



MICROCOPY RESOLUTION TEST CHART NATIONAL BUREAU OF STANDARDS-1963-A (

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NEEDS ASSESSMENT TO DEFINE THE TRAINING REQUIREMENTS FOR A BASIC SKILLS EDUCATION PROGRAM (BSEP) CURRICULUM DEVELOPMENT

EXECUTIVE SUMMARY

Submitted to the TRADOC Education Division by RCA Service Company Cherry Hill, NJ Reference Contract DABT 60-81-C-0017



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Executive Summary (Phase I)

CDRL Sequence No. A013

of

Contract DABT60-81-C-0017

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RCA Service Company

Revised April 1984

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Requirement of Report

The requirement for development of this executive summary is stated in CDRL Sequence Number A013, Attachment 4 to Modification P00006 of Contract DABT60-81-C-0017. Since Phase II is scheduled for completion by 31 July 1983 and Phase III by 31 December 1983, this report describes the effort associated with analysis and related work for 94 MOS and common tasks. A full description of the required effort is given in the subject contract, including Modifications P00001 thru P00007.

Statement of Performance

RCA Service Company of Cherry Hill, New Jersey was the prime contractor for Contract DABT60-81-C-0017. The following subcontractors were utilized for the role listed:

- 1. Educational Testing Service of Princeton, New Jersey was responsible for test development and tryout activities.
- 2. Paradigm, Inc. of Potomac, Maryland was responsible for conduct of activities and development of reports associated with the Initial Entry Course Survival Skills analysis effort.
- 3. Florida State University, Center for Educational Technology of Tallahassee, Florida assisted with revisions to the Extended Task Analysis Procedures manual and provided two weeks of training for the initial cadre of field analysts.
- 4. Temple University, Psychology of Reading Department of Philadelphia, Pennsylvania assisted with extended analysis of reading related prerequisite competencies.
- 5. Braedon Hill, Inc. of Richmond, Virginia provided analysis services at Ft. Devens and Ft. Eustis.

Definition of Terms

Throughout this report certain terms are used to express the original or operationally defined intent of processes or products. These terms and their respective definitions are provided at Attachment A.

Statement of Purpose

The purposes and goals of the project effort are defined as follows:

- 1. Identify and functionally tie prerequisite competencies and basic skills to MOS performance requirements via a uniform process of extended task analysis.
- 2. Facilitate the diagnosing and prescription of needed remedial training for identified prerequisite competencies and basic skills through the development of skills profiles and diagnostic tests.

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3. Provide descriptions, models, and specifications for remedial training programs so identified prerequisite competency and basic skills deficiencies can be remediated on an individual basis,

Throughout this document the degree to which the purposes and goals were achieved is discussed. The final section provides conclusions and recommendations in terms of the stated goals.

Format of Report

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In addition to the sections included above, the report contains the following sections: Startup, Analysis, Test Development, Clustering, Curricula Model, Curricula Design Specifications, and Conclusions and Recommendations. As appropriate, sections are subdivided to provide discussion of activities, results, and other reports.

Startup

Startup covered the timeframe of 6 April thru 8 June 1981 and included general and specific activities associated with initial project work events.

Activities. Major startup activities are identified and briefly discussed as follows:

- Completion of initial project organization and plans. The following three plans were developed: Contract Performance Plan (CPP), Quality Assurance Plan (QAP), and Verification Plan (VP). The major areas addressed by these plans were: timelines for major and sub-work events; quality assurance procedures, beyond normal management practices; and procedures for verifying (substantiating) task analysis results. These plans received substantial modification via subsequent contract communications.
- 2. Establishment of liaison relationship between contractor and Government personnel. Because the work effort was geographically dispersed this activity was viewed as critical for project communications and ultimately for project success. Areas of action included: extensive telephonic contacts between Project Manager and Contracting Officer Representative (COR); conference calls to analysis sites; personal briefings by Project Manager and COR at each analysis site; and orientation packages for use during training sessions. It should be noted that the process of establishing effective relationships between contractor and Government personnel continued throughout the project timeframe. This was necessary because of three main factors. First, project activities were scheduled for initiation on a phased basis. Second, as the project developed processes and procedures were further refined and/or modified. Consequently, information had to be provided to supplement initial briefings. And third, Government personnel were rotated and there existed a need to brief newly assigned personnel.

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- 3. Receipt and cataloging of Government Furnished Materials (GFM). The primary GFM received was Soldier's Manuals (SM) or Task Lists (TL) for each Military Occupational Specialty (MOS) and for common tasks. During this activity it became apparent that TRADOC proponents preferred to view the GFM as an initial submission and to provide more current GFM as the project progressed. This preference was accommodated and the authority to update GFM was included in a contract modification. This decision helped assure the currency and relevancy of analysis results.
- 4. Completion of staff orientation and training programs. Staff orientation and training included the following phases: general orientation; specific training for task analysis; and general informational briefing on U.S. Army practices and protocol. Orientation was a three-day session conducted by the contractor. Emphasis was placed on the following: project overview and organization; task list and Soldier's Manual terminology, structure, and content; planning for task analysis; overview of the Extended Task Analysis Procedures (ETAP); and plans for project communications. Specific training for task analysis was conducted during a ten-day period at Florida State University. Instruction and practice were included for the following: interviewing skills, procedural analysis, mixed analysis, data recording, extended analysis, and analysis planning. Sixteen (16) contractor and and sixteen (16) Government personnel participated in the training.

Reports. Pertinent reports resulting from the startup activities were as follows:

1. Contract Performance Plan, CDRL Sequence Number A001.

2. Quality Assurance Plan, CDRL Sequence Number A002.

3. Verification Plan, CDRL Sequence Number A003.

4. Letter Progress Report of 15 June 1981 with analysis planning guide attached.

5. Letter Progress Report of 15 July 1981 with training schedule attached.

Analysis

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A two-part analysis effort covered the timeframe of 1 May 1981 to 31 December 1982. One part of the analysis effort addressed identification of Initial Entry Training Course Survival Skills (IETCSS). The other part involved extended task analysis for skill level-10 and skill level-20 in 94 MOS, plus common tasks contained in FM 21-2 and FM 21-3, dated May 1981. Parts of the analysis effort are described in separate subsections below.

IETCSS Activities. Work on the IETCSS effort covered the timeframe of 1 May 1981 to 31 December 1981. Major work activities included the following:

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- Based on the definition of IETCSS and contract requirements to conduct the effort at eight (8) locations, decisions were made concerning selection of specific MOS for study. The twenty-five (25) MOS selected are identified at Attachment B. Selection factors included the following: MOS technical content, MOS density, geographical location, mode of instruction, and academic attrition rate.
- 2. Consideration and selection of data sources. Data sources were as follows: literature search, consultation with authorities, students, instructors, instructional materials, and training processes.
- 3. To operationalize the data collection effort instruments were developed for student interviews, instructor interviews, student surveys, instructional materials review, and training observation. Though developed, the training observation form was not utilized due to lack of availability of technical assistance personnel and results obtained from tryouts of student and instructor interview formats.
- For each study MOS, optimum sample sizes for respondents were set as follows: student interviews - 10 students; student surveys - 60 students; and instructor interviews - 5 instructors.
- 5. To further define the student sample, "marginal students" were identified. "Marginal students" were defined as meeting any one of the following requirements: attendance in BSEP program, recycle through target lesson(s) or course for academic reasons, or rank in the bottom 20% of the class.
- 6. A final refinement to the study methodology involved identifying target lessons. Target lessons were those points in the MOS training at which students were having the greatest difficulty, as evidenced by: greatest number of recycled students; greatest number of attrited students; greatest counseling or remediation effort required; greatest number of NO-GO's in testing; or highest Student Progression Index (for selfpaced courses only).

IETCSS Results. Results for the IETCSS effort are in terms of fulfillment of study design requirements and interpretation of data from the several main sources. A major statement of results is provided below for each area. Supporting substatements are also provided.

- Major descriptive statistics for the student sample are as follows: Regular Army service -65%; high school graduates - 62%; race - 63% white, non-Hispanic; sex - 86% male; attendance in BSEP - 12%; recycled in course - 7%.
- 2. Due to time and other administrative constraints, most sample sizes were reduced for student surveys. In all but a few select cases sample sizes were maintained for student interviews and instructor interviews.

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- 3. All eight training locations involved in the study supplied the requested instructional materials for review. A range of written and audio visual materials were included; however, instructor-based materials were not reviewed.
- 4. Early in the study, especially in the open-response format of the student interview, it was determined that some responses could not be expressed in terms of IETCSS. These responses, because they represented student problems, were termed learning barriers. Examples include: cannot hear instructor while instruction is presented outdoors, cannot see demonstration because group is too large; not enough sleep; too hot or cold in training area; and not enough time to learn everything.
- 5. Results identified for the IETCSS effort were in most cases a unique blend of the requirements of the technical training and the selected method of instruction. However, the following common threads can be synthesized from the data:
 - a. in Reading and comprehension: gaining the main idea; obtaining a detail; following written sequential information; and understanding common civilian vocabulary.
 - b. in Mathematics: addition, subtraction, multiplication, and division of whole numbers; handling fractions -- operations, conversions, and sequencing; and manipulating simple formulae.
 - c. Visual comprehension: following or remembering a sequence of steps shown in a demonstration and relating a picture to a real situation.
 - d. Writing: being able to spell and copying material verbatum.
 - e. Listening: gaining a main idea; following or remembering a set of directions given orally.
 - f. Study/work skills: concentration; memorization; attention to detail; taking notes; relating notes to course materials.
- 6. With due caution concerning sample sizes, it is important to note that a significant question arises when data for the subsample of "marginal students" is compared with data for all other students. The question is: If both groups report the same problem e.g., following written sequential information, is the "problem" with the student or with the "written sequential information?" This question cannot be answered in a single manner for the complete IETCSS effort. The best answer appears to that attention should be given to student remediation of IETCSS and to refinement and restructuring of instructional materials and to study/work skills.

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IETCSS Reports. Reports resulting from the IETCSS effort were as follows:

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- 1. Preliminary Initial Entry Training Course Survival Skills Report, CDRL Sequence Number A012.
- 2. Final Initial Entry Training Course Survival Skills Report, CDRL Sequence Number A005. (Includes lists of IETCSS, CDRL Sequence Number A004.)

Task Analysis Activities. Work on the task analysis effort covered the timeframe of 1 May 1981 to 31 December 1982. Major work activities included the following:

- 1. As a startpoint for the task analysis activities the Extended Task Analysis Procedures (ETAP) were provided as GFM. Following a review for internal consistency and clarity of presentation, the ETAP were field tested at Ft. Belvoir. The following resulted from the pretest: simplification and redefinition of terminology; establishment of initial descriptions for Subject Matter Expert (SME) qualifications; development of initial procedures for analysis planning sessions; and specification of initial data recording procedures.
- 2. Staff training, as described above in the Startup section, was completed for the group of analysts initially assigned to field locations.
- 3. Establishment and conduct of analysis activities at various locations. The first complement of analysts reported to five (5) field locations. Additional locations were activated as the project progressed. Information at Attachment C shows how the analyst work force was built up and phased down. A common scenario for startup and conduct of task analysis activities at the various locations was as follows:
 - a. Initial information briefing by Project Manager and COR. Very often at least two briefings were held for personnel at various levels in the TRADOC school directorates. Also, as the project progressed, analyst personnel were included in portions of the briefings.
 - b. Additional briefings by the TRADOC-designated Point of Contact (POC). The most important briefings were held at source that would supply SME and GFM.
 - c. Establishment of work locations and work schedules. An extreme amount of flexibility was used in these areas. As a guideline face-to-face contact between analyst and SME was four (4) hours per day.
 - d. Conduct of initial analysis planning sessions. Issues handled at these sessions included: verification that SM or TL was current; review and plans for obtaining support GFM, such as Technical Manuals, Field Manuals, Supply Bulletins, Regulations, and Directives; review and sequencing of tasks for analysis.

- e. Dependent upon availability of personnel, work schedules, and number of analysts at a particular location, analysis, substantiation, verification, and instructional review sessions were alternated (see discussion below).
- 4. Conduct of task analysis included sessions for analysis, substantiation, verification, and instructional review. The purpose and structure of each type of session is briefly described below.
 - a. Analysis sessions served the purpose of gathering the basic task analysis and prerequisite competency information. In most instances information was gathered by face-to-face interviews between an analyst and SME. These interviews were often augmented by review of GFM, observation of task-related training, or SME demonstration of portions of the task. Most commonly the interviews were followed by data recording sessions during which the analyst worked alone.
 - b. Substantiation sessions (procedures) were used so the initial SME could review data recorded by the analyst. These procedures were commonly incorporated with interview sessions. Telephone sessions were also used frequently.
 - c. Verification sessions provided an opportunity for an independent review of the task analysis and prerequisite competency information. A second SME or group of SME was used for verification. Matters of differences between the interview results and verification results were resolved by the analysts. In a limited number of instances, both results were reported.
 - d. Instructional review sessions were used to determine if task procedures and prerequisite competencies were instructed during technical training. This process was the main attempt to establish baseline prerequisite competencies. Instructor personnel, in many instances the same person who had performed the verification, were used in these sessions.
- 5. Integral to the task analysis process was the development and utilization of a taxonomy of prerequisite competencies. A taxonomy fulfilled a requirement contained in the ETAP manual and served to add breadth and standardization to the process of identifying prerequisite competencies. Development and utilization of the taxonomy proceeded along the following lines:
 - a. Based on a review of relevant GFM, definitions contained in the subject contract, issues addressed during analyst training, and consultations with the COR, initial taxonomy categories were identified and provided as part of the data recording forms used by analysts. The categories provided a gross coding scheme that could be used with results from the knowledge analysis step of the ETAP manual.

- b. Using ETAP results and follow-on discussions with the COR, the beginning categories were expanded by inclusion of additional major untegories and subcategories. By 31 July 1981 the first expansion of the taxonomy had been fielded. It contained fifteen (15) categories and ninety-three (93) subcategories. Analysts continued to write studements from the knowledge analysis step of the ETAP and to code the statements in accordance with the taxonomy.
- c. By 15 May 1982 the taxonomy had been expanded to thirty-six (36) major categories and two hundred (200) subcutegories. At this time analysts began coding results directly onto data recording forms.

Task Analysis Results. Results of the task analysis effort can be expressed in terms of both the concepts, issues, and processes encountered and engaged in and the data and products produced. Data and products are described in the next section, the remainder of this action is devoted to concept, issue, and process results.

- 1. An optimum circumstance exists for task analysis when the input units are equivalent as to amount of activity subsurned, level of definition, and specificity of expression, i.e., tasks are equivalent units of lob performance. TRADOC Pamphlet 350-3 provides guidance in terms of defining a task and describing and giving examples of task components. Optimum circumstances did not exist however for the current task analysis efforts. Extremes can serve to highlight the operational situation. In one MOS fifteen (15) tasks were used to describe complete job performance and a majority of the tasks were coded as appropriate to skill levels 1-4. In another MOS more than five hundred (500) tasks were contained on the task list. The significance of noting this diversity is to demonstrate that responsibility for fully defining and delimiting tasks often fell to the analyst and SME during the analysis sessions.
- 2. Another assumption at the beginning of the current task analysis effort was that all tasks were equivalent with regard to SME knowledge of performance. However, it became obvious quite early in the process of analysis that different "types" of tasks often equated to different levels of knowledge on the part of SME. Operational terminology was quickly developed for the various "types" of tasks. This terminology served as an avenue of communication on the current effort and may have relevancy in a larger context. The terminology developed was as follows:
 - a. "Old common task." Prior to the issuance of the Common Task Soldier's Manual each proponent school included common tasks on any task list developed. Therefore, when the current task analysis effort was initiated, many TL and SM contained "old common tasks." In most instances, at the request of the proponent school, these tasks were not analyzed. This circumstance explains, in large part, why the number of tasks to be analyzed was reduced significantly below the original count of approximately 14,500.

