TRAINING SYSTEMS R&D PROGRAM: PROGRESS AND CHALLENGES

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ABSTRACT

The training device and simulation community has achieved the technological power to simulate military systems and operations with impressive realism. This technological strength is offset by the fact that we do not always consider the cost and potential training benefits of alternative approaches, and the training effectiveness of the training systems that we field.

This paper describes a joint R&D program between the Army Research Institute (ARI) and the Program Manager for Training Devices (PM TRADE) to provide training developers and engineers a set of tools to establish the capability for evaluating training alternatives with respect to: (1) desired effectiveness at minimum cost, or (2) maximum effectiveness at a given cost. We are developing computerized decision aids with supporting databases and procedures to help optimize the training development process.

The program upon which we have embarked addresses: (1) the implications of MANPRINT for developing simulator/device based training systems, (2) the analysis of training requirements to determine skills and knowledges to be trained ; (3) the development of training strategies, (4) the question of how much simulation or fidelity is enough given that a training device or simulator is needed; and (5) the best manner of implementing embedded training. We are also examining optimal ways to organize and present the information needed for embedded training and electronically presented technical information.

INTRODUCTION

As witnessed by this conference, and the *development of sophisticated and* complex training systems, the technology of training devices and simulators continues to develop explosively. The engineering community has the capability to simulate with impressive fidelity our *major weapon systems. Despite this growth* and the level of sophistication which we have achieved, there remain many challenges. We would like to present some of these challenges as well as describe the course of research we have set to develop *new tools and capabilities which* lead to their solution. While we speak from the Army perspective, we believe these challenges are true for our sister services as well.

OVERALL CHALLENGE

The following represent what we see as our key challenges today:

o <u>Development of Comprehensive Training Solutions</u>

While the industry-government team has been skilled in developing sophisticated training devices and simulators, these devices and simulators have not been developed within the context of comprehensive training systems. Our devices are not planned as part of a comprehensive training solution to assure cost-effective and responsive training. We need to develop training strategy based devices rather than device based training strategies relative to well defined performance criteria.

o <u>How Much is Enough?</u>

Given the need for a training device or simulator, the answer to one question has eluded us. How much simulation and fidelity do we need to satisfy the training requirement? Is a multi-million *dollar simulator needed or will a much* less complex simulator be adequate? Will a simple training device do the job? We are all aware of the range in sophistication and cost of training alternatives for the same requirement.

o <u>Disciplining the Design Process</u>

The results of training and cost implications of alternative approaches are not fully assessed or considered. Our *solutions are not constrained by cost or* performance requirements. We must become more concerned about the <u>affordability of</u> training solutions, and development of long term investment strategies for implementing these solutions. A dollar constraint would invariably result in lower cost approaches. A required performance outcome should lead to new and perhaps innovative solutions. A requirement to meet a performance standard within a prescribed period of time would also pose a significant challenge. In addition, we often do not require a design rationale or audit trail to justify the design approach adopted. Alternative design concepts are encouraged, with evaluation criteria and measures of effectiveness to guide selection of the optimum approach relative to cost and effectiveness.

o Results of Training

On the other hand, no hard analysis of training alternatives is possible unless we can measure the results of training. We need performance data to assess the relative training value of alternative approaches. For example, what is the relative training value of a Video Disc Gunnery System (VIGS) versus a Unit Conduct of Fire Trainers (UCOFT)? Despite the cost of training systems, no comprehensive assessment technology or performance assessment program are in place.

o Adding Training Value

Simulation or replication of the operational equipment does not assure training. The relationship between behavioral requirements, learning theories, training media, student aptitude levels and instructional processes are not well understood. In this respect, the difference between training devices and simulators is often overlooked. From our perspective, a training simulator represents a replication or "analog" of the weapon systems being addressed. A training device, on the other hand, can be likened to an "analytical" model, whereby explanatory principles are demonstrated or enunciated. Embedded training sharpens the focus on this issue, and may be more suited to an analog model. We must break the mental set of striving for a simulator which provides practice, at the expense of not providing an understanding and insight into the processes being replicated and the relevance to combat readiness.

