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A Development & Testing Project on a New Proposed Method to Produce Technical Documentation for Use in Training & Work Performance by the United States Army

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A DEVELOPMENT AND TESTING PROJECT

ON A NEW PROPOSED METHOD

TO PRODUCE TECHNICAL DOCUMENTATION

FOR USE IN TRAINING AND WORK PERFORMANCE BY THE

UNITED STATES ARMY

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ABSTRACT

A DEVELOPMENT AND TESTING PROJECT ON A NEW PROPOSED METHOD TO PRODUCE TECHNICAL DOCUMENTATION FOR USE IN TRAINING AND WORK PERFORMANCE BY THE UNITED STATES ARMY

Charles E. Burleson May 1978 99 Pages

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The purpose of this study was to examine the development, evaluation, and testing of a technical manual produced by the new United States Army Improved Technical Documentation and Training concept. The concept involved a complete systems analysis of the hardware being considered prior to the actual writing of the manual. The manuals were validated and verified by actual soldiers performing maintenance tasks using only the manuals.

A comparison of the new manual with the old manual was performed using untrained and trained soldiers.

Conclusions formulated were that the new manual seemed to be a great improvement over the old manual and may assist in improving the present maintenance system.

Chapter 1

Introduction

Since the beginning of nations and armies, the need for the soldier to maintain his equipment has existed. In the days of the Roman soldier and his spear, maintenance was a matter of time and work application in cleaning, straightening, sharpening, or other such tasks which required minimum learning on the part of the soldier and little supervision on the part of the supervisor.

Today the soldier's equipment is much more complicated. It requires a great deal more maintenance than just cleaning and sharpening. Rifles, grenade launchers, cargo trucks, and even tanks must be repaired, disassembled, reassembled, and rebuilt. Today's soldier must be able to perform many complicated tasks in order to accomplish the mission. To assist the soldier the army produces special tools, test equipment, and technical manuals for each system and piece of equipment in operation.

Since the advent of the tank in World War II, the requirement for detailed maintenance programs and their proper performance has become a must in all mechanized units throughout the armies of the world. Fighting forces are only as good, or as combat ready, as the quality of the maintenance services provided. Therefore, performance of maintenance personnel is just as important in the total

system as the equipment.

The U.S. military today experiences a great deal of wasted effort in the area of equipment, maintenance, and training of personnel. In addition, millions of dollars are lost each year due to mismanagement within the Army Maintenance Management System, (i.e. poor diagnosis in the troubleshooting area) resulting in the inappropriate and costly replacement of many repair parts.

Buchanan & Knutson (1977) reviewed a number of studies which indicated that one of the major reasons for these problems is poor and ineffective technical documentation which cannot be used by the soldier. The failure can partly be attributed to the reading and comprehension level of Technical Manuals (TM). TM's contain summarized procedures as opposed to simple and detailed ones. Also, the omission of pictorial drawings and diagrams make them difficult to understand. The average reading level of the soldier in today's army is at the 7th to 9th grade level. The combination of these highly technical documents and low reading level of the soldier causes the army great difficulty in properly maintaining equipment.

The new philosophy of the army is to place technical documentation and related maintenance training in the forefront. These elements are considered to be just as important as the design of a system in that the reliability of the system for its complete life cycle depends on the

ability of maintenance personnel. The army will acquire 60 to 70 percent more weapons systems in the next 10 years than it has in any prior comparable period. These systems will be more sophisticated, more complex, and more costly than their predecessors, thus requiring more and better maintenance. Therefore, it seems necessary to develop and refine new ways to improve and enhance the soldier's capabilities in the maintenance management system.

To combat this problem, a new method of producing materials called Improved Technical Documentation and Training (ITDT) was designed. New manuals have been developed which allow a soldier to perform complex tasks proficiently with very little training or experience.

The main purpose of this study was to examine the development, evaluation, and testing of a manual produced by the Army's new ITDT concept. A comparison of the new ITDT manuals with the old Technical Manuals was performed using untrained and trained soldiers. Results were used in the overall evaluation of the new manuals. The manuals were validated and verified by actual soldiers performing maintenance tasks using only the manuals and adjunctive materials. Items examined included the positive and negative aspects of the new manual, soldier understand, and usability in job performance. The major limitation of the study was that the testing of materials had to be performed in a controlled laboratory, not in the normal field setting.

Field testing was postponed, due to limited time and non-availability of funds. Personnel utilized were students and instructors in the United States Army Armor School at Fort Knox, Kentucky. Selection of participants was partially controlled by the Department of the Army Assignments Board. The board assigns all incoming students to the school based on predetermined acceptance criteria.

Unique terminologies used in this paper are defined below.

1. Hardware - the actual piece of equipment on which the documentation is written and on which the training must take place.

2. Life Cycle - the period of time from the completed production item until it becomes uneconomical to continue operation.

3. Technical Documentation - publications produced in explanation and support of a piece of equipment or system designed to perform certain functions.

4. Training Materials - materials produced to assist the student in learning to perform those tasks necessary in job performance.

5. Novice Technician - a beginning job performer who must learn proficiency.

6. Mechanic - a trained individual who can perform limited work without assistance.

7. Subject Matter Expert - a highly trained specialist

in all facets of maintenance and operation of a particular system or piece of equipment.

8. Equipment Analysis - analysis done to identify equipment components which require maintenance actions.

9. Functional Analysis - analysis to determine input and output relationships between components of a system.

10. Task Analysis - analysis to expand and fully detail all identified job task.

11. Behavioral Task Analysis - analysis to identify responses, depict cues needed to guide responses, and to precisely state responses in short instructions necessary to achieve an objective.

12. Task Procedure - a step-by-step sequenced presentation of how to perform a task.

13. Operator Manual - a manual which is used by an operator or crew member of a system or vehicle in job performance.

14. Organizational Manual - a manual used by a mechanic at the small unit level in job performance.

15. Maintenance Level - the echelon within the Army Maintenance Management System where the performance of a certain task is authorized.

Related literature is reviewed in Chapter 2. Project methodology is shown in Chapter 3. The results and discussion are provided in Chapter 4. A summary, conclusions, and recommendations are described in Chapter 5.

Chapter 2

Review of the Literature

Technical documentation in the military does not provide the necessary information needed by the soldier to do his job. Further, the information provided is presented in such a manner that the average soldier cannot successfully use it in everyday job performance (Potter & Thomas, 1976). A new concept called Integrated Technical Documentation and Training (ITDT) has been developed to produce new and improved manuals that the soldier can understand and use.

A review of the literature relating to present manuals revealed poor job performance by the maintenance mechanic in the field. The mechanic's inability to use available documentation, also, pointed out shortcomings in the training system (DA Board, 1966; Troubleshooting Test, 1974; Red Team Assessment, 1976).

Experimental studies relating to improved documentation which directly assists the user on the job showed success in using supplemental job aids (HumRRO, 1969; Potter & Thomas, 1976). In the area of monitary cost and personnel inadequacies, research showed a large dollar loss and a realization by the government that the poorly trained personnel and inaccurate documentation was the cause (Foley, 1975; Joyce, 1975; Rowland, 1973; Post, 1975). Finally in the area of actions taken for improvement, investigation showed

that improved documentation did bring about positive change in maintenance performance and that the ITDT concept presented a new and innovative method (Buchan & Kuntson, 1977; DIC, 1977). Also, a new group of military specifications on manual production have been written and tested (Military Specification 63035; 63038; 63040; 1977).

This study was performed to examine the development, evaluation, and testing of a new manual produced under the ITDT concept. The new manual was compared with the old Technical Manual for usability. Validation and verification of the new manual were performed using regular military personnel.

In research performed to determine the basic cause of poor maintenance, the Department of the Army Board of Inquiry (1966) completed a study on the Army Logistics System which showed that of 118 tracked vehicle mechanics, working at the organizational level in a combat unit, 30 percent of the malfunctions diagnosed were incorrect. Also of 59 wheel mechanics sampled at the direct support level in a combat support unit, 70 percent of the malfunctions diagnosed were incorrect. A study conducted by the United States Army Maintenance Management Center at Fort Carson, Colorado, revealed an average of 35 percent of the generators, regulators, alternators, distributors, and starters returned to maintenance shops as malfunctioning were actually serviceable and replaced unnecessarily (Troubleshooting Test, 1974).

The Army Maintenance Red Team (1976) in conducting an analysis of the electrical troubleshooting procedures in the current technical manual for the Armored Personnel Carrier (M113/M113A1) also found that certain procedures were impossible to perform and others contained incorrect information. These studies indicated specific shortcomings in the Army Maintenance Management System and pointed out the need for improvement in the technical manual area.

Rowan (1973) in his final report on improving the Department of Defense Maintenance found that over twenty billion dollars is spent annually in the maintenance area with more than half being used for personnel support. Emphasis in the past has been placed in the equipment improvement area whereas now it is being placed on personnel. Information presented indicated that a large cost saving could be realized if more research and development in the personnel area were performed. Indications were that format and content of maintenance information influenced performance, and the precise step-by-step procedure presentation showed improvement in performance.

Further study in this area performed by Joyce (1973) found that the maintenance technician must have correct technical information on-the-job to help solve problems. The technician obtains this information from two primary sources. These include (a) information that has been conveyed to him through training and experience, and is

considered to be stored in his head, and (b) information that is stored in documents such as technical manuals and performance aids. Experience has shown that the human memory bank is not adequate for TM recall, therefore, the major source of information must be the manual (DCI, 1977).

Foley (1975) suggested that documentation used by the mechanic must be more orientated toward needs which become apparent during job performance. This would seem to simplify training and improve the performance of the individual. In support of the mechanic's need, Post (1975) in his presentation on the comprehensibility of technical manuals provided data which suppported his statement that "People read better when the words are familiar to them"(p.6). This characteristic can be obtained by requiring the writer to use short syllable words. However, technical subject matter frequently limits that technique. To assist in overcoming this limitation, a manual could be formatted in such a way as to give consistency in presentation at all times (i.e., the same content, sequence, and format).

In an effort to find ways of improvement, Human Research Development Laboratories (1969),in developing a training program for an Artillery Radar Mechanic, produced a symptom-collection manual which was essentially a proceduralized troubleshooting aid. In a test using a 30 man experimental group, students using a symptom-collection manual in conjunction with tradition documentation were

able to isolate 80 percent of the defects inserted in the equipment, while other students using only traditional documentation isolated only 40 percent. Further analysis concluded that use of the symptom-collection manual increased as the manfunctions diagnosis became more difficult.

