AUTOMATED-TRAINING, EVALUATION, ACQUISITION, AND MANAGEMENT (A-TEAM)

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ABSTRACT

The Automated-Training, Evaluation, Acquisition, and Management (A-TEAM) program is developing a prototype automated training development system for multi-Service use. The present training development process is time consuming, labor intensive, costly, slow, and requires instructional design expertise. The emergence of proven advanced computer technologies offers the potential for automating the entire training development process. The A-TEAM development technical approach will capitalize on three existing tools already under development or completed: the Army's Automated Systems Approach to Training (ASAT), the Joint Service Instructional Systems Development/Logistics Support Analysis Record (ISD/LSAR) Decision Support System (DSS), and the Navy's Authoring Instructional Materials (AIM) program. ASAT is an automated set of tools to aid training developers in conducting front-end analysis of collective and individual tasks for the design and development of instructional training materials. The Joint Service ISD/LSAR DSS is an integrated set of automated procedures that provides training decision support analysis, including: task selection for training, learning objectives analysis, training media selection, and training equipment requirements analysis. In addition, the Joint Service ISD/LSAR provides an interface with the Logistics Support Analysis Record (LSAR) to allow front-end data integration with the ISD decision-making process. The Navy's AIM system is a set of software programs that provides tools for the design, development, and maintenance of instructional training materials. Each of these tools, however, was designed specifically to meet the needs, requirements, and priorities of each service and are therefore specific to the need of each service. The A-TEAM effort will functionally integrate the ASAT, ISD/LSAR DSS, and AIM tools through effective data interfaces. The effort will also identify functional "gaps" that may exist in the Joint Service ISD capability. This paper will describe the progress of A-TEAM Phase I, including a functional description of each of the three component tools, the A-TEAM integration approach, and the production schedule for the first A-TEAM software prototype.

ABOUT THE AUTHORS

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THE A-TEAM PROGRAM

The present training development process is time consuming, labor intensive, and requires instructional design expertise. The emergence of proven advanced computer technologies offers the potential for automating the entire training development process. The Automated-Training, Evaluation, Acquisition, and Management (A-TEAM) Program will use these emergent technologies by building upon three existing U.S. Department of Defense programs and their data interfaces to develop a comprehensive, efficient training development system.

A-TEAM is a Joint Service management initiative to provide a standardized, integrated set of training development, maintenance, and management tools to support and sustain military training requirements. The A-TEAM Program is sponsored by the Office of the Assistant Secretary of Defense, Force Management and Personnel (OASD/FM&P).

The A-TEAM Program will evaluate approaches for integrating service-specific automated training development, maintenance, and management tools. The A-TEAM training development capability will be provided by linking three training development tools which are either under development or already completed: the Army's Automated Systems Approach to Training (ASAT), the Joint Service Instructional Systems Design/Logistic Support Analysis Record Decision Support System (ISD/LSAR DSS), and the Navy's Authoring Instructional Materials (AIM) system. ASAT is an automated set of tools (under development) to aid training developers in conducting front-end analysis of collective and individual tasks for the design and development of instructional training materials. The ISD/LSAR DSS is an integrated set of automated procedures that provide training decision support analysis, including task selection for media selection, and training equipment requirements analysis. AIM is a set of software programs that provides tools for the design, development, and maintenance of instructional training materials.

Each of the three ISD tools - ASAT, the ISD/LSAR DSS, and AIM - were designed to meet the specific needs, requirements, and priorities of its developing service. For example, the Navy's AIM system lacks a mission-oriented front-end analysis whereas, that is one focus of the Army's ASAT system. The ISD/LSAR DSS is designed to build training requirements data bases from LSAR data that are especially useful for new system acquisitions. Both AIM and ASAT lack this capability. The potential advantage of the A-TEAM concept is seen in the case of the equipment based training. Using A-TEAM, one service can tailor a training program for an existing system developed in another service.

For example the engines of the Air Force's F-15 and Navy's F-18A are the same and could be adequately maintained by personnel trained using virtually the same course.

