Research Note 85-76

(1)



# ADVANCED TECHNOLOGY UNIT TRAINING AND MANAGEMENT SYSTEM

Phase I Final Report

A. G. Silliman
Jet Propulsion Laboratory

Presidio of Monterey Field Unit
Jack H. Hiller, Chief

TRAINING RESEARCH LABORATORY
Robert J. Seidel, Acting Director





U. S. Army

Research Institute for the Behavioral and Social Sciences

July 1985

# U. S. ARMY RESEARCH INSTITUTE
# FOR THE BEHAVIORAL AND SOCIAL SCIENCES

A Field Operating Agency under the Jurisdiction of the

Deputy Chief of Staff for Personnel

EDGAR M. JOHNSON
Technical Director

WM. DARRYL HENDERSON
COL, IN
Commanding

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

## REPORT DOCUMENTATION PAGE AD-A160 572

| | |
|---|---|
| 1a. REPORT SECURITY CLASSIFICATION<br>UNCLASSIFIED | 1b. RESTRICTIVE MARKINGS<br>NONE |
| 2a. SECURITY CLASSIFICATION AUTHORITY | 3. DISTRIBUTION/AVAILABILITY OF REPORT<br>Approved for public release; distribution unlimited. |
| 2b. DECLASSIFICATION/DOWNGRADING SCHEDULE | |
| 4. PERFORMING ORGANIZATION REPORT NUMBER(S)<br>ARI Research Note 85-76 | 5. MONITORING ORGANIZATION REPORT NUMBER(S) |
| 6a. NAME OF PERFORMING ORGANIZATION<br>Jet Propulsion Laboratory<br>Calif. Inst. of Technology<br>6b. OFFICE SYMBOL (If applicable)<br>Sec. 363 | 7a. NAME OF MONITORING ORGANIZATION<br>U.S. Army Research Institute Field Unit |
| 6c. ADDRESS (City, State and ZIP Code)<br>4800 Oak Grove Drive<br>Pasadena, CA 91109 | 7b. ADDRESS (City, State and ZIP Code)<br>P.O. Box 5787<br>Presidio of Monterey<br>Monterey, CA 93944 |
| 8a. NAME OF FUNDING/SPONSORING ORGANIZATION<br>ARI, ADEA/ATB<br>8b. OFFICE SYMBOL (If applicable) | 9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER<br>NAS7-918, Task Order RE-182<br>Amendment 282 |
| 8c. ADDRESS (City, State and ZIP Code)<br>5001 Eisenhower Ave., Alexandria, VA 22333<br>Ft Lewis, WA 98433<br>Ft Eustis, VA 23604 | 10. SOURCE OF FUNDING NOS.<br>PROGRAM ELEMENT NO.: 63743A<br>PROJECT NO.: A794<br>TASK NO.: 4413<br>WORK UNIT NO.: 101 |
| 11. TITLE (Include Security Classification)<br>See Next Page | |
| 12. PERSONAL AUTHOR(S)<br>A. G. Silliman | |
| 13a. TYPE OF REPORT<br>Final<br>13b. TIME COVERED<br>FROM Jan 83 TO Jun 85 | 14. DATE OF REPORT (Yr., Mo., Day)<br>85/07/11<br>15. PAGE COUNT<br>18 |
| 16. SUPPLEMENTARY NOTATION | |
| 17. COSATI CODES<br>FIELD / GROUP / SUB. GR. | 18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)<br>(U) AUTOMATED BATTALION TRAINING MANAGEMENT; ~~(U)~~ GOAL PROGRAMMING; ~~(U)~~ LINEAR PROGRAMMING; ~~(U)~~ COMPUTER ASSISTED MANAGEMENT. |

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

A computer-based management information system was designed to assist unit training at the battalion level. A prototype system was successfully implemented and made operational within a host battalion of the U.S. Army. This Final Report presents an overview of the task and summary conclusions and recommendations.

| | |
|---|---|
| 20. DISTRIBUTION/AVAILABILITY OF ABSTRACT<br>UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☒ OTIC USERS ☐ | 21. ABSTRACT SECURITY CLASSIFICATION<br>UNCLASSIFIED |
| 22a. NAME OF RESPONSIBLE INDIVIDUAL<br>Dr. J. Hiller, Chief<br>ARI Field Unit, Presidio of Monterey | 22b. TELEPHONE NUMBER (Include Area Code)<br>(408) 242-8316<br>22c. OFFICE SYMBOL<br>ARI |

