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# EARLY COMPARABILITY ANALYSIS (ECA)

PROCEDURAL GUIDE

*February 1987*



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**EARLY COMPARABILITY ANALYSIS**

**(ECA)**

**PROCEDURAL GUIDE**

**February 1987**

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## CHAPTER 1

### INTRODUCTION

1-1. Future force integration requirements will impact heavily on Army manpower, personnel, and training (MPT) resources. The demand for more highly sophisticated weapon systems is accompanied by requirements for increased numbers of skilled personnel. This increased requirement for skilled personnel is known as "skill creep" and is fast becoming one of the most crucial problems in the materiel acquisition process. The number of highly qualified personnel, in the recruiting base, is limited. The situation is further complicated by the fact that the Army must compete with the other branches of the service as well as the civilian sector for this limited number of highly skilled personnel. Manpower, personnel, and training factors must be considered early in the materiel acquisition process to insure that the Army's needs for such skilled personnel can be met.

MPT

1-2. Historically, few MPT factors have been considered in the actual design of new equipment. It has been estimated that 70% of life cycle cost decisions are made by the end of the concept phase of the acquisition process. Consequently, it is important to insure that consideration be given to MPT resources prior to and during concept exploration. The Early Comparability Analysis (ECA) methodology was developed as a tool to assist Combat Developers (CD) in the timely and effective introduction of MPT considerations early in the system acquisition process. The early input of MPT information into the acquisition process can result in equipment design modifications which will lead to a more effective deployment and sustainment of new or improved weapon systems.

1-3. Early Comparability Analysis assumes an intent to replace or substantially improve existing equipment. Existing equipment, in ECA terms, is referred to as a predecessor system. The ECA methodology is based on a "lessons learned" approach to the design of a conceptual system. Problems are identified in the predecessor system and an attempt is made to determine a solution and "fix" the problem. Steps are taken to insure that the identified problems are resolved and are not built into the conceptual system. If there is no single distinct predecessor system, many of the components of the conceptual system can be found in one or more operational systems that are currently fielded. Data from such operational systems, known as reference systems, can be used together with data from predecessor systems to build the ECA data base.

ECA

1-4. The Early Comparability Analysis methodology is based on an analysis of the operator, maintainer, and repairer tasks associated with predecessor and/or reference systems. The

methodology does not study crew level tasks. The analyst is primarily interested in determining which tasks, associated with predecessor/reference systems are MPT resource intensive. Such resource intensive tasks are known as "High Drivers". Several situations occur that can cause a task to be a "High Driver". Mastering a task may require an inordinate amount of training. Actual performance of the task in the field may require the services of more personnel than the unit can support. Task performance may require special skills or knowledge that are not prerequisites for entry into the particular MOS. Finally, a task may be so difficult to perform that its accomplishment is unusually prone to error.

1-5. The Early Comparability Analysis methodology is not a panacea. It will not solve every problem encountered in materiel acquisition. However, when combined with other HANPRINT tools, the ECA methodology can help to eliminate MPT problems with both currently fielded equipment and future conceptual systems.

## CHAPTER 2

### ECA AND THE SYSTEM ACQUISITION PROCESS

2-1. The Early Comparability Analysis methodology was developed as a tool to assist Combat Developers (CD). As the development of the methodology matured, it became obvious that ECA also affected other school activities such as Training Developers (TD) and Directorates of Evaluation and Standardization (DOES).

2-2. The original tasking that led to the development of the ECA methodology specified three interlocking objectives for this new MANPRINT oriented data management tool: (1) the establishment of soldier tasks as a common language for systems design; (2) the identification of predecessor system tasks and potential new system tasks that are costly in manpower, personnel and training (NPT) resources ("high drivers") and; (3) the limitation of "high drivers" in contracted design by addressing NPT in planning, requirements and contractual documents.

2-3. Early Comparability Analysis is designed to be utilized before, during and after the drafting of the Operational and Organizational Plan (O & O Plan). The ECA process should be initiated as soon as practical after the Concept Based Requirement System (CBRS) has identified a materiel need or upon receipt of a proposed product improvement, while the actual design of the projected materiel is still in flux and can be easily influenced.

2-4. Although ECA was originally designed to support major system "new starts", the methodology is equally effective when applied to non-major new starts, product improvements and non-developmental item acquisitions. ECA can provide data to support alternative materiel decisions and can be applied throughout the materiel acquisition process. The results of an ECA can influence design and can help insure system supportability. After component/system fielding, ECA can help identify soldier tasks that are resource intensive. Such problem tasks may be resolved in the near term with a manpower, personnel, or training "quick fix". In the long term, problem resolution may require a product improvement.

2-5. One of the primary uses of ECA is the identification of those NPT "high driver" tasks that can be limited or eliminated in the design of new or improved weapon systems. Additionally, such information can be used in an acquisition audit trail to support system design requirements. An ECA yields preliminary manpower, personnel, and training constraints and a preliminary target audience description.

2-6. In a twelve step process, ECA not only condenses task information and simplifies its interpretation, but also provides

provides easily understood records of the data analysis and findings. Early Comparability Analysis also yields a great deal of documentation that can be used by the CD to support his justification for design requirements.

2-7. Early Comparability Analysis provides a great deal of useable data, but it is not a MANPRINT cure-all. The methodology has the following characteristics/limitations:

- a. ECA addresses individual tasks but not collective tasks.
- b. ECA does not address supervisory/managerial tasks.
- c. ECA addresses manpower, personnel and training issues and to a lesser extent, human factors; it does not currently address safety or health hazard issues.
- d. ECA provides a basis of comparison for comparable tasks.
- e. ECA helps preclude a repeat of old "mistakes", but it does not prevent all new "mistakes".

## CHAPTER 3

### METHODOLOGY

3-1. Early Comparability Analysis is a twelve step process. The twelve steps of the ECA methodology are:

- Step 1: Initiation
- Step 2: Identify relevant MOS .
- Step 3: Collect task lists
- Step 4: Collect data
- Step 5: Assign values to data
- Step 6: Calculate task scores
- Step 7: Identify "high drivers"
- Step 8: Conduct task analysis
- Step 9: Conduct learning analysis
- Step 10: Identify deficiencies
- Step 11: Identify solutions
- Step 12: Prepare report

#### 3-2. Step 1. Initiation.

a. The first step of the ECA methodology is to determine if an ECA is appropriate. Early Comparability Analysis requires the existence of an Army predecessor or reference system/component.

(1) Early Comparability Analysis assumes that most equipment development is evolutionary not revolutionary in nature. Typically, an item of equipment is identified as inadequate to meet current or future needs. However, the new or product improved replacement will have essentially the same type of components and perform the same functions. For example, the Redeye missile is clearly the predecessor of the Stinger missile and the M915 truck is clearly the predecessor of the M915A1 truck.

(2) There will be some cases where there is a clearly identified predecessor system, but the conceptual system will



have an additional component. In such a case, study the predecessor system. If the additional component or a similar component is in the inventory, study it as a reference component. An example of such a situation is the development of a replacement for the Armored Personnel Carrier (APC). The APC is the predecessor of the Bradley Fighting Vehicle (BFV). However, unlike the APC, the BFV has an armored turret. To complete the study, personnel would need to determine if there is a similar component in the Army inventory and if there is, study the component as a reference component.

(3) There are occasions when a need will be identified for a completely new item of equipment for which there is no clearly defined predecessor. If there is a similar system in the inventory it may be studied as a reference system. For example, there is no predecessor for the Ballistic Missile Defense System Radar. However, the Patriot Radar is similar and could be studied as a reference system.

**b. ECA is not appropriate if:**

(1) There is a vast technological gap between predecessor/reference system or component and the conceptual system or component.

(2) There is no clearly defined predecessor system in the Army inventory.

(3) Similarities between the predecessor or reference system and the conceptual system are too minimal to justify resource expenditure.

(4) Tasks will not be performed by soldiers on the conceptual item.

(5) Previous studies have served the purpose of ECA.

(6) Predecessor/reference tasks are insignificant from a MPT perspective.

**c. If an ECA is appropriate, resources must be allocated to conduct the study. A model to estimate ECA resource requirements is located in Chapter 5. Proponents should consider the following resourcing possibilities:**

(1) Allocate internal resources.

(2) Use personnel awaiting school or personnel who are awaiting further assignment following completion of a school.

(3) Incorporate ECA studies into school staff study projects.

(4) Let personal service contracts.

- (5) Use temporary limited hires.
- (6) Obtain assistance from integrating centers.
- (7) Obtain assistance from other TRADOC agencies (e.g. TRASANA).
- (8) Request an AR 5-5 Study Program.
- (9) Request funding assistance from AMC major subordinate commands or project managers.
- (10) Prepare justification for permanent positions (long range).

d. The ECA methodology is a TRADOC MANPRINT tool and thus, is optional to TRADOC. Early Comparability Analysis will be required in the Mission Area Analysis process as specified by appropriate TRADOC study directives. The ECA methodology is also available to proponents as an optional MANPRINT tool for systems already identified as inadequate to meet the Army's needs. The need for an ECA should be determined during the System Manprint Management Plan (SMMP) development process.

e. In most cases, an ECA application will require the participation of other service schools in addition to the proponent for the conceptual system. The proponent service school has the final responsibility to determine if an ECA is appropriate and if so, the components or systems to be studied. However, the proponent should coordinate with and solicit comments and recommendations from all affected service schools. Similar coordination should be conducted between the various directorates within the proponent service school. This coordination will be facilitated if all interested parties are members of the MANPRINT Joint Working Group. The CD from the proponent service school will have final authority to resolve any conflicts that cannot be resolved by the members of the MANPRINT Joint Working Group.

