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Research Memorandum 76-13

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PLANIT SUPPORT AND UTILITY PROGRAMS--

TEST PROCEDURE

Richard F. Bergfeld, James L. Cilva, Barry Seid
James M. Fletcher and Alan M. Hoff
Litton Systems Incorporated

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ABSTRACT

↙
This document provides the procedures for testing the AN/GYK-12 PLANIT support and utility programs to verify compliance with the contractual requirements. These programs were developed under contract number DAHC19-74-C-0064 as a part of the system installation of PLANIT (Programming Language for Interactive Teaching) on the AN/GYK-12 (TACFIRE) computer. ↘

The PLANIT Support and Utility Programs were developed as a part of a Litton Systems, Inc., Data Systems Division (DSD), contract with the U. S. Army Research Institute for the Behavioral and Social Sciences (ARI). This contract (# DAHC19-74-C-0064) was awarded on 11 June 1974 as a part of an overall ARI research project which addresses the application of tactical computers to training. This contract specifically addressed the installation of the PLANIT author/student language on the U. S. Army Artillery Tactical Fire Direction System (TACFIRE) general purpose computer. This computer (AN/GYK-12) is also used in several other Army tactical computer systems.

The successful completion of this contract included the delivery and demonstration of a fully operational PLANIT system on the AN/GYK-12 computer. This project included the development of a translator and translation of PLANIT (version 2.6) from FORTRAN to TACPOL (AN/GYK-12 computer programming language). This task was accomplished under a separate ARI contract to the Northwest Regional Educational Laboratory. The Litton contract included the development of the operating system, machine input/output programs, system start and termination routines, utility support programs, and system integration and support to the installation of PLANIT on the AN/GYK-12 system.

BACKGROUND OF THE PLANIT USER TRAINING SYSTEM

Several explicit user requirements converged to generate the research which resulted in the documents contained in this set of reports. The need for some type of user training subsystem in support of tactical automatic data processing (ADP) system developments was clearly established during the evolutionary phase of the Army Tactical Operations System (TOS) development in Europe.¹ In 1974, after a decade of involvement in the development of tactical ADP systems, the Army Computer Systems Command summarized this experience into six "Lessons Learned."² One of these lessons was: A dedicated and trained user is required if tactical ADPS is to succeed.

One approach toward meeting this requirement is to apply techniques derived from modern educational technology and the computer sciences by embedding training subsystem packages within the operating system and then using the system itself to teach the user how to use the system. The approach was delineated in a concept paper,³ which was subsequently submitted, evaluated and found by key Army Personnel to have merit. As a consequence, a requirement was placed on the Army's Behavior and Systems Research Laboratory (BESRL--the predecessor of what is now the Army Research Institute) by what was then the Assistant Chief of Staff for Force Development (ACSFOR) and the Director of Army Research, Office of the Chief of Research and Development (OCRD),^{4,5} to effectuate the research necessary to test the concept.

¹Baker, J. D. "Human Factors Experimentation Within a Tactical Operations System (TOS) Environment." Proceedings: Office of Naval Research Sponsored Tri-Service Coordination Meeting, London, England, 20-21 February 1968.

²Memorandum from Headquarters, U.S. Army Computer Systems Command to Assistant Deputy Commander, CACDA, Ft. Leavenworth, KA; Deputy Commander, MASSTER, Fort Hood, TX; Project Manager, Army Tactical Data Systems, Fort Monmouth, NJ, dtd 30 January 1974, Subject: TSDG Lessons Learned.

³Memorandum from U.S. Army Behavior and Systems Research Laboratory to Assistant Chief of Staff for Force Development, dated 28 September 1971, Subject: Proficiency Maintenance Using Computer-Assisted Instruction in an Operational Setting.

⁴Memorandum from Assistant Chief of Staff for Force Development to Chief of Research and Development, dated 10 November 1971; with 18 November 1971 indorsement to Behavior and Systems Research Laboratory, Subject: Request for Research in Application of Tactical Data Systems for Training.

⁵Memorandum from Chief of Research and Development to Assistant Chief of Staff for Force Development, dated 29 Nov 1971, Subject: Request for Research in Application of Tactical Data Systems for Training.

