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14. ABSTRACT This paper describes the TRIADS (not an acronym) Joint-Services Computer-Based Instruction (CBI) program. The TRIADS effort will develop a family of software and hardware to support CBI in a wide variety of military training and educational applications. TRIADS consists of a library of computer-based programs, sufficiently flexible to support development, delivery, and management in meeting most military instructional requirements. The TRIADS program is also concerned with demonstration of and specifications for hardware systems capable of executing TRIADS software, as well as planning for institutionalization of Joint-Services CBI programs. The TRIADS program will assist in the establishment of operational military CBI centers as well.					
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TRIADS A FOUNDATION FOR MILITARY COMPUTER-BASED INSTRUCTION

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This paper describes the TRIADS (not an acronym) Joint-Services Computer-Based Instruction (CBI) program. The TRIADS effort will develop a family of software and hardware to support computer-based instruction in a wide variety of military training and educational applications. TRIADS consists of a library of computer-based programs, sufficiently flexible to support, development, delivery, and management in meeting most military instructional requirements. The TRIADS program is also concerned with demonstration of and specifications for hardware systems capable of executing TRIADS software, as well as planning for institutionalization of Joint-Service CBI programs. The TRIADS program will assist in the establishment of operational military CBI centers as well.

Program Description

The TRIADS program is a Joint-Services effort to develop a family of hardware and software in support of computer-based instruction (CBI) for a variety of military training and educational applications. It is also intended that the program will serve as a foundation for the creation of operational Military CBI Centers.

Such CBI Centers could assist interested DoD agencies by: (a) demonstrating CBI system capabilities; (b) identifying steps needed to obtain funding; (c) performing or assisting in system definition studies; and (d) assisting in system acquisition, development, implementation and maintenance. The Centers would maintain a software library, ensure configuration management, and perform software acceptance tests of new additions obtained from such sources as research and development (R&D) programs, other military agencies, etc.

The TRIADS program has several critical elements. First, a library of CBI programs, sufficiently flexible to support development, delivery, and management in meeting requirements of most military training environments, must be assembled from existing R&D products. Second and at the same time as the first, it is necessary to conduct demonstrations to promote the program, formative evaluations, along with developing functional specifications for hardware systems capable of executing the TRIADS software. Third, it is necessary to plan for the institutionalization of Joint Services CBI programs.

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Defense for Research and Engineering, and is being performed by a working group composed of representatives from the Air Force Human Resources Laboratory, Army Research Institute, Navy Personnel Research and Development Center, Naval Training Equipment Center, and the Army Project Manager for Training Devices.

THE RATIONALE FOR TRIADS

The Secretary of Defense recently endorsed the recommendations of the Defense Science Board (DSB) 1982 Summer Study on Training Technology. The DSB recommended that DoD accelerate use of computer-based instructional methods (CAI and CMI) in the schoolhouse, on the job, and in the Reserve Components. In his endorsement, Secretary Weinberger called for increased development and application of technology to make training more efficient and effective. He asked that the Services take advantage of existing training technologies, and emphasize research on emerging technologies.

A variety of issues are involved in the application and development of modern CBI technology. First, throughout the Services, many training activities are buying computers. Unfortunately, these systems are often not compatible with one another, therefore, common software packages cannot be developed and shared without substantial recoding and duplication of effort. Second, many current CBI programs are not sufficiently "user-friendly" for application in military training environments. The Defense Science Board has addressed both these issues, and recommended that future acquisitions of training equipment use transportable software and that they be user-friendly in meeting instructional needs. Third, training activities with requirements for CBI need assistance in requirements analysis, planning, budget justification, acquisition, and implementation. Up-front hardware capitalization is one

problem, but, as the DSB noted, software and instructional development and maintenance make up most of CBI life-cycle costs. Finally, activities acquiring new weapons and support systems with associated training need to be aware of CBI capabilities which have already developed and paid for by the Services.