Potter and Thomas (1976), in an Air Force evaluation of a Fully Proceduralized Troubleshooting Aid (FPTA) against a much less detailed Logic Tree Troubleshooting Aid and the old type Technical Order (TO), found the FPTA to be superior to the other two in performance of maintenance when used by an apprentice and by a six month or less experienced mechanic. The six month or more experienced mechanic could perform better with the TO. Performance time was reduced substantially and replacement of spare parts was cut down. All personnel involved in the project preferred the FPTA over the other materials. Results seemed to indicate that proceduralized technical documentation would lead to more effective maintenance.

In presenting an overall view of the maintenance situation in the Army, Buchan and Knutson (1976) found that numerous maintenance studies provided similar insights into the utilization of a step-by-step procedure with illustrations on information presentation. Evaluation of all studies concluded that (a) repair time was reduced by 33 percent, with 80 percent fewer errors, (b) 42 percent more malfunctions were found in 41 percent less time, (c) diagnosis

time fell by 67 percent, (d) training time was reduced by up to 60 percent, and (e) inexperienced technicians using Job Performance Aids performed better than experienced technicians using traditional type technical manuals.

This information fully accelerated the search for a new concept. Data Communication, Inc. (DCI, 1977) in an open paper presentation indicated that:

> ITDT materials must be carefully human engineered for the real world performance capabilities of today's troops and, therefore, are people rather than equipment oriented. They tell soldiers only that which they need to know to do their job and tell them precisely how to do it. (p.4).

This definition was projected throughout the army maintenance community and resulted in a Department of Army decision to change the method of technical manual production. As a result, a group of military specifications were developed to be used as guides in future manual and training production. This created the ITDT concept. A review of these specifications is presented in the following paragraphs.

MIL-M-63035 (1977) stated that a content analysis must be the basis for the development of technical documentation. Actual content is determined by a system front end analysis which consists of (a) equipment analysis, (b) functional analysis, (c) task analysis, and (d) a behavioral task

analysis. The final and intermediate products developed as a result of these analysis are required as a data base for the content or procedures contained in a manual.

MIL-M-63036 (1977) empahsized the designing of a simplified technical manual for the systems operator which contains methods and techniques to effectively present information required to do the job. Special consideration should be directed to: (a) using animated drawings/cartoons in the manual when the style of the manual lends itself to this type presentation, (b) keeping the text brief, accurate and simple; the simplest words and phrases which will convey the intended meaning, and (c) highlighting important information needed by an experienced user to quickly utilize essential information after becoming familiar with the detailed procedure. This allows the highly skilled user to scan the procedure and pick out the information needed without reading the entire procedure.

MIL-M-63037 (1977) showed that detailed troubleshooting procedures must be presented in the form of symptom-oriented, branching, illustrated flow charts. These flow charts may be augmented with detailed test equipment procedures in the form of a set of illustrated non-branching procedures organized by test equipment types. They are necessary for the task performance. Summary troubleshooting procedure flow charts may also be provided for use by skilled technicians. These are intended to provide the skilled technicians with

information to supplement the detailed fault isolation procedures and detailed test equipment procedures which they must use as their primary source of instruction.

The necessity for very detailed instructions in a troubleshooting volume of technical manual is required because this is the most difficult work for personnel to perform. Discovering the fault is the larger part of maintenance performance.

MIL-M-63038 (1977) presented a detailed discussion on the manual writing and style to be used. The objective is to convey technical information to the reader in a style and format which can be understood and used in job performance. Examples of the various types of materials to be included must be prepared. Specific consideration must be given to previous manuals from the viewpoint of what has worked in the past. Also, user reading level is important. Specific knowledge about the target audience is necessary before writing begins. These considerations and the ability of a technical writer to convey the necessary information to the target audience are extremely important in producing a successful manual.

MIL-M-63040 (1977) tied the Job Performance Manual (JPM) directly to the training of the mechanic. The requirement to use the JPM in the development and use of all training given to a soldier makes it possible to learn how to perform a job in the least amount of time and at the

lowest possible cost. As the major resource document used in training, the JPM is considered to be training material and must stand alone in the performance of training tasks. The verification phase of manual development is the primary basis for determining the ability of the manual to teach.

The literature review presented here revealed the shortcomings of the maintenance system in the military and has shown a concern of the Army for improvement. The development and testing of job performance aids was reviewed with the showing of significant cost savings and training improvements becoming possible by their use. As a result, it was found that the step-by-step, people oriented, easy to read type manual production should be utilized and the ITDT system should be initiated. A new set of military specifications were written to provide guidelines for future manual production.

Chapter 3 will present the methodology used in performance of this project.

Chapter 3

Procedures

Information given in Chapters 1 and 2 has suggested a need to improve the maintenance posture in the U.S. Army. Recommendations and suggestions were made and as a result the Integrated Technical Documentation and Training (ITDT) concept was initiated. The final goal of the overall project was to produce a new type manual using the ITDT concept. The purpose of this study was to compare the new manual through testing and evaluation with the old manual now being used.

A full ITDT approach integrates the development of technical documentation in the form of highly illustrated, simple to read manuals with performance orientated training materials. The basic concept underlying this approach is that the amount of resources that must be devoted to training is tied directly to how well the technical documentation communicates to the soldier the information he needs to perform training. Good manuals will enhance and accelerate the training of a mechanic.

The purpose of this chapter is to describe the procedures used in comparing the new manual developed using the ITDT concept with the old style manual. A summary of the manual development cycle is presented for reader's clarification and understanding. The project was conducted using

Military Specifications MIL-M-632XXX (Part 1, 1976) as a general guideline. Two complete sets of Job Performance Manuals (JPM) were developed by Hughes Aircraft Corporation at the United States Army Armor School, Fort Knox, Kentucky. The first manual was for the operator or tank crew member and contained maintenance information which must be known in order to do the job. The second manual was for the combat unit mechanic (Organization) and contained information on a more advanced and complicated set of job performance tasks. Acutal performance took place in two phases, an analysis phase and a development phase. Information comparing the old TM with the new JPW was collected. Figure 1 shows the overall development process. Table 1 gives a list by volumes of the operator and organizational manuals.

Phase 1

The steps of the analysis phase for manual development are summarized in the following paragraphs.

Front End Analysis

The development of the technical documentation is based on a foundation of precisely defined job performance requirement data. These data are developed through a process commonly referred to as a front end analysis (MIL-M-63035, 1972). The front end analysis entails a systematic process of data collection, analysis and decision-making to provide the basic data and associated documentation needed for developing the technical manuals.

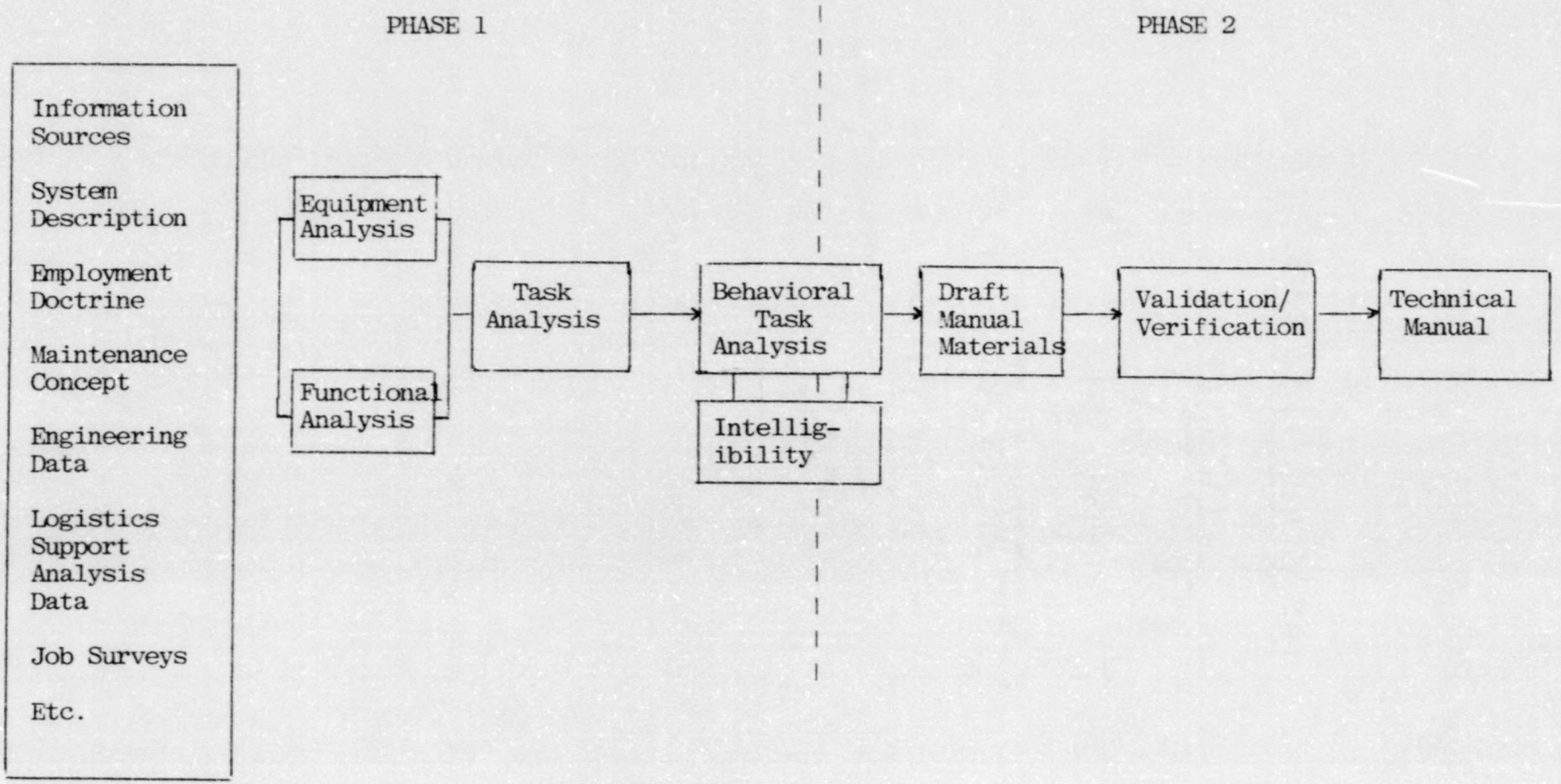


Figure 1 ITDT Manual Development Process

Table 1

Documentation

Operator Manuals

Volume I	Operator (OP)
Volume II	Preventative Maintenance (PM)
Volume III	Maintenance (MA)
Volume IV	Troubleshooting (TS)
Volume V	Job Performance Guide (JPG)

Organizational Manuals

Volume I	Preventive Maintenance (PM)
Volume II	Maintenance (MA)
Volume III	Troubleshooting (TS)
Volume IV	Job Performance Guice (JPG)

Information Sources

Primary data sources to be accessed in the performance of the front end analysis are dependent to a large extent upon the developmental status of the object system. For new systems, primary data sources will include the current set of system design documentation, engineering data, system design and manufacturing personnel, and subject matter experts. For existing systems, primary data sources will include the set of technical publications for the referenced system, job incumbents, and their supervisors.