DD FORM 1473, 83 APR EDITION OF 1 JAN 73 IS OBSOLETE

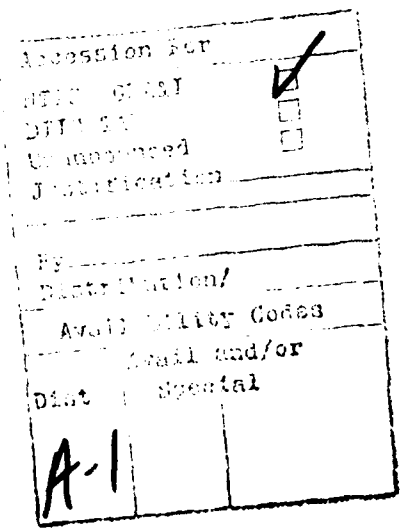


UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

11) Title.

**Advanced Technology Unit Training and Management System**
Phase I Final Report.




The following names are trademarks of their respectively listed companies: INGRES, Relational Technology Inc.; VAX, VMS, Digital Equipment Corporation; MUSE, MARC Software International, Incorporated.

The work described herein was carried out by the Jet Propulsion Laboratory and was sponsored by the United States Army Research Institute under an agreement with the National Aeronautics and Space Administration, under contract NAS7-918. The views, opinions and findings contained in this report are those of the author and should not be construed as an official Department of the Army position, policy, or decision unless so designated by other documentation.

TABLE OF CONTENTS

Defense Information Systems Program

Advanced Technology Unit
Training and Management System, Phase I
FINAL REPORT

Written by:

A. G. Silliman
Task Manager

Approved by:

C. A. Beswick
Section Manager

Approved by:

T. Thornton
Division Manager

Approved by:

F. Vote
Program Manager

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

# SECTION 1
# PURPOSE AND SCOPE

## 1.1 INTRODUCTION

This document is the Final Report for the Advanced Technology Unit Training and Management System (ATUTMS) task undertaken by the Jet Propulsion Laboratory for the Army Research Institute under contract NAS7-918. The report presents an overview of the task and summary conclusions and recommendations.

This report is organized as follows: Section 2 describes the ATUTMS task in terms of its background, requirements, and objectives, Section 3 presents a summary of activities and products produced, and Section 4 offers conclusions and recommendations.

## 1.2 ATUTMS DOCUMENTATION

In addition to this Final Report, three documents were developed during the course of this task and may be referred to for more detail about the ATUTMS system:

1) User Requirements for an Advanced Technology Unit Training and Management System.

2) Users Guide for the Advanced Technology Unit Training and Management System.

3) Design Description for the Advanced Technology Unit Training and Management System.

# SECTION 2
# DESCRIPTION OF THE ATUTMS TASK

## 2.1 BACKGROUND OF THE ATUTMS TASK

One of the critical requirements for achieving/maintaining combat readiness is the management of unit training. However, the management procedures and tasks required to 1) determine individual soldier and unit collective training needs, 2) plan and schedule, 3) provide resources, and 4) conduct training and evaluation are extremely difficult to perform because:

a) There are a large number of different jobs and associated Soldiers' Manual (SM) tasks which may need to be trained;

b) The diversity of the task training needs of individual soldiers;

c) The large number of collective tasks which may need to be trained;

d) Prerequisite training requirements: (1) SM tasks before other SM tasks; (2) SM tasks before collective tasks; (3) collective tasks before other collective tasks; (4) collective tasks across echelons (e.g., Squad Movement to Contact, before Platoon Movement to Contact);

e) The difficulty of acquiring accurate assessments of individual and collective training needs;

f) Personnel turbulence and turnover; different forgetting rates for different task skills and knowledge;

g) Constrained resources: time, terrain, ammunition, vehicle availability and spare parts, simulators and training aids, etc.

h) Frequent interruptions to scheduled training and slow communication of changes in taskings; and

i) Shortages of qualified trainers and training supervisors.