The overall goal of A-TEAM is to reduce the cost and time to develop training systems by exploiting the information collected by each service during many years of training experience. A-TEAM will be sufficiently generic to be used by the different services whose varying training requirements may warrant tailoring of A-TEAM products. A-TEAM will be compatible with the training products defined in MIL-STD-1379D, the Joint Service standard for the acquisition of contractor delivered military training materials and curricula.

A-TEAM COMPONENT SYSTEMS

The A-TEAM component tools are ASAT, the Joint Service ISD/LSAR DSS, and AIM. Descriptions of each system follow.

ASAT

The Army's ASAT will automate the Systems Approach to Training (SAT) procedures described in U.S. Army Training and Doctrine Command (TRADOC) Regulation 350-7. The SAT process systematically assesses the needs for training; determines training requirements; plans the development of training products; analyzes specific unit and individual training deficiencies; designs, develops, and implements required training; and evaluates training products. Army training developers use SAT to conduct collective and individual front-end analyses for the design and development of instructional training materials (e.g., Army Training and Evaluation Program/Army Training and Evaluation Program Mission Training Plans and soldiers manuals).

When developed, ASAT will provide automated support for TRADOC service schools, major subordinate schools, headquarters, and other activities to execute their training development and management functions. Figure 1 displays the major ASAT functional areas. ASAT will incorporate a relational data base of training information, available to users via a networked environment specifically tailored for each

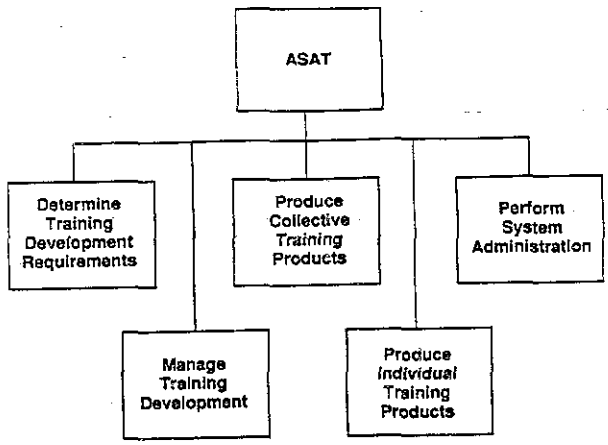

Figure 1. Major ASAT Functional Areas

training activity. The TRADOC Decision Support System will provide the communications foundation necessary to share data between and among ASAT installations.

The ASAT approval authority is the TRADOC Deputy Chief of Staff for Training (DCST). The ASAT project manager is the U. S. Army Training Support Center's Training Support Management Division. The ASAT functional proponent is the DCST's Training Development and Analysis Directorate-Training Information Management Division. The ASAT developer is the TRADOC Directorate of Information Management's Application System Division.

ISD/LSAR DSS

The Joint Service ISD/LSAR DSS is a completed software system that supports ISD decision making and training system development integration with other weapon system design activities. The ISD/LSAR DSS provides an automated ISD process and an automated LSAR-to-ISD data interface that reduces labor-intensive data handling tasks, and allows training analysts to effectively focus on task analysis and evaluate training system requirements. The ISD/LSAR DSS tool can be used with or without LSAR data.

The ISD/LSAR DSS is an integrated set of automated procedures that provide training decision support analysis capabilities, including task selection for training, learning objectives analysis, training media selection, and training

equipment requirements analysis. Figure 2 displays the major functions of the ISD/LSAR DSS. The automation of analysis procedures and efficient data management techniques streamline ISD functions, eliminate redundant tasks and data, improve analysis quality and efficiency, and reduce cost and lead time required for training analysis. The ISD/LSAR DSS supports ISD analyses for maintenance, support, and operator training. The ISD/LSAR DSS PC-based ISD analysis modules document an analysis on automated worksheets.

The ISD/LSAR DSS LSAR interface improves the quality of the information exchange between ISD analysts and system/equipment designers by addressing a wider, more comprehensive range of training issues. The LSAR interface also permits an ISD analyst to maintain concurrency with an evolving weapon system design that has supportability characteristics recorded in the LSAR. By promoting early systems engineering interaction with equipment designers, the ISD/LSAR DSS ensures that more effective training systems are developed.