o Training to Fight

Training to operate is not the same as training to fight. This distinction is not fully recognized or accommodated. SIMNET technology has made important strides in providing a capability for training to fight. The results of stress and fatigue on performance must also be understood to assure the necessary overtraining, cross-training and other requirements to overcome performance decrement.

o Timely Development

The timely development of training systems parallel to the weapon system development process has eluded us. The MANPRINT initiative together with embedded training, requires early conceptual description of soldier system interface and job performance requirements. It also requires the combat developer and training developer to develop integrated Operational and Organizational (O&O) concepts which express strategies, performance requirements and envisioned usage for both weapon and training systems. We must meet these goals to assure timely development.

o Presentation of Information

Embedded training, portable electronic maintenance aids and videodisc training devices have opened a new realm of how to organize and present information, and how to prepare (author) such information. These new technologies offer an opportunity to by-pass technical manuals and to prepare the necessary information in a more effective and less costly manner.

ARI and PM TRADE have joined forces to collectively address some of the above issues. The purpose of this paper is to describe our initial and emerging efforts.

PROGRAM GOALS

Our primary goal is to permit the evaluation of training alternatives with respect to: (1) desired effectiveness at minimum cost, or (2) maximum effectiveness at a given cost. Our approach to achieve this goal is to develop a computer based system with supporting databases and procedures to permit interactive utilization by multi disciplined teams for the support of the training development process.

We are obviously not starting at the beginning. A large amount of information and technology is available. What is new, is our attempt to organize, in a comprehensive and systematic way, the large body of training technology and information now available in a manner which addresses the challenges set forth earlier. We are relying on the power of our new computer systems and networks to implement the required analytical and analog models, and their supporting databases. We envision a sufficiently flexible system so that different users may come up with different solutions to the same problem. However, they will be able to provide a design rationale and audit trail for the decisions that they have made.

Today we will describe our interrelated program objectives, and some of our more significant accomplishments. We will start with our effort to interface with early weapon system development through the MANPRINT initiative. During the conceptual phase of weapon system development it is important to assess the impact of different design concepts/alternatives on training requirements. This consideration is a key part of MANPRINT objectives to assure reasonable and achievable manpower, personnel and training demands of emerging weapon systems. In addition to assessing the training impact of a design alternative, we must also identify at this time which portions of the training requirement should initially be allocated to embedded training. As part of this effort, we are developing techniques to: (1) evaluate the impact of different weapon system design concepts on training requirements, (2) assess the costs of potential training systems needed to meet these requirements, and (3) identify early candidates for embedded training.

Our second major effort addresses the formal training development process. It is designed to conduct the necessary front end analyses of a training requirement, in order to provide the necessary input for the development of a training strategy or system. Training strategies are needed during the materiel development cycle to put embedded training, and other training approaches in context, for parallel development with weapon system development. In addition, the new Army policy to acquire weapon systems as families, such as the Army Family of Vehicles and the Light Helicopter Experimental (LHX), requires the early development of a training strategy. This effort includes: (1) how a training requirement should be stated to support a comprehensive training requirements analysis and an effective training strategy, (2) the development of computer based aids for the analysis of training requirements to provide the necessary input data for the development of training strategies or training devices/simulators, and (3) methodology for the development of training strategies.

Our third effort deals with the Optimization of Simulation Based Training Systems (OSBATS) which addresses the cost-effective design of training devices and/or simulators. OSBATS is a family of computer based models designed to determine how much simulation is enough during the concept formulation process.

The above efforts are supported by two major database efforts. The first database, identified as "Functions and Tasks," is being designed to support the analysis of training requirements, and will in part rely on MANPRINT Data. The second database, identified as "Resident Data" will support the data internal to the optimization models, to be processed by their rules and algorithms. These efforts are being supported by the OSD Training Performance and Data Center.