The terms of the requirement actually levied, however, went well beyond the scope of the original concept and called for a simultaneous attack on all facets of the problem associated with testing the feasibility of the approach. In terms of broadened scope, the primary role of these systems is in support of tactical operations. Our original concept paper suggested a potential, select secondary role for these computerized tactical data systems, viz., that of directly supporting the system user by using the system itself, in a stand-alone mode, to teach the user how to use the system. The agencies structuring the research requirements saw a possible tertiary role for these systems. About the time they were structuring their requirements, the Army's Dynamic Training Board identified the maintenance of proficiency of Military Occupation Specialty (MOS) 11B40, the light weapons infantryman, as a glaring unit training problem and suggested that Computer-Assisted Instruction (CAI) as one technique for alleviating the situation.⁶ In addition, a subsequent Continental Army Command (CONARC) Task Group report on CAI identified the 11B40 MOS as a top contender for attention in the "non-technical" skills area.⁷ Consequently, the scope of the effort was expanded to encompass an examination of a tertiary role, i.e., in support of the system's parent unit by using these computers to meet individual and unit training requirements such as those associated with the 11B40 MOS. Additionally, in response to concern that the implementation of the Modern Volunteer Army concept might produce a need for general education development (GED) upgrading it was determined that an examination should be made of the feasibility of employing extant CAI GED on tactical computers in an operational setting. The assumption was made that accomplishment of these latter requirements would be tantamount to proving the feasibility of the secondary role concept as well. The test, therefore, would be a cost-effective undertaking since it would provide data directed toward answering a number of diverse questions concerned with a common training delivery system, viz., tactical computers.

Irrespective of whether it was the secondary or tertiary role concept being assessed, four major components were required: a test in a credible operational environment; appropriate hardware; functioning software and representative people-ware. The vehicle for this overall assessment was MASSTER⁸ Test FM 122, "IBCS: Automated Instruction." The hardware was a "given" viz., the Developmental Tactical Operations

⁶Report of the Board for Dynamic Training, Volume II. 17 December 1971, page 116.

⁷Headquarters, United States Continental Army Command Task Group Report and Computer Assisted Instruction. April 1972.

⁸MASSTER - Modern Army Selected Systems Test, Evaluation, and Review--is the Army's test bed for assessing equipment, concepts and doctrine. This activity is located at Fort Hood, Texas.

System (DEVLOS) which was then located at Fort Hood, Texas (Hoyt, et al⁹ provide a description of the hardware). Likewise, the people were a "given"--our student population would be MOS 11B40 personnel drawn from the 2nd Armored Division and 1st Cavalry Division located at Fort Hood. The question of what "software" approach to take (specifically, whether to use an existing student/author language) was key to the success or failure of Test 122. Clearly, the decision made at this juncture would determine whether we would hit the assigned "test window" in time to conduct the test. As a related issue, courseware development would largely depend upon the structure of the student/author language selected, so courseware development could not commence until this decision was made. The decision itself had to be correct and timely--and whatever decision was made would undoubtedly be risky.

To add to the difficulty in reaching a decision, it must be realized that it could not be made unilaterally. Conduct of a test of the complexity of MASSTER Test FM 122 required support from and coordination between a number of different agencies--key among them being mutual cooperation of the organization which had DEVLOS responsibility, the U.S. Army Computer Systems Command (USACSC), and the Army Research Institute (ARI). A Memorandum of Understanding¹⁰ was drawn up between these two organizations and, as the first USACSC task in this joint undertaking, a MASSTER Test 122 CAI Concept Paper¹¹ was to provide alternative concepts for implementing automated instruction materials on the DEVLOS in support of MASSTER Test 122. Concurrent with this effort, a contract was let by ARI with the System Development Corporation (SDC) to develop the courseware (i.e., the instructional materials which would be presented through CAI). The first task SDC had to accomplish was to provide alternative student/author language alternatives for generating the courseware and to determine which alternative provided the best likelihood of success under the test conditions and time constraints imposed. In essence, the combined results of these analytic studies were expressed as follows: "At this stage, many alternative design concepts can be formulated. However, due to time constraints on the implementation of any concept, the only alternative concept considered feasible...is the use of PLANIT."¹²

⁹Hoyt, W. G., Butler, A. K. and Bennik, F. D. "Application of Tactical Data Systems for Training: DEVLOS Feasibility Determination and Selection of an Instructional Operating System." ARI Technical Paper 267, October 1975.

¹⁰Memorandum of Understanding Between Commander, U.S. Army Research Institute and Commander, U.S. Army Computer Systems Command, Dated 5 June 1973.

¹¹Bunker-Ramo Technical Note "MASSTER Test 122--Computer Assisted Instruction (CAI) Concept Paper," February 1973, prepared for the U.S. Army Computer Systems Command.

¹²Ibid. 11, page 18.

PLANIT (Programming Language for Interactive Teaching) is an instructional system consisting of an author language and supporting computer programs for preparing, editing and presenting any subject matter suitable for individualized CAI presentation to students, as well as recording all relevant response data for immediate utilization and subsequent analyses. PLANIT was developed over an eleven year period under the aegis of the National Science Foundation (NSF) at a total investment cost of approximately \$740,000. The main goal of this NSF project was to produce a student/author language which would be fully transportable and guaranteed compatible with a large and diversified class of machines.¹³ We at ARI take professional pride in the fact that it was our early and subsequent work with PLANIT which validated this visionary transportability notion of NSF.¹⁴ We also take "economic" pride in the fact that we capitalized upon an already "hefty" U.S. Government investment to solve a problem, rather than slipping into the classic mold of "reinventing the wheel" by starting from scratch and building a separate student/author language tailored to the hardware/software system constraints.

