. Audio-visual (Beseler Cue/See)

One of the strongest reasons for going to an audio-visual approach is that the lesson's instructional effectiveness does not depend on the student's reading level. Therefore, marginal readers learn better from audio-visual devices.

Another advantage of the audio-visual approach is in its effectiveness in showing operations performed on equipment. It provides for the use of high quality color pictures of equipment and allows the learner to maintain continuous visual contact with a changing visual display while listening to an audio commentary. This can be compared to an illustrated text where the learner must glance back and forth between text and illustration.

Most programs that teach equipment operations require a large number of color visuals to show each step of a procedure and the subsequent changes in the equipment's controls and indicators. The cost of reproducing large numbers of color visuals in film is lower than in printed text with color printing.

Another advantage of the audio-visual approach is its appeal. Most people prefer the audio-visual approach over non-AV approaches and, therefore, it is more motivating to the student.

Another essential factor to consider when selecting an audio-visual approach is the costs associated with the approach. Cost can be divided into the following three major categories:

(1) Implementation Costs — These are the costs associated with the acquisition and maintenance of the audio/visual devices at the training site. In this case, the Army has already selected, purchased, and deployed the Beseler Cue/See at numerous sites as part of the Army's Training Extension Course (TEC) program. Implementation costs associated with using the Beseler Cue/See as a training device are thereby minimized from that of introducing a new device into the field.

(2) Reproduction Costs — These are costs for reproduction of copies of the 8mm film and cassette tapes. Presently, there are several contractors set up to produce copies of Cue/See programs at reasonable prices. As part of the TEC program, the cost of program reproduction is extremely low.

(3) Development Costs — These are costs to prepare and film artwork, prepare and record scripts, and test and revise programs. As a rough rule of thumb, developmental cost for a Cue/See lesson will run about three times as much as a programmed text, but only one-fifth to one-tenth the cost of producing

a motion picture. Considerable economies are realized by selecting the Cue/See as the audio-visual training device for the TACFIRE program.

e. CAI/Computer Mediated Practice

CAI utilizes a computer to generate displays, analyze student responses, and instantly reconfigure the instructional sequence for each individual student based on his performance.

CAI can be relatively expensive, more so in equipment utilization requirements than in courseware development costs. CAI would not be used to teach behaviors that could be taught just as well with less costly instructional approaches. Costs for CAI are generally divided into three main areas. These are:

(1) Software. Refers to the computer program that controls the computer actions during instruction.

(2) Hardware. Refers to equipment including the computer itself, and the peripheral input and output devices.

(3) Courseware. Refers to the instructional program that is put into the computer.

The PLANIT (Programming Language for Interactive Teaching) CAI software for TACFIRE has been basically developed under a separate research contract with the Army Research Institute. This software operates completely on TACFIRE tactical equipment. For this reason there is minimal software and equipment development and procurement costs associated with using CAI for TACFIRE. For these reasons the use of CAI, where appropriate, for TACFIRE training is a practical and necessary media.

The words "Computer Mediated Practice" more aptly describe the instructional application of the computer in TACFIRE training than does the term computer assisted instruction. Computer mediated practice in TACFIRE will allow the trainee to apply skills and knowledges learned via other media to the operation of the Artillery Control Console (ACC) and the Variable Format Message Entry Device (VFMED). Just as a learner cannot become a good automobile driver without driving practice, likewise the console operators cannot

become proficient without practice on the console. Computer mediated practice provides for the presentation of a wide variety of staged exercises and real world simulations that are not possible in the conventionally configured TACFIRE system.

f. System Simulation

In addition to individualized hands on practice on the ACC and VFMED, practice with other system equipment and subsystem team practice are required for TACFIRE training. A relatively inexpensive system simulation software package will be developed to operate with the TACFIRE field software on the actual tactical field equipment to provide individual and/or team practice exercises in a (simulated) real world environment. These exercises can be performed in the school environment or in the field.

8. CONCLUSION

The media identified for use in TACFIRE training provide a well rounded course of instruction which will meet the TACFIRE training requirements and satisfy the primary considerations identified at the beginning of this discussion.

A-2: SELECTION RATIONALE FOR SPECIFIC LESSONS

Example Lesson Design Approaches
(Litton Documents 148201-601 and 148201-603)

LESSON DESIGN APPROACH

LESSON TITLE:	ACC OPERATION — PART 1
LESSON NUMBER:	2.01-1 AV
TARGET AUDIENCE:	See Training Managers Guide, Document No. 148000-900, Appendix G
STUDENT MATERIALS:	Paper and pencil
OBJECTIVES:	1. The soldier will identify the components of the ACC. 2. The soldier will specify the function of each ACC control, indicator, key or switch.
INSTRUCTIONAL STRATEGY:	This A/V lesson will teach the soldier the functions of the ACC in the TACFIRE system. The lesson will illustrate each component of the ACC, testing the soldier's ability to name each component illustrated in the test exercises. The lesson will also teach the function of each component.
CONTENT OUTLINE:	This lesson will provide illustrations and descriptions of the physical characteristics and applications of the ACC.
CRITERION TEST:	The soldier will be asked to perform all the tasks listed in the objectives presented earlier in this LDA. He will perform the tasks using the JPM as a reference.

METHOD/MEDIA SELECTION: Audio-visual

EFFECTIVENESS ANALYSIS: General — See MEDIA SELECTION FOR TACFIRE TRAINING, Document No. 148000-901.

Specific — The audio-visual format was selected for teaching this lesson because the teaching sequence requires continuous monitoring of a changing visual display accompanied by an audio commentary, and because it is a convenient medium for depicting the interrelationship of various elements taught in this lesson.

LESSON ADMINISTRATIVE INSTRUCTIONS: The Lesson Administrative Instructions (LAIs) will include the title of the lesson, the required materials, the objectives and the approximate time required to complete the lesson. The LAI will also contain instructions for administering the lesson.

VALIDATION: This lesson should be validated in small group trials with no less than ten soldiers. The criterion for acceptable validation is 90/90.

LESSON DESIGN APPROACH

LESSON TITLE: ACC OPERATION — PART 3

LESSON NUMBER: 2.01-3 CAI

TARGET AUDIENCE: See Training Managers Guide, Document No. 148000-900, Appendix G

STUDENT MATERIALS: Paper, pencil and JPM

OBJECTIVES:

1. Given instructions to call up a particular format, the soldier will use the SPA matrix to request that format.

2. Given instructions to call up a particular format (not stated on the SPA matrix), within a category directory listing, the soldier will request the specified format.

3. Given instructions to adjust the brightness, character size, or focus of the CED, the soldier will identify and turn the actual knobs.

INSTRUCTIONAL STRATEGY: This is the first of three lessons which practice the soldier on the operation of the ACC. In this lesson the soldier will receive his training instructions on the RD/ELP. The lesson will consist of drills to familiarize the operator with the function of the matrix, command, and select buttons of the SPA and cursor positioning of the A/N keyboard. Following the drills, the soldier will be given timed exercises in which he must use a key, switch, or series of controls to perform a task as specified in the instructions on the RD. The soldier will be evaluated against specified time parameters for completion of an exercise. The soldier will repeat a series of drills until mastery as specified in the LAI is achieved.

CONTENT OUTLINE: Drills will consist of the soldier calling up at least one format from each format category using the MATRIX. Format call-ups using the format directory will be from each category.

CRITERION TEST: The soldier will be asked to perform all the tasks listed in the objectives presented earlier in this LDA. He will use the JPM as a guide while performing the task.

METHOD/MEDIA SELECTION: Computer Assisted Instruction

EFFECTIVENESS ANALYSIS/ RATIONALE: General — See MEDIA SELECTION FOR TACFIRE TRAINING, Document No. 148000-901.

Specific — CAI was selected for use in this lesson because it allows the soldier to practice newly acquired skills on the real world equipment. The levels of proficiency which are the objective of this lesson necessitate practice on hardware and this programmed practice can only be accomplished through the use of CAI.

LESSON ADMINISTRATIVE INSTRUCTIONS: The Lesson Administrative Instructions (LAIs) will include the title of the lesson, the required materials, the objectives and the approximate time required to complete the lesson. The LAI will also contain instructions for administering the lesson.

VALIDATION: Final validation will take place with no less than ten soldiers. Upon completion of the lesson, each soldier should be performance tested on the actual equipment. The criterion for acceptable validation is 90/90.

A-3: COST-AVOIDANCE ESTIMATES SUPPORTING DELIVERY SYSTEMS

Estimated Savings from Individualized, Self-Paced Instruction
(Appendix E, Individual-Collective Training Plan for TACFIRE, Oct 76)

E.1. TACFIRE Advanced Training Program.

Phase 1 of the TACFIRE Advanced Training Program (Reference s) has addressed the overall program definition of individualized, self-paced "Improved Technical Documentation and Training (ITDT)" program for TACFIRE. Phase 2 will address the detail design definition for the program prior to full scale implementation and training materials (Phase 3).

The subject program addresses operational training and organizational maintenance training for FSO, FSE, Div Arty FDC and Bn FDC. The forward observer and firing battery training were not included as these are being separately developed as self-paced training courses as a part of the current TACFIRE/BCS programs. DS maintenance was also not included in the subject program.

The Phase 1 results show rather dramatic reduction in the average instructional time for TACFIRE students. A major portion of these savings are the direct result of individualizing the instructional requirements for each duty position. For example, the training requirements for a Fire Direction Sergeant, TACFIRE Equipment Specialist, and Counterfire Officer are significantly different. The current platform instruction includes one common Fire Direction Course (10 weeks) for all duty positions at Div Arty and Bn Fire Direction Centers and a common Fire Support Course (4 weeks) for all FSE and FSO duty positions.

At Annex 1 to this appendix is the preliminary training matrix from Phase 1. The left side lists the TACFIRE performance modules (a lesson or series of lessons). Across the top are the duty positions requiring TACFIRE instruction. In section I are duty positions trained within the Fire Direction Course. In section II are duty positions trained within the Fire Support Course. Section III are seven of the fourteen duty positions trained in the Command and Staff Course which can be self-paced as a direct result of self-pacing the Fire Direction Course and the Fire Support Course. Section IV shows those positions which receive no formalized school training but receive limited training from the New Equipment Training Team in the field. Personnel in these positions can function without the training but can function more effectively with the training.

Although cost savings are enumerated in this appendix only for the Fire Direction Course and the Fire Support Course, the benefits derived from self-pacing the TACFIRE instruction overflow into the Command and Staff Course and into the very important realm of exportability and OJT enhancement in the field. The former then requires only half as many students for the formal classroom instruction. The latter provides a structured OJT program for those personnel who require some TACFIRE training to increase their effectiveness but do not require a significant amount to necessitate formal school training.

At Annex 2 to this appendix is the overall self-pacing cost analysis for TACFIRE instruction in both the Fire Direction Course and the Fire Support Course. At Annex 3 is the cost development model. Although these were submitted to the Training Management Institute (TMI) separately for each course, both analyses and models were combined here; because, as can be seen in Annex 1, many modules (lessons) are common to both courses. For this reason, funding for self-pacing the two TACFIRE courses through contractor assistance must not be considered separately. Discrepancies between these annexes and that submitted to TMI are due to the latest available information being included herein.

The Phase 1 course length estimates are preliminary and may experience some growth as more detailed data is developed in Phases 2 and 3. The detailed savings resulting from introduction of the individualized self-paced modules cannot be precisely estimated at this time. However, for purposes of this plan a "best case", "worst case" and "average" potential savings in instructors, student salary (during training) and student TDY costs have been developed.

The savings is based on the Phase 1 estimated lesson lengths with the following assumptions:

a. A possible 30 percent growth in lesson lengths from the Phase 1 estimates.

b. The average student can complete 30 hours of self-paced lesson materials per week.

c. Integration of the self-paced course of instruction into resident instruction begins with the FY 80 courses.

d. It is estimated that up to 50 percent of the self-paced TACFIRE training can be transitioned from the school (USAFAS) to the field units following full TACFIRE deployment. Following the establishment of a training base in the field (i.e., an adequate number of trained personnel to supervise the unit training), this percentage may be increased. However, a detailed study of this proposition can be made only after the results of the module validations have been correlated.