TRIADS addresses these problems and issues. By providing transportable, user-friendly, carefully tested, government owned CBI software, for example, compatibility and supportability problems are solved, user requirements are more efficiently addressed, implementation and life-cycle costs are reduced, standard data on trainee performance and CBI cost/effectiveness can be obtained, and acquisition costs of training for emerging weapons systems can be reduced.

Specific Goals

- The specific goals of the TRIADS effort are to:
- develop a computer-based instructional software library and generalizable courseware existing for government-owned systems
- build demonstration CBI systems
- develop functional specifications for military CBI hardware systems
- conduct demonstration/evaluation projects in each Service to demonstrate feasibility, acquire implementation experience, evaluate and refine software, and analyze cost data
- assist in the transfer of products from military CBI research and development efforts to user communities
- assess software effectiveness in education and training, and determine multiservice software compatibility

The TRIADS program has actively sought participation from the military user community and technical experts. The plans for FY84-86 include the establishment of a User Advisory Group to assist in identifying and meeting user needs, and a Technical Advisory Group to consult on program issues.

TRIADS Philosophy

There are two principle philosophical orientations embedded within the TRIADS program. The first is that user requirements should drive the selection or development of instructional software. Some commercially available authoring systems have instructional strategies predetermined, and alternative instructional strategies can be used only if an authoring language is available. The TRIADS CBI library will contain a variety of authoring tools to meet the diverse situational needs of military users. These tools will be predominantly government-owned, but, in some cases, software licensed from commercial vendors could be acquired. The second overriding philosophy is that the instructional software requirements should drive the selection of hardware for delivery. Too often it is the other way around. Hardware is bought and then an instructional application is bought or developed, resulting in a substantial number of unsupported hardware configurations and associated software. TRIADS will provide military users with software to meet their needs, and establish the conditions for users to obtain assistance in configuring both software and hardware for instructional development, delivery, and management.

TRIADS System Characteristics

TRIADS software and hardware systems are envisioned to have certain key characteristics. Software will, to the maximum extent possible, be machine independent to enable military users to make use of existing equipment, and ensure transportability to more powerful, less expensive systems. In order to achieve this, the instructional software programs are being written in Ada, the Department of Defense standard language. Virtually all 16-bit processing units and major operating systems will be able to execute

this software. This should dramatically reduce implementation costs for particular hardware configurations.

The TRIADS software library will contain three types of programs: authoring and management tools, special purpose instructional strategy programs, and generalizable courseware. The authoring and management tools are designed to be "user-friendly," meaning that no programming experience is required to use them. These tools are necessary because the development, delivery, and management of over 10,000 military training courses are conducted by content experts but not instructional or computer-programming experts. Special purpose instructional strategy programs are those in which the instructional "driver" programs are separable from the content which they deliver. This means that the user must supply only subject-matter content, not reinvent instructional delivery routines. Finally, some courseware which is widely applicable across the services will be maintained in the library. Most other courseware will be indexed and those military users who want to review it for potential adaptation to their own needs will obtain copies electronically. The initial contributions to the library are shown in Table 1.

Table 1. Contributions to the TRIADS Program.

Air Force	Navy	Army
ISS CAI Software: <i>Delivery, Development, Graphics.</i>	2-D Simulation [EEMT]: <i>Freeplay, Tutorial, Data-Base Authoring.</i>	Spatial Data Management System: <i>Navigation, Learning Strategies, Study Skills.</i>
ISS Simulation Software: <i>Interactive Graphics, Hierarchically Oriented Simulation Training.</i>	Study Management System [CAISMS]: <i>Test Development, Delivery, Student Progress Management.</i>	AREIS: <i>Counseling System.</i>
ISS CMI Software: <i>Student Progress Management, Status Reports, Test Development and Delivery, Resource Allocation, Course Evaluation.</i>	Memorization Games: <i>Data-Base Authoring, Instructional Games.</i>	Hand-Held Tutor: <i>Vocabulary, Mathematics</i>
	Language Skills CAI: <i>Vocabulary, Literal Comprehension, Authoring</i>	Microcomputer: System: <i>Reading Skills, Fault Analysis.</i>

The TRIADS program is not a hardware development effort. Instead the emphasis is on required functionality. It is envisioned that devices capable of executing some or all of the TRIADS software will range from low-cost hand-held portable devices to large-scale mainframe machines. All of them, however, will be compatible, modular, expandable, and adaptable to technology advancement. Fortunately, many vendors are building system families with these characteristics.

