AD-A167 100 METHODOLOGY FOR ABBREVIATED ANALYSES FORMERLY MINI-COST AND OPERATIONAL EFFECTIVENESS ANALYSES ABBREVIATED ANALYSES(U) ARMY SIGNAL CENTER AND FORT GORDON GA 1/1

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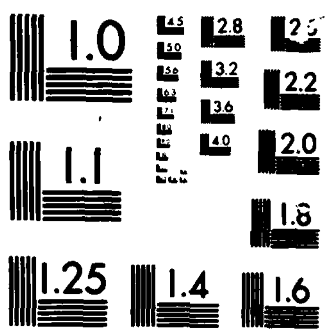
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METHODOLOGY

FOR

ABBREVIATED ANALYSES

FORMERLY

MINI-COST AND OPERATIONAL EFFECTIVENESS ANALYSES

ABBREVIATED ANALYSES

DIRECTORATE OF COMBAT DEVELOPMENTS

USASC&FG

FORT GORDON, GEORGIA

JAN 86

(SUPERSEDES AUG 85 EDITION)

Superseded AD-A161 761

[redacted]

METHODOLOGY

for

Abbreviated Analyses

formerly

Mini-Cost and Operational Effectiveness Analyses

SUPERSEDES AUGUST 85 EDITION

PLEASE NOTE: This Methodology is pending approval and should not be considered as an accepted USASC&FG document.

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JANUARY 86

PREFACE

Although a great deal of guidance is available for full COEAs there is only very limited guidance for Abbreviated Analyses. Proponent schools have developed their own methods and styles to conduct these studies. This document sets forth a standard methodology for Abbreviated Analyses to be used here at the Signal Center. The main resource used for the methodology is a course offered at the U.S. Army Management Engineering Training Activity (USAMETA), Rock Island, Illinois. The course is entitled "Economic Analysis for Decision Making" and consists of two weeks of classroom activities. Any comments or suggestions for this document should be referred to S&A Branch, C&S Div, DCD.

POC: CPT John G. O'Lone, C&S Div, DCD, AV 780-3782

OUTLINE

METHODOLOGY FOR ABBREVIATED ANALYSES

1. GENERAL: Cost and Operational Effectiveness Analyses (COEAs) are required for the evaluation of new materiel systems and are of two types: a COEA and an ABBREVIATED ANALYSIS. An average COEA takes approximately 1 year to complete. An "Abbreviated Analysis", however, is conducted on a much smaller scale and takes approximately one to six months to complete. Concepts and Studies Division, DCD, completes approximately 10 Abbreviated Analyses per year.

2. PURPOSE: The purpose of this document is to establish a standard methodology for Abbreviated Analyses to be used by C&S Div, DCD.

3. REFERENCES:

a. DoD Instruction 7041.3 Economic Analysis and Program Evaluation for Resource Management, dtd 18 Oct 72.

b. AR 71-9.

c. TRADOC Reg 11-8.

d. TRADOC Cost Handbook, dtd 19 May 83 (TRADOC PAM 11-8).

e. "Economic Analysis for Decision Making", Defense Management Joint Course, USAMETA, dtd 9-20 Jan 84.

4. BACKGROUND:

a. The COEA is a study which compares alternative means of reducing or eliminating a deficiency in the force. The alternatives are examined in terms of cost and operational (combat) effectiveness. In accordance with AR 1000-1 and AR 71-9, COEAs are conducted to support the materiel acquisition process for Department of the Army designated major and non-major systems.

b. For the evaluation of materiel systems which are not HQ DA designated major or non-major but still require a Letter Requirement (LR) or Required Operational Capability (ROC) IAW AR 71-9, a COEA will also be conducted. However, these studies, referred to as "Abbreviated Analyses", are sponsored by the proponent school or center and are much more limited in scope. Here at the Signal Center, Concepts and Studies Division, DCD is responsible to perform Abbreviated Analyses to accompany appropriate LRs and ROCs. Abbreviated Analyses are considered part of the materiel development and are not studies covered by AR 5-5 or the provisions of TRADOC Reg 11-8.

c. The guidelines and methodology for conducting a full COEA are given in detail in several official publications to include TRADOC Reg 11-8 and TRADOC PAM 11-8. However, there is very limited guidance given for conducting Abbreviated Analyses, and there is no standard methodology established. This document sets forth a standard methodology for Abbreviated Analyses to promote credibility and uniformity.

5. METHODOLOGY OVERVIEW:

a. Abbreviated Analyses are needed for appropriate requirements documents, Required Operational Capabilities (ROCs) and Letter Requirements (LR). The Abbreviated Analysis is normally prepared as an Annex to the ROC or LR and is needed to complete the requirements document. TRADOC PAM 11-8, points out that an Abbreviated Analysis should be an austere effort documented by a 10-20 page report.

b. Within the Directorate of Combat Developments, Concepts and Studies Division (C&S) is responsible for the development of the Abbreviated Analysis unless otherwise directed. Materiel and Logistics Systems Division (MLSD) provides input in the form of technical performance data for each alternative. MLSD also receives cost estimates on alternatives from the Army Materiel Command (AMC). Thus, the following must be provided or available to C&S personnel before conducting an Abbreviated Analysis for a ROC or LR:

(1) List of alternatives.