3-3. Step 2: Identify relevant MOS that operate, maintain and repair the predecessor/reference items selected for study in Step 1. If it is not clear which MOS are involved with the system to be studied, contact other service schools that are involved with the system for information. The Qualitative and Quantitative Personnel Requirements Information (QQPRI), if available and current, is also a good source of information.

Example: Studied Equipment: 107mm Mortar Unmounted

Relevant MOS:	11C Operator	- Infantry
	76Y Organizational Maintenance	- Quartermaster
	41C DS/GS Repair	- Ordnance
	45B DS/GS Repair	- Ordnance

3-4. Step 3: Collect complete task lists by MOS and major component for the studied equipment. Complete task lists or inventories, by MOS, showing all tasks performed by an MOS on specific equipment should be available from the Directorate of Training and Doctrine (DOTD). If the task lists exist, extract the tasks relating to the components or systems being studied. If a task list does not exist, it must be generated. Recommended sources for maintainer and repairer MOS are Logistic Support Analysis Records (LSAR), specifically LSA-02, and applicable technical manuals. Recommended sources for operator task lists are Soldiers Manuals, Field Manuals, Technical Manuals, Army Occupational Survey Program (AOSP) questionnaires, and subject matter expert input. Task list preparation is a critical step. If task lists are inadequate, problem tasks may not be identified and ultimately may be left unresolved. For ECA purposes, a "task list" is defined as an inventory of all tasks that a MOS performs in order to operate, maintain, or repair the system/components being studied. The list includes both critical and non-critical tasks.

3-5. Step 4: Collect data on task criteria as it relates to each specific task. Each task, identified in Step 3, is rated on each of six criteria. A simple 4 point ordinal scale is used to evaluate each criteria of each task. The scale values are interpreted as low (1), moderately low (2), moderately high (3), and high (4). Slightly more sensitive than a simple go/no-go dicotomy, the scale is similar to a forced choice Likert scale. Using the six Task Criteria, the scale provides a straightforward, relatively uncomplicated means of differentiating problem versus non-problem tasks. The criteria and values used for ECA are:

a. Percent Performing: What proportion of the relevant MOS and skill level performs this task?

- 1 = 1-25%
- 2 = 26-50%
- 3 = 51-75%
- 4 = 76-100%

b. Task Learning Difficulty: How difficult is it for the average soldier, in the appropriate MOS and of the appropriate skill level, to learn this task?

- 1 = Not difficult
- 2 = Somewhat difficult
- 3 = Moderately difficult
- 4 = Very difficult

c. Task Performance Difficulty: How difficult is it, for the average soldier, of the proper skill level and in the proper MOS, to perform this task? Consider both cognitive and physical difficulty.

- 1 = Not difficult
- 2 = Somewhat difficult
- 3 = Moderately difficult
- 4 = Very difficult

d. Frequency Rate: On the average, how often is this task performed by the average soldier of the proper skill level and in the proper MOS?

- 1 = Seldom (Annually)
- 2 = Occasionally (Semi-annually/quarterly)
- 3 = Often (Monthly)
- 4 = Frequently (Daily/weekly)

e. Decay Rate: Given this task, how much proficiency is lost by the average soldier from the end of his formal training until he first performs the task in the field? (Assume that the task is performed within a reasonable period of time after training and is performed by an average soldier of the proper skill level and in the proper MOS.)

- 1 = Low
- 2 = Moderately low
- 3 = Moderately high
- 4 = High

f. Time to Train: How much time is required to train the average soldier, of the proper skill level and in the proper MOS, to perform this task to standard?

- 1 = Less than 3 hours
- 2 = 3 hours or more but less than 6 hours
- 3 = 6 hours or more but less than 9 hours
- 4 = 9 hours or more

g. Many of the major sources of data for the respective task criterion are listed below. The list is not all inclusive. The sources will vary depending on the specific equipment and MOS studied.

Percent Performing

Army Occupational Survey Program (AOSP)  
Service School surveys  
Subject Matter Expert (SME) opinion

### Task Learning Difficulty

AOSP

Service Schools (go/no-go data, critical task selection board results, surveys)

Job and Task Analyses

SME opinion

### Task Performance Difficulty

SME opinion

US Army Operational Test and Evaluation Agency (OTEA) data

US Army Research Institute for the Behavioral and Social Sciences (ARI) studies

US Army Human Engineering Laboratory (HEL) studies

AOSP

Training Effectiveness Analyses (TEA)

### Frequency Rate

Logistic Support Analysis Records (LSAR)

AOSP

Job and Task Analyses

Service School surveys

Technical manuals

SME opinion

Sample Data Collection (SDC)

### Decay Rate

SME opinion

Service School surveys

ARI studies

### Time to Train

Programs of Instruction

Lesson plans

Soldiers Manuals/Trainers Guides

SME opinion

h. Subject Matter Expert opinion is a major source of data that is used in the ECA methodology. Usually, Subject Matter Experts are Army Non-commissioned Officers who have had extensive "hands on" experience with the studied equipment, recent unit experience, and experience as a trainer or training developer. There will be occasions when very few of the available NCOs have all of the qualifications listed above. Some NCOs will have an

extensive training background; others will have extensive unit experience. To compensate, select NCOs with a wide variety of background experience. Good judgement must be exercised to insure that a representative sample of the best available NCOs is selected for use as SMEs. Subject Matter Experts can be found among the personnel of the school directorates, school instructors and students attending various courses at the school. With some special coordination, it may be possible to have personnel in TO&E units provide subject matter expertise. Subject Matter Expert opinion should be routinely sought on all six MPT Task Criteria. Attempt to survey at least 10 SMEs. The statistical significance of the data increases as the number of SMEs surveyed increases.

i. Care must be taken when obtaining SME opinions. To facilitate the collection of SME opinions:

(1) Tell the SMEs who you are, what your mission is, and how their input will be used.

(2) Have the SMEs complete the questionnaires independently. Do not allow SMEs to discuss questions and answer as a group. Strong personalities, in a group, can often overwhelm issues of fact and influence individual responses. The SME responses will be averaged during the data reduction process, but this is different from an apparent group consensus.

(3) Insure the SMEs respond to questions in terms of the average soldier in the proper grade and in the proper MOS. They should not answer in terms of just their own personal experience.

(4) Assure SMEs that their input will be used only for ECA purposes and that they will not be associated individually with their responses.

(5) If the questionnaire is lengthy and a sufficient number of SMEs is available, divide the questionnaire into sections and assign SMEs to specific sections.

j. Percent Performing will not be used as a criterion on unfielded equipment or equipment with limited fielding since reliable data may not be available. If AOSP data is available for percent performing on a task, no other data is required for that criterion.

k. The preparation of readable, easy to understand task list questionnaires will help SMEs quickly and accurately complete them and make scoring easier for the analyst. An example questionnaire is located at Appendix B.

3-6. Step 5: Assign values for task criteria. In some cases, collected data will be based on scales that are larger or smaller than the 1 to 4 scale used in the ECA methodology. In such cases, the scales will have to be collapsed or expanded to fit

the 1 to 4 ECA scale. In other cases, task criteria values may be of a descriptive nature rather than a quantitative one. Some subjective judgement may be required in order to equate a descriptive term with a quantitative score.

**a. Examples:**

(1) Task Learning Difficulty: A given task has a learning difficulty of 4.9 on a scale of 1 to 7. The 1 to 7 scale must be compressed and the 4.9 score must be equated with a score on a scale of 1 to 4. Simple interpolation results in:

```

***** 7                      4 *****
★                                     ★
★                                     ★
★      4.9   *****    =    ***** X     ★
★                                     ★
★                ★           ★               ★
★                ★           ★               ★
***** 1       *****    ***** 1 *****

```

$$(4.9)(4/7) = X \quad X = 2.8$$

The equivalent value on a 1 to 4 scale would be 2.8.

(2) Frequency Rate: A given task is performed with a frequency of 4 on the following scale from 1 to 6:

1 = Annually  
2 = Semi-annually  
3 = Quarterly  
4 = Monthly  
5 = Weekly  
6 = Daily

The ECA frequency rate is evaluated on a scale of 1 to 4 as follows:

1 = Seldom (Annually)  
2 = Occasionally (Semi-annually/quarterly)  
3 = Often (Monthly)  
4 = Frequently (Weekly/Daily)

Through a visual comparison of the two scales, it can be determined that the task performance frequency would be a 3 on the ECA scale.

(3) Task Performance Difficulty: An ARI study indicates that a given task is moderately difficult to perform. The ECA methodology scores task performance difficulty on the following scale:

- 1 = Not difficult
- 2 = Somewhat difficult
- 3 = Moderately difficult
- 4 = Very difficult

Therefore, the task would be given a score of 3 on the ECA scale.

b. Subject Matter Expert (SME) opinion will always be scored on the 1 to 4 ECA scale.

c. Once the data collection effort is completed, perform the following tasks:

(1) Insure that scores exist for all criteria used for each task. SME opinion, as a minimum, should always be available.