AIM

The Navy's AIM is an existing software system that automates the design, development, and life cycle maintenance of instructional materials. Figure 3 depicts the Navy AIM system. AIM is used by Navy subject matter

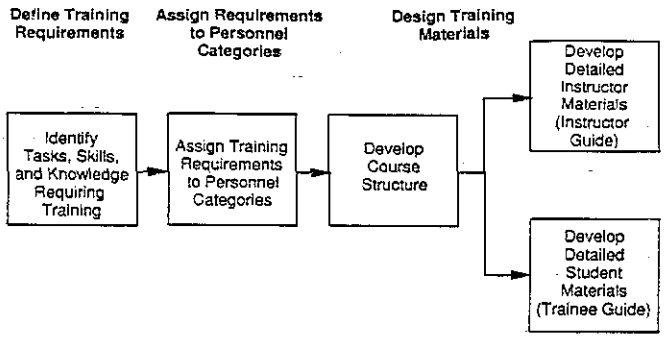

Figure 3. AIM Training Development Functions

experts to make the curriculum development process more efficient and to standardize instructional material products. The software programs ensure the Navy's compliance with the MIL-STD-1379C/D curriculum development standards and decrease the effort needed to document the curriculum development process.

AIM maintains the accuracy of training materials by electronically updating the AIM data bases. Local and wide area networks such as Defense Data Network (DDN) provide the exchange of course data among training sites.

AIM currently supports the design, development, and maintenance of instructor guides, trainee guides, and their supporting management documentation; Personnel

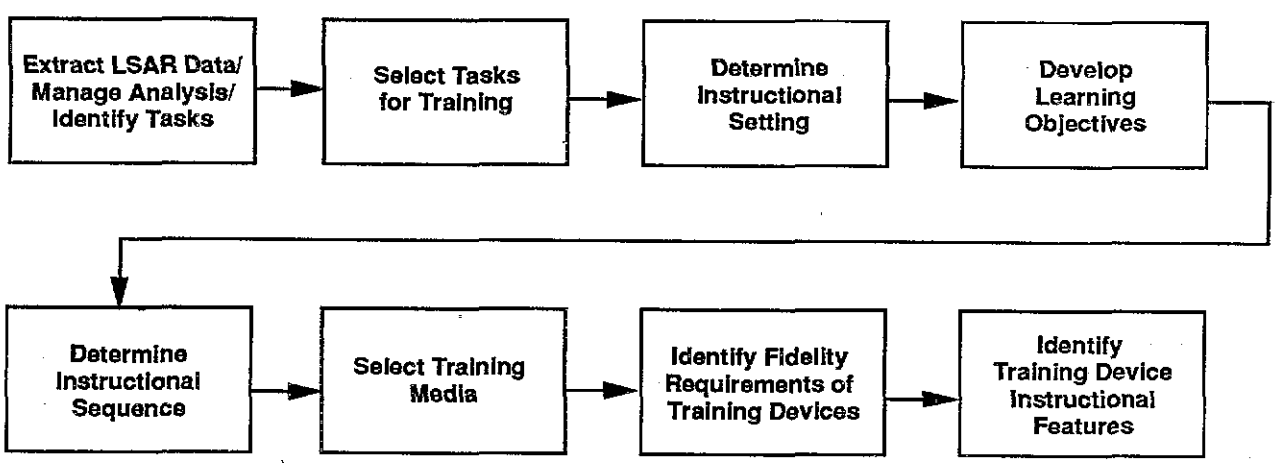

Figure 2. Joint Service ISD/LSAR DSS

Performance Profiles (PPPs); and training path systems; in a MIL-STD-1379C-compatible format. Adaptation of AIM to the MIL-STD-1379D standard is planned for fiscal year 1993. Development of training materials in AIM is currently based upon the PPP table, which lists the skills and knowledge necessary to support a system, subsystem, or equipment; to perform a task or function; or to provide a trainee with necessary background information prior to undertaking more detailed training.

