Research Product 85-22

(2)

HARDMAN

Comparability Analysis Methodology Guide

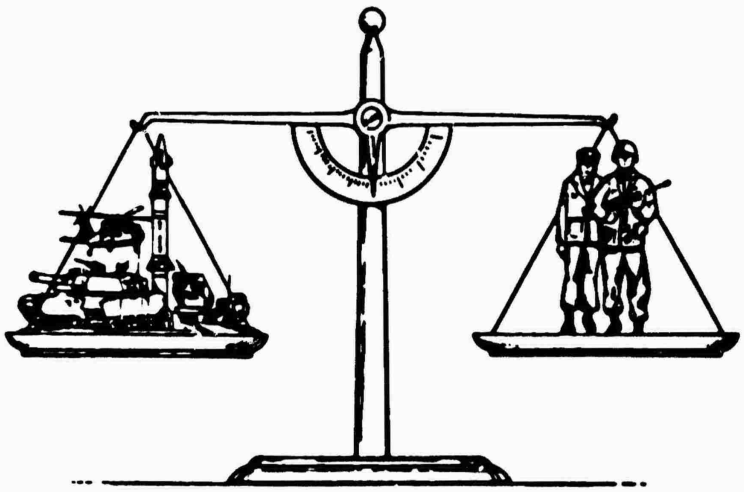
AD-A156 790

Volume IV

Interpretation and Evaluation

Step 5 – Impact Analysis

Step 6 – Tradeoff Analysis



HARDware vs. MANpower

DTIC FILE COPY

DTIC
ELECTE
JUL 24 1985
S D
D

April 1985

US Army
Research Institute

Soldier Support Center-
National Capitol Region

85 7 24 082

FOREWORD

This is the first edition of the Army HARDMAN Comparability Analysis Methodology Guide. It was compiled jointly under the auspices of the Army Research Institute (ARI) and the Soldier Support Center-National Capital Region (SSC-NCR).

The five volumes constitute a detailed specification of the Army HARDMAN Methodology as applied to major materiel systems. The Guide is intended to provide the Army with a basis for competitive HARDMAN contracting, conducting "in-house" Army HARDMAN applications, and providing HARDMAN training for Army personnel. In the future, many of you may become involved in the process and/or with the products of an Army HARDMAN Analysis. These volumes have been provided as an aid to your understanding of this analytical tool.

It should be noted that the HARDMAN procedures described herein are not expected to remain forever unchanged. Rather, it is desired that HARDMAN evolve over time to better meet the Army's changing information needs on newly emerging systems. You are invited to participate in this evolutionary process by providing your comments on, and recommended improvements to, the Methodology. Such comments concerning the Army HARDMAN Guide or the Army HARDMAN Methodology should be mailed to:

Commander
Soldier Support Center-National Capital Region
ATTN: ATZI-NMS
200 Stovall St.
Alexandria, VA 22332-0400

Additional copies of the HARDMAN Comparability Analysis Methodology Guide will be available through the Defense Technical Information Center (DTIC) in the near future.

Table of Contents

List of Figures

List of Tables

To the Analyst

Volumes II through IV are intended to be used by individual engineers and MPT analysts who have been tasked with conducting the HARDMAN analysis. These volumes provide detailed descriptions of each HARDMAN step, substep group, and substep. The analyst is referred to the preface of Volume I for an overall description of these volumes and a description of the organizational format of each step.

The analysis flow diagrams depict, at a high level, the general flow of data and the interrelationship of the individual HARDMAN substeps (see Volume I, Figures 1.2-3 and 1.2-4). The descriptions of these substeps provide the detailed procedures, algorithms, and rules required to conduct the analysis as well as examples of products that represent the results of the analysis.

In essence, these flow diagrams and substep descriptions provide the analyst with guidance on how to conduct the discrete methodology steps. However, the diagrams and descriptions do not capture much of the dynamics of a study application.

Throughout the substep descriptions, the analyst is directed to interface with other analysts and other data. In most instances, these directions are not intended to reflect formal, one-time meetings, where the output of one substep is passed on as input to the next. Instead, they reflect an ongoing give-and-take between analysts.

In light of that, it cannot be overemphasized to the individual analyst that the HARDMAN methodology is a highly interactive process that is, by necessity, conducted by a multi-disciplinary study team of engineers and analysts. The magnitude and complexity of the factors that are necessary to capture the total operational and maintenance requirements of a weapon system are such that no one analyst or analysis manager can be expected to have a total grasp of the whole.

Each analyst must contribute not just the formal output of his or her discipline's analytical substeps but must participate in partnership with other analysts in

system definition. This is especially true in Step 1 (Systems Analysis), where the decisions about the system's scope and its mission, functional, task, and equipment requirements provide the basis upon which much of the subsequent analysis is conducted.

Finally, the requirement for early identification and collection of data must be stressed. Results obtained from using the substep procedures described in this handbook reflect the quality and completeness of the data that are input. Every analyst must regard as crucial the need to identify data at the earliest possible time and to see to it that data requests are pursued in a timely manner.

Alternative or second-best data may have to be obtained if it appears that initial data requests will not be received in time. The analyst must continuously keep the analysis manager informed of data collection problems, as delays will have a negative impact on study milestones. Accordingly, the analyst should give special attention to the guidance presented in Appendix A (Data Operations) of Volume V.

STEP 5
Impact Analysis

Purpose

In Impact Analysis, a Proposed System's demand for manpower, personnel, and training (MPT) resources is compared with the present and projected resources. The analysis identifies those characteristics of a Proposed System which will require management attention throughout the acquisition process due to either an intense demand for or projected lack of availability of MPT resources.

Application of Impact Analysis serves two important purposes. First, by analyzing the MPT resource demands/requirements identified from the previous steps in the HARDMAN methodology, MPT "high drivers" are identified for each parameter of interest.