(2) For SME opinion, average the values assigned to each criterion for each task.

(3) Once SME opinion has been averaged, average that result with the values from each of the other data sources.

d. Each different data source (SME opinion, AOSP results, Service School surveys, etc.) is weighted equally.

e. The following example should help to clarify the procedure up to this point:

(1) EXAMPLE: A survey, administered to 5 SMEs, yields the following information:

TASK 1	PP	TLD	TPD	FR	DR	TT
SME 1	4	1	1	3	1	2
SME 2	3	1	1	3	1	3
SME 3	3	2	2	4	2	2
SME 4	3	2	1	4	3	1
SME 5	2	1	2	3	3	3
AVERAGE	3.0	1.4	1.4	3.4	2.0	2.2



(2) Additional information sources yield the following data:

(a) An AOSP indicates that TASK 1 is performed by 48% of the MOS.

(b) A service school survey conducted by DOES indicates that TASK 1 is performed by 75% of the MOS.

(c) HEL studies indicate that TASK 1 is moderately difficult to perform.

(3) Based on the above data the average values would be:

Average:	Percent Performing	Task Learning Difficulty
----------	--------------------	--------------------------

SME	3	SME	1.4
AOSP	2	HEL	3
Svc Sch	3		

Average Value	2.7	2.2
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f. Based on the above calculations, the data to be used for determining the ECA Task Score for TASK 1 is:

<u>TASK 1</u>	<u>PP</u>	<u>TLD</u>	<u>TPD</u>	<u>FR</u>	<u>DR</u>	<u>TT</u>
	2.7	2.2	1.4	3.4	2.0	2.2

g. Average values, computed in each operation, will be rounded to the nearest tenth.

3-7. Step 6. Calculate the ECA Task Score. Once the criterion values for each data source have been averaged, the ECA Task Scores may be calculated. To calculate the ECA Task Scores, multiply the criteria values for each task.

a. ECA Task Score = Percent Performing X Task Learning Difficulty X Task Performance Difficulty X Frequency Rate X Decay Rate X Time to Train

b. The ECA Task Score for TASK 1 would be:

$$2.7 \times 2.2 \times 1.4 \times 3.4 \times 2.0 \times 2.2 = 124.4$$

c. Percent Performing is omitted if data is not available.

3-8. Step 7: Identify "High Drivers". The ECA scoring methodology was developed through a series of studies on several weapon systems. The following cut-off scores have been established to tentatively identify "high driver" tasks:

a. 6 MPT Criteria = 216 (based on 2x2x2x3x3x3)

b. 5 MPT Criteria = 90 (based on 2x2x2.5x3x3)

c. Tasks that score 216 or higher, in the case of 6 MPT criteria, or 90 or higher, in the case of 5 MPT criteria, are considered to be "high drivers". Tasks that score below 216 or 90 respectively are not initially considered to be "high drivers".

d. Once the task scores have been computed, they should be reviewed and validated by Subject Matter Experts. The SMEs should review all task scores. They should verify that the tasks that scored below the "high driver" cut-off are not resource intensive and also verify that the tasks that scored above the "high driver" cut-off are in fact resource intensive. The SMEs should also determine if there are any tasks that should be "high drivers" even though they did not score above the cut-off. Discrepancies between task scores and SME determined status should be thoroughly investigated by the Combat Developer. In cases of discrepancies, the Combat Developer will decide if the task is or is not a valid "high driver"; document his reasoning; and, if appropriate, adjust the task scores.

3-9. Step 8: Conduct Task Analysis. The purpose of task analysis is to break each "high driver" task into its individual steps; identify the tools and test equipment required to perform the task; identify the conditions under which the task must be performed; and identify the standard to which the task must be performed. Completed task analyses should be on file within the Directorate of Training and Doctrine. If however, task analyses are not on file, they will have to be developed. In most cases, field and technical manuals will provide enough information to conduct a task analysis that is sufficient for the purposes of ECA.

3-10. Step 9: Conduct Learning Analysis. The purpose of the learning analysis is to identify the knowledge, skills, and abilities (KSA's) a soldier must possess to perform each "high driver" task under specified conditions and to accepted standards. Assembling the KSA's for each step, yields the cumulative KSA's required for the "high driver" task. Completed learning analyses may be available within the Directorate of Training and Doctrine (DOTD). If they are not available, learning analyses must be conducted. The level of detail found in a DOTD learning analysis is normally not required for the purposes of the ECA methodology. The procedures for conducting an ECA learning analysis should consist of the following as a minimum:

a. A thorough review of the task analysis generated by step 8.

b. Determination of the MPT requirements for each step of the "high driver" task. (i.e., How many people are needed to

perform the step? What mental and physical attributes are required? What training/education is essential for each step?).

**3-11. Step 10: Identify Deficiencies.** Identify the knowledge, skills, and abilities required by the MOS. To determine deficiencies, compare the KSA's required for each task with the KSA's required by the MOS.

a. The types of data that must be collected and analyzed include:

- (1) MTOE/TDA authorizations in typical units/activities
- (2) Personnel requirements for entry into the MOS.
- (3) Personnel requirements for retention in the MOS.
- (4) Personnel qualifications of accessions into the MOS.
- (5) Personnel qualifications of personnel in the MOS.
- (6) Training given and strategy.

b. Compare the knowledge, skills, and abilities required to perform the task with the KSA's required by the MOS. This comparison will result in the identification of manpower, personnel and training deficiencies. Task criteria values can help identify deficiencies. For example, if Task Performance Difficulty is very high for a given task, it implies that the task has high cognitive and/or high physical demands. Other examples of deficiency identification include:

(1) The learning analysis indicates that the task requires a basic knowledge of algebra. If algebra is not a prerequisite for entry into the MOS and it is not taught in AIT, a deficiency exists.

(2) The learning analysis shows that the soldier is required to carry a 75 lb item at least 20 feet. It is determined that the MOS has a physical demand rating of light and that women in the 5 - 95 percentile can enlist in the MOS. A deficiency exists.

(3) The learning analysis indicates that completion of the task requires an elementary knowledge of welding. It is discovered that welding is not taught in the soldiers training. Therefore, a deficiency exists.

**3-12. Step 11: Determine Solutions.** Now that the deficiencies have been identified, identify all possible manpower, personnel and training solutions.

a. Questions to be asked include:

(1) Manpower: Can manpower authorizations be increased? What tradeoffs would be required? What would be the Army-wide impact? What are the projections for the MOS? Would the MOS still be supportable?

(2) Personnel: Can the quality of personnel be changed and still get the required quantity of accessions and retentions? What quality has been coming into the MOS and what is projected? Consider possible mental, physical and educational requirements.

(3) Training: Can training be changed and still be supportable? Can a training aid/device be developed to resolve the deficiency? Can a current training aid/device be improved? Can simulation be employed as a training vehicle to improve/enhance current training?

b. If there is a reasonable manpower, personnel or training solution, it should be initiated by the proponent. If there is a reasonable MPT solution then a materiel change is not necessary. However, if there is no reasonable MPT solution, a materiel solution is required. The Combat Developer is responsible for conveying this need to the Materiel Developer. It then becomes the Materiel Developer's task to find a solution. Determination of the limits or flexibility that exists in the MOS, also results in the development of preliminary manpower, personnel and training constraints for the conceptual system or product improvement. The preliminary target audience description is also developed at the same time. Preliminary MPT constraints and preliminary target audience descriptions, should be developed even if there are no "high driver" deficiencies to resolve.

3-13. Step 12: Prepare Report. After all preceding steps have been completed, a report will be prepared to document and disseminate findings. Other participating service schools will submit a feeder report to the proponent service school. The proponent service school will prepare the consolidated final report. This report not only supports materiel requirements but also has many secondary uses. It provides useful data to DOTD, DOES, Proponency Office, and potential contractors, to cite a few. As a minimum, the report should consist of:

- a. Summary.
- b. Study Scope.
- c. Sources of task criteria data.
- d. Complete task lists, by MOS by component, with values for all criteria and task scores.
- e. "High Drivers", by component, for each MOS.

- f. MPT constraints developed.
- g. MPT data examined.
- h. Target audience description.
- i. Identified solutions to deficiencies.

## CHAPTER 4

### RESPONSIBILITIES/COORDINATION

#### 4-1. Headquarters, TRADOC (DCD) will:

- a. Establish general TRADOC policy regarding ECA.
- b. Provide resources to support ECA applications.
- c. Resolve conflicts in cases in which a lead proponent desires to conduct an ECA but other service schools desire not to participate.

#### 4-2. Commander, USASSC-NCR will:

- a. Serve as the TRADOC manager for ECA.
- b. Review and comment on all ECA reports.
- c. Make recommendations to TRADOC concerning whether or not a specific ECA is appropriate.
- d. Develop refinements and expansions of ECA.
- e. Provide advice and guidance to all TRADOC activities on matters concerning ECA.
- f. Develop and publish ECA guidance and information.