Additional efforts described in this paper include: (1) embedded training, with particular emphasis on criteria for the utilization of embedded training, and the necessary design trade-offs to assure cost-effective training and (2) authoring efforts, which are designed to support material needed by embedded training, portable maintenance aids (e.g., MEIDS), and electronic classroom training aids (e.g., EIDS).

MANPRINT INITIATIVES

During the conceptual phase of weapon system development, it is important to assess the impact of different design concepts and alternatives on training requirements. This consideration is a key MANPRINT objective to assure reasonable manpower, personnel, and training demands of emerging training systems.

MANPRINT Techniques for Early Training Estimation

The goals and objectives of MANPRINT require that the manpower, personnel and training requirements of alternative weapon systems design concepts be accurately estimated. Early determination of training requirements, and their associated training resources, can help to optimize the design of the total weapon system. In addition to assessing the training impact of a design alternative, it is also important to identify which portions of the training requirement should be satisfied by embedded training. Our project is directed towards integrating active consideration of training into the earliest stages of the Life Cycle Systems Management Model (LCSMM) so that the design of the operational system and its supporting training system will be optimized.

In order to address the above objectives, we are developing a technique to provide an early estimate of the training requirement impact of a weapon system concept. This information will help us to assess the impact of this concept on Army training resources (cost, number of instructors, training devices, etc.). During the development of an Operational and Organizational (O&O) plan, or subsequently during the further refinement and development of weapon system design concepts, a framework is needed to consider the following aspects of MANPRINT for the early estimation of training requirements.

1. Number and type of MOS and/or quality level of personnel.

2. Jobs or tasks relative to the specificity of the emerging concept.

3. Identification/definition of man/machine interfaces.

4. Functions allocated to man or machine.

5. Knowledges and skills required by operator/maintainer functions.

The Early Training Requirements (ETR) data for a weapon system alternative will be stated at a gross level (i.e., functions and tasks) and be used for estimation purposes. The detailed training requirements (i.e., skills and knowledges required to perform the functions and tasks) would be detailed later as a part of training requirements analysis. We are currently developing an "organizational framework" to identify what ETR data is required and to serve as a basis for integrating the ETR data. The completed database "framework" will represent the ETR from which: initial training resource estimations can be made, and early embedded training candidates identified. The above information will also be used to represent the necessary MANPRINT inputs for subsequent training requirements analysis and should be of form and character to support the simulation, if desired, of the man-machine interfaces represented.

Strategies for the Early Estimation of Required Training Resources

The purpose of this task is to develop techniques and tools which will use the ETR to identify initial training strategies so that estimates of required training resources can be made. These tools, currently under development, will allow designers to assess the impact of the ETR on individual training in the institution and the unit, and collective training in the unit. The tools are being designed to allow the training developer to define initial training strategies at a general/macro level. The macro training strategies will be developed relative to basic weapon system or functional classes. These estimates will be configured to permit rough relative training resource estimates to be made between competing weapon system candidates.

Early Estimation of Embedded Training Candidates

The purpose of this task is to develop a tool that will allow training developers to determine, in a timely fashion, the best candidates for embedded training. The tool will use as input the data associated with the ETR (described above). Issues in the development of this tool include:

- Within the range of training requirements identified for each weapon system class, which of the tasks and content domains are best suited for embedded training, taking into account the characteristics of the weapon system itself?

- To what level can these tasks be trained, taking into account the equipment characteristics, the environmental requirements, and the instructional needs of the trainees in both the active and reserve components?

TRAINING REQUIREMENTS AND TRAINING DEVICE STRATEGIES FOR WEAPON SYSTEMS

Effective conduct of the above MANPRINT activities and the selection of a weapon system candidate puts us in a position to define a training requirement and to conduct a training requirements analysis.