E.2. Fire Direction Course Savings.

a. Estimated Instructor Savings. It is estimated that self-pacing,

modularity of the TACFIRE instruction and exportability will reduce the TACFIRE instructor requirements for the Fire Direction Course 33-67 percent. For this reason, an "average" potential savings of 50-percent has been used in the following computations:

	FY78	FY79	FY80	FY81	FY82	FY83	FY84	FY85
Required Platform Instructors from Annex 1 to Appendix D(a).	21.6	21.6	28.8	36.4	45.6	45.6	45.6	45.6
- 50% "average" potential savings			14.4	18.2	22.8	22.8	22.8	22.8
TOTAL INSTRUCTORS	21.6	21.6	14.4 (16)*	18.2	22.8	22.8	22.8	22.8

*NOTE: Lab exercises (practical exercise) require the use of a minimum of one instructor per computer to preclude inadvertent student damage to the equipment, tapes, etc. Also, one instructor is required for each TTS.

The net estimated average instructor savings for the Fire Direction Course based on self-pacing and exportability to the field are:

	FY78	FY79	FY80	FY81	FY82	FY83	FY84	FY85
Estimated Instructor Savings	----	----	12.8	18.2	22.8	22.8	22.8	22.8

b. Estimated Student Savings. In addition to the instructor savings, the reduced instructional time and the export of training to the field provides savings in student salaries and TDY costs attributed to "resident" (USAFAS) instruction. Preliminary Phase 1 course estimates provide an average of 75 lesson hours for the 26 duty positions going to the Fire Direction Course. Using the assumptions in E.1., the "average" course length is:

1.3 x (75 hours) - 30 hours/week = 3.3 weeks

Adding 1.7 weeks for the command post exercise, in-processing, out-processing, and graduation, the average overall course length is 5 weeks. Based on the current Fire Direction Course length, this is an average potential savings of 50-percent.

The total student costs below are based on the minimum essential TACFIRE trained positions (Annex 2 to Appendix B) and an average time in grade. Costs are based on FY76 salaries.

FIRE DIRECTION COURSE STUDENT SALARY/TDY
IN THOUSANDS OF DOLLARS

	FY80	FY81	FY82	FY83	FY84	FY85
Platform Instruction Costs	$999.9	$1,171.8	$1,553.0	$1,793.3	$1,749.3	$1,512.9
Self Paced Instruction	$469.4	$ 566.5	$ 739.9	$ 852.4	$ 835.8	$ 727.1
Manyear Savings	33	38	51	59	57	49
Potential FY Savings	$530.5	$605.3	$813.1	$940.8	$913.5	$785.8

E.3. Fire Support Course Savings.

a. Estimated Instructor Savings. It is estimated that self-pacing, modularity of the TACFIRE instruction, and exportability, will reduce the TACFIRE instructor requirements for the Fire Support Course by 24-48 percent. For this reason, an "average" potential savings of 36 percent has been used in the following computations.

	FY78	FY79	FY80	FY81	FY82	FY83	FY84	FY85
Required Platform Instructors from Annex 1 to Appendix D	2.0	2.6	6.3	6.3	6.3	9.5	6.3	6.3
-36% "average" potential savings			2.3	2.3	2.3	3.4	2.3	2.3
TOTAL INSTRUCTORS	2.0	2.6	4.0	4.0	4.0	6.1	4.0	4.0

The net estimated average instructor savings for the Fire Support Course based on self-pacing and exportability to the field are:

	FY78	FY79	FY80	FY81	FY82	FY83	FY84	FY85
Estimated Instructor Savings	----	----	2.3	2.3	2.3	3.4	2.3	2.3

b. Estimated Student Savings. In addition to the instructor savings, the reduced instructional time and the export of training to the field provides savings in student salaries and TDY costs attributed to "resident" (USAFAS) instruction. Preliminary Phase 1 course estimates provide an average of 49 hours in E.1., the "average" course length is:

1.3 x (49 hours) - 30 hours/week = 2.1 week

Adding .9 weeks for the command post exercise, in-processing, out-processing, and graduation, the average overall course length is 3 weeks. Based on the

current Fire Support Course length, this is an average potential savings of 25 percent.

The total student costs below are based on the minimum essential TACFIRE trained positions (Annex 2 to Appendix B) and an average time in grade. Costs are based on FY76 salaries.

FIRE SUPPORT COURSE STUDENT SALARY/TDY
IN THOUSANDS OF DOLLARS

	FY80	FY81	FY82	FY83	FY84	FY85
Platform Instruction Costs	$192.4	$299.7	$256.9	$406.4	$363.6	$342.5
Self Paced Instruction	$145.3	$219.1	$189.9	$292.4	$263.2	$242.1
Manyear Savings	3	5	4	7	6	6
Potential FY Savings	$47.1	$80.6	$67.0	$114.0	$100.4	$100.4

E.4. Equipment Savings.

As a means of reducing the requirements for TACFIRE tactical sets for training a TACFIRE Training System (TTS) has been proposed as a part of the individualized, self-paced TACFIRE Advanced Training Program (subsections 4.g., 6.f., and 6.i.). As described in paragraph 6.f., two TTS (approximately $6 M) eliminate the need for a minimum of ten tactical sets (approximately $16-18 M). In addition, the self-paced courseware modules to be used with the TTS will also be exportable to the field units for use on the tactical equipment.

E.5. Cost Savings Summary.

a. Estimated Instructor Savings

	FY78	FY79	FY80	FY81	FY82	FY83	FY84	FY85
Fire Direction Course	----	----	12.8	18.2	22.8	22.8	22.8	22.8
Fire Support Course	----	----	2.3	2.3	2.3	3.4	2.3	2.3
TOTAL POTENTIAL INSTRUCTOR SAVINGS	----	----	15.1	20.5	25.1	26.2	25.1	25.1
(TOTAL FY SAVINGS IN THOUSANDS OF DOLLARS)	----	----	184.1	289.6	339.9	351.4	339.9	339.9

b. Estimated Student Savings.

	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85
Fire Direction Course	$530.5	$605.3	$813.1	$940.8	$913.5	$785.8
Fire Support Couse	$ 47.1	$ 80.6	$ 67.0	$114.0	$100.4	$100.4
TOTAL POTENTIAL FY SAVINGS IN THOUSANDS OF DOLLARS	$577.6	$685.9	$880.1	$1054.8	$1013.9	$886.2

c. Estimated Total Potential Savings.

	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85
Instructor Savings	$184.1	$289.6	$339.9	$351.4	$339.9	$339.9
Student Savings	$577.6	$685.9	$880.1	$1054.8	$1013.9	$886.2
TOTAL POTENTIAL FY SAVINGS IN THOUSANDS OF DOLLARS	$761.7	$975.5	$1220.0	$1406.2	$1353.8	$1226.1

Annex 1 to Appendix E - Preliminary Training Matrix

FORMATS / EQUIPMENT

Duty Position		1.01 Introduction to Formats	1.02 System Format Fundamentals	1.03 NNFP Format and Output Report Fundamentals	1.04 MET Format Fundamentals	1.05 AFU Format and Output Report Fundamentals	1.06 SPRT Format and Output Report Fundamentals	1.07 SURV Format and Output Report Fundamentals	1.08 BN ATI Format and Output Report Fundamentals	1.09 DIVARTY ATI Format and Output Report Fundamentals	1.10 FM Format and Output Report Fundamentals	1.11 Formats Used at FSE	1.12 Formats Used at FSO	2.01 Operation of the ACC	2.02 Operation of the ACC Data Entry	2.03 Operation of VFMED	2.04 Operation of VFMED to Process FSE Missions	2.05 Operation of PCG	2.06 Operation of the Computer Components	2.07 Operation of the ARMM	2.08 Operation of the ETD Console	2.09 Operation of the DPM	2.10 Operation of the DDT	2.11 Operation of the ELP	2.12 Operation of the CCU and Accessory Set	2.13 Cabling
BATTALION	FDO	X	X	X	X	X	X	X	X	X	X			X	X			X	X	X		X	X	X	X	
BATTALION	FD SGT	X	X	X	X	X	X	X	X	X	X			X	X			X	X	X		X	X	X	X	
BATTALION	EQ SPEC	X	X											X	X	X		X	X	X		X	X	X	X	X
BATTALION	S 3	X		X		X	X		X		X															
BATTALION	OP SGT	X	X	X	X	X	X	X	X		X					X							X	X		
BATTALION	INTELL SGT	X	X	X	X	X	X		X		X					X							X	X		
BATTALION	OP SPEC	X	X	X	X	X	X		X		X					X							X	X		
BATTALION	S 2	X		X		X	X		X		X					X							X	X		
DIVARTY	OP OFF	X	X	X	X	X	X	X		X	X	X		X	X			X	X	X	X	X	X	X	X	
DIVARTY	FIRE CONT NCO	X	X	X	X	X	X	X		X	X	X		X	X			X	X	X	X	X	X	X	X	
DIVARTY	EQ SPEC	X	X											X	X	X		X	X	X	X	X	X	X	X	X
DIVARTY	S 3	X		X		X	X			X	X										X					
DIVARTY	ASST S 3 PLANS	X		X		X	X			X	X										X					
DIVARTY	OP SGT	X	X	X	X	X	X	X		X	X	X				X										
DIVARTY	INTELL SGT	X	X	X	X	X	X	X		X	X	X				X										
DIVARTY	ASST OP SGT	X	X	X	X	X	X																			
DIVARTY	OP SPEC	X	X	X	X	X	X	X		X						X										
DIVARTY	CHEM O	X		X	X					X		X														
DIVARTY	CHEM NCO	X		X	X					X		X														
DIVARTY	M INTELL OFF	X				X				X											X	X				
DIVARTY	M INTELL NCO	X		X		X				X											X	X				
DIVARTY	M INTELL ENL M	X		X						X											X	X				
DIVARTY	CFO	X	X	X	X	X	X	X		X	X	X		X	X	X		X	X	X	X	X	X	X	X	
DIVARTY	TGT CHIEF	X	X	X	X	X	X	X		X						X							X	X		
DIVARTY	TGT NCO	X		X						X						X							X	X		
DIVARTY	TGT ENL M	X		X						X																
DIVARTY	FCS	X		X	X			X		X						X							X	X		
DIVARTY	SR RADIO OP	X																					X	X	X	
FSE	ASST FS COORD	X										X				X	X									
FSE	FA INTELL OFF	X										X				X	X									
FSE	TGT ANAL	X										X				X	X									
FSE	CHEM O	X										X				X	X									
FSE	INTELL SGT	X										X				X	X						X	X		
FSE	OP SGT	X										X				X	X						X	X		
FSE	ASST OP SGT	X										X				X	X						X	X		
FSE	FS SGT	X										X				X	X						X	X		
FSE	RADIO TEL OP	X										X				X	X						X	X		
FSO	FSO	X											X			X							X	X		
FSO	FS SGT	X											X			X							X	X		
FSO	FS SPEC	X											X			X							X	X		