- b. "Nonproponent shared task." In this case a task developed for an MCS at one proponent school is used in an MOS at a different proponent school. An example would be using a MOS 64C task in MOS 16H.
- c. "Proponent shared task." In this case a task is used in more than one MOS at the same proponent school. An example would be in MOS 11B, 11C, and 11M at Ft. Benning.
- d. "MOS unique task." A task developed for use in only one MOS.
- 3. Task analysis results must be viewed in terms of the sources of variance which existed at the time they were obtained. Two sources of variance, task description and "type" of task, were noted above. Other sources of variance were as follows:
 - a. Technical knowledge and communication skills of SME. A total of 1,443 SME were interviewed as part of the task analysis effort. Considering that the ETAP called for both original interviews, verification, and instructional review, this computes to an "average" of approximately ten (10) task per SME. The main reasons for this "low average" were administrative, i.e., all SME were released from regular duties for this effort and consequently were scheduled back on their regular duties even if they were performing adequately as SME. Other reasons had to do with technical knowledge and communication skills of the SME. Most frequently requests to replace SME had to do with efficiency of operation, rather than a complete lack of technical knowledge or communication skills. In other words, some SME had limited experience and some had limited communication skills, so they were replaced with more capable SME.
 - b. Level of detail required or desired in the analysis results. Of ten, throughout the intensive period of task analysis, personnel needed reminders that a dual focus analysis product was being developed. The first focus was on the technical aspects of the task -- the actions a soldier performs. The second focus was on the identification of prerequisite competencies -- the skills and knowledges that allow a soldier to perform technically. The need for the reminder was precipitated by attempting to answer the question: When is a task completely analyzed? Answers such as, when all the action steps have been identified or when all the prerequisite competencies have been identified. Also, attempts to define "entry level soldier" or "lowest ability soldier" were inadequate. The effort finally settled on a relative answer that included the concepts mentioned above plus generous examples of analysis results. Unfortunately, relative answers are open to analyst interpretation and thus constitute another source of variance.
 - c. Maintaining a field orientation to the analysis activities. The following represents a continuum of analysis techniques: Observation of task performance, interview/ demonstration of task at the job site, interview/demonstration of task in the proponent school setting, panels of experts, surveys of job incumbents, examination

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of GFM and doctrine, intuition. While some may argue about placement of certain techniques on the continuum, it can be seen that the current effort used a technique that was "middle-of-the-road." Therefore, special approaches were used in an attempt to maintain a field orientation. Introduction of the discrepancy report (see next section on products) assisted with this effort.

- d. MOS turbulence and areas of doctrinal concern. The following is strong, yet verifiable, statement: Each MOS is characterized by turbulence and areas of doctrinal concern and the analysis results represent this situation. Many areas of turbulence are widely recognized, but others are more subtle. An example of a subtle area has to do with analyzing the use of GFM, such as TM and FM. In many instances use of TM and FM are viewed as integral to task performance when in fact task conditions prohibit their use. In such cases GFM is best viewed as a resource and not as an instrinsic job aid. The current analysis effort attempted to sort through the task information and to make these destinctions. Again, an error source exists because resources were not adequate to address all areas of turbulence and doctrinal concern.
- 4. An objective of the current task analysis effort was the identification of MOS baseline skills. The baseline was conceptualized as a zone of demarcation -- below the baseline skills were assumed to be prerequisite; they were not instructed as part of normal training; the baseline was the assumed entry behavior level. The process for determining the baseline was instructional review. Instructional review was performed by a knowledgeable individual who reported whether skills were taught or not taught. Several major problems were encountered with the process. First, identification of knowledgeable persons was difficult -- most persons at a proponent school have detailed knowledge of only a portion of the POI, especially at the prerequisite competency level. Second, the process could not be applied to BSEP II tasks since no resources were available from unit training environments. And third, no reasonable criteria could be established for whether a skill was taught or not taught. Criteria considered included: mention in the POI; stated in a lesson plan; contained on a test; required mastery on a test. The effort did aather information through interviews as to what actions or prerequisite competencies were taught and not taught and the information has been reported. Prior to using the information additional verification is recommended.

Task Analysis Reports. Task analysis reports were extensive. Attachment D provided a diagram showing derivation, an explanation of contents, and a listing of reports.

Test Development

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The test development effort covered the timeframe of 1 June 1981 to 15 January 1983. The effort consisted of three (3) major areas of work: item development, item pretesting and final form assembly. The products produced are currently being submitted to an initial validation study which will culminate in December 1983.

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Test Development Activities. Test development efforts were carried out concurrently with task analysis activities. Major work activities included the following:

- Defining the structure of the diagnostic tests. Based on the requirements of the subject contract, it was decided that the diagnostic tests would consist of a collection of short subtests (approximately ten (10) items each) on an MOS-by-MOS basis. Tests were planned for BSEP I and BSEP II tasks.
- 2. Defining the input of the diagnostic tests. It was evident from the initiation of the effort that input for test development was to come from the task analysis effort. The major issue confronting test developers was the amount of transformation that was needed so analysis results could be used for item development. Criteria established included the following:
 - a. Input statements should be specific enough to lead to development of a subtest -approximately ten (10) items. If input statements were at some other level of specificity then test developers either had to combine or divide the statements.
 - b. Input statements should be mutually exclusive. This criterion was important because it helped reduce questions of redundancy or overlap between subtests.
 - c. Input statements should be objectively stated in measurable terms so as to reduce ambiguity for item developers.
 - d. Input statements should reflect behavior that could be assessed in a paper-based, multiple-choice format.
 - e. Input statements should be arranged in an hierarchical manner so test branching algorithms could be developed.
- 3. Defining the context and level of difficulty of the test items. At the initiation of the test development effort context clues were taken from samples of MOS content. Samples were drawn primarily from GFM which were identified as resources or intrinsic job aids during task analysis activities. Level of difficulty was arbitrarily set at a low level to account of anticipated reading difficulties on the part of test takers.
- 4. Following the guidelines established in #1, 2, and 3 above, item development proceeded through December 1981. At that time a reassessment was made of the test development process. The following concerns were noted:
 - a. Proceeding on an MOS-by-MOS basis was a very costly undertaking and it was evident that resource constraints would prohibit full development under this approach.
 - b. Proceeding on an MOS-by-MOS basis was a very time consuming process which required that all analysis be accomplished for a specific MOS prior to knowing if test development was complete.

- c. Analysis results provided only clues to hierarchical arrangements of input statements and it became clear that the effort necessary to establish hierarchies would significantly add to the development time.
- d. Analysis results were expressed at varying levels of specificity and thus input statements required extensive review and work by test developers prior to being usable by test developers.
- 5. Based on the considerations noted above, adjustments were made to the test development process in January-February 1982. The approach to development included the following:
 - a. To accommodate concerns regarding hierarchies it was decided to develop two (2) locator tests. Results from the locator tests could then be used to predict results on subtests and subsequently, in operation, a student may bypass many of the subtests.
 - b. Simultaneous with expansion of the taxonomy a consolidated list of test development objectives was produced. These objectives met many of the criteria described above. The objectives were also coded to the expanded taxonomy.
 - c. Input for test development was in terms of taxonomy statements on an MOS-by-MOS basis.
 - d. Item context was changed from MOS to Army.
 - e. Test items were developed for taxonomy entries (objectives) and were used across as many MOS as applicable for both BSEP I and BSEP II.
- 6. Test items were assembled into pretest formats and pretested on samples of IET students and reviewed by expert judges. Pretesting was scheduled for up to 300 students per item. Students were used for a four (4) hour block of time, including administration of a locator test.
- 7. Following analysis of pretest data and review of information from judges, test items were assembled into final test forms.

Test Development Reports. Products from the test development effort are listed below and are all in response to CDRL Sequence Number A007 of the subject contract.

- 1. Mathematics and verbal locator tests and scoring keys.
- 2. Sixty-nine (69) mathematics subtests and scoring keys. Complete listing of titles at Attachment E.
- 3. Fifty-nine (59) verbal subtests and scoring keys. Complete listing of titles at Attachment E.

- 4. Item analysis data for verbal and mathematics pretests.
- 5. Statistical summary sheets for verbal and mathematics final forms.
- 6. Prediction charts for use with locator tests and subtests.
- 7. Individual record sheets for each MOS.
- 8. User's guide.

Clustering

Clustering activities were pursued on an intermittent basis during the timeframe of September 1981 through June 1983. Activities followed a test, interpretation, and retest cycle.

Clustering Activities. Major work activities associated with the clustering effort were as follows:

- Defining the purpose or intent of clustering. As stated in the subject contract, MOS
 clustering was envisioned as a procedure that could consolidate analysis data for use in
 a more parsimonious curriculum development effort. Parsimony was described in terms
 of curriculum design, development, and delivery. The primary focus was on determining the extent to which a clustering solution could assist with curriculum design.
- 2. Defining and selecting the input to clustering. As prescribed by the subject contract, one input to clustering was MOS designation. While other factors were considered it was determined that a second input would be prerequisite competency statement code. Another portion of the effort was devoted to attempting to determine whether the input should be in terms of nominal data (occurrence or nonoccurrence of prerequisite competency statement) or ratio data (percentage of frequency of occurrence of prerequisite site competency statement).
- 3. Selecting the clustering methodology. As reported in the professional literature several acceptable methodologies for clustering exist. Each methodology is appropriate for the present situation, when factors such as measurement assumptions, verifiability, and validity of results are considered. Selection of methodology, therefore, was partially determined by access of the methodology on an existing computer system.
- 4. Pretesting and interpretation of results. Using input from twelve (12) MOS a preliminary clustering solution was produced. A review of the interpretation of the results was made, including input from the COR and representatives of the Air Force Human Resources Laboratory.

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- 5. Based on the results of pretesting and interpretation, the following decisions were made:
 - a. The Statistical Analysis System (SAS) methodology was selected for processing clustering results. For comparative purposes, input data are supplied to the National Capitol Region Soldier Support Center so results can be processed via CODAP.
 - b. Both nominal and ratio expression of input data has merits. Therefore, percentage of frequency of occurrence of prerequisite competency statements is used in the primary clustering solution and nominal data (occurrence or nonoccurrence of prerequisite competency statement) are used for an alternate solution.
 - c. While clustering results were successful in summarizing data and could be logically interpreted, they did not have practical application in developing curricula models.
 (A more thorough explanation of this decision is provided in the next section on curricula models.)

Clustering Reports. A single clustering report, in accordance with CDRL Sequence Number A006, has been produced. A description of the results is provided at Attachment F. In addition, the National Capitol Region Soldier Support Center has produced a clustering solution using CODAP methodology. Personnel at that agency should be directly contacted concerning CODAP results.

Curricula Model

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Development of the curricula model proceeded on an intermittant basis during the timeframe of 15 December 1982 and 15 May 1983. "Straw reports" were developed, reviewed, and further development undertaken.

Curricula Model Activities. Major activities associated with development of the curricula model were as follows:

- 1. Formulation of major issues associated with model development. The following, in the form of questions, were stated as major issues:
 - a. What is the potential program content that the curricula models should address?
 - b. How could MOS clustering results be used?
 - c. How should the remediation content be divided into curricula modules? What are the modules?
 - d. How should the curricula modules be arranged into a "course map?" Instructional sequence?
 - e. How should lessons be derived for modules?

- f. Is more than one version of each module necessary to accommodate factors such as MOS context, level of difficulty of presenting stimuli, diversity of prerequisite competency statement?
- g. How should (if at all) frequency counts for prerequisite competencies impact curricula?
- h. If clustering results are used, what approaches can be taken to insure that each MOS has access to only the modules supported by analysis data? What is the consequence of having access to more than needed or less than needed?
- i. If the same prerequisite competency has been identified for BSEP I and BSEP II, should there be differences in the curricula to accommodate this situation?
- 2. Assessment of use of clustering results as basis for model development. In accordance with the subject contract, MOS were to be clustered and the clustering results were to be the basis for developing the curricula model. In February 1983 it became clear that a curricula model based on clustering results would provide several areas of ambiguity and inefficiency. First, only indirect information was available to formulate and sequence modules. Second, information contained in other reports could be more directly used to determine and sequence modules and lessons. Third, there is a considerable redundancy of prerequisite competencies across clusters. And finally, there was concern that frequencies may have determined clustering solutions without regard for other more important factors.
- 3. Based on considerations noted above, the clustering report was not used as the basis for curricula model development. The following data sources were used as a basis for development:
 - a. An MOS by prerequisite competency by BSEP level matrix. Nominal scaling -occurrence or nonoccurrence of prerequisite competency -- was used on the matrix.
 - b. Categories and subcategories identified on the elaborated taxonomy.
 - c. Prerequisite competency indicator statements and extended analysis results.

Curricula Model Results. Results of the curricula model development effort are expressed in a comprehensive report which contains the following:

- 1. Rationale of approach.
- 2. A graphic presentation of a module configuration which is at Attachment G.
- 3. Module descriptions in terms of basic content, context, levels of difficulty, and functional designations.

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4. Utilization of the model designations in terms of MOS Baseline Skills Profiles.

Curricula Model Report. The Curricula Model Report, CDRL Sequence Number A008, contains all information on the model as described above.

Design Specifications

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Development of the curriculum design specifications proceeded on an intermittent basis during the timeframe of 15 November 1982 to 30 June 1983. "Straw reports" were developed, reviewed, and further development undertaken.

Design Specifications Activities. Major activities associated with development of the curriculum design specifications were as follows:

- Defining the unit for which specifications were to be developed. Since the curricula model is expressed in terms of modules, the main unit for the specifications is the module. However, to provide specific guidance additional detail is required on a lesson level. Therefore, it was decided that specifications would be developed on a lesson-by-lesson basis.
- 2. Describing the structure of the design specifications. In order to convey information for curriculum development purposes each specification contains the following information:
 - a. A narrative description of the module contents.
 - b. A lesson structure (sequence).
 - c. Recommendations as to the predominant MOS or CMF from which context clues can be gained.
 - d. A narrative description of the lesson contents.
 - e. Recommendations on primary and secondary instructional delivery approaches.
 - f. Descriptions of instructional strategies (activities).
 - g. Recommendations on sequence of instructional strategies.

Design Specifications Reports. The Design Specifications Report, CDRL Sequence Number A009, consists of specifications for the lessons for 122 modules. A list of the module titles is at Attachment H.

Conclusions and Recommendations

Listed below are major conclusions and recommendations resulting from the effort, but not contained in the separate reports noted above.