A computer-based management information system offers great potential to overcome the above difficulties and therefore improve unit training management.

One of the missions of the U.S. Army Research Institute (ARI) is to improve U.S. Army tactical unit training capabilities. Along the lines of this mission the ARI Field Unit at the Presidio of Monterey, CA. was requested by the Army Development and Employment Agency (ADEA) at Fort Lewis, and by the Training and Doctrine Command (TRADOC) Army Training Board to conduct research needed to develop a comprehensive, automated training management system for U.S. Army battalions.

To help solve this problem, ARI developed the concept of a computer-based information system - the Advanced Technology Unit Training and Management System (ATUTMS). This prototype system was to be implemented in a phased approach over several years in a single brigade of the 9th Infantry Division. Initial work would be done in a single battalion.

## 2.2 CONTRACTUAL REQUIREMENTS

In October 1982, the Jet Propulsion Laboratory (JPL) made a proposal to ARI to develop the ATUTMS system. Contractual arrangements were completed and work began in February 1983 and continued through December 1984. The requirements of the task as stated in JPL's proposal were:

1) Evaluate the existing user requirements for the ATUTMS. Refine these requirements and develop an ATUTMS User Requirements Document.

2) Conduct a preliminary design activity which would result in a system functional design that would meet the established user requirements.

3) Define the subset of the ATUTMS design necessary to implement Phase I.

4) Develop a cost estimate for Phase I of ATUTMS.

5) Procure the hardware and software as required to meet the Phase I system design.

6) Manage the Phase I system installation, check-out and initial data entry into the system and provide training in the use of the Phase I system.

7) Participate with ARI in the evaluation of the Phase I system performance when it is operated by 9th Infantry Division personnel.

8) Develop a Task Plan for follow-on phases of ATUTMS.

9) Prepare a Final Report for Phase I.

## 2.3 THE OBJECTIVES

The broad objective of ARI and ADEA was to enhance unit training management through the use of an automated system. The more specific JPL objective for Phase I was the design, development and implementation of a battalion-level system to support training management. A successful proof of the concept of the prototype ATUTMS could then lead to an extension to brigade and division echelons.

## 2.4 LIMITATIONS AND CONSTRAINTS

This section discusses the limitations and contraints imposed on the task. The reasons for each limitation and/or constraint are discussed along with their effects on the ATUTMS task.

### 2.4.1 Resources

Two independent cost estimates for Phase I were developed. They were both in the 1.5-2 million dollar range. Since this magnitude of funding was not available, the original concept for Phase I was de-scoped to $800,000. This de-scoping resulted in a minimal set of applications in each functional area. Effects of the de-scoping during the conduct of Phase I limited Phase I applications, user training and user support. The de-scoping also limited documentation and forced it to be developed after the system was implemented.

### 2.4.2 Security

ATUTMS was implemented with a standard commercial computer system. This system includes the use of User Names and Passwords to restrict undesirable access, but is not a secured system in a classified sense. This fact ultimately led to determining that the Unit Status Report, for example, could not be implemented because this data is considered sensitive.

# SECTION 3

# SUMMARY OF ACTIVITIES AND PRODUCTS PRODUCED

## 3.1 TASK IMPLEMENTATION

The ATUTMS task was comprised of four subtasks: 1) collecting and documenting user requirements, 2) developing a Phase 1 design, 3) implementing the Phase 1 design, 4) and fielding the Phase 1 system.

## 3.2 USER REQUIREMENTS

JPL collected user requirements through technical discussions with ARI and other Army contacts. Mr. Pat Whitmarsh of ARI made a significant contribution to this task through his initial version of the ATUTMS requirements. In July 1983, the 1-11 FA Battalion at Fort Lewis was identified as the host unit. The 1-11 FA provided valuable inputs to the requirements collection. Draft requirements were prepared and modified in response to comments from the involved organizations. This cycle was repeated several times. The product of the subtask, the User Requirements for an Advanced Technology Unit Training and Management Systems divided the requirements into two phases: Phase I - a baseline system for garrison operations, and Phase II - a paperless processing system.

## 3.3 PHASE 1 SYSTEM DESIGN

In this subtask, JPL performed a functional analysis of the requirements and derived a Phase I system design. This design was iterated numerous times to arrive at a design commensurate with the funding and manpower constraints. The functions identified for the Phase I system are listed below.