(2) Validated cost data for each alternative.

(3) Technical performance data for each alternative.

(4) Supporting available resources to include:

(a) Organizational and Operational Plans (OOP)

(b) Training Manuals (TMs)

(c) Commercial brochures

c. Once the necessary information is available, the Abbreviated Analysis can begin. It is essential to remember that an Abbreviated Analysis is not designed to make a decision, rather it is designed to aid in the decision making process. Thus, the scope of the study should support the final recommendation with the findings and conclusions and not be intended to be biased or "prove a point".

d. The following outline sets forth a logical flow for the Abbreviated Analysis. Although this should be used as a standard outline, it may be necessary at times to add or delete items for discussion based on the unique needs of each study. The methodology for each step in the process is expanded upon following the outline:

ABBREVIATED ANALYSIS
OUTLINE

I. Introduction:

   A. Background
   B. Purpose
   C. References
   D. Limitations/Constraints
   E. Assumptions
   F. Alternatives

II. Performance Analysis:

   A. General
   B. Methodology
   C. Performance of Alternatives (Table/Chart)
   D. Findings

III. Cost Analysis:

   A. General
   B. Methodology
   C. Cost of Alternatives (Table/Chart)
   D. Findings

IV. Comparison of Alternatives:

   A. Performance/Cost Comparisons
   B. Findings

V. Sensitivity Analysis:

   A. General
   B. Uncertainties

VI. Recommendation:

   A. Concluding Remarks
   B. Final Recommendation

6. Abbreviated Analysis Introduction: The introduction for the Abbreviated Analysis should be written in clear and concise terms. It should be informative by allowing someone who is unfamiliar with the study understand the scope and rationale of it. This begins by including a description of background actions which have led up to the need for an Abbreviated Analysis. A good introduction will state the purpose of the study and the references used. Limitations and constraints such as time or budget ceilings should be adequately revealed to the reader. It is important to list assumptions because there is a degree of uncertainty or risk involved. Therefore, assumptions must be clearly identified and justified as to their selection and usage in the study. Finally, an adequate description should be given for each alternative course of action. The status quo is always a course of action even though it may not be desirable.

7. Performance Analysis:

a. General: The performance analysis portion of the Abbreviated Analysis is perhaps the most difficult section because of the degree of subjectivity involved. In essence, the same amount of time spent in developing and analyzing cost data should also be spent in developing and analyzing performance data. However, since cost data is supplied by AMC agencies, the C&S project officer will spend most of his time developing and analyzing performance data. Because of the subjectivity involved, the performance analysis is subject to criticism. However, if the methodology explained in this document is used, it will bring uniformity and a degree of credibility to the study. Although subjectivity can never be totally removed, it can be minimized. This methodology presents a quantification of performance which minimizes subjectivity. Decision makers are now able to concentrate their experience, judgement, intuition and values in the areas where subjectivity cannot be removed.

b. Process: The process for analyzing the performance of alternatives consists of several logical steps:

(1) Identify the performance parameters.

(2) Identify the measurements of performance (MOP).

(3) Quantification of performance.

(4) Calculate overall performance rating.

(a) Identify the performance parameters: Identifying performance parameters is an important basic step which is essential when evaluating operational effectiveness of a system or piece of equipment. It not only includes tangible physical characteristics (i.e., weight, height, etc) but also includes intangible characteristics such as ease of operation. The requirements document will usually list essential characteristics needed for the system. These are the basic performance parameters. It is important to look at all impacting performance parameters, however, it would be worthless to look at irrelevant items which will have no influence on the decision making process. The performance analysis is sometimes referred to as a "benefit analysis". It is similar in meaning because it pertains to identifying the course of action that offers the most benefits. Benefits offered by a course of action can also be performance parameters. For instance, it is beneficial for an antenna to have a low physical profile. This easily translates to a height parameter measured in meters or feet. However, there are some benefits that should not be treated as performance parameters. This is the case when cost savings are misconstrued as benefits. For example, the fact that a piece of equipment may require less operator training time than another, could be translated into a cost savings in manhours. The performance parameter that should be considered is the benefit of training time, measured in hours or days. However, it would be improper to list the benefit of cost savings for manhours, since the dollar amount should be present in the cost analysis. Simply stated, it is important to separate costs and performance data in the Abbreviated Analysis. The mistreatment of cost savings as benefits in the performance analysis will mislead the decision makers. In order to speed up the performance analysis process a generic list of performance parameters is attached at Annex A as an example. This will assist the project officer in identifying those parameters which will have an impact on their particular study.