The proper statement of training requirements is critical for the effective conduct of a comprehensive training requirements analysis and the development of a training strategy. Therefore, we are developing standards and examples of how training requirements should be stated. We consider the following as important factors to be considered in the statement of a training requirement:

- Performance level to be achieved

- Environmental constraints

- Cost constraints

- Time to train

- Location of training (institution or unit)

We will develop operational definitions, with examples, to facilitate comprehensive training requirements analysis to support the development of training strategies and training subsystems.

Analysis of Training Requirements

The goals of this initiative are to: (1) collate and augment available techniques to assure the development of the prerequisite input data for the optimization models, (2) develop new techniques where required, and (3) develop a computer based system to guide an analyst (with appropriate examples) in developing the required input data for the optimization models.

We are aware that many techniques are available and we are attempting to identify techniques which can be used or adapted to provide the necessary input data to our models. We plan to develop computer models, with examples of well conducted training requirements analyses. Table 1 depicts the categories of data required by our optimization models and represents the expected outcome of the training requirements analysis effort. This analysis will be based on the functions and task database described below and shown in Table 2.

Functions and Tasks Database

This project will develop the databases necessary to support the conduct of a training requirements analysis. These databases will provide the necessary information to permit the development of the input information needed by the optimization models as shown in Table 1. The database is intended to supplement or complement existing data (e.g., MANPRINT). Where necessary, techniques will be constructed to help develop data not otherwise available. Examples of these data are shown in Table 2.

TABLE 1

INPUT REQUIREMENTS TO OPTIMIZATION MODELS

Task Requirements
- Tasks to be trained
- Performance criteria/standards
- Difficulty/criticality/frequency
- Safety considerations
- Skills and knowledges required

Trainee Characteristics Input

- Identified precursor skills and knowledges
- Entry level information (e.g., ASVAB)
- Training deficiency
- Aptitudes/learning rate
- Physical requirements

Training System Management Inputs

- Time allowed for training
- School resources
- Instructor requirements
- Number of students
- Cost constraints
- Available facilities
- Unit training considerations

Defining Training Strategy

Based on the results of a training requirements analysis, we are identifying the variables and considerations necessary for the development of a training strategy. We define training strategy as "a general comprehensive solution description to guide the development of training plans. The strategy gives consideration to a variety of factors such as policy, goals, constraints, resources and standards. It addresses the location, media, content, clustering, sequence and frequency of training." As a general solution, it would represent a top level training system design, and would serve as a higher level precursor of individual and collective training plans (ICTP). Our efforts in this regard would address individual training in the institution and unit. It will be designed to interface with the Computer-Aided ARTEP Production system (CAPS), which is a top down approach from collective training in the unit. The training strategy model would help the user to determine whether a training device or simulator is needed, and the appropriate role for embedded training.

The ICTP would represent the detailed and specific training plan developped by the appropriate Army School or Command. It would include detailed, specific information on tasks to train, training location, sustainment frequency, and appropriate supporting products, and would represent the training system design.

The training strategy tools to be developed should aid the decision maker and developer to:

TABLE 2

FUNCTIONS AND TASK DATABASE

- Missions grouped by functional categories

- Task listings by functional categories

- MOS used to operate/maintain end items (e.g., numbers, grade levels)

- Personnel statistics
  --demographics (age, sex, first language, etc.)
  --aptitude test scores (e.g. ASVAB)
  --time in service
  --physical capabilities

- Entry performance levels for tasks

- Standards and conditions for job performance

- Existing taxonomies and lists of skills and knowledge

- Data concerning existing training systems

- Identify all of the variables that affect an optimal training solution

- Comprehensively integrate training resources

- Adjust the training strategy over time to maximize effectiveness in response to shifts in constraints and criteria.