- 1. The following specific recommendations result from the IETCSS analysis effort:
 - a. Study and listening skills appear to be related to success in IET. The Government should review existing commercially produced instructional materials in the areas of study and listening skills, procure materials most suited to their needs, place the materials in education centers, and conduct studies to verify whether success in IET is enhanced through utilization of materials.
 - b. Enhanced quality control is needed with regard to instructional materials. The areas in which quality control should be exercised include: reduction in reading grade level (RGL) or at least adherence to RGL directives; improvements in the size and quality of materials presented graphically; inclusion of more practice exercises in written materials; selection of audio visual materials that are high in quality with regard to presentation.
 - c. Each service school should conduct a study of potential barriers to learning--excessive heat, cold or noise and limited vision in training areas, etc. If such studies have been made, as has been indicated, then the time appears appropriate for action. Controlled studies comparing existing conditions with improved conditions should be designed, funded, authorized, and conducted.
- 2. The following specific conclusions and recommendations result from the task analysis effort:
 - a the ETAP are a viable approach to task analysis.
 - b. The basic ETAP need to be augmented through analysis planning procedures. Analysis planning consists of the following: checking with training development personnel to ensure the appropriate task list or Soldier's Manual is being used; having SME and analyst personnel review all tasks and assemble, or at least locate and arrange for access to, all job aids; establish a specific time schedule for analysis activities---up to four (4) hours per day is recommended; group tasks for analysis according to common function and/or equipment and from simple to complex; if job aids have recently been introduced or revised have SME review them and check references to Soldier's Manual citations before each analysis session; and identifying the person or persons responsible for providing guidance to the SME and analyst.
 - c. Mixed analysis procedures (factor and principle transfer) should proceed with a single SME and analyst. Once an initial write-up of analysis results has been obtained, a panel of 3-5 SME should review the write-up for technical accuracy and completeness. The original SME and analyst should be present at the panel sessions.
 - d. The present project was able to identify prerequisite competencies and basic skills through utilization of the ETAP. Due to limitations in resources it was not able to adequately

determine if the competencies and skills were "taught" or "not taught" as part of the instructional process in IET. In order to make this determination the instructional review process needs to be extended to include review of POI and tests by analysts and SME and observation of training by analysts and SME. In addition, there must be an operational definition of the extent to which a competency or skill must be included in the instruction before it is considered to be "taught." One approach would be to require an objective and test for each competency or skill.

- e. On the current effort is was extremely difficult to get SME to perform analysis for shared tasks, except at the proponent school. If this situation is indicative of the confidence senior NCO have in their ability to perform shared tasks, then perhaps an examination should be made as to whether most shared tasks are indeed critical tasks. If they are, the frequency with which shared tasks are included on the SQT should be increased.
- 3. The following specific recommendations result from the test development effort:
 - a. Tests should be developed for the following taxonomy codes: 4c, 15c, 30c, 38d, 38e, 38f, 39b, 39c, 41f, 41g. Because these competencies were not conductive to a paper-based, multiplechoice format, subtests were not developed under the current effort. Tests for these competencies should be structured for administration in IET.
 - b. Locator tests and subtests should be submitted to extensive validation studies. Modification P00006 to the subject contract describes and initial effort. (See Phase III report).
 - c. Cut scores should be established for the various subtests and MOS via the Angoff method. If this is not practicable, the cut scores should be set administratively based on resources available and the stated purposes and goals of current or planned remedial programs.
- 4. The curricula model and design specification efforts resulted in three (3) general conclusion and recommendations. First, an effort should be made to determine how and to what extent the model coincides with present BSEP instruction. Second, controlled studies are needed to determine if MOS context is a significant factor in determining instructional content, especially at the BSEP I level. And finally, pilot programs are recommended to determine the extent to which BSEP instruction can be made more functional—how BSEP instruction can interface in a more relevant way with technical training.
- 5. The current effort has resulted in several unique products for the U.S. Army: a defensible process that functionally ties prerequisite competencies to task requirements; an automated data bank for technical task analysis information for 94 MOS and common tasks; methodologies for producing valuable summary reports from the task analysis data. These products must now be maintained so they are current and accurate for future users. A top priority is to develop a comprehensive approach to data maintenance and update. A second priority is to examine the current results and methodologies to determine if an abbreviated methodology can be developed to apply to additional MOS.

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ATTACHMENT A

Definition of Terms

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- 1. Basic Skills Education Program I (BSEP 1) A designation which originates by classifying tasks. A BSEP I task is trained to mastery in IET.
- 2. <u>Basic Skills Education Program II (BSEP II)</u> A designation which originates by classifying tasks. A BSEP II task is trained to mastery after the soldier has completed IET.
- 3. <u>Baseline</u> A concept associated with an hierarchical arrangement of skills, procedures, or knowledges; a zone of demarcation; above the baseline skills, procedures, or knowledges are trained or instructed; below the baseline skills, procedures, or knowledges are assumed to be possessed because of previous training, education, or general experience.
- 4. <u>Clustering</u> A statistical process by which MOS are grouped based on similarity of prerequisite competencies.
- 5. <u>Course</u> A curricula organizational element that is subordinate to program and superordinate to module.
- 6. Curricula Model A contract deliverable that shows and describes recommended curricula modules and an overall module configuration.
- 7. <u>Curriculum Development</u> Those processes following analysis and design and preceding program operation. Includes original development work and adaptation and adoption of curriculum and program materials.
- 8. Design Specifications A contract deliverable that describes the content-related instructional parameters for the designated modules and lessons.
- Discrepancies Incongruities between stated doctrine or practice for task performance and actual performance practices as reported by SME.
- 10. Extended Task Analysis Procedures (ETAP) A comprehensive approach to task analysis with provisions for action and hierarchical analysis and knowledge analysis; provided as CFM on this effort and used with modifications.
- 11. Initial Entry Training (IET) A collective term that applies to basic training (BT) and advanced individual training (AIT).

- 12. Initial Entry Training Course Survival Skills (IETCSS) A contract deliverable which is a report on those skills required of and assumed to be possessed by a soldier for participation in and graduation from IET; derived from an analysis of the training environment and not from an analysis of job tasks.
- 13. Instructional Review An integral step in the ETAP; the purpose of the process is to determine whether a skill, knowledge, or action is instructed or not instructed; requires the judgement of persons knowledgeable of instructional content of IET.
- 14. Knowledge Statement A statement obtained from an SME in response to questioning concerning information related to task performance; may include entries from the taxonomy.
- 15. Lesson A curricula organizational element that is subordinate to module and is composed of the instructional content associated with one or more prerequisite competencies.
- 16. Locator Test A short test (30 items) from which raw scores are used to predict scores on subtests; established based on performance of students in pretest samples; bears only a general content relationship to particular subtests.
- 17. <u>MOS Baseline Skills Profile</u> A contract deliverable that contains: prerequisite competencies, example prerequisite competency indicator statements, frequency of occurrence of prerequisite competencies, and descriptive summary information.
- 18. <u>Module</u> A curricula organizational element that is subordinate to course and superordinate to lesson. It is composed of one or more lessons.
- 19. <u>Prerequisite Competency</u> A statement taken from the taxonomy developed on the effort.
- 20. <u>Prerequisite Competency Indicator Statement</u> A procedural (action) statement taken from task analysis results, that requires performance or utilization of a prerequisite competency.
- 21. <u>Pretest</u> A preliminary collection of test items assembled for the purpose of pretesting as part of the test development process.

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- 22. <u>Program</u> The highest level curricula organizational element. There are two programs - - BSEP I and BSEP II.
- 23. Subtest A short test (approximately ten (10) items) assembled after pretesting to relate to one or more prerequisite competencies.
- 24. Task The statements contained in a Soldier's Manual (SM) or on a Task List $\overline{(TL)}$.
- 25. <u>Task Analysis Results</u> A collection of completed data collection forms (usually three) that contain the results of enacting the ETAP for a particular task.
- 26. <u>Taxonomy</u> A statement of skills developed on the effort. The skills are directly related to task performance and are based on excerpts from analyst's work related to skills and knowledges that underlie task performance.
- 27. <u>Technical Prerequisite</u> A procedural (action) statement within task analysis results which is identified as not instructed as a result of enactment of the instructional review process.

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- 28. <u>TPA-1, TPA-2, TPA-3, TPA-X</u> Codes contained on the task analysis data collection forms; sometimes used as an abbreviated form of denoting what is in the results of task analysis.
- 29. Verification A process integral to the ETAP in which a second SME reviews the write-up of results obtained from an interview/demonstration with a first SME.

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ATTACHMENT B

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Location/MOS In IETCSS Effort

Location .		MOS Number and Title
Aberdeen Proving Ground	44E 45B 63G 63W	Machinist Small Arms Repairer Fuel and Electrical Systems Repairer Wheel Vehicle Repairer
Ft. Sam Houston	91B	Medical Specialist
Ft. Benning	11B 11C 11H	Infantryman Indirect Fire Infantryman Heavy Antiarmor Weapons Crewman
Ft. Eustis	61B 67U 67Y 68G	• Watercraft Operator Medium Helicopter Repairer Attack Helicopter Repairer Aircraft Structural Repairer
Ft. Sill	13F 15D 31∨ 82C	Fire Support Specialist Lance Missile Crew Member Tactical Communications Systems Operator∕Mechanic Field Artillery Surveyor
Ft. Gordon	05B 26L 26Q 72E	Radio Operator Tactical Microwave Systems Repairer Tactical Satellite/Microwave Systems Operator Telecommunications Center Operator
Ft. Benjamin Harrison	71D 71Q 75B	Legal Clerk Journalist Personnel Administration Specialist
Ft. Knox	19D 19E	Cavalry Scout M48 – M60A1/A3 Armor Crewman ●

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ATTACHMENT C

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Staffing Pattern for Analysts at Field Locations

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Location (X = Operation)

ATTACHMENT D

Task Analysis Reports

Derivation of Task Analysis Reports

Analysis reports, all in response to CDRL Sequence Number 2004, are characterized as analysis results (data) and summary reports. Figures 1 and 2, below, show the derivation of each report. Two (2) additional reports were produced. The first is an operational summary that describes major features of events associated with conducting the task analysis effort. The second is a matrix which provides prerequisite competency frequency and percentage of frequency of occurrence data on an MOS-by-MOS basis by BSEP level.

Listing and Description of Analysis Reports

The separate analysis reports and a brief description of each are as follows:

- 1. <u>Analysis Data (Results)</u> A two- or three-part report, on a task-by-task basis. Contains descriptive information on the task, including discrepencies; the hierarchical arrangement of task analysis information; and prerequisite competency information.
- 2. Operational Summary As noted above, describes major features of events associated with conducting the task analysis effort; presented mainly on an MOS-by-MOS basis.
- 3. Task Statement List Presented on an MOS-by-MOS basis and as a complete listing. Shows shared tasks and common tasks.
- 4. Subtask Statement List Presented as a listing of titles which shows the original task and all other tasks that use the subtask. Also, presented with all steps and substeps (complete subtask).
- 5. <u>Discrepencies</u> Information on variance between doctrine and stated procedure and performance of procedure as reported by an SME.
- 6. Knowledge Statements Statements obtained from SME in response to questions concerning information related to task performance; may include entries from the taxonomy.
- 7. Technical Prerequisites A procedural (action) statement within task analysis results (data) which is identified as not instructed as a result of enactment of the instructional review process.
- 8. Prerequisite Competency Indicator Statements Procedural (action) statements within task analysis results (data) and the attendant prerequisite competency statement code. Presented on both an MOS-by-MOS and complete basis.
- 9. <u>Matrix</u> As noted above, provides prerequisite competency frequency and percentage of frequency of occurrence data on an MOS-by-MOS basis by BSEP level.
- 10. MOS Baseline Skills Profile Presented on an MOS-by-MOS basis by BSEP level. Contains: prerequisite competencies, example prerequisite competency indicator statements, frequency of occurrence of prerequisite competencies, and descriptive summary information.

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RCA/BSEP ANALYSIS CLUSTERING AND DESIGN INFORMATION FLOW FOR 24 MOS TO BE DELIVERED USING THE ORIGINAL BSEP TAXONOMY

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Figure 1.

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RCA/BSEP ANALYSIS, CLUSTERING AND DESIGN INFORMATION FLOW FOR 72 MOS TO BE DELIVERED USING THE ELABORATED BSEP TAXONOMY

Figure 2.

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Review/Approval of Analysis Results

Several processes were used to review analysis results and one process was used to approve results. Each is briefly described below.

- 1. As described previously, substantiation sessions (procedures) were used so the initial SME could check data recorded for technical accuracy and completeness. Those sessions were the first stage of a review process.
- 2. Verification sessions were the second stage in a review process. A second SME or group of SME reviewed analysis write-ups and recommended changes. Analysts resolved differences between SME.
- 3. All results of analyses were edited and reviewed prior to data entry. Structure, format, and conventions for coding were the main areas checked. Analysts were contacted via telephone to clarify or verify areas of substantive discrepancy.
- 4. After analysis results had been entered into the data system copies were printed and mailed to the service school for review and approval. Based on guidance provided by the COR, each service school formed groups or committees of key technical and educational personnel to review and approve the analysis reports. These reviews were concerned with technical accuracy and completeness and accuracy of coding for prerequisite competencies. Each group received written guidelines for the review process. The efforts of the review were recorded and supplied back to the contractor. Where practicable changes were incorporated in the analysis reports. If not practicable, comments were included as errata to the analysis reports. Since all summary reports (as shown in figures 1 & 2) are derived from the analysis reports. Also, since profiles, curricula models, clustering, and curricula design specifications were finalized subsequent to review and approval of analysis reports, changes recommended are reflected in these products.

Usability of Analysis Reports Within the Project

Various analysis reports shown in figures 1 & 2 contributed to the development of other project products and reports. The main areas of contribution are as follows:

- 1. Codes and frequency counts for prerequisite competencies were the main inputs to the clustering solutions.
- 2. MOS Baseline Skill Profiles were prepared as follows:
 - a. Codes and frequency counts for prerequisite competencies were derived from analysis reports.
 - b. For each MOS, prerequisite competency indicator statement lists were reviewed. Based on this review a statement was selected for inclusion on the profile. The main factors considered in the review were thoroughness of coverage of the competency and representativeness of the indicator statement for the MOS.

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- c. Based on frequency counts the summary portions of the profiles were developed.
- 3. Profiles, prerequisite competency indicator statement lists, and the matrix were used to provide input to the development of the curricula models.
- 4. Prerequisite competency indicator statement lists and the matrix were the most useful in developing the curricula design specifications.

Potential Usability of Analysis Reports

Perceptions of the potential (future) usability of analysis reports are as follows:

- 1. Analysis data (results) should be directly usable in the 94 MOS for any future training development activity.
- 2. Efforts related to shared task management can use the Complete Task Statement List and the Subtask Statement List as resource documents.
- 3. The Discrepancies List can be viewed as a summary of the major areas of variance resulting from the verification process. It can serve as one tool toward an action survey of current training practices.
- 4. One major goal of the project was design of remedial training programs based on prerequisite competency deficiencies. MOS Baseline Skills Profile, lists of prerequisite competency indicator statements, and the matrix should provide a rich source of input and job specific foundation for any future program and curriculum development effort.