Major documentary data sources applicable to the ITDT front end analysis process are listed in Table 2. The M551/M551A1 Armored Reconnaissance Vehicle used in this project is an existing system. Much of the data required for the front end analysis was available from one or more documentary sources. In this case, the front end analysis effort did not duplicate the data collection, analysis, and decision-making that went into compiling the data contained in all sources; rather, the front end analysis simply compiled, reorganized, and further detailed these data as necessary to meet the needs of the project. The collection, reformatting, and detailing of system specific data was a continuous activity throughout the front end analysis, designed to meet the specific needs of the individual analysis efforts and the cumulative needs of the overall development process. For most systems, there will be gaps in the data

Table 2

Informational Sources

1. Operating/Maintenance Concept
2. Logistic Support Analysis Record
3. Engineer Data/Drawings
4. Maintenance Allocation Chart
5. Provisioning Parts Breakdown
6. Development Plan
7. Lubrication Orders
8. Technical Manuals
9. Modification Instructions
10. Unsatisfactory Condition Reports
11. Maintenance Bulletins

in the data available from documentary sources that must be resolved through on-site interviews and observation.

Equipment Analysis

As an initial processing step in the front end analysis, an equipment analysis was performed to identify all tasks involved in the operation and maintenance of the system (MIL-M-63035, 1977). The principle product of this analysis was a task matrix to be performed on each item of equipment and the level at which it is to be performed (see Appendix A). When available for use, the maintenance allocation chart will display this information and may serve in lieu of the task matrix (see Appendix B). In the case of the M551 Reconnaissance Vehicle both the maintenance allocation chart and a task matrix were available.

Other products developed during the equipment analysis for later inclusion as equipment descriptive or reference material in the development process included an equipment breakdown, equipment description, tabulated equipment characteristics, tools and test equipment list, and lubrication references.

Functional Analysis

Following the equipment analysis, a functional analysis was performed for all job tasks identified as troubleshooting or operator tasks (MIL-M-63035, 1977). This analysis defined equipment operations in terms of functional relationships and data flow among components in the system

which, together, perform a discrete operation (i.e., transmit, display, receive power, control). In this analysis, the equipment was divided into successively smaller discrete functional groups. At each level of functional breakdown, the equipment interrelationships were identified in terms of measurable inputs and outputs. These functional breakdowns were used to develop descriptions of the equipment operations and a logical troubleshooting strategy.

In addition to the functional breakdowns, associated troubleshooting data was developed during the functional analysis. This included listing of parts by function, equipment modes, malfunction symptoms, and the identification of components whose failure could cause the symptom. Procedures for isolating malfunctions to a specific component or unit, and associated troubleshooting data in the form of assembly diagrams and schematics, support diagrams, and functional descriptions,were developed. These sets of data are keyed to the specific troubleshooting tasks identified in the task matrix (or maintenance allocation chart) and were used in the design and development of associated training and technical documentation materials for inclusion in the complete package.

Task Analysis

A task analysis was performed on each task identified in the task matrix. In this analysis, each task was further broken down and analyzed in terms of skill and training requirements for on-the-job performance.

As an initial step, each task was detailed in terms of task performance conditions, initiating cues, standards, and amplifying information. This task descriptive data included the job task title, equipment identification, tools and test equipment required, number of personnel required, forms and references, equipment condition, task performance interval, performance standard, identification of preliminary and follow-on tasks, and specific step-by-step procedures for performing each of the subtasks or elements comprising the particular job task. For example, the task of accessing the performance of each of these steps must be completely detailed on the task data worksheets (see Appendix D).

Each task was analyzed in terms of behavioral performance requirement and a task competencies list was developed which identified each of the behavioral competencies the soldier must possess for effective on-the-job performance. The list was prepared in two steps; first, the behavioral competencies associated with each task were identified; secondly, the list was consolidated to identify the task(s) with which each listed competency was associated. Based on this analysis, decisions were made

concerning the documentation treatment to be accorded each task.

After the treatment decisions had been made, the tasks were allocated to the various TM volumes and properly sequenced within each volume. This allocation and ordering of tasks, together with the composite set of job analysis data, provided the basic framework and supporting data for developing the Technical Manual.

Phase 2

The steps of the development phase are covered in the following paragraphs.

Technical Manuals Development

Commencing with the outputs from the front end analysis, the technical manual development process was concerned with developing and validating the TM's. This process consisted of performing a behavioral task analysis (MIL-M-63035, 1977), preparing draft manual materials, validating and verifying the draft materials, and producing the final versions of the TM's for use in the full scale implementation of ITDT.

Behavioral Task Analysis

As an inital step in the TM development process a behavioral task analysis was performed for each task to be treated in the operator and organizational manuals. In this analysis, the responses required to achieve the behavioral objective of each subtask are correlated with the cues that

guide the response. For example, to achieve the objective of gaining access to the engine compartment by opening the access doors on the M551 Reconnaissance Vehicle, the response of turning the door latch is correlated with the cue of where the latch is located and what it looks or feels like. This analysis was performed on the equipment with the prescribed tools and test equipment and using the step-by-step task performance descriptions developed during the front end analysis. In this manner, each task was precisely defined in terms of what the user sees or detects with his sense (the cue) and what his response should be to accomplish the behavorial objective of each task element.

Draft Manual Materials

The results of the behavorial task analysis are recorded on storyboards or draft TM pages which convert the job task data into a set of fully proceduralized task performance sequences with detailed, illustrated, step-by-step performance instructions. In these storyboards or draft TM pages, the objective of the task is identified, responses necessary to achieve each objective are detailed as simple step-by-step instructions, and the cues needed to guide the responses are depicted primarily in graphic forms.

The materials must be intelligible to all levels of personnel comprising the target population, especially the novice user. Accordingly, combinations of graphics showing the objects (nouns) and single syllable verbs (indicating

the response) are used where possible to make the material intelligible to soldiers with a grade school reading ability. However, rather than an absolute readability standard based on word counts or other common measures of readability, the approach used employs an intelligiblity criterion. If the soldier can perform the task, the instructions are intelligible to him, even though readability as such may not be high. To meet this standard, the TM materials were initially prepared in keeping with recognized readability/intelligibility standards for written and graphic information (e.g.,selection of verbs from a common verb list, see Appendix E). The materials were tested on representative users, revised, and retested in an iterative fashion until intelligibility with reference to the target population was achieved. This procedure is called a task adequacy check and begins the validation process.

Validation

The draft TM materials were validated by civilian personnel, primarily through actual performance of the TM specified procedures on the equipment. The performing personnel were representative of the intended users and performed each task with no more information and training then that to be provided to the soldier on the job. The one exception was for troubleshooting; simulation was allowed and certain procedures were performed by an equipment expert. Successful performance of each task in this manner

validated the technical adequacy and intelligibility of the tasks in the draft TM. For tasks not performed to standards of adequacy, corrections were made and the materials revalidated.

While a 100 percent validation of the tasks was required, the validation procedure did not require that all tasks be validated together or in any particular sequence. The only requirement was that each task be performed completely so that the technical adequacy of the associated TM materials could be determined. No segment that stopped short of achieving the task objective was considered as validated.

Verification and Testing

Verification of the validation process was accomplished through a series of troop testing procedures. An organizational plan was implemented (see Appendix G) using monitors and soldiers (real target audience). A total of 22 soldiers were used in the project. For the organization manuals, 12 soldiers were used in testing each procedure, while 10 separate soldiers were used for the operator manuals. Prerequisites for target population required a score of 40th percentile or better in the General Mechanical area as determined by the Armed Forces Qualification Test; to have completed Basic Combat training; and have no prior knowledge or experience in the tank turret field. Each soldier was given preliminary instructions on the proper use of the necessary tools and test equipment using a Job

Performance Guide and preliminary instruction on how to use the Job Performance Manual. After successfully demonstrating proficiency in manual, tool, and test equipment usage, each soldier was issued a complete manual and set of tools, assigned an M551 Armored Reconnaissance Vehicle and instructed to perform assigned procedures in the manual. Soldiers were not allowed to request or receive any assistance from the monitor except in those cases where task performance required more than one person. Additionally, monitors were instructed to interfere where injury to the soldier or damage to the equipment might occur. There were no specific time limits placed on task performance completion. Exceptionally slow progress was a factor used in determining failure. Each soldier was assessed a "GO or NO-GO" on each task performed. If the first five soldiers performing a task successfully completed that task,it was then assessed as acceptable. No further testing was required. If one or more soldiers failed to successfully complete the task, soldier performance was continued until eight out of ten performers completed the task; the task was declared invalid and had to be rewritten.

As a follow-up, five novice soldiers and five trained mechanics were asked to perform ten tasks using the old TM-12 manual and the new JPM-20 manual. Also, three separate groups of soldiers (the novice, the trained mechanic, and the highly trained subject matter expert) were asked to

compare the new and old manual.

Following validation and verification, the TM's were produced in final form for incorporation in a training package to be used in the implementation phase of the new program.

Chapter 4 will present the data collected throughout the project.

Chapter 4

Results

Investigation in the past has concluded that present day technical documentation in the U.S. Army is not adequate to meet the needs of the soldier in job performance. Manuals have been written on a high reading level at a high cost which the average soldier cannot understand. Long training courses were necessary to ensure the soldier obtains the knowledge needed to do the job.