To lower the curtain on MASSTER Test FM 122, the test was successfully conducted and demonstrated that it was feasible to use tactical computers in a stand-alone training mode to satisfy individual and unit training requirements. It was found that automated instruction in a field setting was enthusiastically accepted by the non-commissioned officers (NCO's) examined and, as a training medium, it proved to be more effective than the traditional study-method of training.^{15,16,17,18,19}

¹³Frye, C. H. "A Report on PLANIT: One Stage of Completion," Final Report for the National Science Foundation Grant No. EPP73-07319 A04, August 1975.

¹⁴For a complete account of the experiences of ARI in installing, using and evaluating PLANIT in an Army setting, including all the "warts and blemishes" uncovered during this endeavor, see: Johnson, C. "Implementation of PLANIT at the U.S. Army Research Institute for the Behavioral and Social Sciences," PLANIT Newsletter, July 1975.

¹⁵Hoyt, W. G. and Baker, J. D. The use of tactical computers to provide weapons and tactics training to combat NCO's: Results of a field test. Proceedings: Sixteenth Annual Conference of the Military Testing Association MTA, U.S. Coast Guard Institute, Oklahoma City, OK. 21-25 October 1974.

¹⁶Hoyt, W. G., Butler, A. K. and Bennik, F. D. Application of tactical data systems for training: Volume II - CAI/DEVTOS automation studies. ARI Technical Paper 267, October 1975.

¹⁷Hoyt, W. G., Butler, A. K. and Bennik, F. D. Application of tactical data systems for training: Volume I - Executive Summary. ARI Technical Paper ____, in preparation.

But the results of this test proved more than the preceding. They also indicated that the obvious Army needs mentioned at the outset of this preface, could be met by applying this technology to a real and present problem. It also went beyond the exploratory stage and satisfied a specific Army requirement. The U.S. Army Combat Developments Command (CDC)/Systems Analysis Group (now the U.S. Army Training and Doctrine Command/Combined Arms Combat Developments Activity, or TRADOC/CACDA) had levied the following requirement²⁰ on ARI:

The Proposed Material Need for the Tactical Operations System - TOS (Unclassified title, portions of contents classified CONFIDENTIAL) states: "During system non-tactical employment the equipment shall have the capability to permit the training of user personnel without affecting the mission ready capability of the system." While the need exists, no specific data are extant which can be brought to bear on this problem. The requested research will provide data which could impact on all TOS users and result in considerable savings in training costs related to the user's need to maintain proficiency in the use of these systems.

The 122 Test data satisfied the CDC requirement. The Proposed Material Need (MN) for TOS was found to be a viable concept and that MN remains to this day as a bonafide component of the TOS program.

As previously discussed, the results from MASSTER Test FM 122 demonstrated the viability of the embedded training subsystem concept in general and that tactical data systems could be used in a tertiary role, i.e., specifically, that these systems could be used in a stand-alone mode in support of individual and unit softskills training requirements. But conceptually our main goal had always been to embed system specific training packages within the operating system itself and then to use the system to teach the user how to use the system--the earlier noted secondary role for these systems.

¹⁸Hoyt, W. G., Butler, A. K. and Bennik, F. D. Application of tactical data systems for training: Volume III - Development of courseware and analysis of results for MOS 11B40. ARI Technical Paper ____, in preparation.

¹⁹Hoyt, E. G., Butler, A. K. and Bennik, F. D. Application of tactical data systems for training: Volume IV - Development of courseware and analysis of results for GED math. ARI Technical Paper ____, in preparation.

²⁰Letter, DARB-ARB 19 July 1972, Subject: New Research Requirements for the Human Resources Research and Development Program (RCS CSCRD 70 CRI); letter response from CDCSAG-AG1, same subject as above, dated 1 September 1972.

As a follow-on to Test 122, research was initiated under the aegis of the Product Manager, Computer Training Systems (PM CTS) through HRN 75-158 (and, subsequently, HRN 76-195) which tasked ARI to address the problem of reducing the novice user's difficulties by making tactical data systems (e.g., TOS², TACFIRE, TSQ-73, etc.) more "approachable" through applications of the embedded training concept.²¹

Because of its stage of development, the fact that its basic central processing unit would serve as the core for other Army Tactical Data Systems (ARTADS) to follow, and the fact that its operator training problems appeared to be amenable to reduction through the application of automated instructional technology, TACFIRE (the Army's field artillery tactical fire control system) was chosen by the PM CTS as the test vehicle for assessing the embedded training subsystems concept. The initial and specific requirements for the TACFIRE research were delineated in HRN 76-193, "Development and Evaluation of PLANIT Based Computer Embedded Training Packages for TACFIRE" which was prepared by personnel of the U.S. Army Field Artillery School, Fort Sill, OK.