ATTACHMENT E

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Test Title Listing

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	ţ,	Match a gauge reading to a specification using numbered or labeled intervals	ME 13	Medsurement Mostromont	
			ME 14	Medsurement	

Code		
EN N		Matching Numbers with Word Frames and Models
NU4		Counting and Sequence of Numbers
NUS		Ordering Numbers
SUN		Ordering Numbers
BUN	Numerical: C	Ordinal Use of Numbers
NU2	Numerical P	Place Value
NU12	Numerical - R	Rounding Numbers
NU4	Numerical: C	Counting and Sequence of Numbers
NIK	Numerical P	Points and Intervals on a Number Line
MEI3	t	Number of Parts on a Linear Scale
MF 14	Measurement	Markings on a Lineor Scale
ME11	Measurement	Conversion of Measures
ME13	Measurement:	Number of Parts on a Linear Scale
ME17	Measurement:	Reading a Ruler
ME I	Measurement:	Common Units of Measure
MEI	Measurement:	Common Units of Measure
ME6	Measurement:	Estimation of Linear Measures Not More Than 6 Inches
ME 16	Measurement:	Reading a Scale That is Not Numerically Calibrated
ME 7	Measurement :	Estimation of Linear Measures
ME8	Measurement:	Visual Comparisons of Measures
ME4	Measurement :	Angles
5P 10	Spatial: Visue	Visual Comparison of Sizes of Geometric Figures
	:	-
MES	Measurement -	Bearings and Azimuths
ME2	Measurement -	Telling Time
ME 2	Measurement:	Telling Time
(No test developed)	xped)	
ME3	Measurement :	Use of Julian Calendar
CO14	Computation:	Computation Using Measures
ME9	Measurement:	Solving Measurement Problems
CO14	Computation:	Computation Using Measures
M E9	Measurement -	Solving Measurement Problems
ME 13	Measurement:	Number of Parts of a Linear Scale
ME 14	Measurement:	Markings on a Linear Scale
ME 19	Measurement:	Reading Simple Gauges
ME 16	Measurement	Reading a Scale That is Not Numerically Calibrated
ME 21	Measurement -	Reading an Oscilloscope
ME 16	Measurement -	Reading a Scale That is Not Numerically Calibrated
ME 13	Measurement:	Number of Parts of a Linear Scale
ME14	Measurement.	Morkings on a Linear Scale
ME13	Measurement:	Number of Parts of a Linear Scale
ME 14	Measurement -	Markings on a Lin c ar Scale
ME 13	Measurement	Number of Parts of a Linear Scale
ME 14	Measurement -	Markings on a Lin c ar Scale
AAF 20	Measurement.	Reading Vermier, Micrometar, and Related Scales
MF 22	Mensurement -	Reading a Logorithmic Scale
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C.24	Presequisite Competency Statement	Code	Test Title
į	leterations readings from an unumbered, unmarked interval	ME 13	Measurement - Number of Parts of a Linear Scale
-		ME 1 5	Measurement - Estimating Readings on a Scale
•	loters set a same reading which is fluctuating or momentarily sustained	ME 13	
		ME 15	Measurement Estimating Readings on a Scale
5.	Match specifications of required measures by manipulation, alignment or	ME 13	
	ານຜູ່ເກດໃຊຍາງກາງເອ	ME 18	Medsurenient Keading Ammeters, Valtmeters, and Kelated Scarks
8	lisentify directions that tools, hardware, or components may be moved	591	Spatial: Orientation in Space
£	Monipulate shreets to align, match, mate, make parallel, he perpendicular		
	ar he at an ungle	SP 1 1	
Åc	Interpret wortal relationships of figures and objects from 2-dimensional	5F2	
	drawings, plictures, or photographs	5P6	Spatial Interpretation of Three-Dimensional Models
2	Relate geometric symbols and graphic representations to actual systems,		
	such a strain and romonents	5 P 5	Spatial Schematic Diagrams
	Identify and norme moints lines, rays, and segments	5P8	Soatial Common Geometric Figures and Their Properties
	Lastic interaction line morelial line, and line coments	5P3	Soutial: Parallel and Perpendicular Lines and Planes
	Define and identify nemendicular lines	583	
	theory of the second se	5P4	
-	tarrents congroens xymens Hantis and an a chan anomatic finance	2 D R	
	the state of the second decomposition of the second s	847	
×.	etse mer endroerensnies of geometric rigores Allerife fit - no entropies to the sumbar of meridian or and ar	Bdy	
	identity tiques which possess similarities		
a ,	Identity figures which may be parallel, perpendicular, of congluent	5.40	
r	Identity and name the different lands of angles and triangles, with their		Contraction of the second of the second s
£		272	
	Classify triangles according to their sides or angle-size	518	۰.
T	Identify altitudes and medians of triangles or the bisector of an angle	5P9	Spatial Meaning of Technical Terms
ي. م	ttame an angle by using letters, a numbe r, ar a single letter	ME4	Ê
1 <mark>0</mark>	Recognize and match the names of solids with their corresponding figures	SPB	
110	Identify technical words associated with geometric figures	SP 9	Spatial: Meaning of Technical Terms
116	Interpret meaning of terms derived from spatial orientation	5 P .7	Spatial: Meaning of Spatial Terms
120	Add or subtract whole numbers, without carrying or borrowing	100	Computation Addition and Subtraction of Whole Numbers
		001	
× 1	Add at subtract shale numbers correlate and borrowing		
		100	
12-	Δdd and the recommendation and correction with mixed numbers (whole and decimals) CO^{+}		
,		COIL	
124	Add an subtract positive (+) and negative (-) numbers, using a number line to		
	arrive at a solution	CO?	Computation Addition and Subtraction of Intergers
12e	Add or subtract to find correct time (24 hour clock) using hours or minutes	CO14	Computation Computation Using Measures
		ME9	Measurement Solving Measurement Problems
121	Add at subtract various increments on gouges, dials, or other measuring	014	Computation: Computation Using Measures
	instrument	ME9	Measurement: Solving Measurement Problems
12a	Add or subtract time. Linear, dry, liquid or degree measures requiring regrouping	CO14	Ŭ
7		ME9	

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Sequence events in the order they have occurred RW3 Report Writing	Sequence events in the order they have occurred RW3 Report Writing:		
		Sequence events in the order they have occurred	

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Test Code

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a) < < < < <		Report Writing: Impression of Events Report Writing Clarification of Issues Report Writing: Supporting and Opposing Evidence Report Writing: Jusification for Actions Editing: Spelling of Common Words Editing: Spelling of Toxk-Related Words Editing: Spelling of Common Words Editing: Spelling of Common Words Editing: Mechanics of Grammer	Porograph Organization
	Test Title	Report Writing: In Report Writing: C Report Writing: S Report Writing: A Report Writing: J Report Writing: J Reliting: Spelling Editing: Copitaliz Editing: Mechaniz Editing: Mechaniz	Editing: Porograph

RW4 RW5 RW6 RW7 F01 F01 F02 F03 F03

ED5

ED6

Editing: Clarity ED7

(No test developed)

Appropriate Language Appropriate Language Verbal Communication: Verbal Communication:

Verbal Communication:

Appropriate Type of Communication Appropriate Type of Communication Verbal Communication: VC1 Verbal VC1 Verbal (Yeo test developed) (No test developed) (No test developed) VC2 Verbal VC2 Verbal Appropriate Type of Communication Verbal Communication: ζ

Verbal Communication. Appropriate Type of Communication Š

Verbal Communication: Clarity of Directions (No test developed) Š

(No test developed) (No test developed)

Safety Hazards Precoutions:

PRI

Sofety Hazards Precautions:

Precautions:

Emergency Actions Similarities of Objects Recognition:

Recognizing Motions and Gestures Damage and Defects Recognition: Recognition: PRI RE2 RE3 RE3 RE4 RE5 RE5

Matching Objects Recognition:

Clossifying Objects Recognition:

(No test developed) (No test developed) IL4 Illustrations or Diagrams: Symbols

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Prerequisite Competency Statement	State general impressions of events described	Select examples that will clarify major issues presented in the report	Examine opposing points of view in the report	Summarize the major points developed in the report	Justify an action taken and give reasons for rejecting alternatives	Spell frequently used words correctly	Spell tosk-related words correctly	Identify words that need to be capitalized	Correct all misspelled words with or without the use of a reference source	Apply all rules of end marks, commas, and apostrophes	Apply common rules of grammar	Rewrite the paragraph by stating the main idea in the first sentence, and	restructuring the sentences for coherence	Approve on entire written communication and make adjustments to improve	. loruty	Environments of the proper rate of speech	the technical vocabulary suitable to the task and level of the person	Determine the appropriate amount of information to communicate	Interpret figurative or idiomatic language by reference to its use in context	follow highly detailed, step-by-step directions	Solicit feedback to confirm the accurate reception of the communication	Recognize when tow-key, informal diatague is suitable	Recognize when direct verbal commands are necessary	Recognize when a prescribed series of verbal interactions is required to	coordinate a group elfort	Recognize when the stuation will require a structured, preplanned method	of presentation	Recognize the need for clear, concise directions in order to avoid language	or word meaning differences	Recognize personality factors and interpersonal relationships that may exist	Recognize feedback as a means of communicating more effectively and	increasing task competence	Use common knowledge to avoid hazands in order to prevent injury to self or	equipment	Apply preventive measures prior to task performance to minimize any potential	safety or security problem	Select an appropriate course of action in the event of an emergency	Identify similarities and differences between and among objects	Use body language (motions, gestures, postures) to communicate or signal	Determine the presence of a defect or extent of domoge	Match objects by size, shape, color or significant markings	Clossify objects by size shape, color or significant markings	Determine direction, duration, and intensity of sounds, sightings, and smells	Infer from sights, sounds, touch, smells	Interpret codes and symbols
Prerequisite Competency Code	35	356	359	35	35i	360	366	36c	79	%	36f	369		36h		380	3 8 6	38c	38d	3 8e	38f	389	38r	38:		38;		39 o		39h	39c		40 o	:	4 0		40c	410	41b	41c	4 1d	41e	41f	4 lg	414

ATTACHMENT F

Clustering Results

Approach

Input to the SAS CLUSTER procedure was MOS as observations or cases, with their associated prerequisite competency codes as the attributes or variables. Together, the data for each MOS are called a "profile." The profiles were presented to the SAS CLUSTER procedure both as ratio -- percentage of frequency of occurrence -- and nominal -- occurrence or non-occurrence -- data. For each MOS, the occurrence of each prerequisite competency (PC) code was counted. The count of each PC code in an MOS was divided by the count of all PC codes in the MOS to arrive at the percentage of frequency of occurrence of each PC code. An MOS and its percentages were the ratio input to the SAS CLUSTER procedure. Percentages were changed to ones to be nominal input to the procedure.

Basically what the SAS CLUSTER procedure does is to compare each MOS profile with each other MOS profile by calculating the sum of the squared differences between each prerequisite competency code for each pair of MOS. The sum of the squared differences is called a distance. When each MOS constitutes a cluster, there is no difference in attributes, and the distance is zero. When clusters (MOS and groups of MOS) are compared, the distances are close to zero when the clusters are similar, and increasingly greater than zero as the clusters become less similar. The first clustering is of the two MOS that are most similar in terms of distance. Clustering continues until all MOS are in one cluster.

Handling/Describing Results

The SAS CLUSTER procedure produces two (2) reports; Cluster Analysis and Cluster Map. From these reports the user must decide the number of clusters that best represents the data processed. One reliable guide is to select the number of clusters that occurs when there is a sharp increase in distance measures. Using this guideline, 14 clusters best represented BSEP I ratio data and 13 clusters best represented BSEP II ratio data. (Nominal data results are discussed in the separate Clustering Report.)

Once the number of clusters were chosen, it became necessary to examine the data to determine the extent to which the results accorded with the following guideline: Each cluster should contain MOS that are similar to each other based on the identified prerequisite competencies, and each cluster should be different from each other cluster. The following methodology was used to examine the results for BSEP 1:

 Inspect the input for values that will affect the results. Because the raw input data consisted of up to 201 variables per MOS (percentage of frequency of occurrence of each prerequisite competency), a decision was made to collapse the input data by combining the frequency of PC subcategories into major categories for each MOS. This resulted in 48 categories.

2. Develop a "profile" for each cluster. The profile consisted of the arithmetic mean for each category for each MOS. The number of categories, based primarily on frequency, was further reduced to 21. These 21 categories were referred to as indicant prerequisite competencies, i.e., they were significant in contributing to the descriptions of the clusters. The indicant prerequisite competencies were as follows:

Code Indicant Prerequisite Competency

- 1 Numbering and counting
- 2 Linear, weight, and volume measures
- 5 Gauge measures
- 6a Identify direction that tools, hardware, or components may be moved
- 6b Manipulate objects to align, match, mate, make parallel or be at an angle
- 11 Terminology

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- 12 Addition and subtraction
- 25 Procedural directions
- 26 Vocabulary
- 27 Reference skills
- 28 Tables/charts
- 29 Illustrations
- 32 Forms
- 37 Type (of verbal communication)
- 40a Use common knowledge to avoid hazards in order to prevent injury to self or equipment
- 40b Apply preventive measures prior to task performance to minimize any potential safety or security problem
- 41a Identify similarities and differences between and amont objects
- 41d Match objects by size, shape, color and significant markings
- 41e Classify objects by size, shape, color and significant markings
- 41f Determine direction, duration, and intensity of sounds, sightings and smells
- 41g Infer from sights, sounds, touch, smells, or tastes to determine a course of action
- 3. Analyze and describe the cluster "profiles." The analysis and description was accomplished in terms of the occurrence, non-occurrence, and predominance of indicant prerequisite competencies.

Results for BSEP 1

The results of the clustering of ratio input data for BSEP 1 are provided below. Detailed descriptions are provided in the separate Clustering Report.