To combat this problem the army initiated a project to develop a new manual that could be utilized by the soldier in training and job performance and assist in lowering high maintenance costs. The procedure used in the project began with a very detailed analysis, progressing through the developmental stage, and finally verifying the materials on military personnel. The purpose of this study was to evaluate, examine, and test the new technical manual by comparing it with the old technical manual.

The information presented in this chapter consists of data collected during the performance of the study. It is presented in a tabular format to assist the nonmilitary person. Soldier background information was obtained from official United States Army records. The data was collected through visual observation and recording information, direct question and answer interviews, and survey instruments.

In order to determine manual usability by the target

audience, background and performance information was collected on each soldier as shown in Table 3. The performance summary shows the number of job tasks performed and the related time factors. Specific comparisons of each soldier against all others in the group could not be presented because all soldiers did not perform all tasks in each volume. However, profile parameters can be correlated with performance parameters to show positive and negative results.

Table 4 shows the correlation between the soldier's profile parameters and the speed at which performance takes place using the job performance manual. A high reading comprehension level indicates performance at a faster pace, while a low reading comprehension indicates performance at a slower pace. A high general mechanical aptitude is also directly correlated to fast performance. The positive correlation between education level and the number of NO-GO's received is considered spurious in that the number of NO-GO's was too small to give meaningful results.

Table 5 shows a special comparison using data for two soldiers (Table 3) showing the effect of different reading comprehension levels while holding the general motor constant. The comparison was made using 25 procedures. Performance times were equal for 17 percent of the procedures.

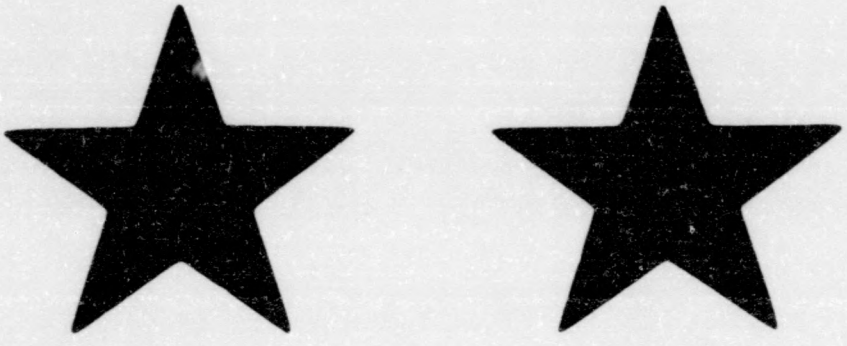
In Chapter 3 the final verification standard set for manual acceptance as written was established at 100 percent

Table 3

Soldier background data and performance summary showing total number of tasks performed, number with fast time, number with slow time, and number with average time.

Soldier Number	Education	AFQT Scores General Mechanical	AFQT Scores General Technical	Reading Comprehension Level	Performance Summary			
					X	F	S	Z
1	12	98	80	9.0	78	1	18	27	32
2	10	95	80	***	90	1	22	20	47
3	9	95	86	6.7	95	0	25	17	63
4	10	109	90	8.3	116	1	35	15	65
5	10	122	104	13+	121	0	58	19	43
6	10	100	99	6.7	102	0	13	46	43
7	10	105	109	***	115	1	37	21	56
8	9	110	112	11.3	104	0	31	22	51
9	11	117	125	10.7	71	2	16	23	30
10	9	95	96	6.8	88	0	18	27	43
11	9	98	94	4.6	82	0	21	28	53
12	10	114	90	9.0	93	0	37	11	45
13	11	100	106	7.9	70	0	20	9	41

CORRECTION



PRECEDING IMAGE HAS BEEN REFILMED TO ASSURE LEGIBILITY OR TO CORRECT A POSSIBLE ERROR

Table 3

Soldier background data and performance summary showing total number of tasks performed, number with fast time, number with slow time, and number with average time.

Soldier Number	Education	AFQT Scores General Mechanical	AFQT Scores General Technical	Reading Comprehension Level	Performance Summary				
						X	F	S	Z
1	12	98	80	9.0	78	1	18	27	32
2	10	95	80	***	90	1	22	20	47
3	9	95	86	6.7	95	0	25	17	63
4	10	109	90	8.3	116	1	35	15	65
5	10	122	104	13+	121	0	58	19	43
6	10	100	99	6.7	102	0	13	46	43
7	10	105	109	***	115	1	37	21	56
8	9	110	112	11.3	104	0	31	22	51
9	11	117	125	10.7	71	2	16	23	30
10	9	95	96	6.8	88	0	18	27	43
11	9	98	94	4.6	82	0	21	28	53
12	10	114	90	9.0	93	0	37	11	45
13	11	100	106	7.9	70	0	20	9	41

Table 3 Continued

Soldier Number	Education	AFQT Scores General Mechanical	AFQT Scores General Technical	Reading Comprehension Level		Performance Summary X	F	S	Z
14	9	114	108	9.0	108	0	45	20	43
15	12	141	130	13.0	80	0	25	14	41
16	9	96	94	4.4	104	0	19	26	64
17	11	98	92	7.2	71	0	17	18	36
18	11	104	99	7.4	78	0	11	23	44
19	10	95	97	5.4	52	5	13	11	28
20	11	98	96	6.0	94	5	22	22	50
21	12	98	96	8.3	86	0	13	35	38
22	12	96	84	5.4	71	0	14	16	41

= Total number of procedures performed

X = Total number of NO-GOs

F = Number performed at a fast rate of performance

S = Number performed at a slow rate of performance

Z = Number performed at a average rate of performance

*** = Not available

Table 4

Correlation Matrix of Soldier Profile Parameters and Performance Time for Task Performance.

	PROFILE PARAMETERS			
	ED	GM	GT	RCL
F	-.051	.670*	.179	.651*
S	.263	-.312	-.007	-.392
X	.715*	.288	.320	.327

ED: Education Level (last grade completed).

GM: General mechanical aptitude score on Armed Forces Qualification Test (AFQT).

GT: General technical aptitude score on AFQT

RCL: Reading comprehension level from results of test given by USAARMS Learning Center.

X= Total number of NO-GO-'s.

F= Number performed at a fast rate of performance.

S= Number performed at a slow rate of performance.

* p less than .10.

Table 5

Separation of Effects Using Constant General Mechanical Aptitude Score With Separate Reading Comprehension Levels for Two Soldiers Performing the Same Number of Tasks.

	Soldier #1	Soldier #11
GM General Mechanical	98	98
RCL Reading Comprehension Level	9.0	4.6
Total Time Minutes	796	819
Faster Times	50%	33%

procedure verification with an 80% soldier performance rate (i.e.,eight out of ten soldiers must pass all the procedures). Table 6 shows the percent of verification of each volume of the manuals during the first trials. For example, in the MA volume of the organizational manual, only seven procedures out of 350 did not verify on the first trial. These were revised and retested with a 100% verification occuring.

Table 7 shows the total number of changes which had to be made in order for the manual to be fully understood and used by the soldier. The changes were discovered by actual usage of the manuals by troops. Additions and deletions are shown separately to indicate the throughness of the analysis and development. The low number of changes is a positive indicator in support of the development system used.

In order to examine the new Job Performance Manual -20 and the old Technical Manual -12 a comparison test was accomplished using novice soldiers and trained mechanics.

Table 8 shows comparison of performance and supports the new Job Performance Manual -20 for use in training and job performance of a mechanic. The ability of the trained mechanic to perform the task regardless of the manual used on fifty percent of the task is attributed to prior training and familiarity with the old -12 manual. Sample size and difficulty of the task selected were directly related to performance.

Table 6

Final Verification by Percent of Job Performance Manuals

Operation Manual (-10)

Volume	Total Procedure	# GO	# NO-GO	Percent Verification
OP Operator	270	270	0	100%
PM Preventive Maintenance	518	518	0	100%
TS Trouble-shooting	256	256	0	100%
MA Maintenance	192	192	0	100%
Total	1236	1236	0	100%

Organizational Maunal (-20)

Volume	Total Procedure	# GO	# NO-GO	Percent Verification
OP Operator	33	33	0	100%
TS Troubleshooting	62	62	0	100%
MA Maintenance	350	343	7	98%
Total	445	438	7	98%

Table 7

Manual Procedural Changes Required By

Volume of Each Job Performance Manual

Operations Manual (-10)

Volume	#Pages	# Changes	Additions	Deletions
OP Operator	373	52	161	124
PM Preventive Maintenance	812	155	178	144
TS Trouble-shooting	376	17	160	23
MA Maintenance	200	35	56	43
Total	1761	259	555	334

Organizational Manual (-20)

Volume	#Pages	# Changes	Additions	Deletions
PM Preventive Maintenance	98	108	83	20
TS Trouble-shooting	780	26	36	24
MA Maintenance	1064	85	41	17
Total	1942	219	160	61

Table 8

Usage of new Job Performance Manual compared to old.

New - 20 Manual

	# Task Performed	# GO's	# NO-GO's
Novice			
1	2	2	0
2	2	2	0
3	2	0	2
4	2	0	2
5	2	0	2
Mechanic			
1	2	2	0
2	2	2	0
3	2	2	0
4	2	2	0
5	2	2	0

Old -12 Manual

	# Task Performed	# GO's	# NO-GO's
Novice			
1	2	0	2
2	2	0	2
3	2	0	2
4	2	0	2
5	2	0	2

Table 8 Continued

Old -12 Manual

Mechanic	# Task Performed	# GO's	# NO-GO's
1	2	1	1
2	2	1	1
3	2	1	1
4	2	1	1
5	2	1	1

Soldiers who participated in the comparison test were asked to fill out survey sheets which indicated opinion on the usability of the new manual as opposed to the old manual. Subject matter experts were included. Responses at both the novice and trained mechanics level indicated preference for the new Job Performance Manual -20 over the old Technical Manual -12. Table 9 gives responses from the three groups on acceptance or rejection criteria.

Responses of all groups to the survey indicate general acceptance. Three of the five subject matter experts stated there was too much detail for competent use at the advanced level. As previously stated in MIL-M-63037 (1977), summary procedures should be developed for use by the journeyman.