Once again we were faced with the dilemma as to whether the best decision would be to develop a tailor-made student/author language smoothly fitted to the hardware/software constraints of the TACFIRE system, or to build upon our already successfully operating PLANIT system and attempt to install it on TACFIRE. The latter approach had many merits, among them: (1) it was an author language system with which we were familiar, while a customized system would be untested, costly and would require an extensive checkout; (2) a customized authoring system would be limited to a given TACFIRE configuration, whereas PLANIT would be transportable to the family of ARTADS systems, and (3) because of PLANIT's machine independent characteristics, courseware could be prepared on commercial computers and, after content checkout, easily installed on the tactical system, whereas a customized approach would tie-up the actual tactical system during courseware preparation.

The effort to install PLANIT on the AN/GYK-12 computer, the results of which are contained in this set of reports, was independently undertaken as Technology Based - Exploratory Development research and not as Advanced Development activity (i.e., it was not done in direct response to an explicit, stated user need). It serves as a classic example of what Dr. Malcolm R. Currie, Director of Defense Research and Engineering (DDR&E) was describing in the following statement to the Second Session of the 94th Congress: "The objective of the Technology Base is the advancement of technology applicable to future systems and subsystem

²¹Human Resource Need (HRN) 75-158, title: "User Training and Proficiency Maintenance in a Tactical Data Systems Environment," submitted as a research requirement for inclusion in the ARI FY 75 Advanced Development Work Program by the Product Manager, Computerized Training System, Fort Monmouth, NJ. HRN 76-195 was a revalidation of the requirements delineated in 75-158 for inclusion in the FY 76 Work Program.

options. These options (or new ideas) usually involve enhanced military capability, reduced cost, increased performance, better reliability and maintainability, more efficient use of resources or some combination of these attributes." Success in this effort would produce a broadly applicable, cost-effective vehicle for employing embedded training subsystem packages in a variety of military system settings.

It merits comment, however, that while this work was a Technology Based-Exploratory Effort, it had the potential for feeding into the Advanced Development program efforts associated with the user tasks presented in HRN 75-158, "User Training and Proficiency Maintenance in a Tactical Data Systems Environment," if the outcome were successful. Consequently, the PM-CTS was appraised of this effort at the outset and he, in turn, coordinated it with the Program Manager, Army Tactical Data Systems (PM ARTADS). During this coordination some valid points of criticism were raised²² concerning the PLANIT approach. The PM ARTADS recommended that ARI meet with system developers, users and training agencies as soon as sufficient data were available to determine whether, or not, PLANIT would operate on TACFIRE. At that time a determination would be made concerning implementation implications and to assess if, indeed, this were the most effective approach to take, given the potential for impact on TACFIRE system development efforts. In keeping with this recommendation, a Workshop was convened at ARI in Arlington, VA on 1 October 1974 and these items were covered in detail with personnel from all of the suggested groups in attendance. The interaction was found to be most beneficial to all concerned and the concensus of the group was to install the system described in this set of reports on the TACFIRE system at Fort Sill, OK, and to use it as the test vehicle for assessing the embedded training concept on that ARTADS system.

This historic overview of the events leading up to the production of the set of quite specialized reports may seem untoward in view of the projected, limited set of users of these documents. It is, however, a quite meaningful forum for discussing these events. Too frequently the question is raised as to how did a particular research product originate and was it utilized. The intent here is to show that the warp and woof of concepts and coordination, requirements and research are so intertwined that a simple one-to-one relationship (one response, one use) does not tell the story--only a view of the whole cloth will put it into proper perspective. Additionally, it exemplifies a point made in the previously cited presentation by the Director of Defense Research and Engineering to the 94th Congress when he said: "To deploy systems DOD must not only pursue advanced technology but must endure the long years of research required to bring an idea through growth problems to a finished, proven and useful end product."

²²Memorandum from Product Manager, Computer Training Systems (PM-CTS) to Program Manager, Army Tactical Data Systems (PM-ARTADS) 28 Jan 74, Subject: HRN 75-158 and 1st indorsement from PM-ARTADS to PM-CTS, same subject as above dated 7 February 74.