Cluster Number 1 (26 MOS)

- 000 Common Soldier's Tasks
- 05G Signal Security Specialist
- 1'iB Infantryman
- 11C Indirect Fire Infantryman
- 11H Heavy Antiarmor Weapons Crewman
- 11M Fighting Vehicle Infantryman

Cluster Number 1 (continued)

- 13B Cannon Crewman
- 15E Pershing Missile Crew Member
- 19D Cavalry Scout
- 19E M48 M60A1/A3 Armor Crewman
- 27E TOW/DRAGON Repairer
- 32H Fixed Station Radio Repairer
- 54E Chemical Operations Specialist
- 55D Explosive Ordnance Disposal Specialist
- 57H Terminal Operations Coordinator
- 63N M60A1/A3 Tank System Mechanic
- 67G Airplane Repairer
- 68F Aircraft Electrician
- 68H Aircraft Pneudraulics Repairer
- 68J Aircraft Fire Control Repairer
- 68M Aircraft Weapon Systems Repairer
- 74D Computer/Machine Operator
- 91B Medical Specialist
- 93J ATC Radar Controller
- 958 Military Police
- 95C Correctional Specialist

Cluster Number 2 (5 MOS)

- 17B Field Artillery Radar Crew Member
- 31J Teletypewriter Repairer
- 31V Tactical Communications Systems Operator/Mechanic
- 61B Watercraft Operator
- 61C Watercraft Engineer

Cluster Number 3 (2 MOS)

- 31N Tactical Circuit Controller
- 35K Avionic Mechanic

Cluster Number 4 (13 MOS)

- 05B Radio Operator
- 05C Radio Teletype Operator
- 26L Tactical Microwave Systems Repairer
- 26Q Tactical Satellite/Microwave Systems Operator
- 31M Multichannel Communications Equipment Operator
- 44B Metal Worker
- 44E Machinist
- 63H Track Vehicle Repairer
- 63W Wheel Vehicle Repairer

Cluster Number 4 (continued)

- 67U Medium Helicopter Repairer
- 68G Aircraft Structural Repairer
- 71L Administrative Specialist
- 96B Intelligence Analyst

Cluster Number 5 (7 MOS)

- 13E Cannon Fire Direction Specialist
- 13F Fire Support Specialist
- 17C Field Artillery Target Acquisition Specialist
- 32D Station Technical Controller
- 55B Ammunition Specialist
- 74F Programmer/Analyst
- 82C Field Artillery Surveyor

Cluster Number 6 (2 MOS)

- 43M Fabric Repair Specialist
- 57E Laundry and Bath Specialist

Cluster Number 7 (3 MOS)

- 71D Legal Clerk
- 71Q Journalist
- 75B Personnel Administration Specialist

Cluster Number 8 (1 MOS)

76X Subsistence Supply Specialist

Cluster Number 9 (3 MOS)

- 128 Combat Engineer
- 43E Parachute Rigger
- 62E Heavy Construction Equipment Operator

Cluster Number 10 (19 MOS)

- 15D Lance Missile Crew Member
- 16E HAWK Fire Control Crew Member
- 16H ADA Operations and Intelligence Assistance
- 17K Ground Surveillance Radar Crewman
- 24C Inproved HAWK Firing Section Mechanic
- 24H Improved HAWK Fire Control Repairer
- 335 EWI Intercept Equipment Repairer
- 36C Wire Systems Installer I Operator

Cluster Number 10 (continued)

- 36K Tactical Wire Operations Specialist
- 52C Utilities Equipment Repairer
- 62B Construction Equipment Repairer
- 63G Fuel and Electrical Systems Repairer
- 64C Motor Transport Operator
- 67N Utility Helicopter Repairer
- 67T Tactical Transport Helicopter Repairer
- 67V Observation/Scout Helicopter Repairer
- 67Y Attack Helicopter Repairer
- 68B Aircraft Powerplant Repairer
- 68D Aircraft Powertrain Repairer

Cluster Number 11 (4MOS)

- 16D HAWK Missile Crew Member
- 16P ADA Short Range Missile Crewman
- 45K Tank Turret Repairer
- 94B Food Service Specialist

Cluster Number 12 (3 MOS)

- 45B Small Arms Repairer
- 76C Equipment Records and Parts Specialist
- 76P Materiel Control and Accounting Specialist

Cluster Number 13 (5 MOS)

- 52D Power Generation Equipment Repairer
- 71M Chapel Activities Specialist
- 72E Telecommunications Center Operator
- 76W Petroleum Supply Specialist
- 76Y Unit Supply Specialist

Cluster Number 14 (2 MOS)

- 71P Flight Operations Coordinator
- 76V Materiel Storage and Handling Specialist

Results for BSEP II

Code

Methodologies, as described above for BSEP 1, were also used for BSEP 11 ratio data. The following six (6) additional indicant prerequisite competencies were identified:

Indicant Prerequisite Competency

- 4 Time-telling measures
- 13 Multiplication and division
- 14 Fractions/decimals

Indicant Prerequisite Competency

15 Geometry

Code

- 38 Characteristics of verbal communication
- 41C Determine the presence of a defect or extent of damage

Cluster Number 1 (3 MOS)

- 000 Common Soldier's Tasks
- 12B Combat Engineer
- 94B Food Service Specialist

Cluster Number 2 (23 MOS)

- 05G Signal Security Specialist
- 16D HAWK Missile Crew Member
- 16E HAWK Fire Control Crew Member
- 17C Field Artillery Target Acquisition Specialist
- 17K Ground Surveillance Radar Crewman
- 26Q Tactical Satellite/Microwave Systems Operator
- 54E Chemical Operations Specialist
- 55B Ammunition Specialist
- 61B Watercraft Operator
- 63H Track Vehicle Repairer
- 63W Wheel Vehicle Repairer
- 67N Utility Helicopter Repairer
- 67U Medium Helicopter Repairer
- 67V Observation/Scout Helicopter Repairer
- 68G Aircraft Structural Repairer
- 71M Chapel Activities Specialist
- 71P Flight Operations Coordinator
- 72E Telecommunications Center Operator
- 74D Computer/Machine Operator
- 74F Programmer/Analyst
- 91B Medical Specialist
- 95B Military Police
- 95C Correctional Specialist

Cluster Number 3 (2 MOS)

- 32D Station Technical Controller
- 43M Fabric Repair Specialist

Cluster Number 4 (29 MOS)

- 11B Infantryman
- 11C Indirect Fire Infantryman
- 11H Heavy Antiarmor Weapons Crewman

Cluster Number 4 (continued)

- 11M Fighting Vehicle Infantryman
- 13B Cannon Crewman
- 13F Fire Support Specialist
- 15D Lance Missile Crew Member
- 15E Pershing Missile Crew Member
- 17B Field Artillery Radar Crew Member
- 19D Cavalry Scout
- 19E M48-M60A1/A3 Armor Crewman
- 31V Tactical Communications Systems Operator/Mechanic
- 32H Fixed Station Radio Operator
- 33S EW/Intercept Equipment Repairer
- 35K Avionic Mechanic
- 43E Parachute Rigger
- 45K Tank Turret Repairer
- 52C Utilities Equipment Repairer
- 55D Explosive Ordnance Disposal Specialist
- 61C Watercraft Engineer
- 63N M60A1/A3 Tank System Mechanic
- 67G Airplane Repairer
- 688 Aircraft Powerplant Repairer
- 68D Aircraft Powertrain Repairer
- 68F Aircraft Electrician Repairer
- 68H Aircraft Pneudraulics Repairer
- 68J Aircraft Fire Control Repairer
- 68M Aircraft Weapon Systems Repairer
- 93J ATC Radar Controller

Cluster Number 5 (15 MOS)

- 13E Cannon Fire Direction Specialist
- 24C Inproved HAWK Firing Section Mechanic
- 24H Improved HAWK Fire Control Repairer
- 27E TOW/DRAGON Repairer
- 31J Teletypewriter Repairer
- 31N Tactical Circuit Controller
- 36C Wire Systems Installer/Operator
- 36K Tactical Wire Operations Specialist
- 44B Metal Worker
- 45B Small Arms Repairer
- 52D Power Generation Equipment Repairer
- 57H Terminal Operations Coordinator
- 628 Construction Equipment Repairer
- 67T Tactical Transport Helicopter Repairer
- 82C Field Artillery Surveyor

Cluster Number 6 (8 MOS)

- 05B Radio Operator
- 05C Radio Teletype Operator
- 31M Multichannel Communications Equipment Operator
- 71D Legal Clerk
- 71L Administrative Specialist
- 75B Personnel Administration Specialist
- 76X Subsistence Supply Specialist
- 96B Intelligence Analyst

Cluster Number 7 (1 MOS)

71Q Journalist

Cluster Number 8 (1 MOS)

44E Machinist

Cluster Number 9 (4 MOS)

- 63G Fuel and Electrical Systems Repairer
- 64C Motor Transport Operator
- 76P Materiel Control and Accounting Specialist
- 76Y Unit Supply Specialist

Cluster Number 10 (1 MOS)

76W Petroleum Supply Specialist

Cluster Number 11 (4 MOS)

- 16H ADA Operations and Intelligence Assistance
- 16P ADA Short Range Missile Crewman
- 62E Heavy Construction Equipment Operator
- 67Y Attack Helicopter Repairer

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Cluster Number 12 (1 MOS)

76V Materiel Storage and Handling Specialist

Cluster Number 13 (1 MOS)

26L Tactical Microwave Systems Repairer

ATTACHMENT G

Module Configuration

Figures 1 and 2 be aw, present the derived module configurations for the BSEP 1 and BSEP 11 curricula models. The following information helps describe the graphic presentations:

- 1. Figure 1 presents modules for the verbal/written prerequisite competencies in categories 25 through 41 on the taxonomy.
- 2. Figure 2 presents modules for the numerical prerequisite competencies in categories 1 through 19 on the taxonomy.
- 3. Progression begins at any point labeled "Entry" and proceeds upward through Levels A, B, and C.
- 4. Levels A, B, and C are arbitrary distinctions that roughly equate to difficulty or to modules that require a larger number of prerequisites.
- 5. The taxonomy numbering system is maintained and can be used as a general guide to module contents.

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Figure 1 - Ato tale Configuration for Verbal/Written Prerequisite Competencies (Sheet 1 of 3)

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4. A solute Continuention for Verbal/Written Prerequisite Competencies (Sheet 2 of 3) : :-:-



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Figure 1. Andule Configuration for Verbal/Written Prerequisite Competencies (Sheet 3 of 3)

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LEVEL C

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Figure 2. Module Configuration for Numerical Prerequisite Competencies (Sheet 1 of 3)

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. More that continue for Numerical Prerequisite Competencies (Sheet 2 of 3) f ture.

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¹¹ University of the Numerical Prerequisite Competencies (Sheet 3 of 3)

Figure 7.

ATTACHMENT H

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Module Title Listing

Module No.	Module Title
la,b,h	Numbering and Counting: Recognition and Beginning Counting
lc,d,h	Numbering and Counting: Sequencing and Other Counting
le,f	Numbering and Counting: Ordinal Position and Place Value
lg,i	Numbering and Counting: Rounding and Number Line
2a,c,b,g	Linear Measures: Naming, System, Use, and Estimating
2d,b,g	Weight Measures: Naming, System, and Estimating
2e,g	Volume Measures: Naming, System, and Estimating
2f	Measures: Nonnumerical Calibration
3a (Temp)	Degree Measures: Temperature
3a ,b	Degree Measures: Degree and Mils
3b,c	Degree Measures: Angle Estimation and Interpretation
4a, b	Time-Telling Measures: Telling Time
4c,e	Time-Telling Measures: Estimation and Conversion
4d	Time-Telling Measures: Calendar Units and Julian Style
4f	Time-Telling Measures: Greenwich Mean Time (GMT)
5a,c,f,b	Gage Measures: Identification and Interpretation of Color Divisions
5a,d,f,b	Gage Measures: Identification and Interpretation on + or - Scale
5a,e,f,b	Gage Measures: Identification and Interpretation on Multi-Scale Gage
5g,h	Gage Measures: Read Nonnumerical and Fluctuating
5i	Gage Measures: Matching to Specifications
6a,b,11L	Spatial: Direction, Manipulation, and Terminology
6a,c,11b	Spatial: Direction, Interpretation, and Terminology
6d	Spatial: Symbols and Systems
7 a	Lines: Basic Identification
7b,c,d	Lines: Types and Characteristics

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Module No.	Module Title
8a,b	Planes: Identification and Characteristics
8c,d,e	Planes: Types and Classifications
9 a ,b,e	Angles and Triangles: Identification and Characteristics of Angles
9c , d	Angles and Triangles: Identification and Characteristics of Triangles
10a	Solids: Names and Recognition
120	Addition & Subtraction: Whole Numbers, Without Carrying or Borrowing
12Ь	Addition & Subtraction: Whole Numbers, With Carrying or Borrowing
12c	Addition & Subtraction: Mixed Numbers
12d	Addition & Subtraction: Positive and Negative Numbers
12e,f,g	Addition & Subtraction: Denominate Numbers
12h	Addition & Subtraction: Estimation
13a	Multiplication & Division: Whole Numbers
13b,c	Multiplication & Division: Mixed Numbers and Decimals
13d	Multiplication & Division: Positive and Negative Integers
13e	Multiplication & Division: Estimation
14a	Fractions and Decimals: Common Subdivisions
14b,c	Fractions and Decimals: Reducing and Converting Fractions
14d,e	Fractions and Decimals: Equivalents and Addition Subtraction
14d,f	Fractions and Decimals: Equivalents and Multiplication. Division
14g	Fractions and Decimals: Estimation
15a,b,c,11a	Geometry: Identification and Terminology for Geometric Figures
15d,e	Geometry: Geometric Construction
15f,g,h	Geometry: Computations for Geometric Figures
151,j	Geometry: Formulas and Problem Solving

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Module No.	Module Title
16a	Problem Solving: Median and Mode
1 6a ,b	Problem Solving: Median, Mode, and Averages
16c	Problem Solving: Whole, Mixed, Fraction, & Decimal Numbers
16d,f	Problem Solving: Denominate Numbers
16e	Problem Solving: Secondary Sources
lóg	Problem Solving: Ratio and Proportion
16h	Problem Solving: Word Problems
17a,b	Graphing: Identification of Coordinates and Points
17c	Graphing: Matching Graph to Equation
180	Algebra: Simple Equations
18b	Algebra: Equivalent Expressions
18c	Algebra: Powers and Roots
19a	Trigonometry: Tables of Functions
196	Trigonometry: Tables of Logarithms
190	Trigonometry: Solving Geometric Problems
19d	Trigonometry: Using Ratios
25a,F, 25a,a, 416	Reading: Identifying Detail and Common Vocabulary
25c, 26a,d, 41h	Reading: Following Detail and Common Vocabulary
25d,e	Reading: Meaning and Inference
25e, f	Reading: Inference and Synthesis
200,0, 41n	Vocabulary: Common
24.	Vocabulary: Task-Related
26с,е	Vocabulary: Context, Figurative, and Idiomatic
27 a ,b	Reference Skills: Identification Codes, Alphabetic and Numeric
27c,d	Reference Skills: Sourcing Skills
27e,f	Reference Skills: Scanning and Cross-Referencing
27e,g	Reference Skills: Scanning and Multiple Sources

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Module No.	Module Title
280 , b	Tables and Charts: Simple
28c	Tables and Charts: Complex
28d	Tables and Charts: Applying Information
29 a ,b	Illustrations: Identification of Details or Parts
29c , f	Illustrations: Cross-Sectional and Usage
29d , f	Illustrations: Three-Dimensional and Usage
29e , f	Illustrations: Sequential and Usage
30a	Flow Charts: Identify and Follow Main Sections
30ь	Flow Charts: Trace All Relationships
30c	Flow Charts: Infer from Symbols
31a,b	Schematics: Section and Component Identification
31c,e	Schematics: Basic Tracing and Interpretation
31d,e	Schematics: Detailed Tracing and Interpretation
32а, Ь	Forms: Identification and Transfer of Information
32c	Forms: Entering Information
32d	Forms: Writing Short Description
32e	Forms Using Completed Form
33b,a	Note-Taking: Basic Organization
33c	Note-Taking: Rewrite
33d	Note-Taking: Advanced Organization
345,0,d	Outlining: Main Ideas
34c,a,d	Outlining: Supordinate Ideas
35а,с	Report Writing: Establishing Intent
35b,c	Report Writing: Establishing Parameters
35d , e	Report Writing: Sequencing and Overall Statement
35f,g,h	Report Writing: Supporting Detail and Examination
35i	Report Writing: Justification and Alternatives

Module No.	Module Title
36a,d	Editing: Spelling Frequently Used Words
36b,d	Editing: Spelling Task-Related Words
Збс	Editing: Capitalization
36е	Editing: Punctuation
36f	Editing: Grammar
· <u>3</u> 6a-f, 36g	Editing: Adjusting for Coherence
36a-f, 36h	Editing: Adjusting for Clarity
38a,f, 38b	Communications: Word Usage, Expressive
38a,f, 38c	Communications: Information Content, Expressive
38d	Communications: Figurative or Idiomatic, Receptive
38e	Communications: Detailed Directions, Receptive
38a,f, 38g-j	Communications: Structuring, Expressive
39a,b,c	Communication Barriers
40a, c	Precautions: Common Knowledge and Course of Action
40b,c	Precautions: Preventive Measures and Course of Action
41b,a	Recognition: Body Language
41c,a	Recognition: Defects or Damage
413,a	Recognition: Size, Shape, Color, & Marking Recognition
41e,a	Recognition: Size, Shape, Color, & Marking Classification
4]+, ·	Recognition: Sound, Sight, Smell, Touch, and Taste

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Scientific and Technical Report

Executive Summary (Phase II)

CDRL Sequence No. A013

of

Contract DABT60-81-C-0017

by

RCA Service Company

Revised April 1984

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Attachments

Attachment A: Listing of Additional 20 MOS by Title Attachment B: Listing of 22 MOS Further Analyzed Attachment C: TSK Coding Attachment D: Tool Coding

Requirement of the Report

The requirement for prerequisite competency analysis and also for prerequisite skills and knowledges analysis of the additional twenty-one (21) MOS is stated in Modification P00006, paragraph 1a-b of Attachment 6 and Exhibit A, Sequence A016, and paragraph 1c (1), (2), (3), (A), (B), (C), and (D) of Attachment 6 (SOW) and Exhibit A, Sequence A017. For purposes of orientation these requirements are restated below:

Α.