ATUTMS Functions Identified for Implementation in the Phase I System:

1) Training
   - o Individual and collective training records
   - o ARTEP and Soldier Manual Reference Data
   - o Training Schedule - not in calendar form

2) Personnel

- o SIDPERS record maintenance and update - not all SIDPERS data was used
- o Personnel Roster
- o Daily Status Report
- o Unit Manning Report
- o Skill Inventory Report

3) Logistics

- o Materiel Readiness Report (DA 2406)
- o Vehicle History File (DD 314)
- o Hand Receipts (DA 2062)
- o Prescribed Load List (DA 2063)

4) Other

- o Unit Status Report
- o Word Processing
- o Electronic Mail

Component selection for the Phase I system was guided by the following criteria:

a) Desire to select components already used at the host installation (which the host might be familiar with or likely to be required to use in the future)

b) Immediate availability of a development system at JPL

c) Funding constraints

d) Desire to use a commercial relational database management system to avoid a large software development effort

The Distributed Command and Control System (DCCS) being developed at Fort Lewis presented the possibility of meeting the first criteria listed above. The DCCS is comprised of Wicat and Grid microcomputers. Contact with both Wicat and Grid companies revealed that a relational database was not available for their equipment to support the ATUTMS application. JPL attempted

to pursuade these companies and several database software enterprises to consider a joint-marketing venture. At least one company considered this proposal but apparently decided the market was not sufficient. Thus, the component selection was driven by the second criterion. The decision was to use a VAX computer manufactured by the Digital Equipment Corporation and the INGRES relational database management system produced by Relational Technology Incorporated. Both of these components were already available at JPL for immediate support of ATUTMS development. Funding constraints limited the computer system, commercial software, and peripherals to the absolute minimum required for Phase I. Three Grid microcomputers were included in the system to provide field operation capabilities.

## 3.4 IMPLEMENTATION PHASE

The implementation phase consisted of procuring and installing commercial hardware and software, specifying facility requirements and interacting with the host battalion on the facility modifications, implementing database applications software, and planning user training.

Procurement of commercial components encompassed requisitioning those items selected during the design phase. These included the VAX 11/750 computer with disk and tape drives, terminals, printers, Grid microcomputers, INGRES software, and word processing software. The installation of these components was mostly a matter of receiving, uncrating, checkout, and initial adjustment or setup. The computer manufacturer performed the setup and initial checkout of the computer.

JPL identified the facility requirements for supporting the ATUTMS system. These requirements were transmitted to the host battalion which ultimately became responsible for implementing them. A small office within the host battalion headquarters building was converted into the central computer site. Necessary electrical power and air conditioning was installed. Cables were laid from the computer site to four other battalion buildings where terminals were installed. JPL fabricated a patch panel which was installed at the computer site. This panel allowed selection and connection of 13 terminals

to the computer from 30 possible locations at one time. Commercial line drivers were incorporated into the panel and located at each terminal site to provide communication over the required distances.

Software implementation consisted of establishing data structures, menus and reports using the INGRES relational database. The applications were divided into three areas: Training, Personnel, and Logistics. The Personnel application was developed first, followed by Training, and finally, Logistics.

User training plans were developed before installing the first application at Fort Lewis. This consisted of developing a training outline and materials to assist training the host soldiers to use the system. Self-paced lessons were developed and installed in the computer for the word processing software.

## 3.5 FIELD INSTALLATION AND USER TRAINING

The first phase of this ATUTMS task was to install the applications software at Fort Lewis, train the battalion users, and support initial operations of the system. This phase required a ten-month period with one JPL person on site for most of the period, and considerable travel by other task members.

## 3.6 PRODUCTS PROVIDED

The following summary of products were provided by JPL in performance of this task.

1) User Requirements for an Advanced Technology Unit Training and Management System. This document describes the user requirements developed for Phases I and II of ATUTMS.

2) Users Guide for the Advanced Technology Unit Training and Management System. This document provides instructions for the operation of the Phase I system.

3) Design Description for the Advanced Technology Unit Training and Management System. This document provides design information for technical support to future design changes to ATUTMS.