MODELS FOR THE OPTIMIZATION OF SIMULATION-BASED TRAINING SYSTEMS (OSBATS)

Whenever a training device or simulator may be required (based on a training strategy or school request) the OSBATS project is designed to answer the question: "How much is enough; do we need a $2,000,000 dollar simulator or is a $100,000 training device enough?"

Our OSBATS project has as its goals to: (1) optimize training systems by either achieving minimum cost for a desired performance level or maximum effectiveness for a given cost, (2) provide designers a flexible and comprehensive set of analytical tools with which they can interact, as needed during the design process, and (3) enable empirical and rational justification of a recommended approach. We have developed a set of models to support different aspects of the training device concept formulation process. We have oriented the model to the functions and processes that are important in any systems engineering effort to assure a cost/effective training device or simulator.

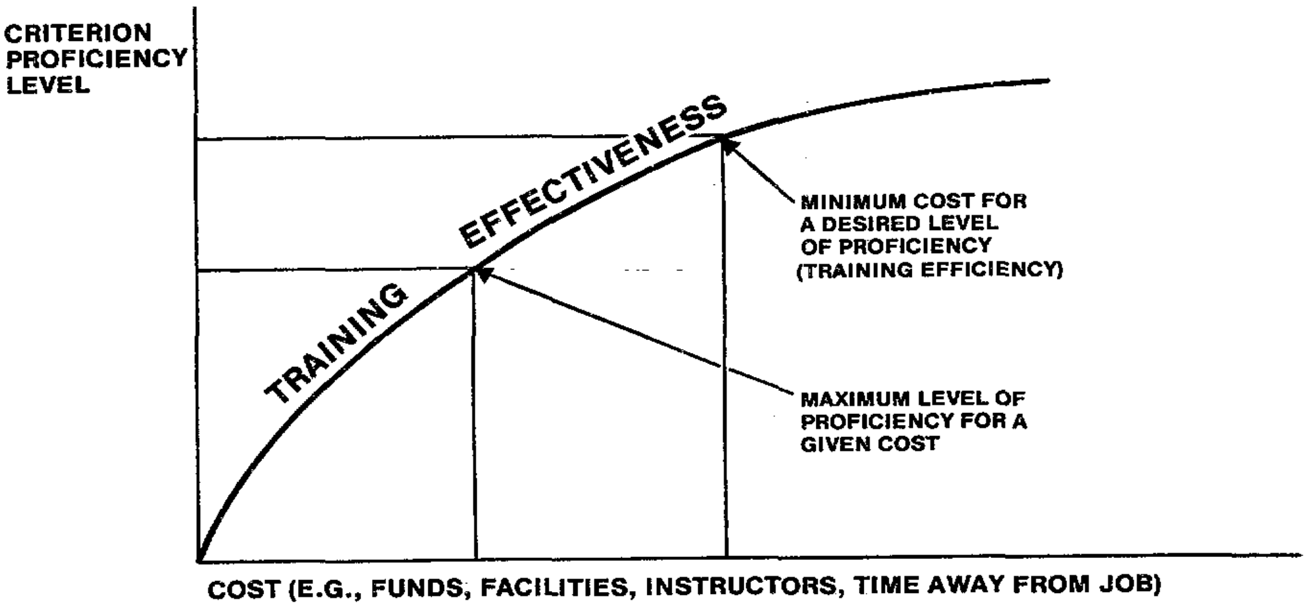

FIGURE 1. Cost-Effective Tradeoffs

Figure 1 illustrates the two issues central to the OSBATS model as well as to our overall program. What is the minimum cost for meeting a desired training goal? This is illustrated by point A. Secondly, what is the maximum training we can achieve at a given cost? This is illustrated by point B. We are seeking to develop the necessary data and techniques to permit the user to identify and evaluate design alternativews in an empirical manner.

At present, the OSBATS effort consists of five models. These are:

1. A Simulation Configuration Module that clusters tasks to be trained according to their need for training on a fullmission simulator (FMS), one or more part-mission simulators (PMS), or actual equipment (AE).