PROCEDURES

Duty Position		3.01 System Hardware Initialization	3.02 System Software Initialization	3.03 Establishing the Tactical Data Base	3.04 System Recovery and Reconfiguration	3.05 Digital Communications	3.06 ATI Operations at DIVARTY	3.07 ATI Operations at Battalion	3.08 Fire Planning Operations	3.09 Tactical Fire Control Operations (DIVARTY)	3.10 Tactical and Technical Fire Control Operations (BN)	3.11 Fire Support Operations	3.12 Nuclear Operations	3.13 Chemical Operations	3.14 Preliminary Target Analysis	3.15 Operating Under Unusual Conditions	3.16 Operator Maintenance and Installation Installation of the VFMED	3.17 Module Test Set	3.18 Maintenance Fundamentals	3.19 Organizational Maintenance
BATTALION	FDO	X	X	X	X	X		X	X		X		X	X		X		X	X	X
BATTALION	FD SGT	X	X	X	X	X		X	X		X		X	X		X		X	X	X
BATTALION	EQ SPEC	X	X		X	X										X	X	X	X	X
BATTALION	S 3							X	X				X	X						
BATTALION	OP SGT					X		X	X								X			
BATTALION	INTELL SGT					X		X	X								X			
BATTALION	OP SPEC					X		X	X								X			
BATTALION	S 2							X	X		X									
DIVARTY	OP OFF	X	X	X	X	X	X		X	X			X	X		X		X	X	X
DIVARTY	FIRE CONT NCO	X	X	X	X	X	X		X	X			X	X	X	X		X	X	X
DIVARTY	EQ SPEC	X	X		X	X										X	X	X	X	X
DIVARTY	S 3						X		X				X	X						
DIVARTY	ASST S 3 PLANS						X		X				X	X						
DIVARTY	OP SGT					X	X										X			
DIVARTY	INTELL SGT					X	X										X			
DIVARTY	ASST OP SGT					X	X													
DIVARTY	OP SPEC					X	X							X			X			
DIVARTY	CHEM O						X		X					X						
DIVARTY	CHEM NCO						X		X					X						
DIVARTY	M INTELL OFF						X													
DIVARTY	M INTELL NCO						X		X											
DIVARTY	M INTELL ENL M						X		X											
DIVARTY	CFO	X	X	X	X	X	X		X	X			X	X		X	X	X	X	X
DIVARTY	TGT CHIEF						X		X											
DIVARTY	TGT NCO						X		X											
DIVARTY	TGT ENL M						X		X											
DIVARTY	FCS						X		X								X			
DIVARTY	SR RADIO OP					X										X			X	X
FSE	ASST FS COORD						X		X				X	X	X					
FSE	FA INTELL OFF						X		X				X	X	X					
FSE	TGT ANAL						X		X				X	X	X					
FSE	CHEM O						X		X					X	X					
FSE	INTELL SGT																			
FSE	OP SGT																X			
FSE	ASST OP SGT																			
FSE	FS SGT								X				X	X	X		X			
FSE	RADIO TEL OP																X			
FSO	FSO							X	X			X								
FSO	FS SGT							X	X			X					X			
FSO	FS SPEC																X			

RELATED INFO / TEAM TRAINING

Duty Position		4.01 Introduction to TACFIRE	4.02 Introduction to Individualized Training	4.03 Survey Data for TACFIRE	5.01 System Initialization	5.02 Establishing the Tactical Data Base	5.03 Operations at the FSE	5.04 Tactical and Technical Fire Control	5.05 Tactical Fire Control	5.06 Non-Nuclear Fire Planning	5.07 Artillery Target Intelligence	5.08 Operations at the FSO	5.09 Operations Under Unusual Conditions	5.10 Overall FDC Operations
BATTALION	FDO	X	X		X	X		X		X	X		X	X
BATTALION	FD SGT	X	X		X	X		X		X	X		X	X
BATTALION	EQ SPEC	X	X		X								X	
BATTALION	S 3	X	X		X	X		X		X	X		X	X
BATTALION	OP SGT	X	X											
BATTALION	INTELL SGT	X	X											
BATTALION	OP SPEC													
BATTALION	S 2	X	X											
DIVARTY	OP OFF	X	X											
DIVARTY	FIRE CONT NCO	X	X		X	X			X	X	X		X	X
DIVARTY	EQ SPEC	X	X		X	X			X	X	X		X	X
DIVARTY	S 3	X	X											
DIVARTY	ASST S 3 PLANS	X	X											
DIVARTY	OP SGT	X	X											
DIVARTY	INTELL SGT	X	X											
DIVARTY	ASST OP SGT	X	X											
DIVARTY	OP SPEC	X	X											
DIVARTY	CHEM O	X	X											
DIVARTY	CHEM NCO	X	X											
DIVARTY	M INTELL OFF	X	X											
DIVARTY	M INTELL NCO	X	X											
DIVARTY	M INTELL ENL M	X	X											
DIVARTY	CFO	X	X		X	X			X	X	X		X	X
DIVARTY	TGT CHIEF	X	X			X			X	X	X		X	X
DIVARTY	TGT NCO	X	X											
DIVARTY	TGT ENL M	X	X											
DIVARTY	FCS	X	X											
DIVARTY	SR RADIO OP	X	X		X								X	
FSE	ASST FS COORD	X	X				X							
FSE	FA INTELL OFF	X	X				X							
FSE	TGT ANAL	X	X				X							
FSE	CHEM O	X	X				X							
FSE	INTELL SGT	X	X											
FSE	OP SGT	X	X											
FSE	ASST OP SGT	X	X											
FSE	FS SGT	X	X				X							
FSE	RADIO TEL OP	X	X											
FSO	FSO	X	X								X			
FSO	FS SGT	X	X								X			
FSO	FS SPEC	X	X								X			

ANNEX 2 TO APPENDIX E
SELF PACING COST ANALYSIS (ESTIMATE)
TACFIRE FIRE DIRECTION AND FIRE SUPPORT COURSES

SAVINGS		Average Load		Average	OMA Savings		Total $	Total Mpr Savings	
Course Number	FY 77-82	Before Self-Pacing	After Self-Pacing	Load (TMY) Savings (c-d)	MSN $	BO $	Savings (f + g)	Civilian	Military
a	b	c	d	e	f	g	h	i	l
	1st YR-FY77	0							
	2nd YR-FY78	36							
	3rd YR-FY79	43							
	4th YR-FY80	77	42	35		23	23	1	15
	5th YR-FY81	95	52	43		28	28	2	19
	6th YR-FY82	120	65	55		36	36	2	24
COSTS	Period	AMSCO	EOE 2100	EOE 2400	EOE 2500	EOE 2600	EOE 3100	OTHER	TOTAL
Course	FY 76-77	812782*			200.0				200.0
	1st Yr								
	FY 78**	812782			1,200.0				1,200.0
	2nd Yr	812786				26.0	19.0	63.0	108.0
		815796						1.0	1.0
	FY 79**	812782			2,050.0				2,050.0
	3rd Yr	812786				23.0	139.0	3.0	165.0
		815796				33.0		3.0	36.0
	FY 80	815796				18.0		3.0	21.0
	4th Yr								
	FY 81	815796				21.0		3.0	24.0
	5th Yr								
	FY 82	815796				24.0		3.0	27.0
	6th Yr								
ANALYSIS		FY 76	FY 77 1st Yr	FY 78 2nd Yr	FY 79 3rd Yr	FY 80 4th Yr	FY 81 5th Yr	FY 82 6th Yr	TOTAL
	Savings $					809.6	10,061.6	10,337.9	21,209.1
	Costs $	100.0	100.0	5,059.0	5,251.0	21.0	24.0	27.0	10,582.0
	Total $	100.0	100.0	5,059.0	5,251.0	788.6	10,037.6	10,310.9	10,627.1
	Savings/Cost	COST	COST	COST	COST	SAVINGS	SAVINGS	SAVINGS	SAVINGS

* Funded by PM, ARTADS

** TACFIRE Training System Costs are not included here but are included in the analysis. (3,750.0 and 3,000.0 in FY 78 and FY 79 respectively)

ANNEX 3 TO APPENDIX E
COST DEVELOPMENT MODEL
TACFIRE FIRE DIRECTION AND FIRE SUPPORT COURSES
Course Start Dates-FY80

COST SUMMARY:	APPROPRIATION OMA	AMS CODE	EOE	* FY 76	* FY 77	FY 78	FY 79	FY 80	FY 81	FY 82	TOTAL
A. One-Time Costs:											
1. Facilities		815796	2600				25.0				25.0
2. Equipment		812786	3100			19.0	139.0				158.0
3. Courseware											
4. Front-End Analysis											
5. Course Design & Analysis											
6. Other develop/design Original Art Production, Duplication 35mm		812786	1000			63.0					63.0
7. Contractor Assistance		812782	2500	100.0	100.0	1,200.0	2,050.0				3,450.0
TOTAL ONE-TIME				100.0	100.0	1,282.0	2,214.0				3,696.0
B. Recurring Costs:											
1. Maintenance											
a. Facilities		815796	2600				3.0	3.0	2.0	2.0	10.0
b. Equipment		815796	1000			1.0	3.0	3.0	3.0	3.0	13.0
c. Equipment		815796	2600				1.0	1.0	1.0	1.0	4.0
2. Supplies		812786	2600			26.0	23.0				49.0
3. Update of Software and Courseware		812786	1000				3.0				3.0
4. Instructor											
5. Printing (Other)		815796	2600				6.0	14.0	18.0	21.0	59.0
TOTAL RECURRING						27.0	39.0	21.0	24.0	27.0	138.0
TOTAL INCREMENTAL COST				100.0	100.0	1,309.0	2,253.0	21.0	24.0	27.0	3,834.0
BENEFITS SUMMARY:											
1. Student Pay and Alws											
2. Instructor Pay & Alws (Cost Avoidance)								16.0	32.0	32.0	80.0
3. Mission NPC											
4. Base Opns NPC		815796						23.0	28.0	36.0	87.0
5. Other-Equipment and Maintenance (Cost Avoidance)									9,041.0	9,041.0	18,082.0
TOTAL RECURRING BENEFITS								39.0	9,101.0	9,109.0	18,249.0

* Funds for FY 76 and FY 77 were furnished by PM, ARTADS

ANNEX 3 TO APPENDIX E (continued)
COST DEVELOPMENT MODEL
TACFIRE FIRE DIRECTION AND FIRE SUPPORT COURSES
Course Start Dates-FY80

	APPROPRIATION MPA	AMS CODE	EOE	FY 76	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82	TOTAL
COST SUMMARY:											
A. One-Time Costs:											
1. Facilities											
2. Equipment											
3. Courseware											
4. Front-End Analysis											
5. Course Design & Analysis											
6. Other develop/design Original Art Production. Duplication 35mm Contractor Assistance											
TOTAL ONE-TIME											
B. Recurring Costs:											
1. Maintenance											
a. Facilities											
b. Equipment											
c. Equipment											
2. Supplies											
3. Update of Software and Courseware											
4. Instructor											
5. Printing (Other)											
TOTAL RECURRING											
TOTAL INCREMENTAL COST											
BENEFITS SUMMARY:											
1. Student Pay and Alws								556.6	684.0	878.2	2,118.8
2. Instructor Pay & Alws (Cost Avoidance)								214.0	276.6	350.7	841.3
3. Mission NPC											
4. Base Opns NPC											
5. Other-Equipment & Maintenance											
TOTAL RECURRING BENEFITS								770.6	960.6	1,228.9	2,960.1

ANNEX 3 TO APPENDIX E (continued)
COST DEVELOPMENT MODEL
TACFIRE FIRE DIRECTION AND FIRE SUPPORT COURSES
Course Start Dates-FY80

	APPROPRIATION OPA	AMS CODE	EOE	FY 76	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82	TOTAL
COST SUMMARY:											
A. One-Time Costs:											
1. Facilities											
2. Equipment						3,750.0	3,000.0				6,750.0
3. Courseware											
4. Front-End Analysis											
5. Course Design & Analysis											
6. Other develop/design Original Art Production. Duplication 35mm Contractor Assistance											
TOTAL ONE-TIME						3,750.0	3,000.0				6,750.0
B. Recurring Costs:											
1. Maintenance											
a. Facilities											
b. Equipment											
c. Equipment											
2. Supplies											
3. Update of Software & Courseware											
4. Instructor											
5. Printing (Other)											
TOTAL RECURRING											
TOTAL INCREMENTAL COST						3,750.0	3,000.0				6,750.0
BENEFITS SUMMARY:											
1. Student Pay & Alws											
2. Instructor Pay & Alws											
3. Mission NPC											
4. Base Opns NPC											
5. Other-Equipment & Maintenance											
TOTAL RECURRING BENEFITS											

APPENDIX B

SUMMARY OF GENERIC DELIVERY SYSTEM CHARACTERISTICS

B-1: INSTRUCTOR WITH STANDARD AIDS

B-2: PRINTED MATERIALS

B-3: AUDIO VISUAL

B-4: TRAINING DEVICES AND SIMULATORS

B-5: COMPUTER-MEDIATED TRAINING SUPPORT

The general capabilities, advantages, and disadvantages of representative delivery system media within each of the above categories are summarized. A selected mix or designed configuration of specific delivery system devices, software, and course materials will not necessarily exhibit the same capabilities or constraints as these generic categories.