TRIADS WORK IN PROGRESS

Current program activities include surveying user requirements, developing software standards, adapting existing software for the library, preparing functional specifications for hardware, and developing hardware prototypes. These activities are well underway and should be completed by September of 1984.

Planned Activities

Providing the basis for establishment of operational military CBI centers will require extensive additional effort. The three major

efforts to be accomplished are: software library development, demonstrations, and implementation.

The software library development will require integration of current programs, as well as newly acquired or developed software and hardware systems. Presently, the Navy has contracted to develop quality assurance programs for CBI software emphasizing both instructional adequacy and software engineering. These need to be integrated with the Department of Defense Software Initiative, and Ada Project, and existing military specifications and standards for software engineering and for training program development. Another effort will develop functional requirements in sufficient detail for competitive procurement of appropriate computer hardware. Finally there is a need to integrate the current and planned contributions to the library.

Another library activity will be to acquire other software appropriate for the TRIADS library. Recent reviews have noted that thousands of CBI programs have been developed by nongovernment activities, some of which should be considered for inclusion in the library. In addition, for purposes of portability, it will be necessary to acquire cross-compilers for common languages, machine-specific code generators, etc.

Developing additional software for the library, basis on experience with demonstrations will be another important activity. It is expected that results of tests and evaluations will lead to revision of some software programs, as well as the identification of training requirements for which additional software should be developed. Also, there are other R&D programs in the service laboratories producing new CBI software; these will also need adaptation to the library.

In the planning processing it was assumed that adequate funding would be available. Although there is funding through the present fiscal year (1983) there is some doubt concerning the availability of resources for fiscal years 1984 and beyond.

The Defense Science Board recommended the establishment of demonstrations of training technology in each of the services to refine, evaluate, and determine costs and benefits of technology applications. TRIADS demonstrations, therefore, will be initiated in

each Service. These demonstrations will involve assistance to users in requirements analysis, software tool selection, training design and development, instruction in the use of library programs, instructional management planning, and procurement assistance, system configuration, and installation. TRIADS project personnel will also design and conduct tests and evaluations, manage data collection, and assess costs and benefits.

Implementation activities include establishment of computer communication facilities among TRIADS' performing activities, advisory groups, demonstration sites, and training command headquarters for each Service. User and Technical Advisory Groups are now being formed. In addition, the Joint Directors of Laboratories Technology Initiative Panel for Training and Simulation has recently recommended to the Joint Logistics Commanders that a CBI Software Center be established. The TRIADS program will provide such planning and implementation assistance, along with TRIADS products.

Potential Benefits and Cost Savings

The TRIADS program is intended to synthesize efforts in all the Services related to CBI technology. Initial programs contributed to the TRIADS library are those which have already received rigorous test and evaluation within the developing Service. Later programs will be accepted in the library only after such analyses have been conducted. Also, the demonstrations to be conducted will include cost/benefit analyses.

Several recent studies of CBI in the Services have demonstrated the potential benefits of such systems. Although significant cost reductions have not yet been demonstrated, costs of CBI are heavily driven by initial software and courseware development. As the Defense Science Board noted, software and courseware development and maintenance are the major lifecycle cost elements. The TRIADS program is targeted at these costs; with the intent to reduce them by providing standard, well tested, supportable, efficient CBI programs, that avoid duplication of instructional software, and thus achieve economies of scale.