(b) Identify the measurements of performance (MOP): Since there are many different and unique parameters, there must also be several ways of measuring performance. Such measurements vary from precise quantities of physical output (most objective) to a general description of the parameter (most subjective) as described below. (Annex A also includes examples of MOP) :

1) The most reliable measures to use are raw data. This can be comprised of physical counts of tangible items or a physical measurement (i.e., tons of output, inches, pounds, etc).

2) When it is not possible to use raw data, an index or ratio is the next most accurate measure. This can be in terms of a percentage or fraction.

3) If neither of the above two methods can be used then a rating scale may be devised. This can be a scale such as "rate from one to ten," a nominal rating matched against a checklist of adjectives such as "excellent, fair, poor," or a scale which describes a "better than" or "worse than" rating scheme. These measurements are useful but not as precise as 1 or 2 above.

4) Far less precise are verbal scales. However these can be extremely useful in identifying present level and predicting changes expected from a new program or method.

5) General descriptions are the least useful. However, these still have value in establishing benchmarks for the differences between alternative methods of accomplishing a project.

(c) Quantification of performance: Although particular parameters may be quantifiable in strict, measurable numbers, this still does not establish a value for the performance or for a specific quantity of performance. The process explained below shows how to assign a value on performance. This value is, of course, a subjective characteristic dependent upon the person doing the validation. The following process which, while not removing any of the subjectivity, forces definition and illustration.

1) For each performance parameter, select reasonable, possible minimum and maximum numbers. These will be the limits of parameter measurement within which all alternatives must fit.

2) Assign numerical values of 0 and +1 to the least desirable and the most desirable limit respectively.

3) For each parameter, establish a worth function; the relationship between the quantity or measurement of the parameter and its worth (i.e., does value increase directly with quantity -- is a 10 lbs manportable radio worth twice as much as a 20 lb radio?). This function not only reflects the relative desirability of various quantities of performance, but also the rate of change of desirability.

4) In some cases it may be possible to establish the relationships in a worth function mentally, without drawing the actual curve on paper. However, a depiction of the worth function promotes a better understanding for the project officer and the decision makers. If decision makers are able to review the worth functions they can inject their own viewpoints and see if results change. With this process, the Abbreviated Analysis becomes a valuable tool, with more validity, and less likely to draw criticism.

5) For each level of performance provided by specific alternatives, determine the value of that level from the worth function derived in step 3.

Construction of a worth function is not difficult; it is however, very subjective. For example, one of the primary parameters of any transceiver/receiver (TR) is its range of transmission. Lets say a particular TR has a minimum range of 0 meters and a maximum range of 20 kilometers. There is then a range of capability to be spread over a scale of 0 to +1. Selecting capabilities of 5, 10, and 15 KMs. the analyst will set subjective values -- relative to 0 for 0 KM and +1 for 20 KM. Here, the value is directly proportional to the capability and the values would be .25, .5, and .75 (see Fig. 1a). This may be true when a maximum range of 20 KMs is desirable. However, lets say the need exists for a TR to be used by infiltration forces of platoon size, where a maximum desirable range is 5 KM. Any greater range could easily be monitored by enemy forces posing a great threat. Then the scale will change where a value of 0 is for 0 KM and +1 for 5 KM. The associated values for the range capabilities of the particular TR now change where any range greater the 5 KM is undesirable (See Fig. 1b).

The depiction of these two situations are represented respectively below as worth functions:

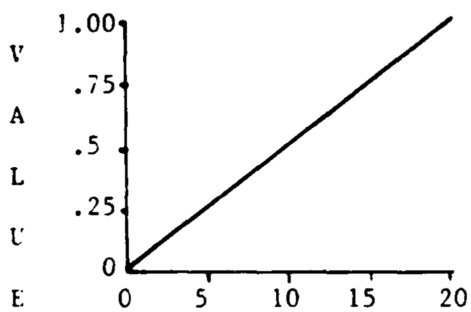


Figure 1a

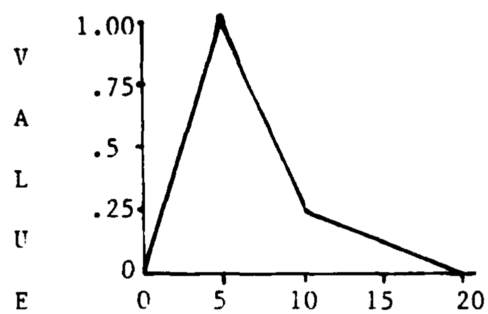


Figure 1b

This process using the worth function presents a method of quantification for performance parameters. A worth function should be established for each impacting parameter. Then alternatives can be evaluated using the worth functions to derive a value associated with each parameter for each alternative. These values are incorporated into the next step for deriving an overall performance rating for an alternative.

d) Calculate overall performance rating: Now that each parameter can be assigned a value we can begin to calculate the overall performance rating of an alternative. However, we cannot simply add up the values and get a total rating. This would assume all parameters have an equal impact on the decision which is almost never the case. Another step must be done. Realizing that some types of parameters will have greater influence than others on a particular decision, the analyst must develop a method of quantifying the degree of influence. One method is by subjectively (again) establishing categories into which each parameter is placed and given a numerical weight corresponding to that category. These categories should be defined in such a manner as to demonstrate each parameter's impact on or assistance in attaining the objective(s) as revealed in the requirements document.