This material supplements information presented in Section 5 of this report.

B-1: INSTRUCTOR WITH STANDARD AIDS

Traditionally, instruction is presented to the student by an instructor in a face-to-face situation, using standard instructional aids such as charts and display boards.

1. Instructor. The instructor presents the instructional information, usually in lecture form and in a classroom setting, to the students, provides opportunities for interaction, clarification, and limited remediation. Quality of instruction may vary as a function of the instructor's abilities. Costs of training and maintaining instructional staff is a major factor in overall program costs. A variant on this technique is peer or peer group instruction wherein selected students assume the role of the instructor for certain purposes.

2. Charts and Display Boards. Wall charts are pre-prepared diagrams or pictorials, usually on paper, cloth, or plastic sheets, for classroom use. Display Boards are any two-dimensional medium for the display of non-projected visuals; they include large writing surfaces such as chalkboards and a variety of boards to which display materials can be attached.

   Both charts (if the surface is properly protected) and display boards permit the addition of illustrative markings during the presentation and the "building-up" of the materials at a rate and manner compatible with student learning. Charts, while requiring advance preparation, are generally less bother while being used than projected visuals (though more trouble to store and set up) and can be made any ratio of height to width. Both charts and display boards, while relatively inexpensive to produce and adaptable to a variety of instructional settings and situations, rely heavily on the availability and effectiveness of a live instructor for their teaching potential

3. Overhead Transparencies. Overhead transparency projectors enable the projection of images and silhouettes drawn upon various sizes of clear acetate, most commonly 8" x 10". Some projectors permit the simultaneous projection of slides (discussed in paragraph 2.2.3) and transparencies. They can be used in settings with near-normal ambient light at close or moderate projection ranges. The projector requires the proximity of an operator (usually the instructor) for effective use. With an operator, transparencies offer a flexible display medium by stacking and overlapping, covering and exposing portions, etc. Transparencies are relatively easy and inexpensive to prepare, the full range of still photography and drafting techniques may be used, and instruction is easily modified by inserting or deleting tranparencies; however, the projectors and transparencies are cumbersome to move and store.

B-2: PRINTED MATERIALS

Printed materials are the most common means of presenting instruction in an individualized or self-study mode and as a supplement to other forms of instructional media.

1. Standard Printed Materials. Standard printed materials include textbooks, workbooks, pamphlets, and single copy sheets. (Excluded in this category are programmed instruction texts and printed materials used in simulation exercises.) Information in standard printed materials form may be presented in words, drawings, or photographs. Major advantages include standardization of information presented; ease of storage and use; adaptability to student self-pacing and remediation; low cost of duplication (Xerox) or reproduction (if done in large quantities); and high adaptability for use with other instructional media. Major disadvantages include heavy reliance on student reading ability; time and cost for development; not easily modified; and lack of student query/response capability (is a one-way medium).

2. Programmed Instruction Texts. Programmed Instruction (PI) texts differ from standard printed texts primarily in the organization and presentation of the instructional materials. In PI texts, the subject matter is systematically organized for student learning in small steps or frames; each frame presents a discrete set of information and then poses a question to which the student is to respond. Two types of texts have evolved. The first is in a linear format in which the student responds to all steps in the instructional sequence. The second is in a branched format. In this format the student is presented a frame, then selects an answer from a multiple-choice question. Depending upon the answer chosen, the student is directed to the next instructional frame or to a set of remedial frames.

Major advantages of PI texts are that the material is organized and sequenced in a manner designed to enhance the learning process; learning is more efficient than with standard text materials; each individual progresses at his own pace, in keeping with his mastery of the materials. Major disadvantages, compared to standard texts, include the time and costs of development; organization of material discourages independent inquiry; and difficulty in using for reference.

3. Microform. Microform enables the storage of great quantities of printed materials in a minimum of space using roll microfilm, microfiche, or aperture cards. Microform viewers are used to view the stored information. With the viewers, various techniques are used to locate and retrieve the desired data from the mass of data contained on the roll or fiche. Among the disadvantages of this technique are viewer fatigue, specialized and complex equipment required for production, equipment required for viewing, and various format/viewing device incompatibilities.

B-3: AUDIO VISUAL

Audio, audio-visual, and visual media may be used in a stand-alone form to present instructional sequences or as a supplement to other presentation media. Pre-recording ensures a uniform quality of presentation.

1. Audio Tapes. Tape cassettes, reels, and cartridges provide a simple, economic, and convenient means for recording and presenting instructional information in audio form. Tapes are strictly linear in pacing and control except for manual stop, search, and replay. Playback units are small and portable, making them suitable for individual student use in a variety of settings and for providing audio instructions for the performance of paced manual tasks. Multi-track and random-access units provide limited branching capabilities. Audio tape is flexible for editing, erasure, and re-use; it may also be used to record student responses for later evaluation.

2. Slides and Sound-Slides. Slides provide a film transparency with the full range of still photography techniques, usually 35mm in 2" x 2" mounts; slide presentations normally employ slide magazines of varying capacities, with the presentation rate under manual or automatic control. Sound-slide presentations use integrators/synchronizers to integrate tape recorders with slide projectors. Some projectors permit the presentation to be stopped while the student performs a task, practices a skill, does a workbook exercise, or answers a question. Special responder devices are available which enable presentation re-start when a correct response has been given by the student; random-access units permit selective review or branching for individual or group presentations.

   Slides permit ease of program rearrangement or update, whereas sound-slide fixes the display time and limits the ease of program

redesign. A particular problem encountered in the use of sound-slide presentations is the loss of synchronization between the visual and sound segments unless a pulsing technique is used to maintain proper synchronization, particularly during rewind and fast-forward operations. Slide and sound-slide units are relatively portable and little space is required for media storage.

3. Filmstrips and Sound-Filmstrips. Filmstrip projectors permit the projection of a still series of color or black-and-white pictures. They may use 35mm motion or slide film, 16mm or 8mm film cartridges, or continuous loop filmstrips. Audio may be incorporated by discs or audio tape cassettes with audio program synch and control signals. While the instructional sequence is fixed, the presentation time is under operator control.

   Filmstrips offer the full range of photographic techniques, ease of storage and handling, and production gear is easy and inexpensive to use. Sound-filmstrip production requires special equipment, with the control signals and sound track programmed independent of the film. Modifying a visual-audio sequence is not easy and combining sound with filmstrip usually eliminates the picture "freeze" capability. There is no inherent or readily adaptable student response capability with filmstrips.

4. Motion Pictures and Sound Motion Pictures. Motion pictures can provide continuity of action, an illusion of motion, slow-motion, control of demonstration speed or aspect angle, time-lapse action, time compression, and timed focus on an event when such features are important to a training requirement. Formats are usually 16mm, 8mm, or super-8. Sound is incorporated using magnetic or optical sound tracks.

Cartridge projectors offer simplicty of operation and longer film life then do reel-to-reel projectors. Films lack a student response and scoring capability (unless with programmed or facilitator-control stop and student response sheets), require darkness for presentation, provide displays at a fixed rate for all viewers, and are comparatively expensive to produce and update.

5. Television and Video Recordings. This category includes live television, slow-scan television, and video recording/playback. Live television may be used in the instructional setting to observe an event at a distance, to provide magnification or focus on a particular aspect of the learning activity, and to present the information to a large or geographically remote audience. The activities may be recorded for immediate or delayed playback. Recorded actions and materials can be displayed at various speeds, stopped or reversed, and preprogrammed material is readily edited and corrected.

   Instructional television (ITV) normally refers to the presentation of preprogrammed material controlled from a central location. Slow scan television is a technique that permits a more efficient use of transmission capabilities by sending a lesser number of pictures per unit of time. Video recording and playback also permits the presentation of the instuctional material under local control: the program is recorded, either at the central location or locally, and stored for later presentation or playback equipment at the local site. Currently, video tape in reel or cassette form is used as the principal recording medium. Video disc recording is a recent development which permits the recording and storage of extensive amounts of information in video format in a very limited space (i.e., on the video disc) for later playback.

B-4: TRAINING DEVICES AND SIMULATORS

Major training devices and simulators are used primarily where the subject matter is too complex for verbal, symbolic, or simple pictorial presentation, or requires extensive hands-on practice for proper skills development.

1. Teaching Machines. Teaching machines refer to a variety of devices which present instruction, require responses, and act on the responses given. Some may be simple portable devices while others use or combine various forms of presentation such as audio, slides, video, film-strips, or even computer-assisted instruction. They tend to be special purpose machines, with attendant problems of operation, maintenance, and cost of software (instructional materials and presentation control programs) development. A major advantage is that they control the information presented to the student, prevent skipping of materials, and adapt the presentation pace to the individual student. They generally require overt responses from the student and many have automatic scoring capabilities.

2. Models and Mock-Ups. Models and mock-ups are three-dimensional representations of objects which differ from the real object in size, material, and/or functional capability. They may be constructed in a manner which permits easy disassembly or may be made of transparent materials so that the student may see internal components and their physical and functional relationships. Their most frequent use is to illustrate both static and dynamic spatial relationships.

3. Hardware Simulator-Trainers. Equipment simulator-trainers are used to train personnel in tasks such as operations, emergency procedures, and maintenance of the operational system. They may be designed for part task, full task, individual, team, or total system training or any combination thereof. They can be designed to provide control

over training by incorporating instructor monitoring of student actions and cues, situational "freezes" and/or recording so that specific student behaviors can be critiqued in depth. They are also designed so that personnel and equipment can be protected from the consequences of erroneous behavior. They may cost anywhere from a fraction to several times the cost of the equivalent operational equipment.

4. Actual Objects. An actual object (component, assembly, unit, or system) may be used as a training device or instructional medium. For this purpose, two broad classes of actual objects are generally identified: in-context and out-of-context. In-context objects are those located in and used for mission performance in the operational setting; they provide the principal medium for on-the-job training. The use of in-context objects for instructional purposes may interfere with on-going operations and present hazards to personnel and equipment. The principal advantages are high transfer of training, motivation, and the accomplishment of productive work. Out-of-context objects are those dedicated for training use and are usually in excess of those required by the operational mission. Compared to in-context objects, their use generally offers more favorable circumstances for training and better control of the learning situation.

B-5: COMPUTER-MEDIATED TRAINING SUPPORT

The computer may be used to present individual instruction and practice, for team exercise, and to manage the presentation of instruction. As an instructional medium, the computer can be programmed to present instructional materials, interact with the student, record and analyze responses, and adapt the instructional sequence based on the cumulative trend of a student's responses.

1. Computer Managed Instruction (CMI). In this mode, student learning performance data (usually test results) are entered into the computer via any of a number of possible data entry devices. The computer aggregates and scores the trainee performance in keeping with the learning objectives and standards, evaluates the results, and prescribes the next set of learning activities. The computer maintains a cumulative record of student performance and learning prescriptions and provides a printout of this information periodically or on request. Instead of the testing taking place off-line for subsequent processing and entry into the computer, the program may also be designed for interactive computer presentation of the test materials and immediate assignment of the next learning activity. This on-line CMI requires similar media capabilities as CAI, below.