The data presented in this chapter focused on the usability of the new manual by the soldier. The use of actual soldiers to test the product was unique and gives strong support to the development process used in the new manual production. The production of a manual which will train and assist the soldier in job performance was the overall project goal.

Chapter 5 will present a project summary, conclusions, and recommendations for future progress by the U.S. Army in the Integrated Technical Documentation and Training area.

Table 9

Soldier acceptance and rejection of the new verses the old manual

Group		Number Asked	Easier to Use JPM/TM	More Accurate JPM/TM	Good TS JPM/TM	Too Much Detail in JPM Yes/No
N	Novice	10	10/0	10/0	10/0	0/10
TM	Trained Mechanic	5	5/0	5/0	5/0	1/4
SME	Subject Matter Expert	5	5/0	5/0	5/0	3/2

Chapter 5

Summary, Conclusion, and Recommendations

Summary

In the modern military setting of today's Army, it has become necessary to improve the maintenance posture because of rising costs of hardware and the inclusion of complicated technical equipment into the inventory. This equipment requires highly trained technicians to maintain it and to extend the equipment life cycle to its maximum.

One of the major causes of poor maintenance in the Army is poor technical documentation and training of maintenance personnel.

The main concern of this study was to evaluate a new manual development process and test the resulting product as to usability by the target audience, the combat soldier.

A complete systems analysis was performed in four stages. The analysis produced a large quantity of new materials which contained more specific information than had been previously covered. This expanded coverage made it possible for all maintenance tasks to be included in one manual.

Results of the test indicated that the process used in manual production could produce a manual which a soldier could use as a major training aid during initial training and also in actual job performance. Soldiers were able to perform specific maintenance tasks in less time using the

new manual as their only resource document. This is a positive indicator that improvement in the overall maintenance system can be achieved.

The first element considered was the validation and verification system used whereby the novice soldier performed all major procedures contained in the manual on the first trial. All procedures which were not fully verified (i.e., soldier being able to complete the tasks on the first trial) were revised. One hundred percent verification of all manuals was accomplished by retrialing those procedures which failed the first time.

Acceptance of the new manual by the user was the second element considered in the data collection plan. Soldiers, in each of three groups (novice, trained mechanic, and subject matter expert), expressed enthusiasm and general preference for the new manual. This seems to indicate that the new manual will be accepted by the soldier in the field. Further analysis of the data showed that the new manual can be used in the training situation and can serve as a basic training document as well as a technical manual. Also, this indicates that improvement in the overall maintenance system can be realized through better trained maintenance personnel.

The third and final element considered was a comparison of the new Job Performance Manual with the old Technical Manual. In the major area of troubleshooting, it was found that soldiers in all three groups could perform the

maintenance tasks at a much faster pace and be more accurate when using the new manual than when using the old manual.

Conclusions

As previously stated, the major objective of the project was to develop and evaluate a new technical manual which could be used by the soldier in the initial training and later when performing as a trained mechanic on the job. Conclusions can be formulated from the data collected that the objective was accomplished. There are several factors which may have accounted for this conclusion. Soldiers, without any prior training, could perform complicated job tasks with little or no assistance, using only the Job Performance Manual. They also learned to use special tools and test equipment which was necessary for task performance. Therefore it appears that learning as well as task performance took place and that soldiers in the field who are similar to those included in the study will be able to perform maintenance tasks using only the job performance manual as an aid. In comparing the old manual with the new, the improved technical accuracy, readability, and overall usability of the new manual over the old was indicated. Additionally, the strong preference by each group for the new manual over the old suggested a good probability for field wide acceptance.

In summary, the new manual seems to be a great improvement over the old and may assist in improving the

maintenance management system of the U.S. Army. This will also help to reduce the overall life cycle cost of present and future systems.

Recommendations

Recommendations are based on the data presentation and basic conclusions made from the project. The project is considered to be highly successful and the following recommendations are suggested.

1. The existing systems in the Army should have new manuals produced under the Integrated Technical Documentation and Training process.

2. All manuals for future systems should be developed using the Integrated Technical Documentation and Training process.

3. Additional studies of the development process should be performed to find weaknesses and to make recommendations for improvements.

4. The U.S. Army should establish a permanent organization to coordinate and supervise all new manual development on future systems.

5. A long term evaluation of the Integrated Technical Documentation and Training products should be performed under field conditions.

In view of the fact that the U.S. Army must improve the present day maintenance management system and reduce the life cycle cost of weapons systems, the Integrated Technical

Documentation and Training concept was conceived and is now being tested. This project is the beginning of a completely new way of learning about and performing maintenance. Its full value to the U.S. Army cannot be realized at present. However, with the implementation of the above recommendations, it is felt that the objective of the project will be fully realized on a United States Army world-wide basis.

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APPENDICES

TASK MATRIX

Ident. Number	Nomenclature	Maintenance Tasks: Operate	Inspect	Service	Test	Adjust, Align, Calibrate	Troubleshoot	Remove/Replace	Disassembly/ Assembly	Repair	Overhaul	Rebuild	Tools and Test Equip. List	Notes
00501C23	Ojective Lens Assy	-	-	-	FH	-	D	FH	D	D	-	-	17	
00501C24	Boresight/Field Stop Assy	-	-	-	FH	-	D	FH	D	D	-	-	17	
00502	Commander's Control	O	-	-	O	-	FH	O	-	FH	-	-	17	
00502A	Circuit Card Assy	-	-	-	FH	-	D	FH	-	D	-	-	17	
00502C	Component Assy	-	-	-	FH	-	D	FH	-	D	-	-	17	
00503	Gunner's Control	O	-	-	O	O	FH	O	-	FH	-	-	17	
00503A	Circuit Card Assy	-	-	-	FH	-	D	FH	-	D	-	-	17	
00504	Display Digital Indicator	O	-	-	O	-	FH	O	-	FH	-	-	17	
00504A	Circuit Card Assy	-	-	-	FH	-	D	FH	-	D	-	-	17	
00504B	Component Assy	-	-	-	FH	-	D	FH	-	D	-	-	17	
00505	Power Supply Control	-	-	-	O	-	FH	O	-	FH	-	-	17	
00505A	Circuit Subassy	-	-	-	FH	-	D	FH	-	D	-	-	17	
00505B	Battery	-	-	-	FH	-	D	FH	-	D	-	-	17	

APPENDIX B

Maintenance Allocation Chart

For

(Nomenclature of End Items)

Group Number	Component/Assembly	Maintenance Function	Maintenance Category C	O	F	H	D	Tools and Equipment
05	COOLING SYSTEM							
0505	Fan Tower Assembly	Inspect		0.2				
		Test		0.2				
		Replace			3.0			37
		Repair		4.5			**	
		Overhaul						
06	ELECTRICAL							
0601	Alternator	Inspect		0.2				
		Test		0.2				
		Replace		2.0				
		Repair			8.0			
		Overhaul					**	

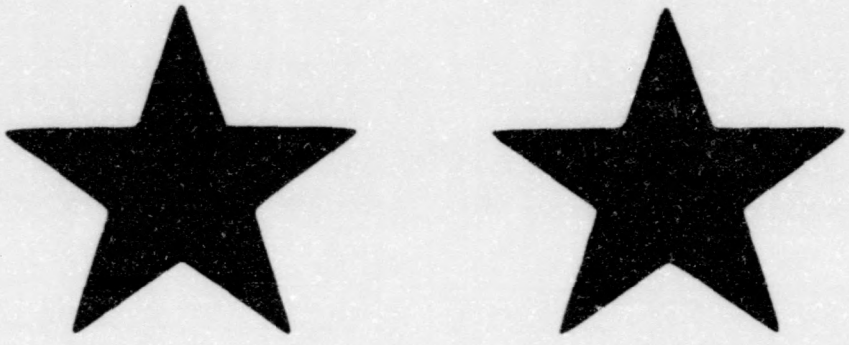
Group Number	Component/Assembly	Maintenance Function	*Maintenance Category C	O	F	H	D	Tools and Equipment
0602	Voltage Regulator	Inspect		0.2				
		Test		0.2	0.7			
		Replace		2.0		1.0		49
		Repair			0.2			
		Inspect		0.2				
		Test			2.0	2.4	**	
0603	Motor, Starting	Replace						
		Repair						
		Overhaul						53

* The subcolumns are as follows:

C -- operator/crew
O -- organizational
F -- direct support
H -- general support
D -- depot

** Indicates WT/MH required

CORRECTION



PRECEDING IMAGE HAS BEEN REFILMED TO ASSURE LEGIBILITY OR TO CORRECT A POSSIBLE ERROR

APPENDIX B CONTINUED

Group Number	Component/Assembly	Maintenance Function	*Maintenance Category C	O	F	H	D	Tools and Equipment
0602	Voltage Regulator	Inspect		0.2				
		Test		0.2	0.7			
		Replace		2.0				
		Repair			1.0			
0603	Motor, Starting	Inspect		0.2				
		Test		0.2				
		Replace		2.0				49
		Repair			2.4			
		Overhaul					**	

* The subcolumns are as follows:

C -- operator/crew
O -- organizational
F -- direct support
H -- general support
D -- depot

** Indicates WT/MH required

APPENDIX C

SAMPLE EQUIPMENT BREAKDOWN LIST

Group No.	NSN	Part No.	Reference Designator	Nomenclature
3403			6A1	Laser Receiver-Transmitter
			6A1A1	Interconnecting Board Subassembly
			6A1A1A1	-1600 V Power Supply Circuit Assy
			6A1A1A2	Low Voltage Power Supply Circuit Card Assy
			6A1A1A3	Select Logic Circuit Card Assy
			6A1A1A4	Reply Gating Circuit Card Assy
			6A1A1A5	Counters Circuit Card Assy
			6A1A1A6	Line Driver Circuit Card Assy
			6A1A2	RFN Charge Power Supply
			6A1A2A1	RFN Circuit Card Assy No.1
			6A1A2A2	RFN Circuit Card Assy No.2
			6A1A2A3	High Voltage Module
			6A1A3	Transmitter Component Assy