The classification of parameters and numerical weights is shown in Figure 2 below.

WEIGHT	CLASSIFICATION OF PARAMETERS
5	Extremely important: strongly impacting on the capability of attaining a primary objective; mandatory.
4	Important: providing the capability for attainment of a secondary or potential future objective.
3	Desirable: of assistance in progressing toward attainment of goals not directly related to this proposal.
2	Nice-to-have: having favorable effect upon personnel or organizations directly or indirectly related to this proposal.
1	Minimal impact: immaterial to the attainment of current or future objectives; having only moderate impact on personnel or organizations related to this proposal.

Figure 2

Once each parameter has been valuated and weighed, derivation of total scores for the alternatives is easily accomplished. Each parameter value is multiplied by its weight and the products are added. These totals are then used to determine the relative ranking of the alternatives and are best depicted in a summary table. This ranking is, of course, from the performance viewpoint only and must still be related to the costs which are incurred with each alternative.

c. Example: The following example illustrates the process for the performance analysis. This simple hypothetical situation presents the need for a new entrenching tool for light forces because the current one is mainly too weak. The E-tool must be compact, sturdy and be carried on a person's web belt without much difficulty. The requirements document calls for these specifications:

(1) The E-Tool must weigh less than 10 lbs.

(2) Folding length must be less than 20 inches.

(3) Desired length when open is 26 inches.

(4) The E-tool must be durable/strong.

(5) Must blend in with camouflage.

(6) Must be able to carry on web belt.

Resources reveal two new E-tools that are possible choices to fulfill this need. Therefore, there are three alternatives; (1) the status quo, (2) E-tool (Type A), (3) E-tool (Type B).

Step 1: The first step calls for an identification of performance parameters. Although there can be many parameters, we will only consider four for illustration purposes. Note that the parameters are also criteria as stated in the requirements document. The performance parameters are:

a. Weight

b. Length when folded

c. Length when open

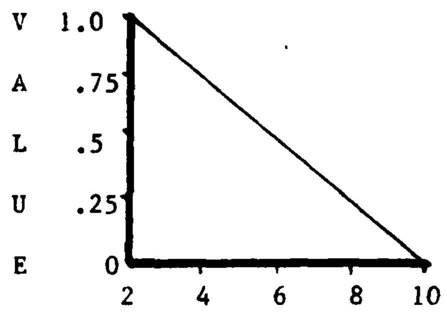
d. Strength

Step 2: Step 2 involves identifying measures of performance for each parameter. This is summarized here:

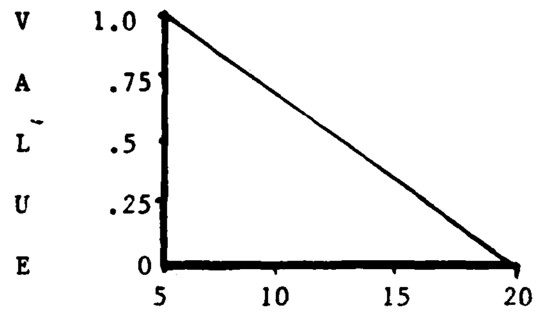
	MOP
a. Weight	Pounds
b. Length when folded	Inches
c. Length when open	Inches
d. Strength	Weak...very strong

Step 3: Step 3 is the development of the worth functions for each parameter. Obviously, the less the E-tool weighs the better. The length, when folded, should be as small as possible. The length, when open, should be long enough for easy handling, but not too long that it becomes awkward. The strength of the E-tool should be as strong as possible. These values are depicted in the worth functions depicted on the next page:

PARAMETER: WEIGHT

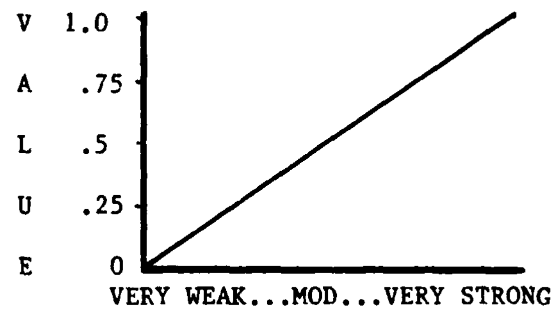


PARAMETER: LENGTH (FOLDED)



PARAMETER: LENGTH (OPEN)

PARAMETER: STRENGTH



We have been supplied by our resources with the following technical data on all three E-tools.