AIM development is conducted by the Navy Personnel Research and Development Center (NPRDC) in San Diego, and is sponsored by Chief of Naval Operations (CNO) OP-11. The Naval Training Systems Center (NTSC) in Orlando, Florida, provides AIM technical support and training.

A-TEAM PROGRAM STATUS

The A-TEAM development technical approach is to capitalize on existing tools already under development or completed (i.e., the ISD/LSAR DSS, AIM, and ASAT). A-TEAM will create a comprehensive training development system for Joint Service use by integrating the tools' functional capabilities. The A-TEAM Program is planned to take place over three years and will use a rapid prototyping, test, adapt, and revise approach. There are two A-TEAM phases, displayed in Figure 4.

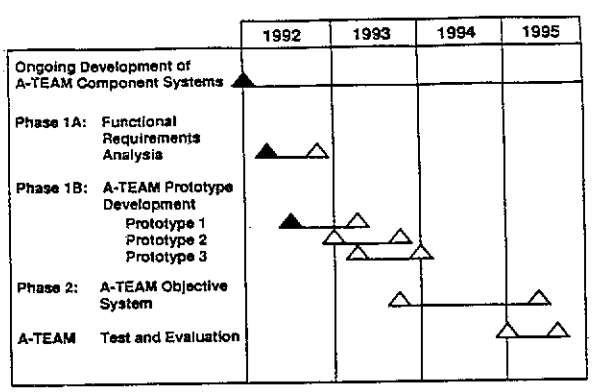

Figure 4. The A-TEAM Program Schedule

A-TEAM Phase 1 has two parts which are proceeding simultaneously. Phase 1A is an analytic task that will generate a functional overview of the proposed A-TEAM system and will examine the functional characteristics of the three initial A-TEAM component tools (ISD/LSAR DSS, AIM, and ASAT). The objective of Phase 1B is to adapt, test, and evaluate prototype demonstrations. Phase 2 of A-TEAM is the design, development, implementation, test, and evaluation of the A-TEAM objective system.

A-TEAM Phase 1A is documenting A-TEAM functional requirements and operational concepts. This task will then match the functional characteristics of the three A-TEAM component tools to the A-TEAM training development functional requirements. Phase 1B will follow the development of the A-TEAM overview and functional architecture. During Phase 1B, three prototype interfaces will be developed to demonstrate A-TEAM tool integration concepts. The prototypes may include simulations of data import and manipulation within the A-TEAM component tools. This will avoid the requirement for software modifications to A-TEAM component tools before the modifications are reviewed in detail (through prototyping) and approved by the government. The A-TEAM prototypes will reveal and help solve functional shortfalls of the existing A-TEAM component tools. The three A-TEAM prototypes are:

Prototype 1 - links the ISD LSAR/DSS and AIM. The linked tools will create and enhance the ISD/LSAR DSS front-end analysis data base to support curriculum development using AIM.

Prototype 2 - links ASAT and AIM. The prototype will link the ASAT mission-oriented, individual and collective task analysis capability to the AIM curriculum design capabilities.

Prototype 3 - combines the front-end analysis capabilities of ASAT with the ISD/LSAR DSS. ASAT will be enhanced by the ISD/LSAR DSS LSAR interface; the DSS will benefit from ASAT's collective task analysis capability and its mission-oriented analysis, as well as its link to occupational survey and other data.

The prototype products will be field tested with users from each of the services. User feedback will be incorporated in the A-TEAM objective system design in Phase 2.

A-TEAM Phase 2 will combine features of the three Phase 1B prototype demonstrations to implement the first A-TEAM production version, called the A-TEAM objective system. The A-TEAM Concept Overview will be revised to reflect lessons learned from the prototype demonstrations, including opportunities to: (1) improve user interfaces that link, as transparently as possible, the ISD/LSAR DSS, AIM, and ASAT, (2) revise selected training development processes within the A-TEAM component tools and to fill functional gaps, (3) incorporate decision support aids to provide on-line advisors for inexperienced training developers, (4) integrate expert tools into A-TEAM as they become available, and (5) support A-TEAM transition, maintenance, and enhancement. Development, testing, and evaluation of the A-TEAM objective system will follow a normal software development process.