2. Computer Assisted Instruction (CAI). In this mode the instructional materials are presented by the computer, usually via a cathode ray tube (CRT) or teletypewriter. The student interacts with the computer via a keyboard or light pen. Responses are scored and evaluated, and decision rules incorporated in the instructional program are used to determine instructional sequencing and performance feedback.

3. Computer-Based Team Training. Team or system training may also be accomplished on-computer, using inputs either from a pre-stored instructional data tape or from real time computer interaction with the operational environment. These inputs may be combined with other preprogrammed messages, synchronized to geographic and time referents, for presentation to a number and variety of positions undergoing simultaneous training. Trainees respond with control actions as they would in live operations.

A principal advantage of CAI is that it can approximate human instructor capabilities (including interaction, response monitoring, and adaptive strategies) while maintaining standardization and quality of instruction. Disadvantages may include high initial development costs; software and hardware complexity and associated maintenance requirements; and the need for additional skills (computer programming) beyond subject matter expertise for program development. The initial acquisition costs may be relatively low if machine-transferrable software is used (such as the PLANIT CAI system) rather than a system wedded to a specific computer or interactive terminal device.

Two advantages of computer-based delivery systems include: (1) automated recording, update, and listing of student records; (2) efficiency of courseware (tests, lessons, simulations) data base update. The second advantage is particularly true with an interactive compiler CAI system and a text editor, such as the configuration accessible by USAFAS on the UNIVAC 1108.

APPENDIX C

PROCEDURES AND FORMS SUPPORTING UNIT CAI IMPLEMENTATION

C-1: PROCEDURES FOR RUNNING PLANIT

C-2: QUESTIONNAIRE(S)

C-3: MONITOR'S OBSERVATION LOG

C-4: CAI ATTITUDE QUESTIONNAIRE

These materials are intended to supplement the instructions and the automated record examples presented in Section 6 of this report.

APPENDIX C-1

PROCEDURES GUIDE FOR EXECUTING PLANIT COURSEWARE

Cue or Display	Your Action	Comment
	(1) CONNECT CONSOLE TO COMPUTER	
	Obtain authorized UNIVAC & PLANIT identifiers	
	Turn CRT power switch ON	- to activate CRT and keyboard
	Press CONV Mode key	- puts console in interactive mode
CRT screen lights	Press print line button	- to activate printer
Printer Hums	Dial (phone number)	- to get computer channel
High pitched tone	Place phone in coupler	- to permit data transfer
CRT carrier light ON	Key #ARIØ5 or ARIØ6 Press NEW LINE key (NL)	- identifies your console - transmits to computer
Edgewood Arsenal, etc. (appears on CRT screen)		- you are on-computer
	(2) DECLARE JOB TO EXECUTIVE SYSTEM	
	key @RUN(space)name,accountnumber,5Ø,4ØØ e.g. @RUN NYSTROM,accountnumber,5Ø,4ØØ	
DATE:DDMMYY TIME:HHMMSS e.g., 130277 074530	Press NEW LINE key (NL)	
>appears on screen	key @@CQUE (NL)	> will no longer appear

(A) CORRECT KEYING ERRORS BEFORE COMPUTER ENTRY		
Incorrect typing	Hold CONTROL key down and then press X key (before pressing NEW LINE key)	to override keyed line before transmit to computer computer
Cursor jumps to next line, left margin of screen	Key new replacement line (NL)	transmit corrected entry

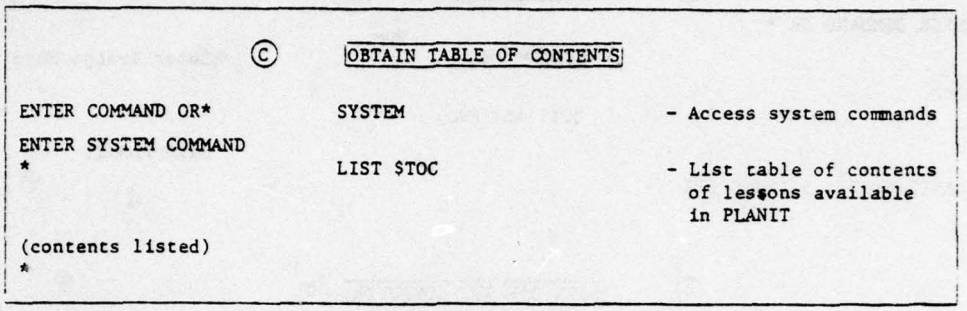
Cue or Display	Your Action	Comments
	(3) ACCESS PLANIT	
	@ADD PLANIT*PRUNS.HOT (NL)	- to load PLANIT
String of READY messages ending with: LOGIN OR END *		(PLANIT loaded)
	Key Identifier (NL) e.g., NYSTROM (NL)	*prompts response
ENTER COMMAND * ENTER SYSTEM COMMAND	& SYSTEM (NL)	- to PLANIT System Mode (System Mode prompt)
	(4) ADDLOG STUDENT NAMES	
* ENTER SYSTEM COMMAND	& SYSTEM	- To access system command
*	ADDLOG/student identification/(NL) e.g., ADDLOG/SMITH/JONES/ (NL)	- To enter student identifications. - Multiple student ID's can be added on a single line separated by slashes.
DONE *		- Student ID has been accepted by PLANIT
	(5) RETRIEVE AND EXECUTE CAI LESSON AS A STUDENT	
	GET lessonname (NL) e.g.,GET INTRO (NL)	- use PLANIT lesson name (para. B3a)
	Student Identifier (NL) e.g.,SMITH (NL)	- use identifier of student (from Step 4 ADDLOG)
Lesson Executes (Frames are administered and appear. Successive responses are cued by *)		

Cue or Display	Your Action	Comments
⑥	RETRIEVE AND EXECUTE CAI LESSON as an AUTHOR	
	GET lessonname (NL) e.g., GET INTRO	- use PLANIT lesson name
IDENTIFY YOURSELF***		
	Authoridentifier (NL) e.g., JOHN (NL)	- author access requested
ENTER COMMAND *		- PLANIT awaits author control
	CLEAR (NL)	- to clear prior execution record
DONE *		
	EX (NL)	- to run lesson from the start
(Lesson frames are administered and appear in sequence as student would see them. Successive responses are cued by *)		
*	&CLEAR,EX (as above)	- to re-execute
*	Sign-off PLANIT when finished	- See Sign-Off procedure ⑧ and ⑨
⑦	OBTAIN STUDENT RECORDS	
(After retrieving CAI lesson with GET and author identifier, Step ⑥		
ENTER COMMAND *	ATTACH studentname (NL)	- use name student issued to get lesson
DONE *	DISPLAY (NL)	- display student record
SUMMARY ONLY (Y/N)? *	Y (NL) N (NL)	- summary data only - complete record printed
(record printed as requested) *		

Cue or Display	Your Action	Comments
	⑧ SIGN OFF PLANIT	
ENTER COMMAND OR *		
	SYSTEM (NL)	- Enter System Mode
DONE *	QUIT ALL (NL)	
		Exit PLANIT
PLANIT SYSTEM SIGNING OFF		
	⑨ SIGN OFF THE COMPUTER	
	@FIN	- terminate session
Display accounting information then TERMINAL INACTIVE		
	HOLD DOWN CONTROL KEY then press D	- disconnect phone line
carrier light goes out		
	Hang up phone, depress power key on CRT	- Turn off CRT
CRT goes to black	Depress power key on printer	- Turn off printer

	Ⓑ RESTORE PLANIT	
	@ADD PLANIT*PRUNS.RESTORE	- Restore PLANIT to reliable operating status
Facility warnings, blocks copied ⋮		
READY	@ADD PLANIT&PRUNS.HOT	- Access PLANIT after restore
FURPURs, READYs ⋮		
LOGIN OR END *		- PLANIT is up

Note: Obtain all PLANIT student records required before restoring system.


©
OBTAIN TABLE OF CONTENTS
ENTER COMMAND OR*
SYSTEM
- Access system commands
ENTER SYSTEM COMMAND
*
LIST $TOC
- List table of contents of lessons available in PLANIT
(contents listed)
*

APPENDIX C-2

QUESTIONNAIRE(S)

Date: _____

QUESTIONNAIRE(S)

Name _____ Grade _____ SSAN _____

Unit _____ MOS _____

Duty Position _____ GCT Score _____ Education ____

1. How long have you been in the Army? _____
2. Have you had previous military service? Yes _____ No _____
3. When did you complete BCT (date) _____
4. Are you currently in Advanced Individual Training (AIT)? Yes _____

   No _____
5. Have you had Land Navigation (Map Reading)? Yes _____ No _____
6. Can you read a military map? Yes _____ No _____

APPENDIX C-3

MONITOR'S OBSERVATION LOG

MONITOR'S OBSERVATION LOG

NAME _____ DATE _____

TIME	COMMENTS	TIME	COMMENTS

APPENDIX C-4

CAI STUDENT ATTITUDE QUESTIONNAIRE

CAI STUDENT ATTITUDE QUESTIONNAIRE

NAME AND GRADE _____ SSAN _____

UNIT _____ PHONE _____ DATE _____

1. What did you think of the Observed Fire CAI Lessons that you have just completed?

_____

_____

_____

_____

_____

2. My attitude toward CAI material was that I...

( ) disliked it very much
( ) disliked it
( ) neither liked nor disliked it
( ) liked it
( ) liked it very much

3. Instructions for taking the lessons were...

( ) very difficult to understand
( ) difficult to understand
( ) borderline
( ) easy to understand
( ) very easy to understand

4. Which Observed Fire CAI Lessons did you take? (check)

____ Determination of Direction
____ Target Location: Polar Plot Method and Grid Coordinates Method
____ Locate a Target by Shift from a Known Point
____ The Call for Fire
____ The Adjustment of Fire by the Bracketing and Creeping Methods, Part I
____ The Adjustment of Fire by the Bracketing and Creeping Methods, Part II

5. Did you have any problems or difficulties in using the console or interacting with the computer?

   ( ) Yes ( ) No

   If Yes to item 5, please describe your most serious problem or difficulty.

6. The lessons covered the areas listed in (4) above. Were any of these, or parts of these, particularly good, and tell why.