	Status Quo	Type A	Type B
WEIGHT	8 lbs	4 lbs	3.5 lbs
LENGTH (FOLDED)	15 inches	5 inches	7 inches
LENGTH (OPEN)	20 inches	26 inches	24 inches
STRENGTH	Very Weak	Very Strong	Strong

Using the above technical data, we now can get a value for each parameter for each alternative. The following values are based on the worth functions:

	Status Quo	Type A	Type B
WEIGHT	.25	.75	.81
LENGTH (FOLDED)	.33	1.0	.90
LENGTH (OPEN)	.75	1.0	.92
STRENGTH	0	1.0	.75

Step 4: The fourth step involves calculating the overall performance rating. This requires placing a weight on each parameter. Our resources, user's input, and the materiel developer's input help decide how the parameters should be weighed. After weights have been assigned it is then possible to produce a summary chart. This summary chart, which should be included in the performance analysis portion of the Abbreviated Analysis, reveals the ranking of alternatives (based on performance only).

SUMMARY OF PERFORMANCE

	WT	Status Quo	S.Q. Score	Type A	A Score	Type B	B Score
WEIGHT	4	.25	1	.75	3	.81	3.24
LENGTH (FOLDED)	4	.33	1.32	1.0	4	.90	3.6
LENGTH (OPEN)	3	.75	2.25	1.0	3	.92	2.76
STRENGTH	5	0	0	1.0	5	.75	3.75
TOTAL			4.57		15		13.35

The above chart shows the scores for each alternative in this example. The E-tool of TYPE A has the greatest performance. However, a recommendation cannot be made until the costs are reviewed.

d. Summary: The previous example showed the step-by-step process for conducting the performance analysis. Subjectivity was minimized through the quantification of performance. The final performance chart will provide the decision maker with a valuable tool to aid in the decision making process.

The performance analysis now carries with it a sense of credibility because the decision makers can see how the analyst derived his conclusions. What makes the performance analysis even more valuable is its dynamic structure. Because of time, budget, and other constraints, the analyst must draw his conclusions based on limited available resources. Within the materiel development process an Abbreviated Analysis may not reach high level decision makers until months after it was completed. These factors can be the cause of several important discrepancies. First, the decision makers have access to more resources than the analyst. Thus, they may know something that the analyst did not know, and consequently it is not included in his study. Another problem is the time factor. In today's fast-paced world, actions could have taken place that would generate new impacting data between the time an analyst completed his study and the time the decision makers reviewed it. These problems could cause (and have in the past) a study to become invalid by the time a decision is needed. However, the performance analysis of this methodology can compensate for these problems because of its dynamic nature. If the decision makers have additional information on some piece of equipment it is easy to see if it will change the conclusions of the Performance analysis. This is done by a plug-and-chug method of changing values in the performance table based on new data. This generates new scores which can then be compared to see if a new conclusion is reached. An explanation of this process is included later in the sensitivity analysis portion. The dynamic nature of the performance analysis allows decision makers to provide input if necessary and retain valid conclusions.

8. Cost Analysis:

a. General: The second major portion of the Abbreviated Analysis is the cost analysis. The cost analysis summarizes the total costs for each alternative to show the relative difference between courses of action. Calculations of cost data is the same for Abbreviated Analyses as for a normal COEA. (Guidance for developing cost data is given in TRADOC Pam 11-8.) Costs must be expressed in common terms to allow a valid comparison. The results of the cost analysis are combined with the results of the performance analysis to render a recommendation.

b. Process: The process for the cost analysis is an objective evaluation somewhat easier than the performance analysis. AMC develops validated Life Cycle Cost Estimates (LCCE) for items of equipment for most ROCs/LRs for which the Signal Center has proponency. The tasking office, usually MLSD, will initiate requests to AMC for cost estimates. The cost data should be presented to the project officer with the ROC/LR when he is tasked to perform the Abbreviated Analysis. Costs must also be expressed in constant and current (inflated) dollars. However, there are situations when all the cost data is not available, especially when considering the status quo. When this arises, the project officer must work in conjunction with the tasking office to obtain cost data. This may consist of phone calls to CECOM or other agencies to gather cost data. The basic process for analyzing the costs of alternatives consists of these logical steps:

(1) Gather cost data.

(2) Express cost data in common terms.

(3) Compare costs.

(a) Gather cost data: The steps to gather cost data may be easy if all is provided. Generally, cost data can be extracted from the Cost Assessment Annex in the ROC/LR which is prepared by CECOM as an LCCE. An example is attached at Annex B. Cost data should be available for each alternative. If unavailable, efforts should be taken to task AMC for the cost estimates when time permits. However, on occasion it may be necessary to perform an in-house collection of cost data for the status quo. A total cost can be calculated for the status quo after the data is collected. However, in accordance with TRADOC Pam 11-8, DCD will not generate cost data.

If it becomes necessary, the project officer must work in conjunction with the tasking office to obtain cost data for the status quo. Phone calls and requests to other DA agencies may be necessary to gather cost figures. When dealing with the status quo the main consideration will be the operating and support costs since the developmental and investment costs are usually sunk costs. Once the cost figures are gathered they must be expressed in proper terms as explained in the next section.