This set of reports provides detailed instructions for implementation and operation of PLANIT and auxiliary programs on the AN/GYK-12 computer. The set consists of a report on:

- o TRANSL - The PLANIT Translator Program: Installation and Application
- o PLANIT Support Programs - Operator/user manual
- o PLANIT Utility Program - Operator/user manual
- o PLANIT Support and Utility Programs - Test Procedure
- o PLANIT Support and Utility Programs - Flow Charts.

The first report contains the information for installing and operating a program which is designed to translate the FORTRAN from the PLANIT system of programs into the TACPOL language for compilation on the AN/GYK-12 computer. The second covers the general and specific aspects of leading and operating PLANIT on the AN/GYK-12 computer. The third document covers the general and specific aspects of operating the PLANIT utility programs which are a specialized group of routines developed to accomplish various tasks in support of the AN/GYK-12 computer installation of PLANIT. The fourth report covers the procedures used to verify that PLANIT Support and Utility Programs are functioning as per specifications. The fifth document provides the detailed flow charts of the computer logic of the PLANIT Support and Utility Programs.

The effort detailed in the first report (i.e., TRANSL) was accomplished under ARI Contract DAHC19-74-C-0038 by the Northwest Regional Educational Laboratory, Portland, Oregon. The other four reports in the series were prepared by the Data Systems Division, Litton Systems Inc., Van Nuys, CA under ARI Contract No. DAHC19-74-C-0064.

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SECTION 1

INTRODUCTION

1.1 Scope

This document provides the test procedures for performance of the parameter and functional testing required to verify the capability of the PLANIT support and utility programs to perform the required functions as described in the contract statement of work (SOW). The programs to be verified are those developed by Litton Systems, Inc., Data Systems Division (DSD), under U. S. Army Research Institute (ARI) contract number DAHC19-74-C-0064.

1.2 General

The detailed contractual tasks to be verified by this procedure are included in appendices to this document as follows:

Appendix A - Original contract SOW tasks, Item 1.

Appendix B - Contract mod. 3 follow-on tasks.

Appendix C - Review and revision of task descriptions resulting from implementation and review of each task with ARI technical personnel.

The approach taken in the test procedure is to use the PLANIT system tapes delivered under the contract (or equivalent) and, following the procedures defined in the deliverable operator/user manuals, demonstrate that all required functions have been provided and operate in accordance with the contractual requirements.

Some of the tasks specified are inherent capabilities of the (TACPOL) PSS-B Compiler and no special software development was required. The capabilities are demonstrated by the proper functioning of the applicable PLANIT CALC functions. Examples of such functions are SOW Item 1, Tasks b, d, and e.

1.3 Verification Cross Reference Index

Appendix D is a verification cross reference index showing the paragraph number of this test procedure which verifies each of the SOW tasks.

SECTION 2

APPLICABLE DOCUMENTS

The following documents are applicable to this test procedure to the extent specified herein.

Litton Systems, Inc.

Data Systems Division

125200-900
(Dated 25 March 1975)

PLANIT Support Programs
Operator/User Manual

125201-900
(Dated 25 March 1975)

PLANIT Utility Program
Operator/User Manual

System Development Corporation

TM-(L)-4422/001/01
(Dated 1 October 1970)

PLANIT Author's Guide

TM-(L)-4422/002/01
(Dated 1 October 1970)

PLANIT Language
Reference Manual

Northwest Regional Educational Laboratory

(No document number)
(Dated 12 February 1974,
revised 27 March 1974)

Document Update Information
for PLANIT, Version 2.0

SECTION 3

LIST OF EQUIPMENT

All testing can be accomplished on either of the following U. S. Army programming support system installations:

- 1) TACFIRE Programming Support System (PSSB)
- located at Van Nuys, California.
- 2) TOS² Software Support System (SSS)
- located at Falls Church, Virginia

In addition, all but the utility program functions can also be executed on the following U. S. Army field system installations:

- 3) TACFIRE (Division or Battalion) Engineering Test/Service Test System - located at Fort Sill, Oklahoma, or Van Nuys, California.
- 4) TOS² Division Central Computer Center (DCCC), Division Remote Computer Center (DRCC), or Brigade Remote Computer Center (BRCC) - located at Fort Hood, Texas.

For formal demonstration purposes, the PSSB and/or the SSS are used. These system configurations (as of 25 March 1975) allow for demonstration of all of the PLANIT support and utility program functions due to the availability of the commercial card reader/punch, tape drives and high speed printer in addition to the field system equipment.

In addition to the system equipment, the following (contract deliverable) tapes (or equivalent) are required:

Reel #0007	PLANIT Object Library
Reel #0008	PLANIT Load Tape
Reel #0009	PLANIT History Tape
Card Deck	PLANIT Cards File

SECTION 4

TEST DESCRIPTION

All of the following procedures assume that all PLANIT functions are performed in accordance with the following PLANIT manuals (hereinafter referred to as the Author Manuals):

PLANIT Author's Guide

PLANIT Language Reference Manual

Document Update Information for PLANIT, Version 2.0

All PLANIT support program procedures are performed in accordance with the PLANIT Support Programs Operator/User Manual (hereinafter referred to as the Support Manual). Appendix I of the Support Manual is a Glossary of Terms for reference purposes.