APPENDIX C CONTINUED

Group No.	NSN	Part No.	Reference Designator	Nomenclature
	5860-00-936-8031	10559405		Q-Switch Assy
			6A1A8	A-Trigger Component Assy
			6A1A9	A-Trigger Sensor Assy
			6A1A4	Transmitter Logic Circuit Card Assy
			6A1A5	Transmitter Logic Circuit Card Assy
			6A1A6	Photomultiplier Tube Chassis Assy
			6A1A6A1	Bias Network Circuit Card Assy
		10559364		Tube Assy
			6A1A7	Video Amplifier
	1240-00-442-6092	10229415		Transmitter Telescope
	1240-00-442-6091	10559375		Boresight Telescope
	1240-00-443-1019	10559433		Objective Lens Assy
	1240-00-443-1018	10559555		Boresight/Field Stop Assy
			6A2	Laser Ranging Commander's Control
			6A2A1	Circuit CardAssy

Group No.	NSN	Part No.	Reference Designator	Nomenclature
	1256-00-457-4956	10559220		Component Assy
			6A3	Laser Ranging Gunner's Control
			6A3A1	Circuit Card Assy
			6A4	Display Digital Indicator
			6A4A1	Circuit Card Assy
	1240-00-457-9465	10559255		Component Assy
			6A5	Power Supply Control
			6A5A1	Circuit Subassy
	6140-00-484-5851	11738943		Battery

APPENDIX D

PRELIMINARY TASK DEVELOPMENT WORKSHEET

TASK: _____

APPLICABILITY: _____

TOOLS AND TEST EQUIPMENT: _____

_____

_____

_____

_____

SUPPLIES: _____

_____

PERSONNEL REQUIREMENTS: _____

FORMS: _____

EQUIPMENT CONDITION: _____

_____

TASK INTERVAL: _____

REFERENCES: _____

_____

_____

_____

PRELIMINARY TASKS: _____

_____

_____

_____

_____

APPENDIX D CONTINUED

FOLLOW-ON TASKS: _____

_____

_____

_____

SUBTASKS: _____

_____

_____

_____

_____

_____

_____

APPENDIX E

VERB SUBSTITUTION LIST

This appendix contains the list of common verbs to be used in the development of task procedures. A corresponding list of substitute verbs or phrases is provided for most multi-syllable common verbs. The intent is that task steps be developed using only the single syllable verbs to phrases and that the multiple syllable verbs be restricted to task headings. This is done both to improve the readability and to meet the readability requirements. Prefixes or suffixes may be used with single syllable verbs.

COMMON VERBS	RECOMMENDED SUBSTITUTION.
Accomplish	do
Actuate	start; turn on; switch on
Add	- - -
Adjust	turn; set; pull
Advance	move; push; turn up
Advise	tell
Alert	warn
Align	- - -
Allocate	give out; give to; assign
Allow	let
Alternate	switch, use in turn
Analyze	look at, scan; test; figure out
Apply	spread on; use; put on; turn on

APPENDIX E CONTINUED

COMMON VERBS	RECOMMENDED SUBSTITUTION
Arrange	group; put in place; put in order; set up
Assemble	(Detail steps)
Assign	give
Assist	help
Assure	make sure
Attach	mate; join
Back off	- - -
Balance	(Detail steps)
Bend	- - -
Bleed	- - -
Blow	- - -
Break	- - -
Calculate	(Detail steps)
Calibrate	(Detail steps)
Cap	- - -
Care for	- - -
Catch	- - -
Change	- - -
Charge	- - -
Check	- - -
Checkout	Check out; test
Chock	- - -

APPENDIX E CONTINUED

COMMON VERBS	RECOMMENDED SUBSTITUTION
Choke	- - -
Clamp	- - -
Clean	- - -
Close	- - -
Coat	- - -
Communicate	tell (to); inform
Compare	(Detail steps)
Compress	squeeze; press down (in)
Connect	form into one unit; plug in; join
Construct	(Detail steps)
Control	(Detail steps)
Copy	write
Correct	fix; change
Cover	(Detail steps)
Crack	open a bit
Crimp	- - -
Cut	- - -
Cycle	- - -
Deflate	let out air
Deflect	move
Depress	press; push down
Depressurize	let out gas or fluid

APPENDIX E CONTINUED

COMMON VERBS	RECOMMENDED SUBSTITUTION
Destroy	- - -
Detect	watch for; see
Determine	find out
Diagnose	troubleshoot, find out; figure out
Disassemble	take apart
Disconnect	(Detail steps)
Dismantle	take apart
Disengage	set free; take off; push
Dispatch	send
Dispose of	get rid of
Distribute	spread
Drain	- - -
Draw in	- - -
Dry	- - -
Eliminate	get rid of
Engage	mesh; hold; bind
Enter	go in; come in; put data on form
Erase	rub out
Erect	put up; build; stand up
Establish	set up
Examine	check out; look at

APPENDIX E CONTINUED

COMMON VERBS	RECOMMENDED SUBSTITUTION
Expedite	speed up; send out
Extend	draw out
Extract	pull out
Fabricate	make; make up
Feel	- - -
Figure	find
File	- - -
Fill	- - -
Flush	- - -
Fold	- - -
Follow	watch
Furnish	get; give
Ground	- - -
Guard	- - -
Guide	- - -
Hand	- - -
Handle	- - -
Hand	- - -
Help	- - -
Hold	- - -
Idle	run at slow speed
Identify	name
Immerse	dip in

APPENDIX E CONTINUED

COMMON VERBS	RECOMMENDED SUBSTITUTION
Improve	help; make good
Indicate	point out
Inflate	fill with air
Inform	tell
Initiate	start
Inject	drive or force in
Insert	put in
Inspect	check; test
Install	(Detail steps)
Insure	make sure
Isolate	find
Jack	- - -
Join	- - -
Keep	- - -
Kick	- - -
Latch	- - -
Leave	- - -
Let	- - -
Level	make flat
Lift	- - -
Light	- - -
Listen	hear
Load	- - -

APPENDIX E CONTINUED

COMMON VERBS	RECOMMENDED SUBSTITUTION
Locate	find
Lock	- - -
Loop	- - -
Loosen	- - -
Lower	move down; pull down
Lubricate	grease; oil
Maintain	hold; keep (up)
Make	- - -
Mark	- - -
Mate	- - -
Measure	- - -
Mix	- - -
Modify	change
Monitor	watch
Moor	tie up
Mont	(Detail steps)
Move	- - -
Notify	tell
Observe	see
Obtain	get
Open	- - -
Operate	(Detail steps)
Order	- - -

APPENDIX E CONTINUED

COMMON VERBS	RECOMMENDED SUBSTITUTION
Orginate	start
Orient	locate; direct
Overhaul	(Detail steps)
Pack	- - -
Paint	- - -
Park	- - -
Patch	- - -
Perform	do
Place	- - -
Plan	- - -
Plug	- - -
Plug in	- - -
Position	place
Post	- - -
Prepare	(Detail steps)
Press	- - -
Pressurize	put gas in; put air in
Prevent	stop
Prove	- - -
Provide	give; get for
Pull	- - -
Pump	- - -
Puncture	put a hole in

APPENDIX E CONTINUED

COMMON VERBS	RECOMMENDED SUBSTITUTION
Purge	- - -
Push	- - -
Put	- - -
Raise	- - -
Read	- - -
Ready	get set; set up
Receive	get
Recognize	see; know; sense
Record	write down
Reduce	turn down; take away
Reject	send back
Release	set free; let go
Relieve	ease off on; let go
Remove	(Detail steps)
Repair	fix
Repeat	say/do again
Repalce	put back
Replenish	add to
Report	tell
Request	ask for
Retract	take back; draw upl pull back
Return	go back; bring back; send back
Rig	- - -

APPENDIX E CONTINUED

COMMON VERBS	RECOMMENDED SUBSTITUTION
Rinse	- - -
Rope off	- - -
Rotate	turn
Route	- - -
Rub	- - -
Safety wire	- - -
Scan	- - -
Schedule	plan for
Screw	- - -
Scrub	- - -
Secure	make fast; make safe; tie
Select	choose
Set	- - -
Shake	- - -
Signal	tell; sign; warn; look at; talk to
Simulate	(Detail steps)
Slide	- - -
Smell	- - -
Speak	- - -
Specify	name; state; choose; select
Spill	- - -
Spin	- - -

APPENDIX E CONTINUED

COMMON VERBS	RECOMMENDED SUBSTITUTION
Spray	- - -
Start	- - -
Stay	- - -
Stimulate	(Detail steps)
Stop	- - -
Store	- - -
Stow	- - -
Strike	- - -
Submit	send in; let
Support	hold up
Survey	look at; scan; search
Synchronize	(Detail steps)
Tabulate	list
Tag	- - -
Take	- - -
Tap	- - -
Test	- - -
Throw	- - -
Tie	- - -
Tell	- - -
Tilt	- - -
Torque	- - -
Tow	- - -

APPENDIX E CONTINUED

COMMON VERBS	RECOMMENDED SUBSTITUTION
Trace	- - -
Transmit	send
Transport	take; send
Trim	- - -
Tune	- - -
Turn	- - -
Turn	- - -
Turn off	- - -
Turn on	- - -
Uncap	- - -
Unlock	- - -
Unplug	- - -
Unscrew	- - -
Unwind	- - -
Use	- - -
Verify	check; checkout
Wait	- - -
Wash	- - -
Watch	- - -
Wire	- - -
Withdraw	take out
Wrap	- - -
Zero	- - -

APPENDIX F

SAMPLE JOB TASK STORYBOARD

Task: Remove Carburetor on xx truck

Applicability: All Models

Tools and Test Equipment: 1. Blade screwdriver
2. 5/16" open end wrench
3. 7/16" open end wrench
4. 5/8" open end wrench
5, L - hammer plastic head

Supplies: None

Personnel: One

Forms: See TM 38-750

Equipment:

Condition: 1. Engine off and cool
2. Handbrake set

Access

1. Pull hood latch to the left and hold
2. Lift hood and release hood latch
3 Lift hood until support bar is straight. Pull bar to the front. Hood should be supported with support bar in position shown.

Remove Air Cleaner Hose

4. Using blade screwdriver, loosen lower clamp screw.
5. Spread clamp until it is loose.
6. Slide off air cleaner hose.

APPENDIX G

JPM VERIFICATION PLAN

1. PURPOSE: To establish procedures and responsibilities for verification of efforts of JPM Technical Documentation during field trials.