A-TEAM FUNCTIONAL ARCHITECTURE

The capabilities of ASAT, ISD/LSAR DSS, and AIM are being compared with the A-TEAM functional requirements. This effort will guide the development of tool enhancements that augment the three A-TEAM component systems to meet the full range of A-TEAM requirements. An A-TEAM functional architecture is being built that will organize A-TEAM functional requirements and map ISD/LSAR DSS and AIM capabilities, and ASAT design features, to each A-TEAM functional requirement.

A-TEAM functional requirements will also be correlated with MIL-STD-1379D, Military Training Programs, 5 December 1990. MIL-STD-1379D provides the requirements for the acquisition of military training programs. The standard systematically organizes tasks to be performed, task inputs, and task outputs. Task descriptions are made up of detailed subtasks. Required inputs to each task are described, and the MIL-STD-1379D task source of that input is identified. Both formal products (contract deliverable items) and informal/interim information outputs of each task/subtask are listed. MIL-STD-1379D is the first standard in the 1379 series to include tasks associated with the conduct and evaluation of training, Interactive Courseware (ICW) development, and detailed requirements for software interfaces and related commands to ensure ICW and ICW authoring system portability on interactive video delivery systems. The application of MIL-STD-1379D is tailored, i.e., tasks and data requirements are selectively invoked to meet the needs of each training system acquisition.

MIL-STD-1379D tasks, subtasks, and outputs provide a generic, detailed, Joint Service-approved description of many of the functions A-TEAM will be required to perform. Table 1 is an example of A-TEAM component system capabilities by MIL-STD-1379D task/subtask. Displays such as Table 1 will support the A-TEAM functional architecture.

A-TEAM DATA MODEL

A-TEAM will be compatible with Department of Defense (DoD) Computer-aided Acquisition and Logistics Support (CALS) standards. The CALS initiative requires the development of standard weapon system data bases that can support life cycle logistic support analyses, including training systems development, for new or emerging weapon systems. New weapon system acquisition programs are being required to be CALS compatible. Both industry and government participants in new system acquisitions expect to realize communication efficiencies and cost reductions generated by CALS compatibility.

The effective use and exchange of weapon system design data in a CALS environment requires standard definitions of data elements and data exchange standards that overcome inherent incompatibilities between host hardware/software. The A-TEAM design will provide automated access to current weapon system data pertinent to training system development decision making using CALS compatible data interfaces. To do this, A-TEAM is being designed to be consistent with existing CALS standard data architectures and data exchange standards.

Training data element standardization. A number of DoD activities related to data standardization and exchange are proceeding in parallel to the A-TEAM effort. These efforts and A-TEAM are mutually supportive. A-TEAM will have to comply with any DoD standards

Table 1.
Functional Comparison of AIM, ASAT, and the ISD/LSAR DSS (Example)

MIL-STD-1379D Tasks	AIM	ASAT	DSS	Process Discriminators
203.2.1 Identify the target population prerequisite knowledge and skills.	X	X	-	DSS - Required task, but non-automated
203.2.2 Develop a listing of all required knowledge and skills for each collective training task.	XP	X	-	
203.2.3 Develop a listing of all required knowledge and skills for each individual training task.	X	X	X	Knowledge and skills (K/S) related differently in AIM and DSS.
203.2.4 Develop learning objectives '(LOs).	X	X	X	AIM - Developed for course segments DSS - Developed for each task to be trained
203.2.5 Develop knowledge and skill requirements for learning objectives.	X	X	-	DSS - K/S and LOs both related to task, but not linked to each other
203.2.6 Group the learning objectives by occupational skill areas and skill level, then arrange the learning objectives in a hierarchal relationship.	XP	X	XP	DSS - LO hierarchy based on task relationships

DSS column heading refers to the ISD/LSAR DSS.
ASAT column shading indicates that ASAT is under development.
"X" = tool support task performance
"XP" = tool partially supports task performance
"-" = tool does not support task performance

eventually produced by such activities; A-TEAM lessons learned and real life software implementation experience will contribute to the evolution of the standards. Each of the data standardization and exchange efforts that will impact A-TEAM are discussed below.