All PLANIT utility program procedures are performed in accordance with the PLANIT Utility Program Operator/User Manual (hereinafter referred to as the PUP Manual).

See Section 2 for further identifying data on the above manuals.

4.1 System Load

- a. Using the PLANIT Load Tape and PLANIT History Tape, perform PLANIT system load as described in Section 2 of the Support Manual. Use the appropriate procedure (subparagraph 2.1, 2.2, 2.3, or 2.4) as applicable to the system installation being used.

Enter device address 0/0 for "ELP2," the "Card Reader," "Card Punch" and the "H-S Printer" before inputting the device address "skeleton." Ensure that ELP1 is enabled. This forces the ELP (for the PSSB or SSS) to be the system printer for list functions to be used in a later section of this test procedure.

- b. Perform START initialization as described in Section 3 of the Support Manual with the following input parameters:

- 1) Type of start: History
 - 2) Number of active terminals: 2
Note: Ensure that at least one VFMED or MIOD (as appropriate) and associated DDTs are enabled.
 - 3) Mount history tape as requested and enter appropriate tape unit number in response to the history tape mount message.
- c. Log in per Author Manuals in response to PLEASE LOG IN message using appropriate operator/author/student IDs (see Appendix F of the Support Manual, CARDS FILE cards 04045700 and 04045800). Terminal operating procedures are per the Support Manual, Appendix B, C, and/or D as appropriate.
- d. The above procedure verifies the implementation of the following SOW tasks:
- Item 1 - Tasks a, f, g, h, i
 - Mod 3 - Tasks d.2, d.4, d.5
 - Added - Task d.7.

4.2 Terminal Activity (CALC Mode)

- a. Enter CALC mode using the horizontal arrow (\leftarrow) character on either terminal (see Support Manual, Appendix E, and Author Manuals).
- b. Enter SIN (PI/4); answer = .7071
- c. Enter COS (PI/4); answer = .7071
- d. Enter LOG (412,10); answer = 2.6149
- e. Enter LN (412); answer = 6.0210
- f. Enter ABSOLUTE (-20); answer = 20.0
- g. Enter SQRT (144); answer = 12.0
- h. Enter 21.2345*2; answer = 42.4690
- i. Enter PI/2; answer = 1.5708
- j. Enter 44**2; answer = 1936.0

- k. Enter $44^{\wedge}2$; answer = 1936.0
- l. Enter $1.1 + 3.6$; answer = 4.70
- m. Enter $4.7 - 1.1$; answer = 3.60
- n. Exit CALC mode using the vertical arrow (\wedge) character (see Support Manual, Appendix E, and Author Manuals).
- o. The above procedure verifies the implementation of the following SOW tasks:
 - Item 1 - Tasks b, c, d, e, f, g
 - Mod 3 - Tasks d.2, d.3.

4.3 Buffered ELP Output

- a. Enter SYSTEM mode on operator terminal.
- b. Enter LIST LOAD (one of the lessons on the history tape).
- c. The resulting lesson listing on the ELP verifies the buffered ELP output function (eliminating hardware initiated multiple line feeds after each line within the lesson listing). This verifies the following SOW tasks:
 - Item 1 - Task i
 - Added - Task d.6.

4.4 System Clock

- a. On both terminals, enter command mode.
- b. On one terminal, get and execute the lesson LOAD.
- c. On the second terminal, get and execute the lesson CLOCK several times in sequence while the other terminal is executing the LOAD lesson.
- d. CLOCK should output the time of day. LOAD, when complete, should output start time, number of times "I = I + 1" has looped, end time and elapsed time (approximately 3 to 5 minutes for 1000 loops).
- e. The above procedure verifies the implementation of the system clock usage requirement of SOW tasks:

Item 1 - Task f, j

Mod 3 - Task d.2.

4.5 System Termination

- a. Enter SYSTEM mode on "operator terminal" (see Author Manuals).
- b. Enter QUIT ALL (see Author Manuals and Sections 4 and 5 of Support Manual).
- c. Perform system termination sequence and history tape dump as described in paragraph 4.6 and Section 5 of the Support Manual.
- d. This procedure verifies the following SOW tasks:

Item 1 - Task f, g, h, i, j

Mod 3 - Task d.2.