Gathering cost data is an important step in the Abbreviated Analysis process. Too often total cost figures are misleading by not being accurate or complete. Status quo costs are sometimes listed as zero (0) when they actually are not. In cases where it is not possible to obtain cost data, the analyst must state this as a limitation to the study. However, such a limitation can become grounds for disapproval of the Abbreviated Analysis and should be avoided.

(b) Express cost data in common terms: Cost data must be expressed in common terms in order to properly compare alternatives. Simply stated you cannot compare apples with oranges.

Basic terms used in the Abbreviated Analysis which must be consistent among alternatives include such things as fiscal year dollars and allocation of devices. TRADOC Pam 11-8 points out that the base year for cost estimates must be the budget year appropriate to real-time date of completion of the study. All alternatives must express costs using the same base year dollars, and the costs must also be in both constant and current (inflated) dollars. Even though both are given, actual comparison should be shown in terms of current dollars. Thus, the in-house collection of status quo costs will also require inflated figures.

If status quo costs are not provided in current cost figures then it becomes necessary to inflate constant costs. Once constant costs are derived, current costs can be calculated by using inflation indices. Updated inflation tables and guidance is provided by TRADOC to DCD on a regular basis. However, inflating cost figures should be avoided by C&S personnel when it is possible to have qualified agencies perform such tasks. Discrepancies and inconsistencies can arise in the methodology to derive current cost figures if different agencies develop data for different alternatives. However, when necessary the updated inflation tables can be used.

Cost data must also be reflected for the procurement of the proper number of devices. Discrepancies in the number of devices will influence changes in cost data which can possibly create an inaccurate comparison. Operating and support costs must also be expressed for the appropriate number of years.

The summary of cost data should include Research and Developmental (R&D) costs, Investment (Inv) costs, Operating and Support (O&S) costs, and any other impacting costs unique to the alternative. Sunk costs should not be included in the comparison, because they represent money that was already spent and not capable of being recalled. Thus, sunk costs should have no impact on the future spending of funds.

Referencing our previous example of the need for a new entrenching tool, we can create a cost summary table. The following table illustrates the total costs for each alternative using imaginary cost figures.

COST SUMMARY
(CURRENT FY 85 $K)

	TYPE A	TYPE B	STATUS QUO
R&D	3.43	2.10	0
INV	26.72	21.94	0
O&S	6.35	7.88	14.84
OTHER	0	0	3.0
TOTAL	36.50	31.92	17.84

(c) Compare costs: The comparison of costs is a simple comparison of total costs. In the table above alternative A (Type A) is the most costly course of action while the least costly is the status quo. However, costs alone are not enough to render a decision. Costs must be weighed in conjunction with performance as the following section will explain.

c. Summary: Although the Combat Developments project officer does not generate the cost data, it is very important that he portray it properly and accurately. The previous example shows the steps involved to ensure costs are displayed correctly in the analysis. This section of the analysis is very important and must be given the proper attention. After costs are calculated and performance scores shown, alternatives can be compared.

9. Comparison of Alternatives:

a. General: A proper comparison of alternatives will include an evaluation of both the costs and performance of alternatives. This is done by focusing in on the findings of both the Performance and Cost Analyses and drawing some basic conclusions to determine which course of action is the preferred alternative.

b. Process: The analyst should first summarize the findings of the Performance and Costs Analyses in a table as illustrated here using our previous example.

	Meets Req'd Specs	Performance Scores	Costs (FY85 $K)
TYPE A	YES	15	36.50
TYPE B	YES	13.35	31.92
S.Q.	NO	4.57	17.84

Conclusions can then be made based on this table and the system requirements set forth in the requirements document.

Looking at the alternatives in terms of performance we will eliminate those alternatives that do not meet the specifications of the requirements document. In many cases, the Status Quo will not meet these specifications, so the Status Quo is most likely not a viable course of action as with our example. The current E-tool in the example does not meet the required specifications for strength so we are left with the two remaining alternatives - Type A and Type B.

The remaining alternatives can then be compared. Looking at performance, Type A is better operationally than type B as their respective scores show, but both meet the required specifications. Incorporating costs, Type B becomes more attractive since it is less costly. This should be reflected in the findings.

c. Summary: This portion of the analysis becomes the basis for the recommendation later on. In summary, you first eliminate those alternatives that do not meet the required specifications. Then the remaining alternatives can be compared, and the least costly alternative should be selected. In rare cases when costs are the same, then the alternative with the greatest performance should be chosen. However, a recommendation cannot be made until a sensitivity analysis is performed as needed.

10. <u>Sensitivity Analysis</u>:

a. General: The sensitivity analysis is designed to evaluate any major uncertainties in the study. Uncertainties can arise from assumptions made in the study and with the subjectiveness involved in the performance analysis. There can also be uncertainties when cost data is not accurate or complete. Although a degree of uncertainty is always present, the analyst can remove some of the uncertainty by checking it's impact on the conclusions. This is done through a sensitivity analysis.

b. Process: Although the sensitivity analysis can take many forms one thing is common in all, that is the changing of a value or assumption made in the study to check its impact on the conclusions. For instance, if the analyst is not overly confident with giving a performance parameter a high weight (5), then he can change that weight to a low value (1) and see how or if the conclusions are changed.