7. Were any of the lessons particularly bad and tell why.

8. I think that this CAI method of instruction/learning is...

( ) very effective
( ) effective
( ) borderline
( ) ineffective
( ) very ineffective

9. For satisfactory understanding of the subject being studied, the amount of time provided was:

( ) much too long
( ) fairly long
( ) about right
( ) fairly short
( ) much too short

10. For satisfactory understanding of the subject being studied, the amount of material (information) provided was:

( ) much too large
( ) fairly large
( ) about right
( ) fairly small
( ) much too small

11. The technical detail provided was:

( ) very satisfactory
( ) satisfactory
( ) borderline
( ) unsatisfactory
( ) very unsatisfactory

12. The organization of the material presented was:

( ) very satisfactory
( ) satisfactory
( ) borderline
( ) unsatisfactory
( ) very unsatisfactory

13. My understanding of the material presented was:

( ) very satisfactory
( ) satisfactory
( ) borderline
( ) unsatisfactory
( ) very unsatisfactory

14. The quantity of the off-line course exhibits provided was:

( ) very satisfactory
( ) satisfactory
( ) borderline
( ) unsatisfactory
( ) very unsatisfactory

15. Were any of the exhibits inaccurate?

( ) Yes ( ) No

If Yes, please describe: _____

_____

_____

16. Were any of the exhibits irrelevant or unnecessary?

( ) Yes ( ) No If Yes, which? _____

_____

_____

17. Can you think of any other exhibits that should be added to the set?

( ) Yes ( ) No If Yes, please describe: _____

_____

18. If you had to carry out the tasks on observed fire covered in the course, how well could you do them?

( ) very effectively
( ) effectively
( ) borderline
( ) ineffectively
( ) very ineffectively

19. Have you ever had this type (CAI) training before?

( ) Yes ( ) No

20. Does this type of training make Army instruction better?

( ) Yes ( ) No

Why? _____

_____

_____

21. Is this type of training interesting to you?

( ) Yes ( ) No ( ) Not Sure

Why? _____

_____

_____

22. Does this type of training make it easy for you to learn?

( ) Yes ( ) No ( ) Don't Know

Why? _____

_____

_____

23. Do you like this type of training?

( ) Yes ( ) No ( ) Undecided

Why? _____

_____

_____

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APPENDIX D

ABBREVIATIONS

ABBREVIATIONS

ABACUS	Experimental Army Computerized Training System (CTS) project underway at Army Training Support Center and U.S. Army Signal School
ACB	Army Classification Battery
ADDS	Applied Digital Data Systems
ADO	Air Defense Officer
AQB	Army Qualification Battery
AR	Army Regulation
ARI	U.S. Army Research Institute for the Behavioral and Social Sciences
ARMCOM	U.S. Army Armament Command
ARTADS	Army Tactical Data Systems
ARTEP	Army Training and Evaluation Program
ASARC	Army Systems Acquisition Review Council
ATSC	Army Training Support Center
Bn	Battalion
CAI	Computer Assisted Instruction
CAMMS	Computer Assisted Map Maneuver System
CATTS	Computer Assisted Tactical Training System
CEP	Concept Evaluation Plan
CFP	Concept Formulation Package
CMI	Computer Managed Instruction
CODAP	Computerized Occupational Data Analysis Programs
COEA	Cost and Operations Effectiveness Analysis
CP	Command Post Exercise
CTEA	Cost and Training Effectiveness Analysis
DA	Department of the Army
DARCOM	U.S. Army Development and Readiness Command
DCSOPERS	Deputy Chief of Staff, Operations
DCSPERS	Deputy Chief of Staff, Personnel

DEVTOS	Developmental Tactical Operating System
Div Arty	Division Artillery
DP	Development Plan
DRAGON	An Anti-Tank Missile Weapons System
DT	Developmental Testing
DT/OT	Developmental Test/Operational Test
ECOM	U.S. Army Electronics Command
EPMS	Enlisted Personnel Management System
ET	Embedded Training
ETM	Extension Training Materials
FADAC	Field Artillery Data Analysis Computer
FDC	Fire Direction Center
FEA	Front End Analysis
FM	Field Manual
FORSCOM	U.S. Army Forces Command
FTX	Field Training Exercise
ICH	Instructor Contact Hours
I-G-L-M	Institutional, Garrison, Local, Major (training areas)
ILS	Integrated Logistics Support
INTEL	Intelligence
IOC	Initial Operational Capability
IPISD	Interservice Procedures for Instructional Systems Development
IPR	In-Process Review
ISD	Instructional Systems Development
ITDT	Integrated Technical Documentation and Training

JPA	Job Performance Aid
JPG	Job Performance Guide
JPM	Job Performance Manual
LAI	Lesson Administrative Instructions
LAW	Light Anti-Tank Weapon
LCSMM	Life Cycle System Management Model
LDA	Lesson Design Approach
LET	Launch Effects Trainer (for DRAGON system)
LOA	Letter of Acceptance
LR	Letter Requirement
LRIP	Low-Rate Initial Production
LSA	Logistic Support Analysis
MAGLAD	Marksmanship and Gunnery Laser Devices
MASSTER	Modern Army Selected Systems Test, Evaluation, and Review
MILES	Multiple Integrated Laser Engagement System
MILPERCEN	Military Personnel Center
MMC	U.S. Army Maintenance Management Center
MOS	Military Occupational Speciality
NET	New Equipment Training
ODP	Outline Development Plan
OJT	On-The-Job Training
OPMS	Officer Personnel Management System
OT	Operational Testing
OTEA	U.S. Army Operational Test and Evaluation Agency
PI	Programmed Instruction
PLANIT	Programmed Language for Interactive Teaching
PLATO	Programmed Logic for Automated Teaching Operation
POI	Program of Instruction, Plan of Instruction

QQPRI	Qualitative and Quantitative Personnel Requirements Information
RDTE	Research, Development, Test and Evaluation
REALTRAIN	Simulation System for REALism of TRAINing
ROC	Required Operational Capability
SCOPES	Squad Combat Operations Exercise, Simulated
SDC	System Development Corporation
SG	Student Guide
SIDPERS	A FORSCOM Computerized Personnel Data and Training Status System (FORSCOM Circular 350-8)
SLS	Student Lesson Sheet
SM	TRADOC System Manager
SOJT	Structured On-the-Job Training, Supervised On-the-Job Training
SOW	Statement of Work
SP ARTY	Special Artillery
SQT	Skill Qualification Test
TACFIRE	Tactical Fire Direction System
TARCOM	U.S. Army Tank-Automotive Command (DARCOM)
TASA	Task and Skills Analysis
TASO/TASC	Training Aids Service Office/Training Aids Service Center
TC	Training Circular
TDI	Training Developments Institute, Army Training Support Center (formerly TMI)
TDR	Training Device Requirement
TEC	Training Extension Course
TEWTS	Tactical Exercise Without Troops

TM	Technical Manual
TMG	Training Management Guide
TMI	Training Management Institute (see TDI)
TOW	A Heavy Anti-Tank/Assault Weapon System
TRADE	Training Devices Command (DARCOM)
TRADER	Training Devices Requirements Directorate of Army Training Support Center, TRADOC
TRADOC	U.S. Army Training and Doctrine Command
TRASANA	TRADOC Systems Analysis Activity
TSM	TRADOC System Manager
USACGSC	U.S. Army Command and General Staff College (Ft. Leavenworth)
USAFAS	U.S. Army Field Artillery School (Ft. Sill)
USAIS	U.S. Army Infantry School (Ft. Benning)
USAREUR	U.S. Army, Europe
WBS	Work Breakdown Structure

APPENDIX E

DEVELOPMENT PLAN

The six sections have presented a preliminary frame of reference and decision model for TEC delivery systems concept planning in the FY 78-83 period. Specifically:

- background, purpose, assumptions, and objectives.
- implication of Army initiatives and directives forecasted to impact training evaluation resources utilization at USAFAS during FY 78-83.
- an overall model of the selection, constraint, and solution factors normally influencing Army training program delivery system decisions with a description of how five program development situations viewed as USAFAS requirements in FY 78-83 will differ on these factors.
- a preliminary delivery systems selection process incorporating four delivery system decision stages keyed to the events, available data, and products needed to integrate individual-collective training and evaluation within a material system or MOS life-cycle proponency model.
- a summary of delivery systems available or potentially available to support USAFAS and/or unit training during FY 78-83.
- a methodology for exporting the observed fire CAI/TEC package, developed by USAFAS, to the field.

This section provides a work plan to further define, develop, and evaluate the frame of reference and decision process in the six referenced sections.

A. OBJECTIVES

1. Obtain USAFAS/ARI concurrence and revisions to the problem definition and preliminary delivery systems selection plan contained in Sections 2 through 5 (Step 1 in work plan detailed below).

2. Further detail and develop the delivery systems selection procedures, define specific data sources, and specify products which incorporate Army priorities (Step 2 in work plan detailed below).

3. Pilot test the application of the delivery systems selection procedures in an appropriate training program development activity at USAFAS; gather data, evaluate the procedure, and revise components in accordance with findings (Step 3 in work plan detailed below).

B. SCOPE OF WORK

Steps of the workplan conform to the three objectives and are discussed below.

1. Step 1 - USAFAS/ARI Review, Revisions, and Concurrence on Approach

The purpose of this step is to obtain USAFAS/ARI review, recommendations, and requirements for the framework, approach, and process set forth in prior sections of this report. This will require meetings with ARI and Ft. Sill personnel to coordinate working assumptions, obtain priority requirements and guidance, and gather data. Because the preliminary delivery systems decision process concerns decision stages (see Section 4) that integrate work from combat, training, and course developers it is suggested that USAFAS review consider such inputs, as well as those from any TRADOC System Managers and the Resource Manager. The best coordination point within USAFAS may be Course Design/Development, because this appears to be the focal point for finalizing delivery system decisions at USAFAS. An additional

purpose for visiting ARI will be to obtain their priorities, suggested data sources, or instruments for determining trainee characteristics data useful to selecting (or assigning) appropriate delivery systems mix, including but not limited to cognitive-perceptual style indices. These meetings should take place within the first month of a six-month workplan, such that revisions and specific inputs will be available for Step 2 by the end of the first month. This report (TM-5841/001/00) will be modified or supplemented as required to incorporate USAFAS/ARI priorities.*

2. Step 2 - Develop Delivery Systems Selection Procedures

The purpose of this step is to define and detail requirements, decision criteria, data sources, and products of the delivery systems selection process based upon USAFAS needs and emerging DA/TRADOC directives, specifications, and delivery systems. Suggested tasks include:

2.1 Determine System, MOS, and Trainee Focus

The purpose of this task is to define those combat missions, systems, jobs, and enlisted/officer MOS and skill levels of priority interest to USAFAS regarding trainee data and delivery systems. Suggestions already advanced by USAFAS include: courses scheduled to go self-paced such as C&E, Gunnery, and Counterfire; MOS 13F (Fire Support Specialist) because it will have the dual problem of resident training and cross-training of MOSs (13E, 13F, 13W) in the field, as well as a good range in types of individual-team tasks; or re-development of the FA Officer Basic Course for Cannon, Target Acquisition, Pershing, and Lance operations. This task interacts with the first task of Step 3 and provides input to other tasks below.

*Considerations for Step 1 are also given in Section 7 (B.1 - B.5).

2.2 Determine Individual-Collective Task Characteristics

The purpose of this task is to define the essential descriptors for types and levels of performance-oriented subject matter which are compatible with system-job, MOS, and trainee data source decisions made in Task 2.1.

2.3 Determine Essential Attributes of Delivery Systems

This task extends and prioritizes the work started in Section 5 and Appendix B of this report. The purpose is to determine those generic individual-collective training and evaluation delivery system (methods-media) and specific Field Artillery delivery system configurations of priority interest to USAFAS. This decision relates to decisions made in tasks 2.1 and 2.2.

The intent is to define those attributes of delivery systems essential for matching with trainee, subject-matter, and constraint factors in view of the decision factors and decision stages covered in Sections 3 through 5 of this report. These attributes may include -- presentation and response capabilities and realism (seeing, hearing, reading, doing); flexibility for feedback and control; flexibility for individual and collective training-evaluation usage; recordkeeping and reporting capabilities; exportability or accessibility; courseware development and update requirements; facility requirements; user support requirements; relative costs, etc. An ambiguous area in this task is availability of relative cost-effectiveness data.

2.4 Develop Delivery Systems Selection Data Bank

The purpose of this task is to develop a USAFAS data file on trainee characteristics, subject-matter characteristics, and delivery system attributes which will assist in identifying an

optimal match. Inputs to this task will be from priorities and outputs of the prior three tasks. The data file could take any of several forms; e.g., matrices or tables cross referencing task characteristics and trainee characteristics to delivery system attributes, delivery system requirements forms to be compared with delivery system attribute tables, etc.[1]

2.5 Proceduralize Decision Stages of Model

The goal of this task is to proceduralize the decision steps, data inputs, and interim product outputs for each of the four delivery system decision stages of the training development life-cycle proponency model shown in Figure 4-1 (foldout) Section 4. The intent is input to an Individual-Collective Training and Evaluation Plan (ICTEP) which integrates system, job, and MOS course development products. Selected stages would utilize the data file developed in task 2.4.

These Step 2 tasks are projected to begin concurrently with Step 1 for the remainder of the six-month workplan. They would result in the documentation of specific data sources, instruments, procedures, and working formats to operate the delivery system selection process.

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1 - Bennik, F., Fallentine, B., Mower, R., Joint Surveillance System Training Requirements Analysis Study, SDC TM-5588 (Vols. I & II), 31 Oct 1975.