2. An Instructional Feature Module that determines the relative priority with which instructional features should be included in a training device.

3. A Fidelity Optimization Module that determines the relative priority of features that allow a training device to represent aspects of the operational environment.

4. A Training Device Selection Module that selects the training devices that can be used to meet the training requirements for each task at the least cost.

5. A Resource Allocation Module that determines the optimal allocation of training time to training devices and actual equipment to meet all training requirements, considering constraints on device procurement and use.

These models are currently in prototype form and are being evaluated by PM TRADE engineers. Their application is currently limited to the aviation domain. We plan to start developing first generation models and expanded data bases for use by PM TRADE, TRADOC and Army schools in the following year.

The concept of operation for the OSBATS model is based on iterative use of the five modeling tools. This iterative concept reflects the interactions inherent in the training-system design process. The tools may be used in a variety of orders, tools may be used several times, and inappropriate or unwanted tools may be bypassed. When used by different analysts who make different assumptions, the OSBATS model will produce different recommendations. However, the model will document the assumptions and rationale that underlie each recommendation.

As the name denotes, OSBATS focuses on simulation-based training systems.* The underlying models and the OSBATS output emphasize training system characteristics for representing the task or mission, in the system and environment that the student must eventually use. The representation is an analog of the real task/mission, system, and environment. We plan to expand OSBATS into the arena of training devices that do not necessarily employ simulation. Many of these devices tutor, instruct, or present new material to the student with little or no representation of real-world tasks,

*Personal communication with P. Sticha, 20 August 1987.

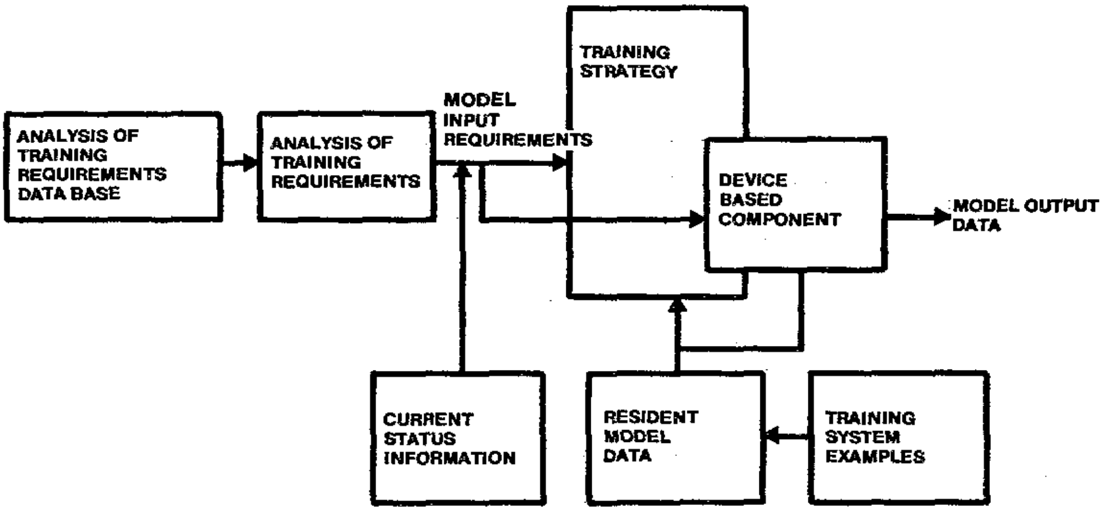

FIGURE 2. Training System Optimization Models and Data Bases

missions, systems, or environments. A model is required to cluster tasks according to their skill requirements, thus identifying common skills that may be addressed by a training device. The following additional models are planned to represent this capability as well as other desired capabilities:

1. Skill-Based Task Organizing Module
2. Skill-Based Training-Device Design Module
3. Instructor/Operator Station Design Module
4. Embedded Training Evaluation Module
5. Embedded Training Design Module
6. Rough-Order-of-Magnitude Cost Estimation Module

DATA BASE DEVELOPMENT FOR THE OPTIMIZATION OF TRAINING SUBSYSTEMS AND TRAINING DEVICES

The developmental efforts described above (Models for Training Strategy Development, and Models for the Optimization of Simulation Based Training Systems) require data bases from which the necessary information for optimization can be drawn. The goals of the required database efforts are to detail the internal data and rules required for the models; to identify or develop methods for collecting, converting or transforming the data; and to define the necessary framework for organizing the varied rules and data required by the different optimization efforts. The discussion below speaks directly to the databases required for the OSBATS. The Training Strategy Development model will also require such databases. However, this project is still in its formative stages.

Figure 2 shows the functional relationship between our planned models and database requirements.

There are two types of data required to support the functioning of the the OSBATS models. The first type includes the basic data involved in the generation of options, tradeoffs, and configurations. These are general task characteristics, types of fidelity options and associated costs, learning parameters, types of instructionsl features and their costs, etc. These data will come from thorough analytical evaluations and data collection efforts, including experiments designed to verify certain parameters (e.g., learning parameters) and the hypothesized relationships within the model. The second includes aggregated relationships between the databases in the form of rules. These rules are expected to be expert system type production rules. They will be structured for use in specifying types of instructional features, fidelity levels, etc., for different tasks and task groupings. The aggregating rules, resident data, and input data are interconnected in several ways. The rules are used for relating input data about tasks to resident variables about training device features and costs, as well as combining input data and resident information in order to generate process data for the analysis session.

The data base management system (DBMS) will support access through the models for user inspection and entry into the data bases. The system will support data tracking, validity checks, and other typical user-friendly features. This interface will include the delivery of data to the models upon demand from the models (for example, in the form of program calls), the acceptance by the DBMS of generated or input data from the models, and the provision of inspection and editing facilities through the model interface. The aggregate rules will also be inspectable through the models, and editable by the existing OSBATS expert systems shell mechanisms.

EMBEDDED TRAINING

Current Army policy advocates the consideration of embedded training as a first alternative but not its exclusive use. Policy further requires that embedded training: (1) will not interfere with the operational requirements/capabilities of the system, and (2) will train individual tasks through force level tasks as required. The policy letter defines embedded training as "Training that is provided by capabilities designed to be built into or added onto operational systems to enhance or maintain the skill proficiency necessary to operate and maintain that equipment end item."

Moreover, Army policy sets these goals:

- Include a training strategy in the O&O plan and develop training requirements and resources during system concept formulation.

- Analyze and provide a rationale for either including or not including embedded training at each materiel decision process milestone.

- Identify the MANPRINT and Integrated Logistics Support (ILS) processes as the catalyst for considering embedded training in the pre-concept formulation and subsequent prototyping phases.

PM TRADE has established the following objectives relative to embedded training, which is consistent with our overall program objectives described above:

- Achieve a top-down systems engineering approach to the definition and development of training systems at all levels beginning in earliest concept phases.

- Integrate training strategies and resources across functional areas to avoid redundant capabilities.

- Ensure the fullest integration of available technology, device, simulators and embedded training to achieve the most effective training at the lowest cost.

Our research objectives are to: (1) identify under what conditions embedded training should, or should not be included in weapon systems under development, (2) identify functions and tasks (by weapon system class) which best lend themselves to embedded training, (3) identify critical design tradeoffs related to embedded training, and (4) organize current and existing information relating to embedded training.

Our joint project in embedded training is designed to provide insight into such questions as:

How does embedded training best complement other training techniques (i.e., the best mix of training programs, devices and embedded training)?

What are the implications of different engineering configurations for classes of materiel end items (e.g., Armor, Artillery, Aviation, Communications)?