4) A magnetic tape copy of the ATUTMS software. This copy was installed on the ARI VAX minicomputer at the Presidio of Monterey for demonstration and evaluation.

# SECTION 4
# CONCLUSIONS AND RECOMMENDATIONS

## 4.1 CONCLUSIONS

### 4.1.1 Conclusions involving the ATUTMS concept are:

1) The ATUTMS concept is viable and was successfully demonstrated.

   a) The JPL objective to design, develop and implement Phase I of ATUTMS was accomplished.

   b) The ARI and ADEA objectives were measured through an evaluation test conducted by the Army Combat Developments and Experimentation Center (CDEC). The CDEC analysis revealed that the majority of users preferred the computerized system over the manual system because it saved time, labor, and enabled them to do their jobs better and faster.

2) Battery and battalion-level soldiers can be trained to use the system successfully with several days of training. (Approximately 70 users were trained.)

3) Soldiers do not have enough time to fulfill their Army duties and also learn how to develop their own application programs as originally envisioned. Nor do they have time to learn complex computer applications. Applications must be fully developed for them and must be easy to use. The programs must be menu driven, and report and query formats must be easy to use.

4) To provide adequate support for maintaining and using this system within a battalion, at least two soldiers must be highly trained to act as database administrators, system managers, teachers, and user consultants. These personnel must be at

least partially relieved of their normal duties in order to perform these functions, and must be made available at the start of system installation in order to allow adequate training time.

5) The ATUTMS concept is applicable Army-wide. Very few of the applications that were developed are unique to the 1-11 FA. Examples of 1-11 FA unique applications are use of the term Battery versus Company, and incorporation of special programs such as the Personnel Reliability Program.

4.1.2 Conclusions involving the INGRES relational database are:

1) The relational database is well-suited for the battalion management system.

2) The commercial relational database is an effective means of reducing the amount of programming required for an information management system of this type.

4.1.3 Conclusions involving the ATUTMS computer system are:

1) The VAX 11/750 minicomputer was reliable and worked well for this application.

2) During heavy usage periods the number of users is limited to approximately 10 due to system response time.

3) Peak user loads occur at mid-morning and mid-afternoon.

4) Memory sizes used for the Phase I System are:

| | |
|---|---|
| VMS System Files | 131 MB* |
| General Utilities | 1 MB |
| INGRES System Files | 15 MB |

| | |
|---|---|
| MUSE System Files | 7 MB |
| ATUTMS System Files | 4 MB |
| ATUTMS Database Files | 47 MB |
| User-Developed Databases | 15 MB |
| Users Files | 41 MB |
| Total | 261 MB |

* Megabytes

## 4.2 JPL Recommendations

The ATUTMS prototype has directly contributed to the decision by the 9th Infantry Division, ADEA, and the Department of the Army Director of Training (Office of Deputy Chief of Staff for Operations & Plans - ODCSOPS) to create a division-wide ATUTMS-like prototype system. This system could potentially produce a division model for adoption throughout the Army. to develop this division-wide system the following recommendations are made:

1) The ATUTMS training management concept should be expanded to a complete battalion management system. Training and battalion management are closely related and both require such comprehensive knowledge of all areas of the battalion that they should be combined into one system. Use of automation capabilities of the existing system should be emphasized.

2) After completion of the battalion management system them Phase II requirements as documented in the User Requirements for an Advanced Technology Unit Training and Management System should be reexamined in respect to the experience gained with the Phase I system. The Department of the Army Personnel and Logistics centers should participate in this process. Additional capabilities such as paperless processing, the Training Management and Cost Accounts System Concepts, and the Tactical Operations Paperless System concept should be considered. This effort should encompass automation to the division level with automated interfaces.

# APPENDIX A

## ACRONYMS

| | |
|---|---|
| ADEA | Army Development and Employment Agency |
| ARI | U.S. Army Research Institute |
| ARTEP | Army Training and Evaluation Program |
| ATUTMS | Advanced Technology Unit Training and Management System |
| DCCS | Distributed Command and Control System |
| ODCSOPS | Office of Deputy Chief of Staff for Operations & Plans |
| SIDPERS | Standard Installation Division Personnel System |
| SM | Soldier's Manual |
| TRADOC | Training and Doctrine Command |