1 The contractor shall conduct an analysis of tasks of the 21 MOS at Enclosure 1. The original analysis shall be performed to the substep level that clearly expresses the procedures involved in performing the task that leads to identification of the prerequisite competencies. The analysis shall be conducted utilizing procedures currently in effect. The contractor shall determine the exact number of unique task by comparing the titles of tasks previously analyzed.

A. The following data shall be submitted on an MOS by MOS basis and divided to reflect BSEP I and II components as a result of the above analysis. Data shall be delivered in hard copy $8 \frac{1}{2} \times 11^{"}$, 20 lb. or heavier bond paper.

- B. In addition to the above data, the contractor shall provide the Government with an operational summary. The summary shall discuss the MOS analysis in aggregate. It shall include discussion of interview, write-ups, substantiation procedures, full elaboration of analysis, operational details such as references used, subject matter expert utilization, date and by whom the analysis was approved, and any additional comments required to clarify the analysis.
- C. The following data shall be submitted on a task basis as a result of the analysis of those MOS at Enclosure 2.
- (1) The contractor shall identify the basic skills and knowledges, the safety hazards, common or special tools, test measurement and diagnostic equipment (TMDE) and other equipment associated with each step and substep of the original task analysis. Basic maintenance skills and knowledges generally have direct military application related to the field of maintenance, administration, electronics or safety. They are described in terms of principles, skills or knowledges related to the above fields. Further clarification of the skills and knowledges concept will be provided by the government as necessary. Safety hazards are related to danger to personnel or damage to equipment.
- (2) The contractor shall provide a user analysis of 500 common tools and 140 items of test equipment to identify the baseline skill prerequisites and the basic skills and knowledges required to operate each. For purposes of the analysis, the operation of each tool shall be considered to be a separate task. The analysis techniques shall be identical to those used to analyze soldier's manual tasks. Reports TPA 1-3 normally prepared for tasks shall be provided for each tool. In addition, the report

of basic skills and knowledges described below shall also be prepared for each tool. The Government will furnish the list of tools and equipment for analysis.

(3) The contractor shall provide the following reports for the basic skills and tools analysis for the additional 21 MOS. Each report shall be submitted in hard copy on $8 \frac{1}{2} \times 11^{\circ}$, 20 lb bond paper.

(a) An operational summary report of the procedures used during the basic skills analysis of each MOS to include interviews, approval of subject matter experts, and discrepancies.

(b) A summary description of the basic skills and knowledges profile of each MOS.

(c) A hierarchical presentation by category of the basic skills and knowledges associated with each task for each MOS. Basic skills and knowledges will be identified by step and substep of the original analysis. Report format of the TPA-2 is appropriate.

(d) For each MOS, separate lists (in order of priority established by frequency of use) of all common tools, of all special tools, of all test equipment (TMDE), of all basic skills and knowledges, and of other equipment used by the MOS.

Definition of Terms

Throughout this report certain terms are used to express the original or operationally defined intent of processes or products. These terms and their respective definitions are listed below.

1. Additional Analysis

Twenty (20) MOS for which original analysis of tasks was required under this phase of the effort. Titles of the MOS are listed at Attachment A.

2. Further Analysis

A process of identifying tools/TMDE and technical skills and knowledges (TSKS) for tasks within an MOS. A list of the MOS to which further analysis processes were applied is at Attachment B.

3. Generic

Applied on the project in the following ways:

- a. A type of analysis process used to identify procedures, technical skills and knowledges (TSKS), and tools/TMDE associated with task performance.
- b. A type of task. A list of 1080 task statements was provided as GFM. The task statements were written to apply to major systems, subsystems, assemblies, or subassemblies that exist on major types or categories of equipment or vehicles. One or more maintenance functions was included in each task statement.

4. Technical Skills and Knowledges (TSKS)

Objective statements obtained via an interview with an SWE or from analyst research of GFM as verified by an SME which can be considered to be the skills and knowledges necessary and/or related to performance of tasks as described by the procedures identified during the analysis of generic tasks.
Format of Report

In addition to the requirements and definitions sections included above, the report contains the following sections: Analysis at Ft. Gordon and Ft. Sam Houston, Analysis of Generic Tasks, Tool Analysis, Reports, Observations and Recommendations.

Analysis at Ft. Gordon and Ft. Sam Houston

Three (3) MOS (31E, 36H, 72G) were analyzed at Ft. Gordon and three (3) MOS (76J, 91E, and 92B) were analyzed at Ft. Sam Houston. These analyses were conducted by primarily using procedures in effect on 1 October 1982. (For details of these procedures refer to Operational Summary Report (CDRL A004, dated 23 June 1983.) The following adjustments were made to the procedures:

- 1. Instructional review and replicate analysis procedures were not used.
- 2. The use of two job aid designations was discontinued.
- 3. Cross references were not used and subtask procedures were emphasized.
- 4. Analysis results were expressed in a more general manner.
- 5. Results were reviewed and revised prior to processing.

Analysis of Generic Tasks

Analysis was completed for a list of 1080 generic tasks provided by the USAOC85. The list actually consisted of task statements. Originally no information was provided as to conditions, standards, MOS designation, or skill level designations. Consequently, the following major actions were involved in analysis of the list of 1080 generic tasks:

- Designation of MOS. In order to assign analysts and obtain services of SME, some designations were needed as to how the generic task list applied to MOS and what major equipment was involved with performance of the various tasks. First, tasks were assigned to various locations (Aberdeen Proving Ground, Ft. Knox, and Ft. Jackson). Ft. Leonard Wood was added later as an analysis site. Second, most tasks were designated as being in one of the following groups: all automative, wheel vehicle, track vehicle, or turret. Third, a pre-liminary listing of major end items of equipment was developed for each grouping. And fourth, with the assistance of SME and other service school personnel, MOS designations, task groupings, and equipment designations were made or verified as part of the analysis effort.
- 2. Scope of tasks. Statements on the list of 1080 generic tasks were quite heterogenious. Some were quite discrete as to level of action required and the object to which the action was applied. Others were broad and general and quite complex with regard to action. As a result, discrete tasks were frequently analyzed first and the results included with other results for a more general or complex task. USAOC&S personnel referred to this latter process as "rolling up" a task, or seeking a higher level of genericism.
- 3. Identification of technical skills and knowledges (TSKs). One of the main efforts associated with analysis of the 1080 generic tasks was the identification of TSKs. As analysts worked to

identify TSKs, processes were refined and various factors were considered. Consideration was given to the following:

- a. Recognition that TSKs are associated with how an end item, system subsystem, assembly or subassembly operates (works) and/or how (or why) procedures (steps in a task) are preformed. The main frame of reference for an analyst is: what are the areas of commonality, generalizability, or transferability across the various procedures or elements of the task and how can they be expressed as TSKs? For the USAOC&S the issue is stated as follows: If the TSKs are instructed are they the skills and knowledges a soldier needs to perform a maintenance function across a considerable inventory of equipment?
- b. Whether TSKs identified are essential for task performance is an issue that must be addressed empirically. The present effort explored the issue in a judgement manner through the use of a single review committee.
- c. Analysts were quick to recognize applicability of TSKs across a range of tasks. Accordingly, a TSK coding system was developed and is at Attachment C. Use of the coding system allows for sorting and printing via data processing equipment.

Tool Analysis

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As part of the effort at the USAOC&S a user analysis was required for tools and TMDE. General procedures enacted were as follows:

- 1. Categorization of items. The list of tools and TMDE for which analysis was required was provided as GFM. Initial review of the list lead to the conclusion that efficiency in analysis, and subsequent coding, could be gained if tools were categorized. Accordingly, functional categories and subcategories were formed for the tool and TMDE items. The intent was to perform a single analysis for each subcategory. As the analysis progressed changes were mode in the categories and subcategories. Also, additional tools were identified, but their use was not analyzed. A complete listing is provided at Attachment D.
- 2. Format for results. A standard format was developed for analysis results. The major steps included procedures for use, care/maintenance, and safety. TSK were identified, as were prerequisite competencies.
- 3. Coding to generic tasks. As part of the analysis process for generic tasks, the tools necessary to perform each major step were identified. Analysts coded the tools identified by specific number or by subcategory or category designation. These codings were reviewed by the review committee.
- 4. Development of job aid. To assist with the analysis and identification of tools, a tool catalog was developed. The catalog contained names, pictures, national stock number (or other identifiers), and short descriptions for each tool. A copy of the completed catalog has been provided to the Government.

Reports

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The following reports resulted from this phase of the analysis effort:

- 1. TPA-1, TPA-2, and TPA-3 (analysis results) for MOS at Ft. Gordon, Ft. Sam Houston, and the 1080 generic tasks at the USAOC&S.
- 2. TPA-3 reports consisting of tools and TSKs for eight (8) MOS, originally analyzed under the 94 MOS effort.
- 3. Task statement list.
- 4. Discrepancy statements.
- 5. MOS baseline skill profiles.
- 6. Subtask statement list.
- 7. Tool analysis results.
- 8. An operational summary report.
- 9. Cluster of TSKs for 117 task groupings developed by the USAOC&S.
- 10. Summary of TSKs for 35 field entries from the TSK coding system as selected by the USAOC&S.

Observations and Recommendations

The following general observations and recommendations are offered based on the analysis effort completed in this phase.

- In effect analysis procedures can be effectively and efficiently employed with trained analysts and service school personnel who have been adequately briefed on the analysis process.
- 2. The main factor in determining the extent of an analysis effort (the amount of time needed to analyze tasks) is the quality of the task statements. To the extent that task statements are complete and accurate analysis will proceed smoothly. If a task list has not been formalized, it is recommended that analysis proceed with analysis but that they be readily supported by training developers who can clarify discrepancies.
- 3. Analysis of generic tasks (tasks listed similarly to those provided on the 1080 list) can be effectively untaken within the following guidelines:
 - a. Tasks should be written in the normal three part format. If this is not desired, then analysis results should be considered as preliminary in nature until tasks have been more completely developed and there is a chance to revise analysis results.

b. Standard definitions of maintenance functions (or other doctrinal descriptions) should be utilized. If part of a generic analysis effort is to redefine or reexamine doctrine, then a preliminary field-oriented study should be conducted for this purpose. Once new or adjusted doctrine has been stated, then the analysis process can be guided by it.

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- c. Generic analysis results merit extensive review. The review should focus on the extent to which the general procedures and TSKs are applicable across task elements and/or MOS. The review groups should be composed of SME from MOS to which the generic tasks ostensibly apply.
- d. The identification of TSKs should be coupled with an attempt to determine empirically if they are essential to task performance. This could be pursued in either of two manners. First, an attempt could be made to describe and identify job holders who are "masters" based on job performance. Once identified they could be tested to ascertain if they "know" the TSKs. Second, a comparison could be made of soldiers who are trained on TSKs and those who have not been trained.
- e. Generic task analysis procedures are a significant departure from the normal mode of operation. If they are utilized, well organized briefings must be provided service school personnel as to the potential impact of the analysis results on subsequent train-ing operations activities.

ATTACHMENT A

Listing of Additional 20 MOS by Title

MOS	MOS Title
31E	Field Radio Repairer
36H	Dial/Manual Central Office Repairer
72G	Data Communication System Speciulist
76J	Medical Supply Specialist
91E	Dental Specialist
928	Medical Laboratory Specialist
41C	Fire Control Instrument Repairer
45D	Field Artillery Turret Mechanic
45E	M1 Tank Turret Mechanic
45G	Precision Electronics Repairer
45L	Artillery Repairer
45N	M60A1/A3 Tank Turret Mechanic
45T	ITV/IFV/CFV Turret Mechanic
63B	Light Wheel Vehicle/Power Generation Mechanic
63D	Self-Propelled Field Artillery System Mechanic
63 E	M1 Tank System Mechanic
63J	Quartermaster and Chemical Equipment Repairer
63 S	Heavy Wheel Vehicle Mechanic
63T	ITV/IFV/CFV System Mechanic
63Y	Track Vehicle Mechanic

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ATTACHMENT B

Listing of 22 MOS Further Analyzed

Analysis Location	MOS
Aberdeen Proving Ground, MD	44B* 44E* 45B* 45K* 63G* 63H* 63W*
Fort Knox, KY	63N*
Aberdeen Proving Ground, MD	41C 45G 45D 45L 63J
Fort Knox, KY	45E 45N 45T 63D 63E 63T 63Y
Fort Jackson, SC	638 635

* Original analysis conducted as part of the 94-MOS effort.

ATTACHMENT C

TSK Coding

CONTRACT NO. DABT60-81-C-0017

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	TRANSMISSION SYSTEMS LUBRICATION SYSTEMS MECHANICAL	NBC EQUIPMENT Turret components	VEHICLE: DRIVE Auxiliary Pomer Units 2 controls	VEHICLE: RECOVERY VEHICLE: PMCS POWER TRAINS	QUARTERMASTER EQUIP CHEMICAL FOUTP			TOWING													2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	
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CONTRACT NO. DABI60-81-C-0017

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FIELD THREE

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DRY	ENERGY	EXPLODE	EXPIDITE	FORCE	FRICTION	FUSING	GRIND	GROUND	HANDLE	HEAT	IDENTIFY	IMPACT	INJURE	INSULATE	INSPECT	INSTALL	JAMMING	NIOC	LEAK	LIFT		LIGHT	100X	LOOSEN	LUBRICATE	MAINTAIN	MARK	MEASURE	MOTION	MOUNT
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ATTACHMENT D

Tool Coding

тот	Annentice
T02	Accessories Blades
T03	Brushes
T04	
T05	Clamps/Vises
T06	Compressions
107	Containers
T08	Drills/Drill Bits
T09	Electronic Testing Equipment
T10	Generators
T11	Guns/Pumps
T12	Hammers
T13	Inspection Devices
T14	Kits
	Lathes
T15 T16	Lifting Devices
	Marking Devices
T17	measuring Devices
T18	Metal Shaping Devices
T19	Pliers
T20	Presses
T21	Protective Clothing & Devices
T22	Prying Devices
T23	Pullers
T24	Punches/Chisels
T25	Saws
T26	Screw Drivers
T27	Sewing Devices
T28	Shearing Devices
T29	Soldering materials and Equipment
T30	Surfacing Tools
T31	Test Equipment (Non-Electric)
T32	Threading Devices
T33	Welding Devices
T34	Wrenches
T35	Expendable Materials and Supplies
	, compared and applied

Scientific and Technical Report

Executive Summary (Phase III)

CDRL Sequence No. A013

of

Contract DABT60-81-C-0017

by

RCA Service Company

30 April 1984

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- Preroquisite Competency A statement takes from the taxonomy developed on this effort.
- 11. Prefest A preliminary collection of test items assembled for the purpose of pretesting as part of the test development process.
- 12. Subtest A short test (approximately 10 Items) assembled after pretesting to relate to one or more prerequisite competencies.
- 13. Taxonomy A statement of skills developed on the effort. The skills are directly related to task performance and are based on excerpts from ETAPS related to skills and knowledges that underlie task performance.