2. FORMS USED:

a. JPM Verification Procedure Control Card (no form number); Short Title: Control Card

b. JPM Verification Daily Procedure Processing List (no form number); Short Title: Processing List

3. ATTACHMENTS:

a. Control Card

b. Processing List

c. Verification Plan

4. DEFINITION OF VERIFICATION (VER)-(Refer to MIL-M-632XX (TM), Part 1, p 41-42):

a. Representatives of the procuring activity will verify the contractor's validation.

b. The JPM/JPG procedures will be performed on the equipment by soldiers whose experience is representative of the target population (e.g. novices entering an MOS school).

c. Attachment C describes the verification plan imposed by the procuring activity.

5. FLOW CHARTS: Flow charts will be developed to provide a visual description of the Job Performance verification

process showing individual responsibilities for all action. The charts will depict two phases, (1) Preparation for verification, and (2) Conduct of verification.

6. PREPARATION FOR VERIFICATION

6.1 Draft Equipment Publication Creation:

Project Director delivers Draft Equipment Publications (DEP's) to Government for review; after review and comment, DEPs are reworked as directed and resubmitted. Twenty copies of all volumes are forwarded to On-Site Representative for use in verification. Government gives approval for verification two weeks prior to start date.

6.2 Field Trial Receiving:

Administrative Assistant:

a. Log receipt of manuals (9 copies required for verification) in Transmit/Receipt Log.

b. Distribute copies as follows:

NUMBER OF COPIES	RECEIPT	PURPOSE
3	Library	Masters
1	On-Site Representative	Preliminary Review
1	Lead Monitor	Preliminary Review
3	Government (COR)	Task Classification

APPENDIX G CONTINUED

NUMBER OF COPIES	RECEIPT	PURPOSE
2	Floor Supervisor	Task Grouping
5	Responsible Monitors (1 for each monitor)	Task Grouping

6.3 Preliminary Review:

a. Lead Monitor reviews manuals to identify tasks which require special attention.

b. On-Site Representative forwards recommendation on special attention tasks to Government (Contracting Officer Representative).

6.4 Training Preparation:

Lead Monitor:

a. Identify training requirements for verification. (Makes maximum use of available Extension Training Materials for safety, use of manuals, and appropriate basic skills and competencies.)

b. Specifies training objectives and makes up performance tests; tests will consist of tasks or group of tasks from the JPM.

c. Selects practical exercises from the JPM.

d. Prepares classroom materials (emphasizing soldier's participation.)

e. Schedules training activities.

6.5 Task Classification:

APPENDIX G CONTINUED

Government (COR) based on Subject Matter Expert (SME) recommendations:

a. Identifies critical tasks.

b. Approves tasks subjected to SME review (in lieu of performance by the target audience).

c. Approves On-Site Representative's recommendations on special attention tasks.

6.6 Task Grouping:

Floor Supervisor and Responsible Monitors (as a team):

a. Fill out Control Cards for all JPM tasks.

b. Trace all references to verify their correctness and completeness.

c. Group tasks into sequences of actions that would typically occur in the field. (Grouping involves, for example: starting with a fault symptom; looking up the corresponding fault simulation; identifying procedures references by the branches of the logic tree that would be followed to identify and correct the fault; and choosing the preventive maintenance or operation procedure which would encounter the fault symptom. Then, all these procedures are collected in a group which will be verified together--the soldier during verification will: encounter the fault symptom by performing, say, quarterly preventive maintenance; identify the fault using the logic tree; and correct the fault, say, by using removal and installation procedure.

APPENDIX G CONTINUED

Therefore, a typical group will contain procedures from different volumes of the JPM. Some groups will contain a few tasks; some tasks will be used in more than one group; some tasks will not be part of any group.)

d. Assign, dividing total effort as evenly as possible, task and groups of tasks to each Responsible Minotor.

6.7 Scheduling: Responsible Monitors, each working separately with their own assigned tasks and groups of tasks, schedule their workload filling out Processing Lists for total verification period (indicating the projected performance date for each Processing List). Easier, simple tasks are scheduled first, progressing to the more complex group of tasks.

6.8 Scheduling Review:

Floor Supervisor:

a. Ensures each procedure has a Control Card.

b. Ensures each procedure is scheduled.

c. Adjusts schedule to ensure effective use of support resources.

d. Modifies Responsible Monitor task assignments as necessary to balance workload.

e. Filex Control Cards by date of performance.

6.9 Support Resources Preparation:

a. Floor Supervisor compiles a separate list of support requirements for each week in the verification period.

APPENDIX G CONTINUED

(List must be ready at least one week prior to start of verification.)

b. Lead Monitor reviews list, recommending possible sources and identifying alternatives for support requirements not easily filled.

c. On-Site Representative forwards requirements to Government (COR).

d. Lead Monitor coordinates acquisition of all support resources.

e. Floor Supervisor and Responsible Monitors inspect all resources (as they become available) to ensure readiness for verification.

6.10 Support Resources Procurement: Government (COR) procures necessary support resources.

6.11 Training Material Review: On-Site Representative, Lead Monitor, Floor Supervisor, and Responsible Monitor review all training materials by conducting desk top audit and actual performance.

7. CONDUCT OF VERIFICATION

7.1 Task Trials (each individual performance by a soldier is called a trial):

NOTE: "Task" refers to a single task or group of tasks as described in Tasking Grouping (para 6.6).

a. Responsible Monitor informs Floor Supervisor which task will be verified first, choosing from those listed on

APPENDIX G CONTINUED

that day's Processing List

b. Floor Supervisor pulls corresponding Control Card from his file, selects soldier, enters soldier's name on back of Control Card, and sends soldier with control card to monitor's work station.

c. Responsible Monitor tells soldier tasked he will be performing (for groups of tasks, only the initial task is identified).

d. Responsible Monitor allows a period of up to three times the time shown on the Control Card for each job task.

If the soldier is not nearing completion of his assigned job task at the end of this period, Responsible Monitor gives that trial a NO GO.

e. Responsible Monitor provides physical assistance:

If the procedure calls for two (or more) personnel, if the other person's tasks are not critical (the driver turning on vehicle power is example of a non-critical task), and if the soldier is able to describe what to do (based on his reading of the procedure), Responsible Monitor performs the actions of the other person.

If an action which will result in injury to personnel or damage to equipment is about to take place, Responsible Monitor acts QUICKLY to prevent the hazardous situation from developing.

APPENDIX G CONTINUED

f. Responsible Monitor provides verbal assistance:

If the soldier asks a question relating to safety or other basic skills and competencies, Responsible Monitor answers his question. (Any question of a general nature may be answered such as "How fast does this go?").

If the soldier's actions indicate he has not (or has improperly) read the procedure, Responsible Monitor asks him to read the manual again (He may be asked to read it aloud).

If the verbal assistance is needed in the form of telling the soldier what to do, Responsible Monitor gives that trial a NO GO.

g. Responsible Monitor makes all necesssary on-the-spot corrections and permits soldier to continue trial. All technical and major changes require on-the-spot approval of Floor Supervisor and Government SME.

h. Responsible Monitor, at end of trial indicates results (GO or NO GO) and time (in minutes) of trial. If performance by other soldiers is still required, sends soldier with Control Card back to Floor Supervisor; steps b thru h are repeated until task is verified.

i. Responsible Monitor and Floor Supervisor analyze

all trial NO GOs when first encountered. Determine if correction can be made on-site. If corrections cannot be made on-site, the Floor Supervisor may declare the task a NO GO and process accofdingly.

Tasks are verified by five GOs without a NO GO for non-critical tasks or otherwise by eight GOs out of ten trials or given a NO GO.

Tasks are given NO GOs when three trials by soldiers are judged NO GO.

7.2 Successfully Verified Tasks (GOs):

a. Responsible Monitor reviews procedures in his copy of the manual to ensure all verification comments (collected during soldier trials) are entered, are legible, and are written as they are intended to appear in the final version of JPM. (A brief description of major changes is entered on back of Control Card, if none so stated.)

b. Responsible Monitor updates his Processing List for that day, lining through (in black) completed task.

c. Responsible Monitor takes Control Card and marked-up procedure to Administrative Assistant for posting of changes in verification master. (Helps Administrative Assistant interpret changes, as required.)

d. Administrative Assistant posts changes in master, clipping changed pages.

e. Administrative Assistant records number of changes

APPDNEIX G CONTINUED

by category for daily report.

f. Administrative Assistant initials Control Card in "Responsible Monitor" signature block when changes have been posted.

g. Responsible Monitor signs and dates Control Card; returns it to Floor Supervisor.

h. Floor Supervisor reviews Control Card for completeness and files in "Completed Today" portion of file.

i. Responsible Monitor informs Floor Supervisor which task he will verify next. (Task Trials procedure, paragraph 7-1, is repeated for this next task.)

7.3 Unsuccessful Tasks (NO GOs):

a. Responsible Monitor and Floor Supervisor review NO GO procedures to determine cause of failure.

b. Responsible Monitor updates his Processing List, lining through (in red) the NO GO tasks.

c. Floor Supervisor judges whether necessary changes can be made on site or if the procedure needs to be returned to the Technical Documentation Team.

d. Responsible Monitor, as appropriate, either makes necessary changes or provides sufficiently detailed markings so that the Technical Documentation Team can rework procedures.

e. Responsible Monitor writes (in red) NO GO across the face of Control Card entering brief description of necessary

APPENDIX G CONTINUED

changes on rear.

f. Responsible Monitor signs and dates Control Card and returns it to Floor Supervisor.

g. Floor Supervisor reviews Control Card for completeness, clips with red tab and files in "Completed Today" portion of file.

NOTE: Changed or worked NO GO procedures must go through TAC/VAL prior to re-verification.

h. Floor Supervisor gives changed or marked-up procedures to Lead Monitor for TAC/VAL.

i. Responsible Monitor informs Floor Supervisor which task he will verify next. (Task Trials procedures, paragraph 7-1, is repeated for this next task.)