4.6 Cold Start With "Cards File" on Cards

- a. Mount (or rewind) PLANIT Load Tape. Perform PLANIT system load as described in Section 2 of the Support Manual. Use the appropriate procedure (subparagraphs 2.1, 2.2, 2.3 or 2.4) as applicable to the system installation being used. Make no device address changes (ensure card reader, card punch, and HSP are active, addresses assigned, and enabled).
- b. Perform START initialization as described in Section 3 of the Support Manual with the following input parameters:
 - 1) Type of start: CARD
Note: Ensure that CARDS FILE has been loaded in the card reader and the card reader readied.
 - 2) Number of active terminals: 2
- c. Log in per Author Manuals in response to PLEASE LOG IN message using appropriate operator/author/ student IDs (see Appendix F, PLANIT Cards File, of the Support Manual, cards 04045700 and 04045800). Terminal operating procedures are per the Support Manual, Appendix B, C, and/or D as appropriate.
- d. Enter CALC mode.

- e. Enter $PI/2$; answer 1.5708
- f. This verifies the requirements of the following SOW task:

Mod 3 - Task d.8.

4.7 Utility Programs

- a. Using the PLANIT Object Library tape, generate a PLANIT load tape using the procedures described in Appendix D.1 and Section 2 of the PUP Manual.
- b. Using the PLANIT Object Library tape and "Cards File" card deck, generate an updated PLANIT object library tape using the procedures described in Appendix D.2 and Section 5 of the PUP Manual.
- c. Using the procedures described in Section 9, and the examples given in Figure 9-1, of the PUP Manual, convert a lesson from one code set to another.
- d. The above procedures verify the requirements of the following SOW task:

Mod 3 - Task C

4.8 Verification by Analysis and Review of Documentation

Several of the SOW tasks are best verified by review of the applicable documents and analysis of the design, testing results and the documentation. SOW tasks which fall in this category are as follows:

Item 1 - Tasks a, b, k

Mod 3 - Tasks a, b^{*}, c, d.1, d.3, d.4, e, f

Added - Task d.6.

* This task deleted

APPENDIX A

CONTRACT STATEMENT OF WORK

SECTION A, ITEM 1

Item 1 - Software Design, Checkout, and Test

The Contractor shall perform the following program design, checkout, and test activities related to modification of the AN/GYK-12 MADCAP operating system and to generation of related subroutines. The resulting program, to be referred to as the PLANIT Operating Systems (POS), will include the compatibility and interoperability of the elements developed under the following sub-items a. thru k. The items a. thru k. set forth below represent the complete PLANIT Operating System which will be prepared by Litton specifically for utilization of the Army Research Institute.

- a. Modify MADCAP to provide generalized input/output (I/O) interfaces permitting installation of PLANIT on a variety of AN/GYK-12 systems except for the following limitation. Where the system configuration differs from the TOS²SSS configuration, the installation of PLANIT will require generation of approximately 100 instructions/data items to change the system device definition tables and will require recompilation, system tape generation, and reverification.
- b. Incorporate in MADCAP the required accuracy and precision for addition, subtraction, multiplication, division, and exponentiation, using a format to be mutually agreed upon by the Contractor and the Government during the first two weeks ARO.
- c. Incorporate the equivalent of the following FORTRAN functions: SIN (sine), COS (cosine), ALOG (natural logarithm), ABS (absolute value), and SQRT (square root), each of which will feature the required accuracy and precision.
- d. Incorporate appropriate calling sequence for the code described in b. and c. above.
- e. Incorporate means for comparison of any two entries according to each of the six standard programming relationals.

- f. Incorporate an interactive terminal support capability.
- g. Incorporate the ability to transfer random blocks of data to and from non-volatile secondary storage.
- h. Incorporate a magnetic-tape data-transfer capability.
- i. Incorporate a data-transfer capability to a line printer.
- j. Incorporate the capability to use the system clock for reading time-of-day, for user time-slicing, and for establishment and maintenance of a variable number of PLANIT-user-defined internal software timers.
- k. Perform software checkout and acceptance test demonstration on processor available to the Contractor.

APPENDIX B

CONTRACT (MOD 3) STATEMENT OF WORK

FOLLOW-ON TASK DESCRIPTION

The following tasks will be performed:

- a. Continue monthly progress and fiscal status reports described under contract line item 0002AA.
- b. Provide support to the government in its conversion of the PLANIT translator and generator to the TACPOL language and the installation of same on the AN/GYK-12 computer.
- c. Develop miscellaneous utility programs, and associated user documentation, to enhance and support PLANIT utilization, lesson development, and field system tape generation. This would include such items as card-to-card, tape-to-tape, and card-to-tape, and tape-to-card translation of lesson materials from one code type to another such as CDC and UNIVAC (ARI standard codes) to EBCDIC.
- d. Develop and incorporate various program modifications to enhance author and student interface and utilization.