- Integrated Weapon System Data Base (IWSDB). Collection of all data related to a weapon system's acquisition, design, operation, and support.
- Contractor Integrated Technical Information Service (CITIS). Contractor-provided service that authorizes the government to access contractor data bases and information.
- Joint CALS Management Office (JCMO) CALS Architecture. To guide near- and long-term DoD infrastructure modernization for the effective management of technical information.

- Joint CALS (JCALS) Program. JCALS is procuring a computer system to integrate selected acquisition and logistics processes. Process performance and data retrieval will be performed on a CALS workstation.

- MIL-STD-1379D Data Standardization. To develop and document definitions and relationships of training data elements used in performing MIL-STD-1379D tasks.

- CALS Industry Steering Group (ISG) Human Systems Components (HSC) Data Dictionary. To support the inclusion of HSC data in the JCMO CALS Architecture.

- DoD 8320.1-M-1, Standard Data Element Development, Approval, and Maintenance, May 1992. DoD procedures for data element standardization and management.

A-TEAM Data Dictionary Data Base. One key to the functional integration of the ISD/LSAR DSS, AIM, and ASAT component tools will be a comprehensive data dictionary that includes all anticipated data elements, with definitions and data relationships, as well as data cross-references to source documents and standards.

A data dictionary will be used to construct the A-TEAM common data architecture, depicted in Figure 5. The data dictionary data base will incorporate the concept of a master data element. Data elements in the A-TEAM component tools, other related tools, and related DoD standards will point to a master data element. Data element commonality with a master data element will be coded as one of the following:

Identical	=	element matches a master data element perfectly with the exception of physical implementation differences
Equivalent	=	element means the same as a master data element, but is not defined exactly the same, or is structured differently
Unconnected	=	no corresponding master data element, but has training value or importance

Information required for data element approval in accordance with DoD 8320.1-M-1 may be included in the data base for later use.

A-TEAM ENVIRONMENT

A-TEAM is being designed to run initially on MS-DOS operating systems, with the intent of evolving to the Microsoft Windows operating system. Design considerations are being given

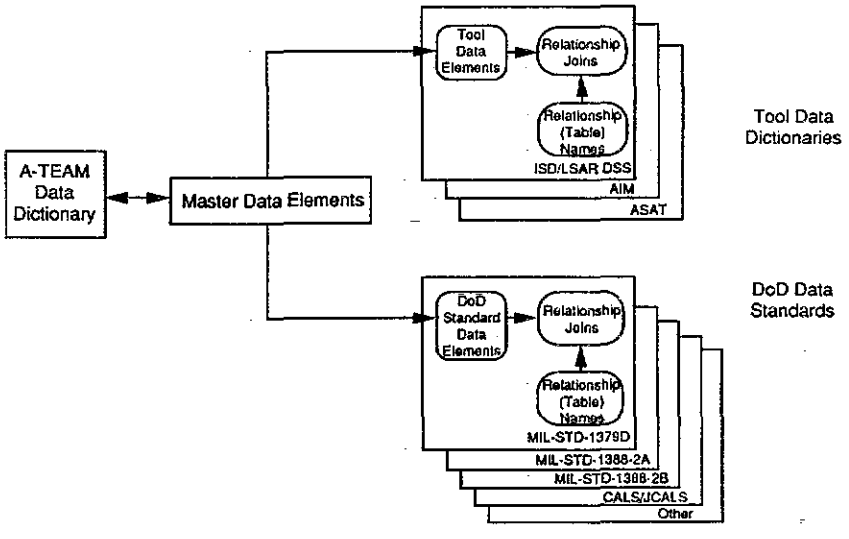

Figure 5. A-TEAM Data Dictionary Data Base Structure

to porting the system to either a POSIX compliant environment or to Microsoft's NT operating system, when available.