#### 4-3. Commandant of the primary user proponent service school will:

- a. Initiate and lead the ECA application efforts.
- b. Notify the Commandants of affected service schools that an ECA has been initiated and request their input.
- c. Insure that steps 1 - 12 of the ECA methodology are completed.
- d. Insure the preparation of the final report.

#### 4-4. Commandants of associated service schools will:

- a. Insure assistance is provided to the lead proponent service school during the conduct of the ECA.
- b. Insure steps 3 - 12 of the ECA methodology are completed.
- c. Insure feeder data is provided for the final report.

## CHAPTER 5

### ECA RESOURCE (TIME) MODEL

5-1. The following model has been developed to assist proponent service schools in estimating time (man-hour) requirements to conduct a specific ECA application. The key elements and their functional relationships are based on previous ECA application results.

a. This model is applicable for estimating ECA time requirements under the following assumptions:

(1) MOS task inventories, and task and learning analyses are not readily available.

(2) 10 SME's per MOS are surveyed.

(3) The ratio of "high driver" tasks to total tasks is 2 per 100.

b. The estimates produced from this model should be used for preliminary planning purposes only.

c. ECA Time Requirement (ECATR).

(1)  $ECATR = w + .5x + 8y + 13.3z + 51$

(2) ECATR = ECA Time requirement.

(3) w = # of data sources used (other than SME input).

(4) x = # of tasks evaluated.

(5) y = # of MOS involved.

(6) z = # of high drivers expected.

5-2. A step by step time requirement estimate illustrates the flexibility associated with this model.

a. Step 1. Initiation. The time associated with Step 1 depends on the amount of knowledge brought into the initiation session/discussion (approximately 1-8 man-hours).

b. Step 2. Identify relevant MOS. This is a direct outcome of Step 1 decisions. (1 mh)

c. Step 3. Develop Task List. The time associated with Step 3 depends on the number of tasks involved and the availability of MOS task inventories. If task inventories/lists must be compiled approximately 15 minutes/task will be required.

If MOS task inventories/lists are available, all that remains to be done in Step 3 is to have SME's validate the inventories.

d. Step 4. Collect Data. The time associated with Step 3 is dependent on the number of tasks involved. Approximately 7 minutes per task is required to administer and complete the SME questionnaires. An additional 2 hours is required for file search for other possible data sources.

e. Step 5. Assign values to task criteria. The time requirement associated with this step depends on the number of other data sources available. Approximately 1 hour per data source (other than SME) is required.

f. Step 6. Calculate the ECA task score. The time associated with this step is also dependent on the number of tasks. Approximately 8 minutes per task is required to compute task scores.

g. Step 7. Identify "High Drivers". The time requirement for this step is dependent of the number of ECA task scores above the high driver cutoff score. Approximately 30 minutes per potential high driver is spent to validate "high driver" status.

h. Step 8. Conduct Task Analysis. The time requirement associated with this step is dependent on the number of validated high driver tasks. Approximately 8.4 man-hours are required per high driver.

i. Step 9. Conduct Learning Analyses. The time associated with this step is also dependent on the validated high driver tasks. Approximately 3.4 man-hours are required per high driver.

j. Step 10. Identify Deficiencies. The time requirement for this step is dependent on the number of validated high drivers and the number of MOS involved. Approximately 1 hour per high driver and 4 hours per MOS is required.

k. Step 11. Determine Solutions. The time requirement for step 11 is also dependent on the number of MOS. Approximately 4 hours per MOS is required.

l. Step 12. Prepare Report. The time requirement for this step depends on the results of each of the previous 11 steps. Time estimates may range from 16-40 manhours.

5-3. The proportion of SME, Non-SME (other professional) involvement and administrative time is provided to assist proponents in assessing the feasibility of contracting an ECA:



	<u>SME</u>	<u>NSME</u>	<u>Admin</u>	<u>Total</u>
Step 1	1-8	0	0	1-8
Step 2	1	0	0	1
Step 3	.03x	.17x	.05x	.25x
Step 4	.10x	.02x	2	.12x + 2
Step 5	0	w	0	w
Step 6	0	0	.13x	.13x
Step 7	.50x	0	0	.50x
Step 8	.40x	4x	4x	8.40x
Step 9	.40x	2.50x	.50x	3.40x
Step 10	0	x	4y	x + 4y
Step 11	4y	0	0	4y
Step 12	0	8-16	8-24	16-40

- a.  $SME = .13x + 4y + 1.3z + 9$
- b.  $NSME = w + .19x + 7.5z + 16$
- c.  $Admin = .18x + 4y + 4.50z + 26$
- d.  $ECATR = SME + NSME + ADMIN$   
 $= w + .5x + 8y + 13.3z + 51$

**5-4. EXAMPLE: Studied Equipment: System XXX**

w = # of data sources used (other than SME) = 2

x = # of tasks evaluated = 500

y = # of MOS involved = 4

z = # of high drivers expected = 10

a.  $ECATR = w + .5x + 8y + 13.3z + 51$   
 $= 2 + .5(500) + 8(4) + 13.3(10) + 51$

$$= 2 + 250 + 32 + 133 + 51$$

$$= 468 \text{ manhours}$$

b.  $SME = .13x + 4y + 1.3z + 9$

$$= .13(500) + 4(4) + 1.3(10) + 9$$

$$= 65 + 16 + 13 + 9$$

$$= 103 \text{ manhours}$$

c.  $NSME = w + .19x + 7.5z + 16$

$$= 2 + .19(500) + 7.5(10) + 16$$

$$= 2 + 95 + 75 + 16$$

$$= 188 \text{ manhours}$$

d.  $Admin = .18x + 4y + 4.50z + 26$

$$= .18(500) + 4(4) + 4.50(10) + 26$$

$$= 90 + 16 + 45 + 26$$

$$= 177 \text{ manhours}$$

## **CHAPTER 6**

### **ECA DOCUMENTATION**

6-1. The Early Comparability Analysis methodology, like any scientific study, should be thoroughly documented. Appendices A, B, and C contain sample notification, report, and control/information formats. While the formats are not all inclusive, they have been found useful in documenting the application of an Early Comparability Analysis. The formats provided are intended to serve as guides, not requirements, and may be modified as necessary.

#### **a. Notification Documents**

- (1) Notification to USASSC-NCR/TRADOC (Mandatory)
- (2) Notification to other staff agencies
- (3) Notification to other proponents

#### **b. Report Documents**

- (1) Executive Summary
- (2) Study Scope
- (3) Study Limitations
- (4) Sources
- (5) Questionnaire Cover Letter
- (6) Task List
- (7) SME Questionnaire
- (8) Task Scores
- (9) MPT Constraints
- (10) Manpower Status
- (11) MOS Requirement Projections
- (12) Retention Data
- (13) Accessions Over Time (Quality Distribution)
- (14) Accessions Over Time (Mental Categories)
- (15) Accessions Over Time (Aptitude Indicators)

- (16) Accessions Over Time (Education/Gender)
- (17) Manpower Requirement Projections
- (18) EMF Data
- (19) POI Extract

c. Optional Control/Informational Documents

- (1) Study Milestones
- (2) Resource Requirements
- (3) Problems Encountered Worksheet

## **APPENDIX A**

### **EARLY COMPARABILITY ANALYSIS**

#### **NOTIFICATION DOCUMENTS**

- A-2 .... Notification to USASSC-NCR/TRADOC (Mandatory)**
- A-3 .... Notification to other staff agencies**
- A-4 .... Notification to other proponents**

LETTERHEAD

OFFICE SYMBOL

DATE

SUBJECT: Early Comparability Analysis (ECA)

THRU: Commander  
USASSC-NCR  
ATTN: ATNC-NMF-C  
200 Stovall St.  
Alexandria, VA 22332-0400

TO: Commander  
TRADOC  
ATTN: ATCD-SP  
Ft. Monroe, VA 23651-5000

1. The (insert name of system or equipment) has been identified as inadequate to meet the Army's needs.
2. An ECA will be initiated o/a (date) and is estimated to be completed o/a (date). Attached is a tentative list of all predecessor/reference components to be studied. A milestone chart will be forwarded under separate cover along with the relevant information pertaining to the ECA.
3. POC for this ECA is .

FOR THE COMMANDER/COMMANDANT:

NOTE: It is a mandatory requirement to notify USASSC-NCR that an ECA has been initiated.

LETTERHEAD

OFFICE SYMBOL

DATE

SUBJECT: ECA Application on \_\_\_\_\_.

TO:

1. The (Piece of Equipment) has been identified as inadequate to meet the needs of the Army. It is our intent to initiate an Early Comparability Analysis. The following components/systems and MOS have been identified for study:

MOS

COMPONENT

2. The following support is required for this ECA application:

- a. DCD:
- b. DOTD:
- c. DOES:
- d. Proponency Office:
- e. Weapons Dept:

3. The Lead Combat Developer for this ECA application is \_\_\_\_\_.

Signature Block

LETTERHEAD

OFFICE SYMBOL

DATE

SUBJECT: Requirement for an ECA

Commandant

-----  
-----  
-----

1. The ----- has been identified as inadequate to meet needs of the Army. As a result, it is our intent to conduct an Early Comparability Analysis.