This would include such items as:

1. Modification to allow the selection of a single lesson from a number of lessons stored on an MLU for field configurations with limited computer main frame and/or peripheral memory.
2. Analyze modification to display output format to provide a blank line at the top of the display for ease of student response.
3. Review and revise character set for ease of conversion from other PLANIT installations. Review of the function of formatting characters such as the line feed/carriage return for the use and application of multiple line feed/carriage return characters.
4. Provide capability for optimum configuration of PLANIT overlays within the main frame computer memory for applicable field configurations.

- 5. Add capability for operator modification of device addresses/
system configuration to enhance field flexibility.
- e) Modify test procedures and other affected documentation to reflect
changes implemented.
- f) Re-run test procedures to demonstrate operability of incorporated
changes.

APPENDIX C

REVIEW AND REVISION OF PLANIT CONTRACT

(DAHC19-74-C-0064) TASK DESCRIPTIONS

The following is a summary of the revisions to the PLANIT contract task descriptions resulting from implementation and review of each task with ARI technical personnel.

A. Original Contract Tasks (including contract mods. 1 and 2):

Item 1: No change.

Item 2: No change.

Item 3: No change.

Item 4: No change.

B. Contract Mod 3 Follow-on Tasks:

Task a: No change

Task b: Delete this task since there is no immediate requirement for use of the translator and/or generator on the AN/GYK-12 computer. If use of these items is required in the future, it will be more flexible and cost effective to install them on a commercial system available to ARI or Litton. Since the current PLANIT configuration is to become a "frozen baseline" for at least one year, it is not likely that ARI would require regeneration or translation during this period. If such activity is required for some unforeseen reason, Dr. Frye of the Northwest Regional Educational Laboratory can perform these tasks on his system.

Task c: No change. A completely general conversion routine has been implemented using an input code card and output code card reflecting code differences. A PLANIT Utility Program (PUP) has been developed and a PUP User's Manual written.

- Task d.1.: This task has been implemented by modifying the cards file to restrict the storage allocations for lesson materials to that available for the given field configuration. With this as a known limitation for a given field site, the lesson materials can be prepared and utilized in segment sizes compatible with the available memory.
- Task d.2.: This task has been implemented by providing an ACC/OCC display format consisting of a blank line at the top of the display followed by up to 6 lines for data usage. The VFMED/MIOD display format consists of a top line communication address with MIOP messages or blanks for the case where student responses are required. Following the first line is up to 6 lines for data usage.
- Task d.3.: The character set has been revised to optimize compatibility (similarity) with prior ARI PLANIT installations, lessons and current PLANIT documentation. The capability to use multiple line feed/carriage return characters for formatting purposes has been incorporated.
- Task d.4.: This task has been implemented by incorporating the primary CALC procedures into main frame memory along with PLANIT MAIN. In addition all of the PLANIT overlays are stored in the main frame memory for system configurations which include an MCMU.
- Task d.5.: No change.
- Task d.6. thru d.8: These tasks have been added to those previously defined in Contract Mod 3. They have been implemented as follows:
- d.6: Added buffered ELP output to reduce hardware initiated multiple line feeds.
 - d.7.: Added capability for operator identification of tape drive for mounting history and/or save tapes.
 - d.8.: Added capability during "cold start" for operator selection of reading the "cards file" from the PLANIT load tape or from the card reader (for system configurations which include a card reader).

Task e: No change.

Task f: No change.

APPENDIX D

VERIFICATION CROSS REFERENCE INDEX

<u>SOW TASK</u>	<u>TEST PROCEDURE PARAGRAPH NUMBER</u>
Item 1 Task a	4.1, 4.8
Item 1 Task b	1.2, 4.2, 4.8
Item 1 Task c	4.2
Item 1 Task d	1.2, 4.2
Item 1 Task e	1.2, 4.2
Item 1 Task f	4.1, 4.2, 4.4, 4.5
Item 1 Task g	4.1, 4.2, 4.5
Item 1 Task h	4.1, 4.5
Item 1 Task i	4.1, 4.3, 4.5
Item 1 Task j	4.4, 4.5
Item 1 Task k	4.8

<u>SOW TASK</u>	<u>TEST PROCEDURE PARAGRAPH NUMBER</u>
Mod 3 Task a	4.8
Mod 3 Task b	(Deleted) 4.8
Mod 3 Task c	4.7, 4.8
Mod 3 Task d.1.	4.8
Mod 3 Task d.2.	4.1, 4.2, 4.4, 4.5
Mod 3 Task d.3.	4.2, 4.8
Mod 3 Task d.4.	4.1, 4.8
Mod 3 Task d.5.	4.1
Added Task d.6.	4.3, 4.8
Added Task d.7.	4.1
Added Task d.8.	4.6
Mod 3 Task e	4.8
Mod 3 Task f	4.8