This process can be illustrated by using the previous example of the need for a new entrenching tool. For example, if the analyst in uncertain about the strength parameter he can manipulate the figures to see its impact on the results. As is, strength was given a weight of 5. For the sake of uncertainty the analyst changes its weight to only 1. This change yields a new table and score for the summary of performance which should be included in the study as follows:

SENSITIVITY ANALYSIS
SUMMARY OF PERFORMANCE
(STRENGTH WT = 1)

	WT	STATUS QUO	SQ SCORE	TYPE A	A SCORE	TYPE B	B SCORE
WEIGHT	4	.25	1	.75	3	.81	3.24
LENGTH (FOLDED)	4	.33	1.32	1.0	4	.90	3.6
LENGTH (OPEN)	3	.75	2.25	1.0	3	.92	2.76
STRENGTH	1	0	0	1.0	1.0	.75	.75
TOTAL			4.57		11.0		10.35

These scores are then compared along with cost data to see the impact of this parameter.

	OLD PERFORMANCE SCORE	NEW PERFORMANCE SCORE	COSTS (FY-85 $K)
TYPE A	15	11.0	36.50
TYPE B	13.35	10.35	31.92
S.Q.	4.57	4.57	17.84

The results of the sensitivity analysis show the significance of the strength parameter. Looking at the results reveals a significant drop in performance scores for A and B while the Status Quo remains constant. A review of the required specifications in the requirements document (see 5.(2)(c)) and this analysis will reveal that strength parameter has a great impact on the results, and that it is the very weak strength of the status quo E-tool that makes it unattractive. If the strength parameter was not important, the sensitivity analysis shows that the status quo would be most attractive because of its low costs, and it would also meet the required specifications. The impact of such parameters should be pointed out in the analysis.

The sensitivity can also evaluate major uncertainties with the cost figures. Uncertainties with costs are most common with the status quo. Other alternatives usually have validated cost figures. If possible, you may be able to show at what cost an alternative becomes attractive when compared to less costly alternatives. It is important that uncertainties with cost figures be reflected in the sensitivity analysis to see the impact, if any, on choosing an alternative.

c. Summary: The sensitivity analysis is an important step and should evaluate major uncertainties. Consideration should be given to both performance parameters and costs. The results of the sensitivity analysis could influence the final recommendation of the study by revealing any major uncertainty or risk that has a great impact on the alternatives.

11. Abbreviated Analysis Recommendation:

a. General: The final stage in the Abbreviated Analysis process consists of the analyst's recommendation. The recommendation is a clear and concise summary of which course of action should be taken. Again, the recommendation is just that - a recommendation, and it does not render a decision.

b. Process: To be of value, the recommendation must be supported by the findings in the study. The results of section 4, Comparison of Alternatives, will reveal the most attractive course of action. Section 5, the Sensitivity Analysis will reveal any major uncertainties in the study. The analyst must make his recommendation based on the findings of these sections. Usually, the most attractive alternative as pointed out in section 4 is recommended. However, there may be situations when another alternative is recommended when the Sensitivity Analysis justifies it.

c. Example: The example previously used (procuring a new entrenching tool) was evaluated in earlier sections. The performance scores and costs of each are again listed here:

	Meets Req'd Specs	Performance score	Costs ($K)
TYPE A	YES	15	36.50
TYPE B	YES	13.35	31.92
S.Q.	NO	4.57	17.84

Based on these findings, alternative B offers the most attractive alternative as pointed out in section 4. Although the Sensitivity Analysis reveals the significance of the strength parameter, the status quo would not be recommended since it does not meet the required specifications. Thus, the proper recommendation would be a recommendation for alternative B (Type B E-tool)

d. Summary: The recommendation is an important step, but is less significant than the previous steps in the Abbreviated Analysis process. The Abbreviated Analysis offers the decision makers a tool to evaluate different courses of action. Although the analyst may recommend one course of action, the decision makers may choose another. It must be understood that the information and different findings brought out in the study still carry great value and are significant to the decision making process, even when a recommendation is not carried out.

12. CONCLUSION: When the Abbreviated Analysis is completed it is given to the tasking agency to accompany the LR or ROC. The requirements document is then staffed for approval being subject to criticism and change. Therefore, the Abbreviated Analysis should be clearly and intelligently written and recommend an appropriate course of action. This document provides a standard methodology to bring validity and uniformity to Abbreviated Analyses. A sense of credibility will accompany these studies when project officers follow these guidelines.