- Boucher, B. G. et al. Handbook and Catelog for Instructional Media Selection. Ed. Technology Publications, January 1973.

- TRADOC Pam 350-30. IPISD Design: Volume III (Block III.2), Aug 1975.

3. Step 3 - Pilot Implementation and Formative Evaluation at USAFAS

The purpose of this work would be to apply the delivery systems selection process documented as a result of Steps 1 and 2 to one or more sizable system, job, or MOS oriented training program and course development activities encompassing a range of individual-collective training requirements. This will permit data to be gathered on the utility of the delivery systems selection procedures against the design and evaluation criteria set forth in Section 4. A., as modified by subsequent work. Lessons learned will be incorporated into the selection procedures and data gathered will be added to the data sources developed in the prior step.

The plan would be for USAFAS personnel to perform the selection tasks in accord with the four decision stages and products defined in Section 4 (Figure 4-1) of this report, and detailed in the Step 2 tasks noted above. Initial workshop training would be provided, followed by data collection for USAFAS application, and procedures would be required as indicated by the evaluation.

Projected work tasks are as follows:

3.1 Select ITDT, Self-Pacing, or TEC Projects with USAFAS

Candidate MOS projects were mentioned in Step 2 (task 2.1) above. Other candidate projects include FADAC maintenance and operation, SR-56 operation, and probable upcoming ITDT developments at USAFAS; XM-204, SP Arty Total System, and Towed Arty (FY 78-81).

3.2 Provide Training Workshop for USAFAS Personnel

The purpose of this would be to familiarize and exercise USAFAS developers in the delivery system selection data and procedures developed in Step 2, using situational problems for practice. The workshop is estimated at three weeks.

3.3 Determine Evaluation Criteria and Data Collection Procedures

A plan, procedures, and forms would be developed to collect data in accordance with criteria defined in Section 4, Part A of this report.

3.4 Perform Needs and Requirements Analysis

USAFAS developers would perform activities of this phase. They would make Stage 1 decisions on delivery systems mix and input these to the Individual-Collective Training and Evaluation Plan (ICTEP).

3.5 Perform Front-End Analysis

USAFAS developers would perform activities of this phase, make Stage 2 decisions on delivery systems mix and input rationale and resource demands to the ICTEP.

3.6 Perform Course Design

USAFAS developers would perform activities of this phase, make Stage 3 decisions on delivery systems mix and provide specific performance module rationale for the ICTEP. In this process they would also decide on the need for alternative delivery systems in the training setting, to correspond with trainee preference or style.

3.7 Perform Course Development

USAFAS developers would perform these activities in accord with the ICTEP. This would include developing lesson, module, and team levels of proficiency measures, as well as training management guides appropriate to the training setting and delivery system(s) configuration decided in Task 3.6.

3.8 Formative Implementation

Following preliminary validation, USAFAS training operations supervisors would be provided the training delivery systems for use in a realistically configured training setting. They would conduct training and make Stage 4 delivery system assignments in accordance with the training management guides.

Data would be collected in accordance with the data collection plan (Task 3.3).

3.9 Evaluate and Revise

Data on effectiveness, efficiency, utility, acceptance and costs of the delivery systems mix would be analyzed, resulting in revisions to procedures for delivery system selection/assignment as required. The final product would be a Training Manager's Handbook.

This Step 3 work is estimated to require 12-18 months beyond Steps 1 and 2 depending upon the magnitude of the system/MOS program and extent of evaluation, and its implementation is awaiting adequate funding.

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APPENDIX F

REFERENCES

F-1: DA and TRADOC

F-2-1: Field Artillery School

F-3-1: Other Organizations

This appendix contains a partial list of the documentation reviewed in the course of conducting this project task. Other references are listed in the text of the report, or in footnotes.

APPENDIX F-1: DA and TRADOC

Baker, James, D., "The Training Effectiveness of Simulation," Proceedings of SALT/NSIA Symposium, Volume IV, 21-23 July 1976, pps. 14-18.

Baker, James D., "Computers, Collective Training and Validity: Key Issues for the Future of Simulation," Proceedings of SALT/NSIA Symposium, Volume IV, 21-23 July 1976, p. 162.

Buchan, LCOL Ross S. and Knutson, Maj. Ray, "The ITDT Program: The Army Departs from Training Tradition," from Defense Management Journal, pps. 33-37, January 1977.

Burdeshaw, BG, "Total Systems Management." Presentation at C.R.I. Sr. Manager's Course, Hampton, Va., 20 April 1977.

Connolly, J.A. et al (AIR). A Cost Assessment of Army Training Alternatives. ARI Research Problem Review 75-3, August 1975.

DARCOM. Mil-M-63035(TM). Manuals, Technical: Front End Analysis (No Date).

DARCOM/TRADOC. Technical Documentation and Training Acquisition Handbook Office of Project Manager, ARTADS, Training Development Office, Ft. Monmouth, N.J., (Draft) revised 9 May 1977.

DCS-CD, TRADOC HQ, MICV-TBAT (briefing).

Dept. of Army. AR 70-1. Army Research, Development and Acquisition, 1 May 1975.

Dept. of Army. AR 1000-2, Operating Policies for Systems Acquisition by the Department of the Army, 23 December 1976 (Draft).

Dept. of Army. ARTEP 6-105. Army Training and Evaluation Program: Field Artillery 105MM Howitzer, Towed, Infantry, Airmobile, Airborne Divisions, and Separate Brigades. HQ DA, June 1976.

Dept. of Army. FM 6-40-5. Modern Battlefield Cannon Gunnery. HQ DA. June 1976.

Dept. of Army. FM 21-6. How to Prepare and Conduct Military Training. HQ, DA. November 1975.

Dept. of Army. DA Pamphlet 11-25. Life Cycle System Management Model for Army Systems, May 1975.

Dept. of Army. FM 100-5. Operations, HQ DA, 1 July 1976.

Dept. of Army. TC 21-5-7. Training Management in Battalions, 31 October 1976.

Dept. of Army. ATCD-TC-D. Operational Test Policy, 27 December 1976.

DePuy, GEN W. and Gorman, MG Paul F, Training Developments. Transcript and briefing charts from TV tape, "TRADOC Mission and Resources Briefing," by GEN DePuy, TRADOC CG and MG Gorman, TRADOC DCST. Summer 1975.

DoD Directive 5000.1, "Major System Acquisitions," 18 January 1977.

DoD Directive 5000.2, "Major System Acquisition Process," 18 January 1977.

Fryer, R. G., "Potential CTS Applications." Proceedings of SALT/NSIA Symposium, Vol. II, 22-24 July 1976, Wash., D.C., pps 229-230.

Germas, J. E., Embedded Training-Utilization of Tactical Computers to Train Tactical Computer Operators. Army Research Institute, 1976.

Germas, J. E., Baker, J. D. Embedded Training: Using a Tactical Computer System to Train System Operators. Paper presented at Sixth Congress of the International Ergonomics Association, College Park, Md., 11-16 July 1976.

Giunti, F. E., and Kimberlin, D. A., "A Synopsis of the Development, Status, and Progress of Project ABACUS, a Computerized Training System." Proceedings of SALT/NSIA Symposium, Vol. II, 22-24 July 1976, Wash. D.C., pgs 71-73.

Gorman, MG Paul F. The Challenge of Army Training, 17 June 1975.

Gorman, MG Paul F. "Engagement Simulation." Proceedings of SALT/NSIA Symposium (Vol. IV), Wash., D.C., 22-24 July 1976, pgs. 136-144.

Gorman, MG Paul F., Opening Remarks to ITDT General Officer Steering Committee, 25 January 1977.

Haines, GEN R. E., Hunt, BG I. A. Methods and Media Specialty Workshop: Vol. V, CONARC Training Workshop. Ft. Gordon, Ga. 1971.

Hixon, Robert C., Integrated Technical Documentation and Training (ITDT) for Tank Turret and Wheeled Vehicle Systems, S-25, February 1977.

Howard, Col. G. B., "The Application of Technology to Army Training," Proceedings of SALT/NSIA Symposium, Vol. II, 21-23 July 1976, pgs. 216-219.

HQ TRADOC. TRADOC Pam 71-10 (Draft). Cost and Training Effectiveness Analysis Handbook. 3 January 1977.

HQ TRADOC. TRADOC Reg 11-8. Army Programs. Cost and Operational Effectiveness Analysis in the Materiel Acquisition Process. 18 March 1977.

HQ TRADOC, ODCST, How to Train Mechanics, 8 April 1977.

HQ TRADOC. TRADOC Reg 350-100-1 (Working Draft). Development, Implementation and Evaluation of Individual Training, 13 April 1977.

HQ TRADOC. TRADOC Pam 71-8. Analyzing Training Effectiveness, 10 February 1976.

HQ TRADOC. TRADOC Cir 351-3. Schools Individual Training Plan, 29 March 1976.

HQ TRADOC. Individual-Collective Training Plan for TACFIRE, October 1976.

HQ TRADOC. TC21-5-3. Training Extension Course Management Instructions (No Date).

HQ TRADOC. Instructional Technology Symposium. 19 May 1975.

HQ TRADOC. Preparing Extension Training. TRADOC Pamphlet (Draft), August 1975.

HQ TRADOC. TRADOC Pam 350-30. Interservice Procedures for Instructional Systems Development (Vol. I and III), August 1975.

HQ TRADOC. TRADOC Reg 11-8. Force Deployment User Testing. 31 December 1975.

HQ TRADOC. TRADOC Commanders' Conference 10-11 December 1975, 6 Jan 1976.

Knerr, C.S; Downey, R. G., Kessler, J. J. Training Individuals in Army Units: Comparative Effectiveness of Selected TEC Lessons and Conventional Methods. Research Report 1188 (AD A022034), Individual Trng and Skill Evaluation Tech Area, U.S. Army Research Institute, December 1975.

Larkins, LTC J. M., Staffing Guide for U.S. Army Service Schools, DA Pam 570-558, 22 November 1976.

Noah, Col Max, W., Resource Management, 18 April 1976.

PM ARTADS. The Army's ITDT Program, March 1977.

Talbott, Lt. Gen. Orwin C., The Modern Battlefield, 17 June 1975.

Thurman, BG Max, School Model 76: Developers, Trainers, Evaluators, handout to accompany videotape #777-0463.

Thurman, BG Max, Resource Management at TRADOC, handout to accompany videotape #777-0464-B.

TMI. ITDT TASK/DUTY LIST, March 1977.

TMI. "Record of ITDT Working Committee Meeting, 22-24 September 1976 at HQ TRADOC." Training Management Institute, Ft. Eustis, Va., 27 September 1976. Contains 3 inclosures and Tabs A-G.

Training Support Center (TSC), TRADOC, "Tank Gunnery Training Devices," TSC Bulletin, No. 76-3, December 1976.

TSC/COMM. Fact Sheet: System Embedded Training Development (SETD), (includes attachment: HRN 75-158, 3 January 1977.

U.S. Army Training Support Activity, Computerized Training Systems Directorate. "Fact Sheet: Status and Progress of Project ABACUS." Proceedings of SALT/NSIA Symposium, Vol. II, July 22-24, 1976, Wash. D.C., pgs. 223-224.

U.S. Army Combat Arms Training Board: "TEC Status List." 13 April 1976.

Velezis, MAJ James A., "Training Challenge - How to Increase Battlefield Effectiveness," Proceedings of SALT/NSIA Symposium, Volume IV, 21-23 July 1976, pps 155-159.

APPENDIX F-2: FIELD ARTILLERY SCHOOL

Directorate of Training Developments. Fact Sheet: Artillery Direct Fire Trainer (ADFT). Field Arty School, Ft. Sill, OK., 30 July 1976.

Directorate of Training Developments. Fact Sheet: Fire Control Simulator BT-33. Ft. Sill, OK. (no date)

Directorate of Training Developments. Fact Sheet: Observed Fire Trainer (OFT). Field Arty School, Ft. Sill, OK., 30 July 1976.