2. The following predecessor/reference components and MOS have been identified for study:

- a. Predecessor components:
- b. Reference components:
- c. MOS:

3. Request you conduct an ECA (Steps 3 through 12) on the following and forward the results to this headquarters NLT -----:

MOS	COMPONENTS
-----	------------

4. The Lead Combat Developer for this ECA application is -----.

FOR THE COMMANDER/COMMANDANT:

Signature Block



## **APPENDIX B**

### **EARLY COMPARABILITY ANALYSIS**

#### **REPORT DOCUMENTS**

B-2 .... Executive Summary  
B-3 .... Study Scope  
B-4 .... Study Limitations  
B-5 .... Sources  
B-6 .... Questionnaire Cover Letter  
B-7 .... Task List  
B-8 .... SME Questionnaire  
B-10 ... Task Scores  
B-11 ... MPT Constraints  
B-13 ... Manpower Status  
B-14 ... MOS Requirement Projections  
B-15 ... Retention Data  
B-16 ... Accessions Over Time (Quality Distribution)  
B-17 ... Accessions Over Time (Mental Categories)  
B-18 ... Accessions Over Time (Aptitude Indicators)  
B-19 ... Accessions Over Time (Education/Gender)  
B-20 ... Manpower Requirement Projections  
B-21 ... EMP Data  
B-22 ... POI Extract

## **EXECUTIVE SUMMARY**

**I. Introduction.**

**II. Methodology.**

**III. Findings.**

**IV. Conclusions.**

**V. Recommendations.**

**NOTE:** The purpose of the executive summary is to provide highlights of the ECA report to management level personnel. It should include "high driver" tasks requiring a design solution; proposed changes to manpower, personnel, and training; significant manpower, personnel, and training constraints; a brief summary of the conduct of the analysis and problems encountered; and a short statement on the uses of the ECA report.

## STUDY SCOPE

<u>JOB/DUTY AREAS</u>	<u>RADAR TASKS</u>	<u>UTL TASKS</u>	<u>M915 TASKS</u>
OPERATOR	237*	28	34
OPERATOR MAINTENANCE		24	35
MAINTENANCE/REPAIR	74	327	236
 TOTAL	 311	 379	 305

### MOSs STUDIED

PATRIOT RADAR	24T	PATRIOT OPERATOR & SYSTEM MECHANIC
UNIVERSAL TRANSPORTER-LOADER	28M	BALLISTIC MISSILE MAINTEN- ANCE SPECIALIST
M915 TRACTOR	63S	HEAVY WHEEL VEHICLE MECHANIC
	64C	MOTOR TRANSPORT OPERATOR

\* Operator/Operator Maintenance tasks combined.

## STUDY LIMITATIONS

- o Complete task lists not available.
- o Limited SMEs available.
- o Data, other than SME opinion, not available.
- o
- o
- o

NOTE: It is recommended that this document be prepared at the end of the ECA application.

## **SOURCES**

### **TASK LISTS**

#### **PATRIOT RADAR**

**Logistic Support Analysis Records**

#### **UNIVERSAL TRANSPORTER-LOADER**

**Subject Matter Expert input  
Various NICON, BNDSOM & SAFEGUARD Systems Command  
documents**

#### **M915 TRACTOR**

**Army Occupational Surveys for MOSs 63S and 64C  
Subject Matter Expert input**

### **TASK CRITERIA DATA**

#### **PATRIOT RADAR**

**Critical Task Selection Board results  
Logistic Support Analysis Records  
Responses from 10 Subject Matter Experts**

#### **UNIVERSAL TRANSPORTER-LOADER**

**Responses from 12 Subject Matter Experts**

#### **M915 TRACTOR**

**Responses from 7 Subject Matter Experts**

**(SME Questionnaire Cover Letter)**

**MIAI PRODUCT IMPROVEMENT SURVEY**

1. The US Army Armor School is conducting a study for future improvements on the MIAI tank. This study, an Early Comparability Analysis (ECA), is a tool designed to aid in the timely and effective introduction of manpower, personnel and training considerations early in the materiel acquisition process. It is a "lessons learned" approach to the design of a future weapon system. The study attempts to identify and "fix" problems associated with currently fielded materiel and is based partially on information provided by experts from the field.

2. You, as a result of your experience, have been selected as a Subject Matter Expert. Your "hands on" experience is very important to us and we would appreciate your cooperation in answering the survey as accurately as possible. The answers you provide will have a direct influence on future product improvements on the MIAI system. Selected components that are currently being studied are:

M1 Commanders Weapon Station  
M1 Laser Rangefinder  
M1 Night Passive Viewer

3. Please respond based on the average soldier in the proper MOS and skill level that you have observed. In addressing time to train, we do not mean time allocated to train but rather the actual time required to train. If you have any comments, add them at the end of the questionnaire.

4. The results of the survey are strictly confidential. Your response will in no way be attributed to you by name. Therefore, we ask for your honest evaluation on each of the tasks.

5. We appreciate your time and cooperation in completing this survey. Your honest responses will help provide important information needed to make far reaching decisions in the MIAI Product Improvement Program.

# **COMPLETE TASK LIST BY MOS AND COMPONENT**

## **M1A1 ABRAMS TANK**

### **REPAIR TASKS**

#### **MOS 45E**

**Component: Commander's Weapon Station.**

**Reference: TM9-2350-255-20-2-3-1**

1. Remove/Install linear-rotar rollers and flat belt.
2. Remove/Install motor-brake remote handle mount assembly and leaf spring detent.
3. Remove/Install stud, washer and helical spring.
4. Remove/ Install gearbox assembly.
5. Remove/Install connector switch and electrical bracket.
6. Remove/Install guard, leaf spring, and gear shift clamp.
7. Remove/Install rollers.
8. Remove/Install connecting link, rod end connector, and knob.
9. Remove/Install tape drive wheel.
10. Replace commander's control handle.
11. Replace control handle push button.

**Component: Commander's Extension, Gunner's Primary Sight**

**Reference: TM 9-2350-255-20-2-3**

1. Remove/Install headrest assembly.
2. Replace bracket slide.
3. Replace lock-release lever.

## ECA SME QUESTIONNAIRE

CONTROL NUMBER \_\_\_\_\_

MOS 45E

**AL TIME TO COMPLETE SURVEY** \_\_\_\_\_

**COMMANDERS WEAPON STATION:**

## AZIMUTH DRIVE SYSTEM

TM 9-2350-255-20-2-3-1

1. Remove/Install linear-rotar rollers and flat belt.
2. Remove/Install motor-brake remote handle mount assembly, and leaf spring detent.
3. Remove/Install stud, washer and helical spring.
4. Remove/Install gearbox assembly.  
Remove/Install connector-switch and electrical bracket.
6. Remove/Install guard, leaf spring, and gear shift clamp.
7. Remove/Install rollers
8. Remove/Install connecting link, rod end connector, and knob.
9. Remove/Install tape drive wheel.
10. Replace commander's control handle.
11. Replace control handle push button.

**COMMANDER'S WEAPON STATION POWER CONTROL UNIT**

12. Remove/Install power control unit 1A230 and bracket assembly.
13. Replace electrical cover.

UNDER'S WEAPON STATION HATCH AND MECHANISM  
PLY. TH 9-2350-255-20-2-3-2

- 1 Remove/Install vehicle hatch door and yoke assembly.

A. PERSONAL PERSONALITIES	
1 = 1-212	
2 = 21-102	
3 = 11-712	
4 = 71-102	
B. THE PERSONALITY DIFFICULTY	
1 = Not difficult	
2 = Somewhat difficult	
3 = Moderately difficult	
4 = Very difficult	
C. FREQUENCY RATE	
1 = Seldom (never)	
2 = Occasionally (seldom)	
3 = Often (sometimes)	
4 = Frequently (often)	
D. THE LEADERSHIP DIFFICULTY	
1 = Not difficult	
2 = Somewhat difficult	
3 = Moderately difficult	
4 = Very difficult	
E. TIME TO LEAD	
1 = Less than 3 hours	
2 = 3 hours or more but less than 4	
3 = 4 hours or more but less than 5	
4 = 5 hours or more	



## 45E page

CONTROL NUMBER \_\_\_\_\_

MOS 45E

AL TIME TO COMPLETE SURVEY \_\_\_\_\_

17. Remove/Install hatch lock handle.
18. Remove/Install cushioning pad and hatch cover block.
19. Replace hatch door rubber special seal.
20. Replace seal wiper.
21. Replace sleeve bearings.
22. Replace collar and hatch hinge plate.
23. Replace eye bolt.
24. Replace hatch door tilt stop.

COMMANDER'S WEAPON STATION MANUAL DRIVE ASSEMBLY  
M 9-2350-255-20-2-3-3

25. Remove/Install manual drive assembly.
26. Remove/Install control assembly, remote control lever, and bracket.
27. Remove/Install knob and handwheel.
28. Replace safety decal.
29. Replace trigger wire rope assembly.
30. Adjust trigger wire rope assembly for commander's weapon.
- Adjust trigger wire rope assembly for commander's alternate weapon.