7.4 Daily Scheduling (following each day's work):

a. Responsible Monitors rescheduled unfinished tasks by entering them on a future Processing List and indicating on original Processing List new date of performance.

b. Responsible Monitors turn in marked up Processing List to Floor Supervisor.

c. Floor Supervisor compares "Completed Today" control cards for rescheduled task by new date of performance, updating support requirements list as necessary.

d. Floor Supervisor compares "Completed Today" Control Card with entries on Responsible Monitor's Processing List, resolves discrepancies and moves Control Card to "Verified"

APPENDIX G CONTINUED

or "NO GO" portion of file.

e. Floor Supervisor forwards Processing Lists to Administrative Assistant and gives a copy of updated support requirements list as necessary.

f. Administrative Assistant extracts data for daily report from completed Processing Lists. Forwards daily report and Processing Lists to On-Site Representative.

g. Lead Monitor renegotiates support resources as required.

7.5 Daily Preparation (Preceeding each day's work):

a. Floor Supervisor and Responsible Monitors discuss results of previous day's work to give all the benefit of lessons learned (problems encountered and solutions found).

b. Floor Supervisor summarized lessons learned for Lead Monitor and On-Site Representative.

c. Responsible Monitors review all procedures for next day's task; trace expected soldier steps through groups of tasks and through logic trees; inspect support resources; and discuss potential problems with Floor Supervisor.

7.6 Verification Review (at the end of each week's work and completion of Verification):

On-Site Representative and Lead Monitor:

a. Ensures that Control Cards file, accurately reflects status of verification effort by comparing Control Cards, masters, and Processing Lists.

APPENDIX G CONTINUED

b. Review all changes posted in masters (for legibility and appropriateness for final manuals) and its recommended changes.

c. Coordinate recommended changes with Floor Supervisor, Responsible Monitors, Administrative Assistant, and Government personnel.

7.7 Outprocessing:

Administrative Assistant:

a. Reviews all masters for completeness (page by page inventory) and for matching comments (page by page comparison); resolves discrepancies with On-Site Representative.

b. Ships one set of Masters to Technical Documentation Team. (ARRCOM gets one set; one set is retained in library).

7.8 Final Draft Equipment Publication Creation:

Project Directors create camera ready copy, incorporating verification comments.

ATTACHMENT A

ITDT TANK TURRET PROJECT FIELD TRIALS

JPM/JPG PRE-VERIFICATION PROCEDURE CONTROL CARD

Originator Furnished Data

Package No: Vehicle/Equipment: Date Submitted:
Trial: BTA TAC VAL DSN: Date Due:
Paragraph No: Pages: Orginator: Ext: Remarks:

Field Trials Collected Data

Personnel Assignment				Hours		Completion Certificate		
Trial	Type	Name	Date	Reg	O/T	Trial	Monitor	Date
BTA	M-1					BTA		
	M-2					TAC		
TAC	M-1					VAL		
	M-2					Processing Certificate		
VAL	M-1					Trial Pre	Date	Post Date
	M-2					BTA		
	P-1					TAC		
	P-2					VAL		

ATTACHMENT B

JPM/JPG VERIFICATION DAILY PROCEDURE PROCESSING LIST

Date Location

Vehicle/Equipment Maintenance Level: OP ORG DS/GS

PRIMARY PROCEDURES:

	Vol	Sec	Para	Title	Time
A					
B					
C					
D					
E					
F					
G					
H					
I					
J					
K					
L					
M					
N					
O					
P					
Q					
R					
S					
T					
U					

REPLACEMENT/ADD-ON PROCEDURES

AA					
BB					
CC					
DD					
EE					
FF					
GG					
HH					
I I					
JJ					
KK					

Prepared by: Date:

ATTACHMENT C

Verification Plan

A. Verification of the JPM's and JPG's will be considered to be acceptable if 80% of the persons participating in the trials successfully perform 100% of the tasks set forth therein.

B. One trial shall consist of 10 persons representing the target audience trying JPM's and JPG's individually. In the event the first five persons performing the same task successfully perform that task, the Government will consider that task as being verified and verification by additional persons will not be deemed necessary.

C. Notwithstanding the above, the Government reserves the right to:

1. Require critical tasks to be performed successfully by eight out of ten persons.

2. Subject the task to review and acceptance by a Government Equipment Specialist in lieu of performance by the target audience.

D. For the purpose of this verification minor corrections to the manuals will not be considered as failures. Minor correction to the manuals is defined as corrections that may be made "on-the-spot" by annotating the manual. If the task can be performed (see B above) without further annotation, it will be considered acceptable.

APPENDIX H

Soldier Performance Survey Sheet

NAME: _____

TASK: _____

MANUAL USED - CHECK ONE: _____-12 _____-20

A. To be filled out at the completion of each task.

1. Describe any problems you had in doing the task

_____

_____

_____

_____

2. If any problems occurred, why do you think you made the mistake or had the problem you had?

_____

_____

_____

_____

	Always	Much of the Time	Only a few Times	Never
6. The manual told me what tools I would need.				
7. It was easy to get the information I needed from the pictures.				
8. When the manual called out parts or locations on the tank, I could find them easily.				
9. The manual went into more detail than I needed to get the job done.				
10. I had difficulty keeping my place in the manual as I worked.				
11. There were more pictures than I really needed to get the job done.				
12. I had difficulty finding the instructions I needed.				

B. To be filled out after one type of technical manual.

You have just finished two tasks. The questions below pertain only to what happened on those tasks. Mark an "X" in the column which best describes your experience on the two tasks.

	Always	Much of the Time	Only a few Times	Never
1. It was clear at each step what I was supposed to do.				
2. I Knew at each step whether I had done it correctly.				
3. The instructions contained less information than I needed.				
4. Steps used words that I was not sure I understood.				
5. I followed the procedures in the manual exactly.				

	Always	Much of the Time	Only a few Times	Never
13. I would like to use manuals such as these regularly on the job.				
14. I was able to tell what order to do things in when several things had to be done in one step.				
15. The pictures were illegible.				
16. The written instructions did not make it clear what I was to do in each step.				
17. More pictures would make it easier for me to use the manual.				
18. When there were several things to be done in a step, I couldn't tell what order to do them in.				
19. The instructions used too many words.				

	Always	Much of the Time	Only a few Times	Never
20. The manual told me to do steps I didn't know how to do.				
21. I would find these manuals too troublesome to use on the job.				

C. To be filled out after completing all four tasks.

Now that you have worked with both types of manuals, select the type of manual that you feel best fits the statement, and mark an "X" in the appropriate column. Mark only one choice for each statement.

	ITDT JPM -20	Conventional TM -12
1. It was clear at each step what I was supposed to do.		
2. I knew at each step whether I had done it correctly.		
3. The instructions contained just about the right amount of information (not too much and not too little).		

	ITDT JPM -20	Conventional TM -12
4. Steps used words that I was not sure I understood.		
5. I liked the way the manual told me what tools I would need.		
6. It was easy to get the information I needed from the pictures.		
7. When the manual called out parts or locations on the tank, I could find them easily.		
8. It was easy for me to keep my place in the manual as I worked.		
9. The manual contained about the right number of pictures (not too many and not too few).		
10. It was easy to find the instructions I needed.		
11. I would like to use manuals such as these regularly on the job.		

	ITDT JPM -20	Conventional TM -12
12. I was able to tell what order to do things in when several things had to be done in one step.		
13. The pictures were legible.		
14. The written instruction made it clear what I was to do in each step.		
15. The instructions contained about the right number of words (not too many and not too few).		
16. I knew how to perform each step the manual told me to do.		

APPENDIX I

INSTRUCTION FOR MONITORS

1. Each task is to be conducted as described. Before beginning each task, and before the soldier enters the tank, check the following:

a. Equipment is properly set up for the start of the particular task.

b. The necessary tools and test equipment are available. (Special tools and test equipment should not be placed in a conspicuous position, but should be handed to the soldier when he states his need for the special tool or test equipment.)

c. The proper technical manuals are available, closed, and stacked in order.

2. When everything is ready, read the task problem to the soldier, and tell him to start. Record the start time on the data sheet.

3. If the soldier asks questions, repeat the task instructions. If he stops or complains about the procedures, tell him "Do the best you can."

4. Record the requested information on the data sheets as the task progresses. Note whether the soldier uses the correct section of the manual, procedures, and tools, etc.

5. Soldiers are not to be coached, prompted, or assisted in any way during the task. If a soldier attempts to use the wrong part of the manual, procedure, or tools, he should

APPENDIX I CONTINUED

be allowed to continue without calling attention to his error.

6. During the task, the soldier can only refer to the manual intended for that task.

7. If a soldier starts an action which poses a danger to the equipment or to personnel, he should be stopped, and the task terminated.

8. Time limits for each task are as follows:

a.

b.

c.

d.

If the soldier is nearly finished with the task when time has expired, allow him up to five minutes to finish. If it is clear he cannot finish within the time limit, the task should be terminated.

9. A soldier will be allowed to stop (give up) before the time limit has expired. Check the appropriate outcome on that data sheet.

10. At the completion of each task, the finishing time should be recorded on the data sheet. The appropriate outcome is to be checked, and the short questionnaire given to the soldier to complete. Note any deviations from proper set up, use of inappropriate procedures, tools, manuals, etc. Check that all criteria of successful performance

APPENDIX I CONTINUED

were, in fact, met; otherwise, note any discrepencies.

11. Turn in all the data sheets and questionnaires at the end of the day.

ATTACHMENT A

DATE: _____

SOLDIER'S NAME: _____

TASK: _____

MANUAL USED - CHECK ONE: ___ -12 ___ -20

START TIME: _____

REFERENCING TIME DURATION (From touching manual to start of work on equipment): _____ minutes

SOLDIER REFERED TO MANUAL: ____ Yes ____ No

SOLDIER FOUND CORRECT PAGE(S) IN MANUAL: ___ Yes ___ No

USE OF PROCEDURES - CHECK ONE:

___ Does not follow procedures in manual

___ Generally follows procedures in manual

___ Follows all procedures in manual

FINISH TIME: _____

OUTCOME - CHECK ONE:

___ Successful

___ Gave up or time expired

___ Stopped for safety reasons

___ Claimed to be finished but failed to meet criterion

FOR MA TASKS - Record all procedural steps omitted

FOR TS TASKS - Record all components soldier requests to have replaced.

APPENDIX J

Manual Reaction Survey Sheet

1. Which manual did you find easier to use in task performance?

   JPM _____ TM _____

2. Which manual did you find to be more accurate?

   JPM _____ TM _____

3. Which manual gave the most information in the area of troubleshooting?

   JPM _____ TM _____

4. Did you find the new manual to have too much detail?