Format of Report

In addition to the Requirements and Definitions sections included above, the report contains the following sections. Background; Test Development, Administration, and Data Collection: BSEP Locutor, BSEP Succests, Congruence; BSEP/ASVAB Congruence; BSEP Test, Performance Test Congruence; BSEP Test Appropriateness; and Recommendations and Conclusions.

Background

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One component of the U.S. Army Basic Skills Education Program (BSEP) contract, which began in April 1981, was the development of a series of tests designed to identify soldiers who lacked the basic skills required for their MOS. These diagnostic tests were developed using data derived from analyzing tasks associated with 94 MOS plus Common Soldiers Tasks using the Extended Task Analysis Procedures (ETAP). This combination of task analysis and lest development presented a unique opportunity to develop a diagnostic tool closely related to the actual skills required by a soldier day-to-day on the job. Test items were developed based upon prerequisite competencies identified during the analysis phase of the contract. These prerequisite competencies were compiled in a taxonomy developed especially for this project.

Following initial development the last trends were assembled into pretest formats and pretested on samples of IET students. They were then reviewed by expert judges. Following analysis of protect aata and review of information from judges, test items were assembled into find test forms. All of this occurred during Phase 1 of the contract.

During Phase that the contract the charactic tests were given to a large sample of tricker ts. The intent was bouldcover the validity of the tests developed for the BSEP or ent. To this use a goost-experimental design was employed. Such a design was our formula the range of the covering of a testion, with full control over the source correction of a substance population,

Requirement of the Report

The requirement for development of this executive summary is stated in CDRL Sequence Number A015, Attachment to Modification P00006 of Contract DABT60-81-C-0017. A full description of the required effort is given in the subject contract.

Definition of Terms

3

Throughout this report certain terms are used in a very specific context. The definitions of these terms are as follows:

- Aptitude Area A means of stratifying examines based upon their MOS. The nine aptitude areas covered in this study include: clerical (CL), combat (CO), electrical (EL), field artillery (FA), general maintenance (GM), mechanical maintenance (MM), operators/food (OF), surveillance communications (SC), and skilled technical (ST).
- 2. ASVAB Tests Armed Services Vocational Aptitude Battery. The comparison with performance on these already existing tests were used to test the validity of the BSEP tests.
- 3. BSEP Tests Tests developed by ETS and RCA as part of the Basic Skills Education Program. These tests consist of a mathematics locator, a verbal locator, 69 mathematics subtests and 59 verbal subtests. (For a complete listing of all subtest titles, see Attachment A).
- 4. Category In this report a category refers to a grouping of subtests, such as all subtests with the title numeric (NU), vocabulary (VO), etc.
- 5. Criterion Exercise Tests, s tressing performance of an action, developed to test the validity of the BSEP tests. See Performance Test.
- 6. ETAP Extended Task Analysis Procedures. A comprehensive approach to task analysis with provisions for action and hierarchial analysis and knowledge analysis.
- 7. Item Analysis A review of questions on locator tests and subtests performed by panels of experts to determine face and content validity.
- 8. Locator Test A short test (30 items) for which raw scores are used to predict scores on subtests; established based on performance of students in pretest samples; bears only a general content relationship to particular subtests.
- Performance Tests Tests developed as criterion exercises employing a structured response approach. They were used to test the validity of the BSEP tests.

The validation was broken down into four parts, or efforts, which overlapped one another. During Part I the diagnostic (BSEP) tests were tested for internal validity. Two locator tests, one verbal and one math, had been developed to screen students. Missing an item or items on a locator test directed a student to a specific subtest or subtests. Success or failure on the locator test was compared with success or failure on the related subtests. The results were then analyzed statistically. The second effort involved testing the validity of the BSEP tests against a group of tests already in operation in the Army, in this case the ASVAB tests. Each locator was compared to a group of related ASVAB subtests. The combined locators were compared to ASVAB composite scores Finally, each individual BSEP subtest was compared to each ASVAB subtest. The mird effort involved testing the validity of the BSEP tests against a set of performance tests. The performance tests were developed especially for this effort by modifying the BSEP tests into structured response exercises. These performance tests were compared to their related BSEP locator test. Then all the performance subtests within a given aptitude area were compared to all the BSEP tests within that same area. The final effort scrutinized the appropriateness of the BSEP tests on a item by item basis. Teams of Government experts were asked to examine the test items and rate them on a number of scales. The results of those ratings were used to further improve the test items.

Test Development, Administration, and Data Collection

The test population consisted of a number of strata differing in their characteristics because they already had been selected for and sorted into different aptitude areas by the U.S. Army. The stratified sample was composed of the following nine aptitude areas: 1. Clerical (CL), 2. Combat (CO), 3. Electronics (EL), 4. Field Artillery (FA), 5. General Maintenance (GM), 6. Mechanical Maintenance (MM), 7. Operators/ Food (OF), 8. Surveillance/Communications (SC), and 9. Skilled Technical (ST). Randomization, while unfeasible to achieve with this population, was achieved with reference to the packaging of the BSEP subtests.

Beginning in May 1983 and continuing throughout mid-November 1983, a population of 19, 462 examinees in the BSEP I category and 2,214 examinees in the BSEP II category were given the BSEP tests. In addition, 1021 examinees in the BSEP I category and 488 examinees in the BSEP II category were given the BSEP performance (criterion) tests.

The task of administering the tests was delegated to personnel located at the testing site. These were persons already employed by the military establishment or hired specifically to administer the BSEP tests. Each test administrator was provided with a handbook containing instructions specific to the test. This handbook was of sufficient clarity and emphasis so that the administrators could establish and maintain a standardized test environment so that test results could be obtained under circumstances essentially alike for all examinees. A special form was designed, Basic Skills Examination (NCS Trans Optic EB01-12483-3), to be used with an optical scanner. These response sheets provided the raw data for the validation. A number of procedural steps were instituted to insure quality control of the data. The forms were then run mough an optical mark reader. The final step was to send the output record to a host computer for final processing and report writing.

BSEP Locator/BSEP Subtests Congruence

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The BSE P tests consist of two locator tests (mathematics and verbal), sixty nine (69) mathematics subtests, and fifty nine (59) verbal subtests. Attachment A lists the subtests by number and title. The locator tests are designed to provide a general measure of basic skills functioning which can be used to point out or locate potential basic skills deficit areas to be further investigated using the various subtests. Each locator test contains thirty (30) items. By using the locator tests the amount of testing time could be reduced by predicting which subtests a soldier would be most likely to pass or fail. The soldier would be administered only those subtests for which the pass/fail status was uncertain.

The validation effort attempted to answer the question, "To what extent do the locator tests empirically predict success or deficiencies on specific subtests of the BSEP tests?" The sample for BSEP I consisted of 19,462 Army personnel, representing 92 MOS at 20 different military locations. The sample for BSEP II consisted of 2,214 Army personnel, representing 81 MOS at 28 sites plus an undetermined number of sites from USAEUR and WESCOM. These students were stratified into nine aptitude areas based on MOS for BSEP I. The relatively low number of BSEP II students made the breakdown into aptitude areas unfeasible. For this reason BSEP II students were considered collectively.

All students took the locator tests. Time constraints, however, permitted only a certain number of subtests to be taken. To facilitate test administration the 128 subtests were divided into seven (7) packages. The objective was to test an equal number of soldiers on an equal number of tests. The tests were randomly assigned to each of the packages. These in turn were assigned to soldiers within each MOS grouping (aptitude area) for an equal distribution of all tests. Data on results from the locator tests and individual subtests were then analyzed. Pearson product moment correlations were run between the mathematics locator test and the mathematics subtests and between the verbal locator test and the verbal subtests. The correlations were run for each aptitude area for BSEP I and collectively for BSEP II. High correlations would indicate that success or failure on the locator test is indeed predictive of success or failure on the subtests. The results of this analysis are briefly summarized in Figures 1 through 4.

Figure 1 is a summary of the correlations between the mathematics locator and the mathematics subtests for BSEP 1. For reporting ease the 69 mathematics subtests have been grouped into seven (7) categories. The figures are cumulative for all nine aptitude areas. So the 12 subtests in the numeric (NU) category are multiplied by the nine aptitude areas to get a total of 108 subtests.

The numbers in the blocks show how many subtests within each category correlated with the mathematics locator within a certain range. Two of the numeric subtests had correlations in the .89- .80 range, 38 in the .79- 70 range, 33 in the .69-.60 range and so on. Examining the summary reveals that a majority of the subtests had correlations above .50. The strongest correlations are in the numeric (NU), computation (CO), and measurement (ME) categories. By far the weakest correlations are within the trigonometry and logarithms (TR) category..

Figure 2 presents the mathematics locator to mathematics subtests correlations for all BSEP II students regardless of aptitude area. Again the vast majority of correlations are above .50 with numeric (NU), computation (CO), and measurement (ME) showing the strongest correlations. Also once again the weakest correlations are in the trigonometry and logarithms (TR) category.

Figure 3 summarizes the BSEP I correlations between the verbal locator and the verbal subtests for all aptitude areas. The majority of correlations are above .40. The strongest correlations are in the categories: procedural directions or prose (PR), flow charts (FC), report writing (RW), verbal communication (VC), and voc abulary (VO). The weakest correlations are in the categories precautions (PR) and recognition (RE).

Figure 4 summarizes the correlations between the verbal locator and the verbal subtests for BSEP II regardless of aptitude area. The majority of correlations fall above .50. The strongest correlations are in the categories: verbal communication (VC), flow charts (FC), schematics (SC), report writing (RW), procedural directions or prose (PD), and vocabulary (VO). Again the weakest correlations are in precautions (PR) and recognition (RE).

BSEP/ASVAB Congruence

The BSEP/ASVAB congruence represents another approach at criterion – related validation of the BSEP tests. For this purpose, performance on the BSEP tests was checked against a criterion which is a direct and independent measure of that which the BSEP tests are designed to predict. The validation question concerning the BSEP/ASVAB congruence was: "To what extent does performance on a locator test and subtest of the BSEP tests correlate with subtests and composite scores on the ASVAB?"

Since the ASVAB has been used by the U.S. Army as a predictor of both success in MOS training and success on the job, validation of the congruence between the BSEP tests and the ASVAB is considered an appropriate indicator of concurrent validity of the BSEP tests. It was unfeasible to extend the validation procedures over the time required for predictive validity or to obtain an Army preselection sample for testing purposes. Therefore, the BSEP tests were administered to groups of soldiers on whom criterion data were already available. As stated earlier, the sample for BSEP I was 19,462 students in nine (9) aptitude areas representing 92 MOS at 41 different sites.

Once the data were collected, Pearson product moment correlations were calculated in three parts. The BSEP mathematics locator test was correlated with the sum of three ASVAB tests: arithmetic reasoning (AR), math knowledge (MK), and numerical operations (NO). The BSEP verbal locator was correlated with the sum of two ASVAB tests: word knowledge (WK) and paragraph comprehension (PC). Finally the total BSEP locator tests (math plus verbal) were correlated with ASVAB composite scores which were based on aptitude area. Figure 5 summarizes the results of these correlations.

The first section of Figure 5 shows the correlations between the BSEP math locator and the sum of three ASVAB numerical subtests reported by aptitude area. The correlations are both high and uniform ranging only from .66 to .73. The second section of Figure 5 shows the correlations between the verbal locator and the sum of two ASVAB verbal subtests. Again the correlations are high and uniform with a range from .60 to .74. The third section shows the correlations between the total BSEP locator (math plus verbal) and the ASVAB composites. The correlations are again high although a much greater range is displayed, from .46 in the Clerical aptitude area to .78 for Field Artillery. The differences in the total locator correlations as compared to the individual math or verbal locator correlations probably results from the inclusion with the composite of ASVAB tests, such as auto/shop information (AS) or general science (GS), whose relationship to math and verbal locator tests were expected to be tenuous.

Correlations were also made between each individual BSEP subtest and each ASVAB test. Even a summary of these extensive data is outside the scope of this report. For a summary, refer to the Scientific and Fechnical Report, MOS Test Validation. Because every BSEP subtest was compared with every ASVAB test, caution should be used in analyzing these data. Many of the low correlations are between tests for which no relationship was expected.

BSEP Test/Performance Test Congruence

A series of performance tests was developed in order to find out to what extent performance on the BSEP locator tests and subtests correlate with performance on criterion exercises developed for specific prerequisite competencies. The approach utilized was to develop a separate set of test items drawn from the same domain as the existing BSEP tests, but organized in a different format. The performance (criterion) tests were developed to achieve the following results:

- 1. Reduce the element of guessing by requiring a constructed response.
- 2. Reduce, as much as possible, any reading problems the soldier may have by having the test administrator read out loud the instructions and test questions.
- 3. Attempt to have the soldier perform a specific act.

To insure that the performance tests measured the correct prerequisite competencies, the existing BSEP tests were modified to achieve the aforementioned aims. The performance tests were administered to 1621 students in 33 MOS. The data were then analyzed and correlations were calculated based on performance on the BSEP locator tests and the individual performance subtests. Figures 6 and 7 summarize the results of this analysis.

Figure 6 shows the correlations between the mathematics locator test and the mathematics performance subtests. A definite majority of correlations fall above .50. The highest correlations were in the computation (CO), numeric (NU), and measurement (ME) categories. The lowest correlations were in the trigonometry and logarithms (TR) category.

Figure 7 shows the correlations between the verbal locator test and the verbal performance subtests. The majority of correlations fall above .40. The highest correlations are in the categories procedural directions or prose (PD), flow charts (FC), and schematics (SC). The lowest correlations are in the categories precautions (PR) and illustrations or diagrams (IL).

Correlations were also calculated between each individual BSEP subtest and each individual performance subtest. Figure 8 summarizes the correlations between the BSEP mathematics subtests and the performance verbal subtests. The majority of correlations fall above .30. The highest correlations are in the categories numeric (NU) and computation (CO). The lowest correlations are in the category trigonometry and logarithms (TR). Figure 9 summarizes the correlations between the BSEP verbal subtests and the performance verbal subtests. The majority of correlations fall above .20. The highest correlations between the BSEP verbal subtests and the performance verbal subtests. The majority of correlations fall above .20. The highest correlations are in the categories procedural directions or prose (PD), flow charts (FC), and schematics (SC). The lowest correlations are in the categories illustrations or diagrams (IL), note-taking (NT), and precautions (PR). Clearly there is a large discrepancy when comparing the BSEP locator/performance subtest correlations and the BSEP subtest/performance subtest correlations. The reasons for this discrepancy are, without further analysis, difficult to ascertain.