A. FREQUENCY OF OCCURRENCE		B. TASK PERFORMANCE DIFFICULTY		C. FREQUENCY OF USE		D. TASK LEARNING DIFFICULTY		E. TIME TO LEARN	
1	1-232	1	Not difficult	1	Seldom (annually)	1	Not difficult	1	Less than 3 hours
2	24-502	2	Somewhat difficult	2	Occasionally (several times a year)	2	Somewhat difficult	2	3 hours or more but less than 6
3	51-752	3	Moderately difficult	3	Often (monthly)	3	Moderately difficult	3	6 hours or more but less than 9
4	76-1002	4	Very difficult	4	Frequently (weekly/daily)	4	Very difficult	4	More than 9

# ECA TASK SCORES (SORTED)

PRF	TDP	FR	TLD	MOS TT	45K DR	Task #	Task Score
2.54	2.08	2.15	2.31	2.23	2.38	-> Task # 34	139.40
1.92	2.77	1.15	2.54	3.15	2.54	-> Task # 18	124.88
1.85	2.38	1.69	2.08	2.69	2.38	-> Task # 32	99.34
2.27	2.33	1.87	2.40	2.00	1.93	-> Task # 11	91.62
2.33	2.33	1.50	2.08	2.33	2.25	-> Task # 42	89.32
2.67	1.60	2.47	1.73	2.07	2.07	-> Task # 1	77.92
2.07	2.29	1.71	2.07	2.00	2.29	-> Task # 26	76.86
2.07	2.21	1.64	2.21	2.07	2.14	-> Task # 12	74.06
2.29	1.93	1.86	2.07	2.00	2.07	-> Task # 40	70.25
1.80	2.33	1.80	2.20	2.00	2.00	-> Task # 5	66.53
2.17	2.33	1.50	2.08	1.92	2.08	-> Task # 43	63.08
2.43	2.07	1.36	1.93	2.36	1.79	-> Task # 35	55.42
2.08	2.08	1.69	1.69	2.15	1.92	-> Task # 31	51.17
1.69	2.23	1.23	2.15	2.31	2.08	-> Task # 17	47.96
2.07	1.86	1.64	1.71	1.86	2.29	-> Task # 27	45.99
2.08	2.00	1.62	1.62	2.08	2.00	-> Task # 30	45.02
2.07	1.79	1.64	1.79	2.00	1.93	-> Task # 37	41.86
1.86	2.00	1.57	1.93	1.86	1.79	-> Task # 13	37.33
1.38	1.92	1.54	1.92	2.15	2.15	-> Task # 33	36.55
2.33	2.07	1.47	1.67	1.67	1.73	-> Task # 7	34.05
1.53	2.07	1.40	1.93	2.00	1.93	-> Task # 14	33.16
1.64	2.14	1.29	1.79	1.85	1.92	-> Task # 4	28.70
2.60	1.60	1.93	1.47	1.40	1.73	-> Task # 3	28.62
2.07	1.64	1.71	1.57	1.71	1.79	-> Task # 21	28.06
2.00	1.69	1.77	1.54	1.38	2.08	-> Task # 25	26.49
1.23	1.92	1.23	1.92	2.54	1.85	-> Task # 29	26.25
2.00	1.57	1.93	1.57	1.29	1.93	-> Task # 28	23.62
2.21	1.57	1.43	1.57	1.50	1.85	-> Task # 41	21.76
2.00	1.79	1.57	1.43	1.50	1.79	-> Task # 22	21.48
1.93	1.64	1.71	1.57	1.50	1.64	-> Task # 24	21.03
2.21	1.50	1.57	1.43	1.43	1.64	-> Task # 23	17.50
1.93	1.86	1.14	1.71	1.57	1.57	-> Task # 8	17.33
2.07	1.64	1.43	1.64	1.43	1.50	-> Task # 36	17.11
2.33	1.67	1.87	1.33	1.13	1.47	-> Task # 2	16.09
2.07	1.50	1.43	1.43	1.50	1.64	-> Task # 20	15.63
2.13	1.47	1.60	1.33	1.33	1.33	-> Task # 10	11.87
2.07	1.21	1.71	1.21	1.14	1.64	-> Task # 6	9.83
2.07	1.20	1.73	1.13	1.27	1.50	-> Task # 19	9.26
1.50	1.50	1.17	1.42	1.42	1.67	-> Task # 44	8.78
2.00	1.21	1.21	1.21	1.21	1.21	-> Task # 9	5.28
2.08	1.08	1.15	1.08	1.15	1.08	-> Task # 38	3.45
2.00	1.14	1.14	1.00	1.00	1.14	-> Task # 15	2.99
1.92	1.15	1.08	1.00	1.15	1.08	-> Task # 16	2.97
1.92	1.08	1.08	1.08	1.08	1.08	-> Task # 39	2.79

## MPT CONSTRAINTS

1. Manpower requirements for the (Equipment System) cannot exceed those for the (Equipment System) which are:

**Crew - MOS 11S: 3 men per vehicle**

**Organizational Maintenance - MOS 45A: 1 per 20 vehicles**

**MOS 63A: 1 per 5 vehicles**

**DS/GS Maintenance - MOS 31A: 1 per 50 vehicles**

**MOS 45Y: 1 per 30 vehicles**

**MOS 63B: 1 per 15 vehicles**

- 2. See report for:**

- a. Total MOS authorizations - current and projected.

- b. Selected representative MTOEs.**

## PERSONNEL

1. Personnel requirements for the (Equipment System) cannot exceed those for the (Equipment System) which are:

MOS	CAT I-IIIA	CAT IIIB	CAT IV
11S	65%	25%	10%
45A	50%	35%	15%
63A	50%	30%	20%
31A	65%	30%	5%
45Y	50%	35%	15%
63B	40%	35%	25%

MOS	APTITUDE AREA	MINIMUM SCORE	PULHES
11S	CO	95	111111
45A	GM	95	122221
63A	MM	90	222221
31A	EL	100	222211
45Y	GM	95	222221
63B	MM	85	222221

MOS	EDUCATIONAL
11S	None
45A	HSG
63A	None
31A	HSG; Algebra
45Y	HSG
63B	None

- 2. See report for:**

- a. Quality of accessions.

- b. Quality of EMF.

- c. Quality Distribution - FY \_\_\_\_\_.

- d. Current AR 611-201 requirements.

- e. Current REQUEST requirements.

## **TRAINING**

1. Tasks requiring institutional training cannot exceed ----- classroom hours.
2. Student/instructor ratio cannot exceed -----.
3. See report for current POI.

# MANPOWER STATUS

As of Date

		SL1	SL2	SL3	TOTAL
*****					
41C	AUTH	247	98	64	409
	ASGN	350	83	54	487
	%	142%	85%	84%	119%
*****					
45E	AUTH	219	113	NA	332
	ASGN	194	78	NA	272
	%	89%	69%	NA	82%
*****					
45G	AUTH	143	77	39	259
	ASGN	130	63	39	232
	%	91%	82%	100%	90%
*****					
45K	AUTH	736	289	347	1372
	ASGN	806	258	341	1405
	%	110%	89%	98%	102%
*****					

SL = SKILL LEVEL

DATE: 30 OCTOBER 1985

UNCLASSIFIED

FORCE STRUCTURE AND PERSONNEL REQUIREMENTS DIRECTORATE  
U.S. ARMY SOLDIER SUPPORT CENTER - NATIONAL CAPITAL REGION  
FORECAST - PERSONNEL AUTHORIZATION MODULE (PAH)

FUNCTIONAL REVIEW REPORT

DATABASE : CAUD8

MOS BY GRADE: MULTI-YEAR BREAKOUT (FRR02)

SELECTION CRITERIA: MPC-E MOS= 41C 45E 450 45K

MOS	GRADE	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92	DELTA	DELTA	%DELTA
41C	E7	0	0	1	1	1	1	1	1	+1		N/A
	E6	64	47	37	36	37	37	37	37	-27		-42.2%
	E5	95	92	77	76	74	74	74	74	-21		-22.1%
	E4	159	158	138	135	134	134	134	134	-25		-15.7%
	E3	84	82	58	60	59	59	59	59	-25		-29.8%
MOS TOTALS		402	379	311	310	305	305	305	305	-97		-24.1%
45E	E5	113	136	159	195	215	244	244	244	+131		+115.9%
	E4	125	173	219	265	292	328	329	329	+204		+163.2%
	E3	106	143	183	220	239	268	268	268	+162		+152.8%
MOS TOTALS		344	452	561	680	746	840	841	841	+497		+144.5%
45G	E6	41	41	42	43	43	43	43	43	+2		+4.9%
	E5	68	69	59	59	58	58	58	58	-10		-14.7%
	E4	138	136	131	131	130	130	130	130	-8		-5.8%
	E3	6	3	5	5	3	3	3	3	-3		-50.0%
MOS TOTALS		253	249	237	238	234	234	234	234	-19		-7.5%
45K	E6	337	365	350	353	353	353	353	353	+16		+4.7%
	E5	265	265	268	266	267	267	267	267	+2		+0.8%
	E4	317	323	317	303	306	306	306	306	-11		-3.5%
	E3	397	406	410	398	387	387	387	387	-10		-2.5%
MOS TOTALS		1316	1359	1345	1310	1313	1313	1313	1313	-3		-0.2%