What are the optimum formats for presenting embedded training information (e.g., job aids vs. training)?

What are the interface requirements among materiel, combat and training developers?

What are the special implications of categories of embedded training such as individual, team functional and force level?

What are the engineering, operations, and logistics impacts in terms of life cycle costs, reliability and supportability?

To date our joint program has taken a major first step. Several reports have been prepared which address: (1) The development of embedded training in exemplar systems such as Fiber Optic Guided Missle (FOG-M), (2) laboratory technological research and surveys to establish the state-of-the-art in emebedded training, and (3) the development of specifications for the inclusion of embedded training in weapon systems. Representative reports include Findley, Alderman, Bolin, and Peckham (1985), Carroll, Harris, and Roth (1986), Massey, Harris, Downes-Martin and Kurkland (1986), and Purifoy, Harris, and Ditzian (1986).

ORGANIZATION OF TECHNICAL INFORMATION FOR ELECTRONIC DELIVERY

Army policy will soon require that information now contained in paper technical manuals be delivered electronically. Both technicians and logistics specialists have long been unsatisfied with technical manuals because they difficult to use, hard to update, and bulky. On the other hand they can present such information as flow diagrams and large schematic drawings far better than any other medium. Weapon systems entering the Army's inventory in the 1990's will be maintained by technicians using computers to access their technical information rather than technical manuals. Kincaid and Braby (1987) discussed a number of ramifications of this policy including user acceptance issues, methods of automating authoring and delivery of the technical information, and techniques for organizing and presenting the technical information. These issues apply equally to information now contained in technical manuals and embedded training. For example, job performance aids are now routinely presented in technical manuals (e.g., in New Look manuals) and are also considered an appropriate format for embedded training.

The primary technical objectives of a project we are just getting underway are to: (1) create and demonstrate techniques for the optimal organization of technical information, (2) create computer-based job performance aid display algorithms appropriate for, and compatible with, electronic devices for delivering technical information, and (3) demonstrate these information organization techniques and display algorithms for job aids, including embedded training.

To achieve these objectives we are: (1) assembling examples of types of technical information (e.g., fault isolation, repairs, operation, casualty procedures, installation, scheduled maintenance) and analyzing and describing the process for presenting this TI using a microcomputer; and (2) describing and illustrating efficient ways to organize and present this information to the user.

This project supports three PM TRADE initiatives for the delivery of technical information: (1) MEIDS - the militarized/ miniturized information delivery system, (2) EIDS - the Electronic Information Delivery System, and (3) embedded training. The concept for MEIDS is currently being formulated; however, it is envisioned as a portable microcomputer to replace paper technical manuals for maintenance of equipment in the field. EIDS devices are videodiscs controlled by microcomputers, supported by courseware development software.

SUMMARY

We have described a series of inter-related projects the purpose of which is to optimize the process for conceptualizing, designing and procuring training systems, including the consideration of training strategy. We are developing computerized decision aids for the training developer, as well as the data bases which are needed to operate the decision aids.

Each of our major projects are being related to each other, with respect to the following considerations: (1) system relationships, (2) data input and output requirements, (3) processing and procedural requirements, and (4) database requirements.

Early training estimates, training requirements analysis, including embedded training will have common database requirements, and somewhat similar analytical procedures. They differ in the level of detail and generalization relative to their stage of use. OSBATS, while an intergal part of this system, will have different data requirements and analytical procedures. However, it depends upon the outputs of the other processes for its initiation.

We are relating our research and development efforts to the weapon and training system development procedures of the Army, that they are designed to support. This includes the Required Operational Capability (ROC), Organizations and Operations (O&O) plan, Training Device Needs (TDN) and Individual and Collective Training Plan (ICTP). The relationship between the technology base and operational base will be made explicit at every point.

PM TRADE and ARI, with the active support of the Army training community, are collectively applying a systems engineering focus to the training development process.

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