BSEP Test Appropriateness

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The BSEP locator tests and subtests were also evaluated using a "panel of experts" approach. Face validity, the subjective evaluation of what a test appears to measure, was taken into consideration, despite its subjectiveness, by the experts. Content validity was built into the BSEP tests from the beginning by a thorough examination of the task analysis and the test specifications that were drawn up for the item writers. The task of the reviewers was to examine the tests to determine how well the items in a test or subtest represented the prerequisite competencies being tested. The review was actually made up of three parts: 1. TRADOC Review, 2. Government Experts Review, and 3. RCA Review. For more details on how the reviews were conducted and for an item-by-item evaluation of the items, refer to section 5 of the Scientific and Technical Report, MOS Test Validation. A brief summary of some of the major findings of these reviews follows:

- 1. The discriminators did a good job in determining the difference between "knowing and not knowing".
- 2. There were problems in the wording of some stems, particularly with the use of the words "not" and "except".
- 3. There was no evidence to suggest that any "patterning" of item responses existed which would have skewed the results of the tests in any direction. However, looking at the frequency of the items missed it does appear that the more difficult items were those that occurred in the latter parts of the subtest.
- 4. On those items in a subtest where a large number of examinees failed, there was evidence of guessing as indicated by the distribution of responses of the discriminators. For mathematics tests in graphing, algebra, and trigonometry this was especially true. There was no evidence to suggest that cheating had any effect on the results.
- 5. There was no evidence to suggest that situational variables related to test administration had any effect on the results.
- 6. There were deficiencies in the manner that some test items were physically presented. In particular the page set-up was sometimes confusing and the graphics were not always clear.

Recommendations and Conclusions

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Based on the validation effort to date the following recommendations and conclusions are offered:

- 1. Of the 128 BSEP subtests developed and submitted to initial validation efforts, 109 show sufficient congruency between locator and subtest that each can be considered for use as designed for BSEP 1 populations. However, prior to utilization the following is recommended:
 - a. Cut scores be established for the various subtests and MOS via the Angoff method. If this is not practicable it is recommended the cut scores be set administratively based on resources available and the stated purposes and goals of current or planned remedial programs.
 - b. Revised prediction charts be established for locator and subtests. These charts would use data available from the effort reported on herein.
 - c. For the nineteen (19) subtests not considered for further use (specifically identified on page 27.2 of the MOS Test Validation Report), further administration should be completed in an attempt to investigate the relationship between the locator and subtest.
- 2. The current study demonstrated the congruence between the locator and the BSEP subtests for a general sample of BSEP 2 soldiers. If BSEP locator and subtests are to be used as designed, then additional studies are needed within aptitude areas with BSEP 2 soldiers. These studies can be conducted by specifying administration of the tests as part of ongoing training activities.

- 3. The current study demonstrated a strong relationship between the BSEP math locator and the ASVAB arithmetic reasoning, mathematics knowledge and numerical operations subtests; the BSEP verbal locator and the ASVAB paragraph comprehension and word knowledge subtests; and the sum of the BSEP math and verbal locator scores and ASVAB composite scores (for the appropriate aptitude area). To the extent that these ASVAB subtests are predictive of training and job success for selected MOS, the BSEP locators and the respective subtests can be used for diagnostic, remedial training purposes.
- 4. As shown on page 68 of the MOS Test Validation Report, forty-seven (47) BSEP subtests demonstrated weak or no relationships with the ASVAB subtests. It is recommended that these subtest data be further analyzed to determine if an interactive relationship exists based on either level of ASVAB scores or on levels of BSEP scores when various BSEP subtests are combined.
- 5. The current study used specially developed structured response exercises to investigate the relationship between the BSEP locator and subtests and a more "performance oriented" criterion. The main assumption was that structured response items (derived from the BSFP subtests) more closely represented the job environment than did the selected response mode of the BSEP subtests. This assumption needs to be investigated further by both expert judgement and item analysis techniques. Presently the BSEP math and verbal locator tests bear a moderate to high relationship with the structured response scores. Little relationship is demonstrated between the criterion verbal subtests and BSEP verbal subtests.
- 6. Additional studies of criterion related and predictive validity are needed for both BSEP 1 and BSEP 2 populations. Several areas of inquiny which can be pursued without changes in remedial training programs are as follows:
 - a. What is the relationship between scores on the BSEP locator tests and subtests and success in IET?
 - b. What is the relationship between scores on the BSEP locator tests and subtests and success in training beyond IET?
 - c. What is the relationship between scores on the BSEP locator tests and subtests and scores obtained on subsequent administration of the ASVAB?
 - d. What is the relationship between scores on the BSEP locator tests and subtests and measures of success on the job?

FIGURE 1 LOCATOR/SUBTEST CORRELATION - MATH

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BSEP 1 - ALL APTITUDE AREAS

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FIGURE 2	JCATOR/SUBTEST CORRELATION

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FIGURE 3 LOCATOR/SUBTEST CORRELATION ~	BSEP 1 - ALL APTITUDE AREAS

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FIGURE 4 LOCATOR/SUBIESI CORRELATION - VERBAL

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BSEP 2 - ALL APTITUDE AREAS

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FIGURE 5

BSEP/ASVAB CORRELATIONS

ASVAB - NUMEFICAL SUBTESTS (AR + MK + NO)

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MATH LOCATCR .72 .70 .66 .71 .66 .72 .67 .70

ASVAB ~ VERBAL SUBTESTS (VE = PC + WK) CO EL FA GM MM OF SC

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ASVAB COMPOSITES

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MICROCOPY RESOLUTION TEST CHART NATIONAL BUREAU OF STANDARDS-1963-A FIGURE 6' Locator/Performance subtest correlation math bsep 1 - all aptitude areas

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FIGURE 7

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LOCATOR/ PERFORMANCE SUBIEST CORRELATION - VERBAL

BSEP I - ALL APTITUDE AREAS

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FIGURE & BSEP SUBTEST/PERFORMANCE SUBTEST CORRELATION Math BSEP 1 - All Aptitude Areas

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SUBTEST GROUP	RANGE OF Correlations	08 68.	07 97.	. 69 60	.5050	. 40	. 30 30	.2920	01 91.	00 60.	TOTAL SUBTESTS

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FIGURE 9

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BSEP SUBTEST/ PERFORMANCE SUBTEST CORRELATION - VERBAL

BSEP I - ALL APTITUDE AREAS

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SUBLEST GROUP	RANGE OF CORRELATIONS	08 68.	07 97.	. 69 60	. 59 50	05 65.	. 39 30	.2920	. 19 10	00 60.	TOTAL SUBTESTS 6 5 4 4

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ATTACHMENT A

D.

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Test Title Listing

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NUMERIC

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1.	NU 1	NUMERICAL: Matching numbers with word names and models	
2.	NU 2	NUMERICAL: Place value	
3.	NU 3	NUMERICAL: Ordinal use of numbers	
4.	, NU 4	NUMERICAL: Counting and sequences of numbers	
5.	NU 5	NUMERICAL: Ordering numbers	
6.	NU 6	NUMERICAL: Points and intervals on a number line	
7.	NU 7	NUMERICAL: Equivalent fractions	
8.	NU 8	NUMERICAL: Equivalence among fractions, decimals, percents, mixed numbers	
9.	NU 9	NUMERICAL: Ratio and proportion	
10.	NU 10	NUMERICAL: Exponents	
11.	NU 11	NUMERICAL: Scientific notation	
12.	NU 12	NUMERICAL: Rounding numbers	
		COMPUTATION	
13.	CO 1	COMPUTATION: Addition and subtraction of whole numbers	
14.	CO 2	COMPUTATION: Multiplication and division of whole number	rs
15.	CO 3	COMPUTATION: Addition and subtraction of fractions	
16.	CO 4	COMPUTATION: Multiplication and division of fractions	
17.	CO 5	COMPUTATION: Addition and subtraction of decimals	
18.	CO 6	COMPUTATION: Multiplication and division of decimals	
19.	CO 7	COMPUTATION: Addition and subtraction of integers	
20.	CO 8	COMPUTATION: Multiplication and division of integers	
21.	CO 9	COMPUTATION: Combinations of operations	
22.	CO 10	COMPUTATION: Averages (arithmetic mean)	
23.	CO 11	COMPUTATION: Approximate numbers	
24.	CO 12	COMPUTATION: Estimation	
25.	CO 13	COMPUTATION: Evaluation of formulas	
26.	CO 14	COMPUTATION: Computation using measures	
27.	CO 15	COMPUTATION: Median and mode	

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SPATIAL

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ME 15

28.	SP T	SPATIAL: Orientation in space
29.	SP 2	SPATIAL: Rotation and reflection
30.	SP 3	SPATIAL: Parallel and perpendicular lines and planes
31.	SP 4	SPATIAL: Comparison of shapes and sizes of geometric figures
32.	SP 5	SPATIAL: Schematic diagrams
33.	SP 6	SPATIAL: Interpretation of three-dimensional models
34.	SP 7	SPATIAL: Meaning of spatial terms
35.	SP 8	SPATIAL: Common geometric figures and their properties
36.	SP 9	SPATIAL: Meaning of technical terms
37.	SP 10	SPATIAL: Visual comparison of sizes of geometric figures
38.	SP 11	SPATIAL: Matching and alignment of figures
		MEASUREMENT
39.	ME 1	MEASUREMENT: Common units of measure
40.	ME 2	MEASUREMENT: Telling time
41.	ME 3	MEASUREMENT: Use of Julian calendar
42.	ME 4	MEASUREMENT: Angles
43.	ME 5	MEASUREMENT: Bearings and azimuths
44.	ME 6	MEASUREMENT: Estimation of linear measures not more than 6 inches
45.	ME 7	MEASUREMENT: Estimation of linear measures greater than 6 inches
46.	ME 8	MEASUREMENT: Visual comparisons of measures
47.	ME 9	MEASUREMENT: Solving measurement problems
48.	ME 10	MEASUREMENT: Perimeter, area and volume
49.	ME 11	MEASUREMENT: Conversion of measures
50.	ME 12	MEASUREMENT: Circumference and area of circles
51.	ME 13	MEASUREMENT: Number of parts of a linear scale
52.	ME 14	MEASUREMENT: Markings on a linear scale

MEASUREMENT: Estimating readings on a scale

MEASUREMENT: Reading a scale that is not numerically calibrated 54. ME 16

MEASUREMENT (continued)

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55.	ME 17	MEASUREMENT: Reading a ruler
56.	ME 18.	MEASUREMENT: Reading ammeters, voltmeters, and related scales
57.	ME 19	MEASUREMENT: Reading simple gauges
58.	ME 20	MEASUREMENT: Reading vernier, micrometer, and related scales
59.	ME 21	MEASUREMENT: Reading an oscilloscope
60.	ME 22	MEASUREMENT: Reading a logarithmic scale
		GRAPHING
61.	GR 1	GRAPHING: Coordinates of a point in a grid system
62.	GR 2	GRAPHING: Points on a line graph
63.	GR 3	GRAPHING: Matching a graph with its equation
		ALGEBRA
64.	AL 1	ALGEBRA: Equivalent algebraic expressions
65.	AL 2	ALGEBRA: Evaluation and estimation of powers and roots
		TRIGONOMETRY AND LOGARITHMS
66.	TRI	TRIGONOMETRY: Basic trigonometric ratios
67.	TR 2	TRIGONOMETRY: Use of tables of trigonometric functions
68.	TR 3	TRIGONOMETRY: Problems using trigonometric ratios
69.	TR 4	TRIGONOMETRY: Use of logarithmic tables

PROCEDURAL DIRECTIONS OR PROSE

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1.	PD 1	PROCEDURAL DIRECTIONS OR PROSE:	Factual details
2.	PD 2	PROCEDURAL DIRECTIONS OR PROSE:	Relevant and irrelevant information
3.	PD 3	PROCEDURAL DIRECTIONS OR PROSE:	Sequence and detail
4.	PD 4	PROCEDURAL DIRECTIONS OR PROSE:	Essential message
5.	PD 5	PROCEDURAL DIRECTIONS OR PROSE:	Inferences
6.	PD 6	PROCEDURAL DIRECTIONS OR PROSE:	Information from multiple sources

VOCABULARY

7.	VO 1	VOCABULARY:	Common words
8.	VO 2	VOCABULARY:	Technical words
9.	VO 3	VOCABULARY:	Words in context
10.	VO 4	VOCABULARY:	Contractions and abbreviations
11.	VO 5	VOCABULARY:	Figurative, idiomatic, and technical terms in context

REFERENCE SKILLS

12.	RS 1	REFERENCE SKILLS:	Code number and title of source documents
13.	RS 2	REFERENCE SKILLS:	Alphabetical order
14.	RS 3	REFERENCE SKILLS:	Table of contents and index
15.	RS 4	REFERENCE SKILLS:	Appendix and glossary

TABLES/CHARTS

16.	TC 1	TABLES/CHARTS: Two-column charts
17.	TC 2	TABLES/CHARTS: Three or more column charts
18.	TC 3	TABLES/CHARTS: Cross referencing
19.	TC 4	TABLES/CHARTS: Troubleshooting
		ILLUSTRATIONS OR DIAGRAMS
20.	IL 1	ILLUSTRATIONS OR DIAGRAMS: Pictorial details
21.	IL 2	ILLUSTRATIONS OR DIAGRAMS: Keys and legends
22.	IL 3	ILLUSTRATIONS OR DIAGRAMS: Sequence
23.	1L 4	ILLUSTRATIONS OR DIAGRAMS: Symbols

FLOW CHARTS

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24.	FC 1	FLOW CHARTS: Organization charts	
25.	FC 2	FLOW CHARTS: Linear paths	
		SCHEMATICS	
26.	SC 1	SCHEMATICS: Schematic diagrams	
		FORMS	
27.	FO 1	FORMS: Entering information	
28.	FO 2	FORMS: Accuracy of statements	
29.	FO 3	FORMS: Locating information	
		NOTE-TAKING	
30.	NT 1	NOTE-TAKING: Essential details	
31	NT 2	NOTE-TAKING: Accuracy	
		OUTLINING	
32.	001	OUTLINING: Organization	
33.	OU 2	OUTLINING: Format	
		REPORT WRITING	
34.	RW 1	REPORT WRITING: Intent	
35.	RV/ 2	REPORT WRITING: Descriptions of events	
36.	RW 3	REPORT WRITING: Sequence of events	
37.	R₩ 4	REPORT WRITING: Impressions of events	
38.	RW 5	REPORT WRITING: Clarification of issues	
39.	RW 6	REPORT WRITING: Supporting and opposing evidence	
40.	κ₩ 7	REPORT WRITING: Accuracy of summaries	
41.	RW 8	REPORT WRITING: Justifications for actions	
EDITING			
42.	ED 1	EDITING: Spelling of common words	
43.	ED 2	EDITING: Spelling of task-related words	

EDITING (continued)

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44.	ED 3	EDITING: Capitalization					
45.	ED 4	.EDITING: Endmarks, commas, and apostrophes					
46.	ED 5	EDITING: Mechanics of grammar					
47.	ED 6	EDITING: Paragraph organization					
48.	ED 7	EDITING: Clarity					
49.	ED 8	EDITING: Complete sentences					
VERBAL COMMUNICATION							
50.	VC 1	VERBAL COMMUNICATION: Appropriate language					
51.	VC 2	VERBAL COMMUNICATION: Appropriate type of communication					
52.	VC 3	VERBAL COMMUNICATION: Clarity of directions					
PRECAUTIONS							
53.	PRI	PRECAUTIONS: Safety hazards					
54.	PR 2	PRECAUTIONS: Emergency actions					
RECOGNITION							
55.	RE 1	RECOGNITION: Similarities of objects					
56.	RE 2	RECOGNITION: Recognizing motions and gestures					
57.	RE 3	RECOGNITION: Damage and defects					
58.	RE 4	RECOGNITION: Matching objects					
59.	RE 5	RECOGNITION: Classifying objects					

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Verbal LOCATOR TEST