PANFRS-PANFR02

UNCLASSIFIED

## RETENTION DATA

As of Date

## RETENTION RATES

MOS	1ST Turners	Mid-Turners	Careerists
41C	40%	68%	95%
45E	37%	67%	-
45G	26%	93%	60%
45K	44%	81%	96%
ARMY-WIDE	44%	77%	96%

# ACCESSIONS OVER TIME

As of Date

## QUALITY DISTRIBUTION

		1980	1981	1982	1983	1984	1985	1986
MOS	CATEGORY	(&)						
41C	I-IIIA	14	14	27	49	65	42	43
45E	I-IIIA	-	50	42	57	72	43	37
45G	I-IIIA	-	-	77	50	76	54	38
45K	I-IIIA	46	37	52	64	71	61	50

41C	IIIB-IV	87	84	73	51	35	58	57
45E	IIIB-IV	-	50	58	42	28	57	63
45G	IIIB-IV	-	-	22	49	25	46	62
45K	IIIB-IV	55	63	48	36	31	38	50

NOTE: Data listed for FY 86 represents the USAREC production mission



# ACCESSIONS OVER TIME

As of Date

## MENTAL CATEGORIES

		1980	1981	1982	1983	1984	1985
41C	CAT I	0%	1%	1%	2%	5%	2%
41C	CAT II	4%	6%	14%	24%	25%	8%
41C	CAT IIIA	10%	7%	12%	23%	35%	32%
41C	CAT IIIB	58%	23%	26%	37%	31%	44%
41C	CAT IVA	19%	36%	24%	13%	4%	14%
41C	CAT IVB	10%	25%	23%	1%	0%	0%
AFQT	MEAN	37	32	39	50	55	46
45E	CAT I	-	0%	0%	0%	3%	3%
45E	CAT II	-	25%	13%	30%	32%	18%
45E	CAT IIIA	-	25%	29%	27%	37%	22%
45E	CAT IIIB	-	30%	46%	21%	27%	50%
45E	CAT IVA	-	15%	8%	21%	1%	7%
45E	CAT IVB	-	5%	4%	0%	0%	0%
AFQT	MEAN	-	48	47	52	57	50
45G	CAT I	-	-	5%	6%	4%	5%
45G	CAT II	-	-	50%	13%	37%	25%
45G	CAT IIIA	-	-	22%	31%	35%	24%
45G	CAT IIIB	-	-	19%	42%	20%	41%
45G	CAT IVA	-	-	3%	6%	5%	5%
45G	CAT IVB	-	-	0%	1%	0%	0%
AFQT	MEAN	-	-	63	52	61	54
45K	CAT I	1%	1%	1%	1%	2%	1%
45K	CAT II	16%	18%	24%	29%	32%	32%
45K	CAT IIIA	29%	18%	27%	34%	35%	28%
45K	CAT IIIB	50%	44%	28%	33%	26%	32%
45K	CAT IVA	4%	13%	16%	3%	5%	6%
45K	CAT IVB	1%	6%	4%	0%	0%	0%
AFQT	MEAN	51	46	50	56	57	56

## ACCESSION OVER TIME

As of Date

## APTITUDE INDICATORS

			1980	1981	1982	1983	1984	1985
	area							
41C	GN	80-84	0%	1%	0%	0%	0%	0%
		85-89	0%	36%	0%	0%	1%	0%
		90-94	65%	35%	41%	46%	42%	14%
		95-99	23%	14%	26%	14%	7%	29%
		100-104	6%	7%	13%	17%	15%	24%
		105-110	4%	2%	6%	7%	11%	18%
		111-114	0%	1%	3%	3%	5%	4%
		115-119	1%	1%	5%	6%	8%	2%
		120-160	0%	2%	6%	7%	10%	8%
	AA MEAN		94	93	99	100	102	103
45E	NH	80-84	-	0%	0%	0%	0%	0%
		85-89	-	6%	0%	3%	0%	0%
		90-94	-	17%	0%	0%	1%	0%
		95-99	-	28%	26%	33%	23%	4%
		100-104	-	0%	26%	21%	17%	32%
		105-110	-	17%	4%	15%	22%	21%
		111-114	-	11%	22%	4%	14%	4%
		115-119	-	17%	17%	3%	9%	12%
		120-160	-	6%	4%	15%	13%	28%
	AA MEAN		-	104	107	106	108	112
45G	EL	80-84	-	-	0%	0%	0%	0%
		85-89	-	-	0%	0%	0%	0%
		90-94	-	-	0%	0%	0%	0%
		95-99	-	-	7%	30%	18%	19%
		100-104	-	-	14%	30%	24%	31%
		105-110	-	-	28%	16%	12%	21%
		111-114	-	-	17%	7%	10%	10%
		115-119	-	-	16%	4%	17%	5%
		120-160	-	-	19%	7%	19%	14%
	AA MEAN		-	-	112	106	110	107
45K	GM	80-84	0%	0%	0%	0%	0%	0%
		85-89	0%	0%	0%	1%	0%	0%
		90-94	0%	0%	0%	0%	0%	0%
		95-99	1%	31%	30%	24%	28%	6%
		100-104	30%	29%	27%	26%	26%	24%
		105-110	35%	16%	18%	21%	16%	23%
		111-114	11%	8%	8%	5%	10%	14%
		115-119	10%	6%	7%	13%	10%	16%
		120-160	13%	9%	4%	10%	10%	17%
	AA MEAN		109	111	106	107	106	111

# ACCESSIONS OVER TIME

As of Date

## EDUCATION/GENDER

	1980	1981	1982	1983	1984	1985
41C HSG	75%	90%	88%	96%	94%	84%
41C GED	1%	2%	2%	2%	1%	8%
41C NON-HSG	23%	7%	10%	2%	5%	8%
MALE	64%	77%	90%	75%	65%	92%
FEMALE	36%	23%	10%	25%	35%	8%
45E HSG	-	65%	67%	67%	92%	86%
45E GED	-	5%	8%	12%	3%	5%
45E NON-HSG	-	30%	25%	21%	5%	9%
MALE	-	100%	100%	100%	100%	100%
FEMALE	-	0%	0%	0%	0%	0%
45G HSG	-	-	86%	86%	92%	86%
45G GED	-	-	7%	3%	5%	7%
45G NON-HSG	-	-	7%	9%	4%	7%
MALE	-	-	98%	97%	100%	97%
FEMALE	-	-	2%	3%	0%	3%
45K HSG	26%	53%	68%	82%	74%	91%
45K GED	7%	5%	8%	5%	7%	2%
45K NON-HSG	67%	42%	23%	13%	19%	7%
MALE	93%	93%	95%	90%	89%	97%
FEMALE	7%	7%	5%	10%	11%	3%

**NANPOWER REQUIREMENT PROJECTIONS  
FY - END**

<b>MOS</b>	<b>SK</b>	<b>FY86</b>	<b>FY87</b>	<b>FY88</b>	<b>FY89</b>	<b>FY90</b>
<b>11S</b>	<b>1</b>	<b>11,111</b>	<b>12,222</b>	<b>12,222</b>	<b>12,111</b>	<b>12,111</b>
	<b>2</b>	<b>5,000</b>	<b>5,555</b>	<b>5,555</b>	<b>5,222</b>	<b>5,222</b>
	<b>3</b>	<b>1,000</b>	<b>1,000</b>	<b>1,000</b>	<b>1,000</b>	<b>1,000</b>
	<b>4</b>	<b>600</b>	<b>600</b>	<b>600</b>	<b>600</b>	<b>600</b>
<b>45A</b>	<b>1</b>	<b>750</b>	<b>800</b>	<b>800</b>	<b>800</b>	<b>800</b>
	<b>2</b>	<b>500</b>	<b>510</b>	<b>510</b>	<b>510</b>	<b>510</b>
<b>63A</b>	<b>1</b>	<b>900</b>	<b>950</b>	<b>950</b>	<b>950</b>	<b>950</b>
	<b>2</b>	<b>600</b>	<b>630</b>	<b>630</b>	<b>630</b>	<b>630</b>
<b>31A</b>	<b>1</b>	<b>90</b>	<b>95</b>	<b>95</b>	<b>95</b>	<b>95</b>
	<b>2</b>	<b>40</b>	<b>42</b>	<b>43</b>	<b>43</b>	<b>45</b>
<b>45Y</b>	<b>1</b>	<b>150</b>	<b>175</b>	<b>174</b>	<b>176</b>	<b>180</b>
	<b>2</b>	<b>80</b>	<b>80</b>	<b>80</b>	<b>80</b>	<b>80</b>
	<b>3</b>	<b>30</b>	<b>31</b>	<b>31</b>	<b>31</b>	<b>31</b>
<b>63B</b>	<b>1</b>	<b>700</b>	<b>725</b>	<b>725</b>	<b>730</b>	<b>730</b>
	<b>2</b>	<b>300</b>	<b>310</b>	<b>310</b>	<b>310</b>	<b>315</b>
	<b>3</b>	<b>100</b>	<b>101</b>	<b>101</b>	<b>101</b>	<b>101</b>
	<b>4</b>	<b>34</b>	<b>34</b>	<b>34</b>	<b>34</b>	<b>34</b>