ANNEX A
PERFORMANCE PARAMETERS (EXAMPLES)

PARAMETERS	MOP
BANDWIDTH	KHz.......
BUILT IN TEST (BIT)	YES/NO/LIMITED
CAPABILITIES	1, 2... FEW... MANY
COMSEC	LOW... HIGH
DF VULNERABILITY	LOW... HIGH
EASE OF OPERATION	EASY... DIFFICULT
EMP HARDENING	YES/NO/LIMITED
EQUIPMENT INTERFACING	POOR... VERY GOOD
FLEXIBILITY	POOR... VERY GOOD
HEIGHT	IN, FT, M
INTEROPERABILITY with ALLIED/JOINT	POOR... VERY GOOD
JAM RESISTANCE	LOW... HIGH
LOGISTICAL SUPPORT	POOR... VERY GOOD
MTBF	HOURS
MTTR	HOURS
NOISE LEVEL	dB
NUMBER OF CHANNELS	1, 2,... 12... 24
OPERATING FREQUENCY	KHz... MHz... GHz
OPERATING TEMPERATURE	°F, °C
PERSONNEL REQ'D TO OPERATE	0, 1, 2,...
POWER REQUIREMENTS	KW/VOLTS... AC/DC
QUALITY OF SERVICE	POOR... VERY GOOD
RANGE	FT, MILES, KM
SET UP/TEAR DOWN TIME	MIN, HRS
SHOCK RESISTANCE	LOW... HIGH
SPEED OF SERVICE	SEC, MIN, HRS
TEMPEST STANDARDS	POOR... VERY GOOD
TRANSMIT POWER	WATTS... KW
VOLUME	FT^3, M^3
WEATHER RESISTANCE	LOW... HIGH
WEIGHT	OZ, LBS, Kg

ANNEX B

COST ASSESSMENT ANNEX (EXAMPLE)

FOR XYZ ANTENNA

a. Summary of estimated life cycle costs as expressed in constant FY-83 dollars and current (inflated) ($M-Millions)

	CONSTANT DOLLARS			CURRENT DOLLARS		
	LOW	MOST LIKELY	HIGH	LOW	MOST LIKELY	HIGH
R&D	1.14	1.20	1.32	1.225	1.320	1.419
INVESTMENT	.91	.95	1.05	1.151	1.212	1.333
O&S (10 YRS)	.35	.37	.41	.521	.548	.603
TOTAL	2.40	2.52	2.78	2.897	3.080	3.355

NOTE 1: Quantity of Prototypes 25 ea XYZ Antenna.

NOTE 2: Sunk Costs (Excluded from Paragraph a).

a. R&D (Actual) $ 385.

b. INVESTMENT (Actual) $ -0-.

b. Quantity/unit costs estimated unit/system flyaway and unit/systems procurement costs expressed constant FY83 dollars (notes).

ITEM	QTY	UNIT FLYAWAY	UNIT PROCUREMENT
XYZ	3500 ea	*$ 224	$ 272
		$	$
		$	$

*See Investment Table

c. Funding profile expressed in constant FY83 dollars and current (inflated) dollars ($M-Millions).

USACECOM
$$CECDC VALIDATED$$
Level II Date 29 Dec'82
Expiration Date 29 Dec'83
Project# XYZ - 32
Analyst John Doe
Phone X 0000
Supervisor Jane Doe

(CONT'D)

R&D PHASE

RDTE	FY 83	FY 84	FY 85	FY 86	TOTAL
APPROVED PROG (CON)	.20	.30	.60	.10	1.20
ESTIMATE (CUR)	.20	.32	.68	.12	1.32
ESTIMATE (CON)	.20	.30	.60	.10	1.20
VARIANCE	0	.02	.08	.02	1.20

INVESTMENT PHASE

	FY 86	FY 87	TOTAL
QTY	(1500)	(2000)	(3500)
APPROVED PROG (CUR)	0	0	0
ESTIMATE (CUR)	.558	.654	1.212
ESTIMATE (CON)	.449	.504	.953
VARIANCE (CUR)	-.558	-.654	-1.212

NOTE 1: Source document for quantity is AAO...

NOTE 2: Inflation has been incorporated in accordance with Ltr; DRCCP-ER, HQ, DARCOM 5 May 82, subj: Inflation Guidance.

DEPARTMENT OF THE ARMY
US ARMY MANAGEMENT ENGINEERING TRAINING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

REPLY TO
ATTENTION OF:

AMXOM-SE 9 September 1985

SUBJECT: Methodology for Mini-Cost Operational Effectiveness Analysis

Commander
USASC&FG
ATTN: ATZH-CDC (1LT John G. O'Lone)
Fort Gordon, GA 30905

1. After reviewing your Methodology for Mini-Cost Operational Effectiveness Analyses, we find no reference or materials from AMETA publications that are copyrighted.

2. We appreciate the opportunity to review your draft document. It includes excellent applications of portions of the materials in our Economic Analysis for Decision Making course and will certainly be of benefit to your organization.

3. We might suggest inclusion of the "time value of money" considerations in your cost comparison process.

4. AMETA - Providing Leaders the Decisive Edge.

JOHN F. McAREAVY, Ph.D.
Director

END
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