Directorate of Course Development. 1976-1977 Field Artillery Catalog of Instructional Material for Unit, Section, and Staff Training. U.S. Army Field Arty School, Ft. Sill, OK., 1976.

The Morris Swett Library. A Selected Bibliography for the Professional Development of the Field Artilleryman. U.S. Army Field Arty School, Ft. Sill, OK., 1976.

USAFAS. Catalog of TEC Programs. 1976.

USAFAS. TC 6-100. Combined Arms Team Effectiveness. U.S. Army Field Arty School, Ft. Sill, OK., February 1976.

USAFAS. FM 6-13E-CM. Commander's Manual: Cannon Fire Direction Specialist, MOS13E, Aug 1976. Soldiers Manuals, Skills 1-4 attached.

USAFAS. FM 6-13F-CM. Commander's Manual: Fire Support Specialist, (Levels 1-4) June 1976.

USAFAS. FM 6-13F 1/2. Soldier's Manual, July 1976.

USAFAS. FM 6-13F 3. Soldier's Manual. July 1976.

USAFAS. Correspondence Course Catalog. 1976.

USAFAS. Field Artillery - Periodic List of Instructional Material. Jan. 1977.

USAFAS. Guide for Fire Direction Operations. Dec. 1976.

USAFAS. Guide for TEC Training Management, MOS 13E, Skill Levels 1 & 2 (1977). 35 pages.

USAFAS. Individual-Collective Training Plan for TACFIRE. TRADOC & U.S. Army Field Arty Center, Ft. Sill, OK., October 1976.

USAFAS. TC6-40-3 (Draft Edition). M31 Field Artillery Trainer. U.S. Army Field Arty School, Ft. Sill, OK., June 1975.

USAFAS. Dept. of Combat Developments. TACFIRE, The Tactical Fire Direction System, Reference Note. FC-AA-RN, Sep. 76.

USAFAS. Staff Directory. August 1976.

USAFAS. Systems Engineering Handout. DE 92 SA, HO, (Supplement to slide-tape presentation). October 1973.

APPENDIX F-3: OTHER ORGANIZATIONS

Allen, W. H. "Intellectual Abilities and Instructional Media Design." AV Communications Review, 23, 2, Summer 1975, 139-170.

Allen, W. H. "Media Stimulus and Types of Learning." Audiovisual Instruction, January, 1967, pp 27-31.

Bean, John G., "Job Analysis: Tool for the Technical Manual (TM) Writer," Proceedings of SALT/NSIA Symposium, Vol. II, 21-23 July 1976.

Bennik, F. D., "Embedded Training & Evaluation Support for Army Computer Based System." Adjunct material prepared for briefing on Embedded Training (ET) to German Army Artillery FRG, January 1977.

Bennik, F. D. Computer-Based Support Systems for Individualized Education and Training: Advanced Development and Interface Concepts. SDC TM-5471/000/00, 4 March 1975.

Bennik, F. D., Fallentine, B. et al. Joint Surveillance System (JSS) Training Requirements Analysis Study: Vol. II - Study Results of Recommendations. SDC TM-5588/000/00, 31 October 1975.

Bennik, F.D., Fallentine, B. et al. Joint Surveillance System (JSS) Training Requirements Analysis Study: Vol. I - Study Analyses. SDC TM-5588/002/00, October 1975.

Bennik, F. D, Hoyt, W. G., Butler, A. K. A CAI Course on Constructing PLANIT Lessons: Development, Content, & Evaluation. SDC TM-5364/000/00, 26 July 1974.

Bennik, F. D., Stone, E. H., Harris, S. A., JSS ADP Training Support Requirements Study: Volume I - Technical Summary of JSS ADP Study. SDC TM 5671/000/00, 20 April 1976.

Bennik, F. D., Stone, W. J., Harris, S. A., JSS ADP Training Support Requirements Study: Volume II - JSS Study Analyses and Results. SDC TM-5671/001/00, 20 April 1976.

Boucher, B. G., Gottlieb, M. J., Norganlander, M. L. Handbook and Catalogue for Instructional Media Selection. Englewood Cliffs, N.J., Ed. Tech. Publications, 1973.

Braby, R., Henry, J. M., et al. A Technique for Choosing Cost-Effective Delivery Systems. (TAEG Report No. 16) Orlando, Fla., Training Analysis & Evaluation Group, NTEC, April 1975.

APPENDIX F-3 (Cont.)

Bretz, R. The Selection of Appropriate Communications Media for Instruction: A Guide for Designers of Air Force Tech Training Programs. Rand Corp., R-601-PR, Feb. 1971.

Bretz, R. A Taxonomy of Communications Media. Ed. Tech. Pubs., Inc., Englewood Cliffs, N.J., 1971.

Butler, F. Coit, Instructional Systems Development for Vocational and Technical Training, Technology Publications, Inc., Englewood Cliffs, N.J., 1972.

Dallman, B. E. "A PLATO IV - Based Air Force Technical Course." Proceedings of SALT/NSIA Symposium, Vol. II, Washington, D.C. pgs. 65-70, 22-24 July 1976.

Davis, John D. CDR. "The Navy's Computer Managed Instruction System." Proceedings of SALT/NSIA Symposium, Vol. II, Washington, D.C pgs. 74-75. 21-23 July 1976

Dowdle, Ben. Problem Definition: One of Many Uses for Task Analysis, Article based on invited paper presented at the Conference on "Uses of Task Analysis in the Bell Syste," October 1972.

Fallentine, B., Harris, L., Maginnis, E., & Hanson, A. L. Advanced Development Work Resulting in Inventory Management (IM) Individualized Instruction Materials. AFHRL-TR-74-17, Tech Training Division, AFHRL, Lowry AFB, Colorado, February 1974.

Folley, N. F., and Newlands, E. Warner Robins Air Logistic Center. Student Workbook for Course B: Software Acquisition. SDC TM 5365/105/00, September 1976.

Hart, Fred S., "Innovations in Technical Manual Specifications," SALT Symposium, pgs. 34-35, 21-23 July 1976.

Hayward, C. D., Hay, L. E., Jaffin, S. R., Computer-based Shipboard Training Administration System: Development Phase. TR 76-11, NPRDC, September 1975.

Hoyt, W. G., Bennik, F. D., Butler, A. K. The Effectiveness of Alternative Media in Conjunction with TEC for Improving Performance in MOS Related Tasks: Final Report. SDC TM-5841/000/01, 5 June 1977.

Hoyt, W. API: Proving It Works. SDC Magazine, Vol. 12, No. 2, pps 8-13, February 1969.

Hoyt, W. G., Butler, A. K., Bennik, F. D. Application of Tactical Data Systems for Training: DEVTOS Feasibility Determination and Selection of an Instructional Operating System. Technical Paper 267 (AD A017436), Systems Integration & Command/Control Tech Area, U.S. Army Research Institute, October 1975.

APPENDIX F-3 (Cont.)

Hoyt, W. G., and Germas, John E., "The Utilization of Tactical Computers for Training Tactical Computer Operators." Proceedings SALT/NSIA Symposium, Vol. II., Washington, D.C., pgs 243-250. July 21-23 1976.

Hoyt, W. G., Butler, A. K., Hayward, C. D., Shipboard Computer Integrated Instruction in General Damage Control: Development Phase. NPRDC, October 1975.

Hoyt, W. G., Butler, A. K., Leung, P. W., Utilization of Tactical Computers for Training: Final Report. TM-5544/003/00, SDC, 5 May 1976.

Hoyt, W. G., et al. Germas, J. E. and Larson, J. T. Development of CAI Performance Measures: TACFIRE Tactical Data System. Paper presented at Military Testing Assn., 1976.

Hoyt, W. G., Storey, E. G., et al. Self-paced Course Development, Aircraft and Watercraft: Training Tasks for MOS 68F10, Aircraft Electrician. SDC, TM-5779-000/00, 19 November 1976.

Hurley, Susan, and Spann, Al, "What to do While Waiting for the Life Cycle Cost Analysis," Proceedings of SALT/NSIA Symposium, Volume II, Pgs 231-237, 21-21 July 1976.

Katz, Ira L. (Data Communication, Inc.), ITDT: A New Way to Go for the USA. February 1977.

Litton Data Systems. Training Managers Guide (Training Handbook) for the TACFIRE Advanced Training Program (TATP), Preliminary Draft. Doc. No. 148000-9000, Litton Data Systems, 24 February 1977.

Litton Data Systems. TACFIRE Advanced Training Plan (TAT), Litton Document, 1977.

Mager, R. F., and Beach, K. M., Developing Vocational Instruction (Chapter 9). Fearon Publishers, Inc., 1967.

Maginnis, E. B., Uchima, A., Smith C. E. Establishing Aptitude Requirements for Air Force Jobs: Historical Review of Aptitude Levels and Impact on the Personnel System. AFHRL-TR-75-44(I) Occupational & Manpower Research Division. Air Force Human Resources Lab., AFSC, Brooks AFB, Texas, October 1975.

APPENDIX F-3 (Cont.)

Maginnis, E. B., Uchima, A., Smith, C.E. Establishing Aptitude Requirements for Air Force Jobs: Methodological Approaches. AFHRL-TR-75-rr (III) Occupational & Manpower Research Division, Air Force Human Resources Lab, AFSC, Brooks AFB, Texas, October 1975.

Paquette, R., API: Operations Training & Evaluation. SDC Magazine, Volume 12, No. 2, pgs. 1-7, February 1969.

Rhode, W. E. et al., Analysis and Approach to the Development of an Advanced Multimedia Instructional System - Volume I: Media Model, Comparisons and Tradeoffs. Westinghouse Learning Corp., Bladensburg, Md., 1970.

Rockaway, M. E., and Yasutake, J. R. "The Air Force Advanced Instructional System: A Brief Status Report." Proceedings of SALT/NSIA Symposium, Vol., Washington, D. C., pgs. 97-99, 22-24 July 1976.

Rowan, Thomas C., Improving DoD Maintenance Through Better Performance AIDS Final Report, 1 March 1973.

Rakow, William O., and Chalupa, Richard P., "Application of Computer Stimulation and Computer Based Instruction to Maintenance Training," Proceedings of SALT/NSIA Symposium, Volume IV, pgs. 21-23, July 1976.

Salomon, G., and Clark, R. E. "Reexamining the Methodology of Research of Media and Technology in Education." Review of Educational Research, pgs 99-120, Winter 1977, 47, 1.

SDC Proposal 76-5077. A Study to Determine the Effectiveness of CAI in Conjunction with TEC, Vol. I - Technical Proposal: Appendix B - List of References. 30 September 1975.

Searle, L. V., Introductory Guide to Computer Program Configuration Management. SDC TM-5327/000/00, 5 June 1974.

Siecko, Nicholas A., "Use of Low Cost Computer Controlled Simulation for Interactive Maintenance Training," Proceedings of SALT/NSIA Symposium, Volume IV, pgs 21-23, July 1976.

Simulation-Supported TACFIRE Exercises. Position paper to PM ARTADS, 1976 No author listed.

Spangenberg, Ronald W., "Selection of Simulation as an Instructional Medium," Proceedings of SALT/NSIA Symposium, Volume IV, pgs 21-23, July 1976.

APPENDIX F-3 (Cont.)

Smith, C. E., Bennik, F. D., Maginnis, E. B., Uchima, A., Career Fields Aptitude Requirements Study: Final Report. SDC TM-5013/001/01, 2 January 1973.

Storey, E. J. et al. Course Organization. MOS68F10, Aircraft Electrician Apprentice. SDC document submitted to Army Transportation School, Ft. Eustis, Va., December 1976.

Walton, Thomas F. Technical Data Requirements for Systems Engineering and Support. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1965.

Wolf, Allen. Avionics Software Training Program Software Familiarization Lecture. Briefing Charts and Text. SDC, 27 September 1976.