**There are currently no supportability problems identified for any of the listed MOS.**

**NOTE: Available from your proponentcy office or contact USASSC-NCR.**

**EMP DATA  
APTITUDE INDICATORS  
BY DUTY MOS**

MOS	SK	HSG	GED	NHSG	APQT MEAN	AA	MIN SCORE	MEAN
118	1	89%	2%	9%	52.3	CO	95	100.4
	2	88%	1%	11%	50.2			

★  
★  
★  
★  
★  
★  
★  
★  
★  
★  
★  
★

**NOTE:** Available from your proponency office.

**POI EXTRACT  
SPECIFIC TASK TRAINING - APC  
MOS 11B/C**

<b><u>TASK</u></b>	<b><u>TIME TO TRAIN</u></b>
PERFORM A BEFORE & AFTER OPERATIONS CHECK WITH MANUAL AND LOCATE MAJOR COMPONENTS	2.0 HOURS
PERFORM PRE-WATERBORNE CHECKS	1.0 HOUR
OPERATE M113A1 ON LEVEL TERRAIN	1.0 HOUR
REMOVE/INSTALL TRACK SHOE	1.0 HOUR
PERFORM FIELD EXPEDIENT TOWING & RECOVERY	1.0 HOUR
LOCATE & IDENTIFY MAJOR COMPONENTS	1.0 HOUR
PERFORM BEFORE & AFTER PHCS	1.0 HOUR
SUBTOTAL:	8.0 HOURS
TRANSFERRABLE SKILLS:	0.0 HOURS
TOTAL:	8.0 HOURS

**TRAINING INFORMATION TO ALSO INCLUDE:**

CLASS SIZE: MAXIMUM, MINIMUM, OPTIMUM  
 CLASS FREQUENCY  
 STUDENT-INSTRUCTOR RATIO  
 ATTRITION RATE  
 TOTAL COURSE LENGTH  
 TRAINING AIDS/DEVICES/SIMULATORS

## **APPENDIX C**

### **EARLY COMPARABILITY ANALYSIS**

#### **OPTIONAL CONTROL DOCUMENTS**

- C-2 .... Study Milestones**
- C-3 .... Resource Requirements**
- C-4 .... Problems Encountered Worksheet**

## STUDY MILESTONES

<u>STEP</u>	<u>START DATE</u>	<u>MILESTONE DATE</u>	<u>COMPLETION DATE</u>
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

NOTE: This document is intended for in-house use only.



## RESOURCE REQUIREMENTS

A. PERSONNEL:

B. ADMINISTRATIVE SUPPORT:

C. SUPPLIES AND EQUIPMENT:

NOTE: It is recommended that resource requirements be identified at the beginning of an ECA application to preclude later delays.

## PROBLEMS ENCOUNTERED WORKSHEET

A. PROBLEM:

B. DISCUSSION:

C. RECOMMENDATION:

NOTE: This form is intended to record lessons learned information for use in future ECA's.

## **APPENDIX D**

### **EARLY COMPARABILITY ANALYSIS**

#### **ABBREVIATIONS**

## ABBREVIATIONS

ARI	U.S. ARMY INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES
AOSP	ARMY OCCUPATIONAL SURVEY PROGRAM
CD	COMBAT DEVELOPER
ECA	EARLY COMPARABILITY ANALYSIS
HEL	U.S. ARMY HUMAN ENGINEERING LABORATORY
LSAR	LOGISTIC SUPPORT ANALYSIS RECORDS
MAA	MISSION AREA ANALYSIS
MANPRINT	MANPOWER PERSONNEL ACQUISITION
MAP	MATERIEL ACQUISITION PROCESS
MD	MATERIEL DEVELOPER
MOS	MILITARY OCCUPATIONAL SPECIALTY
MPT	MANPOWER, PERSONNEL AND TRAINING
OTEA	U.S. ARMY OPERATIONAL TEST AND EVALUATION AGENCY
PIP	PRODUCT IMPROVEMENT PROGRAM
POI	PROGRAM OF INSTRUCTION
QQPRI	QUALITATIVE AND QUANTITATIVE PERSONNEL REQUIREMENTS INFORMATION
SM	SOLDIERS MANUAL
SME	SUBJECT MATTER EXPERT
SMMP	SYSTEM MANPRINT MANAGEMENT PLAN
DOTD	DIRECTORATE OF TRAINING AND DOCTRINE
TM	TECHNICAL MANUAL
TRADOC	U.S. ARMY TRAINING AND DOCTRINE COMMAND
USAREC	U.S. ARMY RECRUITING COMMAND

## **APPENDIX E**

### **EARLY COMPARABILITY ANALYSIS**

#### **GLOSSARY**

## GLOSSARY

Army Occupational Survey Program (AOSP). With the cooperation of service schools, AOSP compiles data on Military Occupational Specialities (MOSs). Using soldier tasks as the basic units of analysis, data are collected on such variables as percent performing, task learning difficulty and relative time spent. After the survey data have been analyzed, a report on the MOS is prepared.

Combat Developer. Individuals so designated at the user proponent service school and service schools involved in the maintenance and/or repair of the equipment. The CD at the user proponent school is designated as the lead combat developer and will coordinate the overall effort with the CDs at the other service schools and training developers at the user proponent service school.

Cut-off Score. A preestablished value that identifies potential "high drivers".

ECA Task Score. The product of values assigned to each of the task criteria identified during an ECA application. ECA Task Score =  $A \times B \times C \times D \times E \times F$ . An ECA Task Score is calculated for each task associated with operation, maintenance and repair of the predecessor or reference system.

Enlisted Master File. A file which contains personnel record data on every enlisted individual. The ASVAB scores and associated data, for every soldier in a given MOS, can be obtained from this file.

High Driver. A task identified, through analysis of task criteria, as costly in manpower, personnel and training resources. The primary objective of ECA is to aid Combat Developers in identifying "high drivers" requiring a design change so that these tasks can be reduced in number or completely eliminated from new system design. Information from tasks derived from predecessor or reference systems are the key to determining the impact these tasks have on the Army MPT resources.

Learning Analysis. A process of determining knowledge, skills and abilities required to perform each step of a task. This analysis is important for determining manpower, personnel and training deficiencies.

Logistic Support Analysis Report (LSAR). All tasks, required to maintain an equipment system, appear on LSAR worksheets along with the hours needed per task and people needed per task.

**MANPRINT.** A process to identify, address, and impose human factors, manpower, personnel, training, system safety, and health hazard considerations prior to, during, and after the MAP.

**Manpower.** The personnel strength as expressed in terms of the number of men and women authorized and available to the Army.

**Personnel.** Military and civilian persons, of the specific skill levels and grades required to operate and support a system in peacetime and war.

**Predecessor System.** A system or item of equipment that currently exists which has been targeted for replacement or product improvement.

**Qualitative and Quantitative Personnel Requirements Information (QQPRI).** A document which describes the personnel skills and knowledge required to operate and support a specific equipment system. This description includes the MOSs associated with the equipment.

**"Quick Fix".** The use of ECA findings to make MPT changes as rapidly as possible to help ensure that maximum effectiveness of a new system is achieved. It is an interim solution until appropriate design changes can be made on a future product improvement or new acquisition.

**Request for Proposal (RFP).** A solicitation by the U.S. Army to potential contractors for suggested solutions to an equipment requirement. The RFP essentially presents the needs of the Army and a general framework for meeting those needs. Specific solutions are requested.

**Reference System.** A system or components of existing systems which can be found in current inventories to meet or closely approximate mission requirements of a new, proposed system or component.

**Sample Data Collection (SDC).** A method for obtaining information on the performance and maintainability of an item of equipment. Data are obtained directly from observations made in the field. An effort is made to insure that the sample from which the feedback is obtained is representative of the total population.

**Subject Matter Expert (SME).** Usually a non-commissioned officer who has extensive "hands on" experience with the studied equipment, recent unit experience and a background as a trainer/training developer.

**System MANPRINT Management Plan.** The SMMP is the cornerstone of the MANPRINT effort. It is a comprehensive planning and management document that is used by all activities involved in the MAP to insure that MANPRINT issues are addressed throughout the system's life cycle.

**Task.** The simplest level of behavior that describes the performance of a meaningful function in a job under consideration. Tasks are:

- o Observable actions
- o Measurable actions (in terms of performance)
- o Time - rateable (have a definite beginning and end)
- o Actions which take a relatively short time (minutes or hours versus days or weeks)
- o Independent actions

To the extent that individual tasks performed by soldiers are crucial to determination of MPT impact of new system design, these tasks become a common language for combat developers, system designers, training developers and training evaluators.

**Task Analysis.** The process of breaking down a task into its individual steps; identifying the tools used; and defining the conditions and standards under which the steps are performed.

**Task Criteria.** Categories of information about tasks which are either readily available or easily made available. Specific examples of such information are data on percent performing, decay rate, frequency of performance, task learning difficulty, performance difficulty, and time to train.

**Training.** The instruction/teaching of job skills and knowledge to prepare individuals for job performance.

**Training Developer.** Those responsible for development and conduct of training which will provide skills necessary to operate and logistically support materiel systems.

**USAREC Accessions.** The number of soldiers entering the Army that are scheduled to train in specific MOSs. Data, for specific MOS's, are available by distribution of mental category, average AFQT score, aptitude area scores, gender and educational level.