Programmatic considerations require the eventual platform/operating system decisions be determined by financial criteria also. The software design and development are being undertaken to make the numerous elements of the software programs as portable as possible to a variety of acceptable compliant platforms. A-TEAM is evolving from existing software (ISD/LSAR DSS and AIM) and a system under development (ASAT). A-TEAM data access and exchange will result from software enhancements to existing systems, keeping the current users operable while enhanced data handling processes are being developed. Both the ISD/LSAR DSS and AIM use commercial data base management software. Each system provides for direct data access by American National Standards Institute (ANSI) Standard Query Language, Revision 2 (SQL2) compliant queries of their data structure for data extraction. A-TEAM will also use ANSI SQL2 compliant queries for data extraction and exchange between tools.

A-TEAM PC workstations will be able to operate in a stand-alone or local area network (LAN), operating NET-BIOS (if MS-DOS). Specific A-TEAM PC requirements with regard to memory and storage capacity are currently being defined. Communication capabilities will be required to access data from external sources.

USER INVOLVEMENT

Successful A-TEAM development is highly dependent on the active involvement of both government and industry developers and users of the ISD/LSAR DSS, AIM, and ASAT component tools. User coordination is being accomplished by the A-TEAM Coordinating Group (ACG), which consists of experienced, knowledgeable members of the training development community. The ACG will guide the development effort and ensure A-TEAM training development analysis results and products have Joint Service utility. The ACG is chaired by Dr. Barbara Sorensen, Armstrong Laboratory Acquisition MPT Technology Team, Brooks AFB, Texas. Members are representatives from OSD, the services, and other government agencies.

The early A-TEAM determination of functional requirements is based on input from the ACG. The ACG will also review and provide feedback on A-TEAM design and operational concepts, and will represent the services at A-TEAM prototype demonstrations. Other tasks may be added as needs are recognized. The following major ACG activities are planned:

Information Exchange

- Provide a forum to exchange information concerning training development.
- Present and discuss innovative ideas and approaches to encourage community solutions to common problems.

A-TEAM Requirements Documentation

- Assist in creating a standard training development data model.
- Identify DoD training development processes as A-TEAM functional requirements.
- Map the A-TEAM functional requirements to the initial A-TEAM component tools (ISD/LSAR DSS, AIM, and ASAT).
- Explore approaches for comprehensive data exchange.
- Provide the capability for efficient use and re-use of training data across services and functional areas.

Design Feedback and Evaluation

- Provide for functional user input to the A-TEAM design and integration effort.
- Observe and comment on software prototype demonstrations.

A-TEAM Implementation

- Lead the introduction and implementation of A-TEAM training development tools.

- Serve as A-TEAM system proponents.

- Promote the development and acceptance of the Joint Service standard approach to training development.

SUMMARY

The A-TEAM Program will automate training development technology for the analysis, design, development, production, and maintenance of individual and collective training. By integrating the functions and sharing the data used by three complementary, training development tools, A-TEAM will reduce labor-intensive, data-handling tasks and will allow training analysts to effectively focus on training development analyses. Some of the benefits that A-TEAM users can expect to realize are the following:

- Data Integration A-TEAM will support comprehensive training development analyses in an integrated product development/concurrent engineering environment.

- Automated Reports A-TEAM will produce output reports tailored to user needs and in accordance with MIL-STD-1379D and other standards to reflect pertinent training information required for training development decision making and management.

- Cost Savings A-TEAM will allow for more efficient use of training developers' time because of productivity improvements that result from using automated decision support and automated, CALS-compatible data interfaces.

A-TEAM will be a powerful system for performing the integrated analyses of training system requirements and developing training curricula, material, and devices. A-TEAM data interfaces will improve the quality and timeliness of information exchanged among training analysts and weapon system designers, and will address a wider range of training issues in a comprehensive and cost-effective fashion. Both the early analysis of training requirements and the interaction with weapon system designers will contribute to the development of more effective training systems.

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