Second, determining availability of present and projected MPT resources allows a supply and demand comparison to be made. This establishes whether sufficient MPT resources will be available in the Army to support the Proposed System's demands.

Within the Hardman analysis, "high drivers," created by high or disproportionate demands for MPT resources, constitute a principal input into Step 6 (Tradeoff Analysis). Input and products are discussed in detail at the beginning of each substep.

Objectives

The three major objectives of the Impact Analysis are:

- Establish the availability of present and projected MPT resources to meet the demand of the proposed systems.

- For each system alternative, determine which resource categories are critical. In other words, do MPT demands exceed supply?
- Determine impacts that introduction of the Proposed Systems will have on the force structure.

Interrelationships

Figure 5-1 provides an overview of the relationships between Impact Analysis and other HARDMAN steps. The analysis requires input from Step 2 (Manpower Requirements Analysis), Step 3 (Training Requirements Analysis), and Step 4 (Personnel Requirements Analysis).

These provide input to Step 6 (Tradeoff Analysis) through identification of high drivers of MPT resources in order that the source or cause of the high driver can be identified and tradeoff analysis conducted as applicable. Feedback information is exchanged interactively between each of the steps as alternatives are evaluated to determine the impact on the MPT high drivers.

Assumptions/ Constraints

The following assumptions and constraints apply when conducting the Impact Analysis:

- MPT resources dedicated to the Predecessor System will be available to support the Proposed System.
- Units are organized at Level 1 (Wartime Manning).
- Authoritative data identifying total Predecessor MPT resources requirements rarely exist on a system-by-system basis.

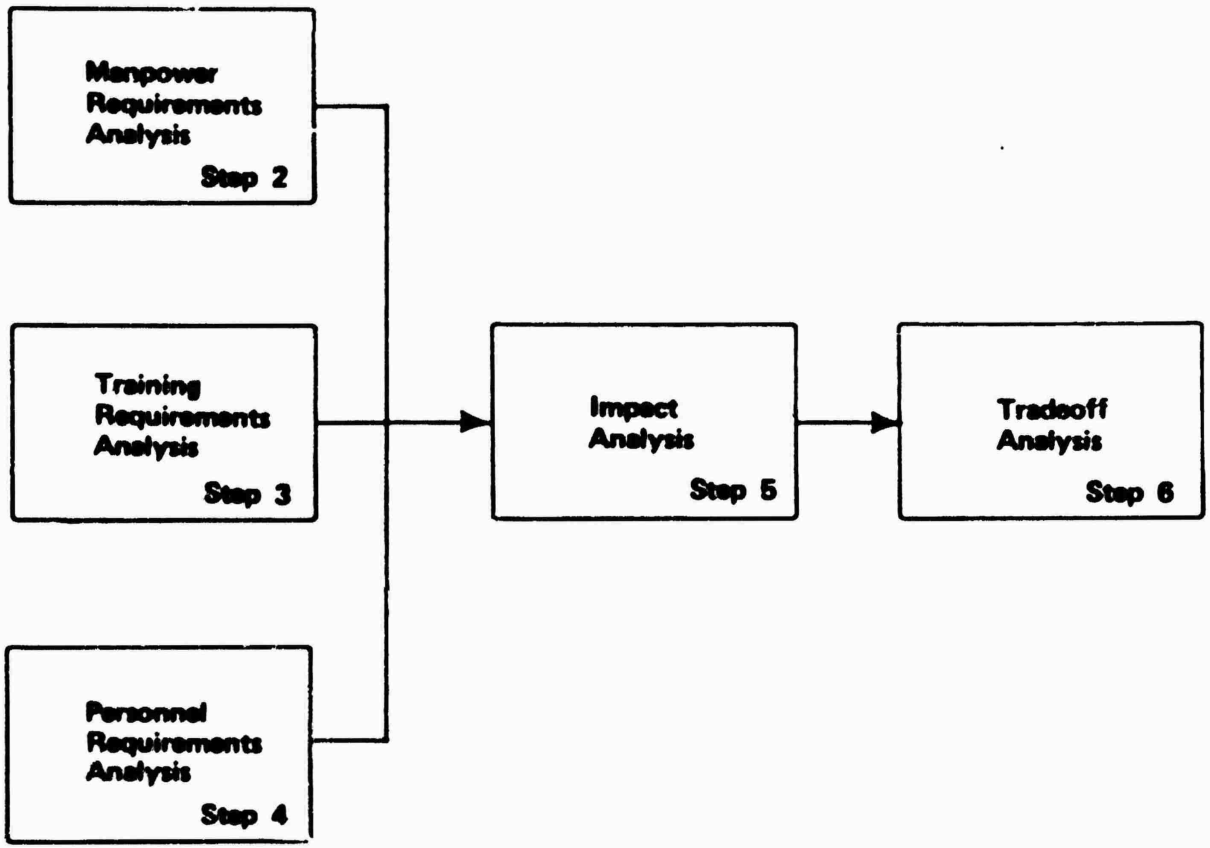


Figure 5-1. Relationship of Impact Analysis to other HARDMAN steps.

- Projections of future MPT resources availability are not normally on hand by the projected fielding date of a new system.

Logic

Once system-specific MPT requirements (demand) have been identified, availability of resources (supply) to meet these demands must be determined. While definitive resource data may not always be obtainable, estimates of MPT resource availability are made in order to determine critical resource impacts that require further management attention and may affect supportability of the new system when fielded. Figure 5-2 reflects the logic supporting Impact Analysis.

Step 5 consists of three substeps:

5.1 Establish Resource Availability

5.2 Determine Critical Requirements

5.3 Determine Force Level Impacts

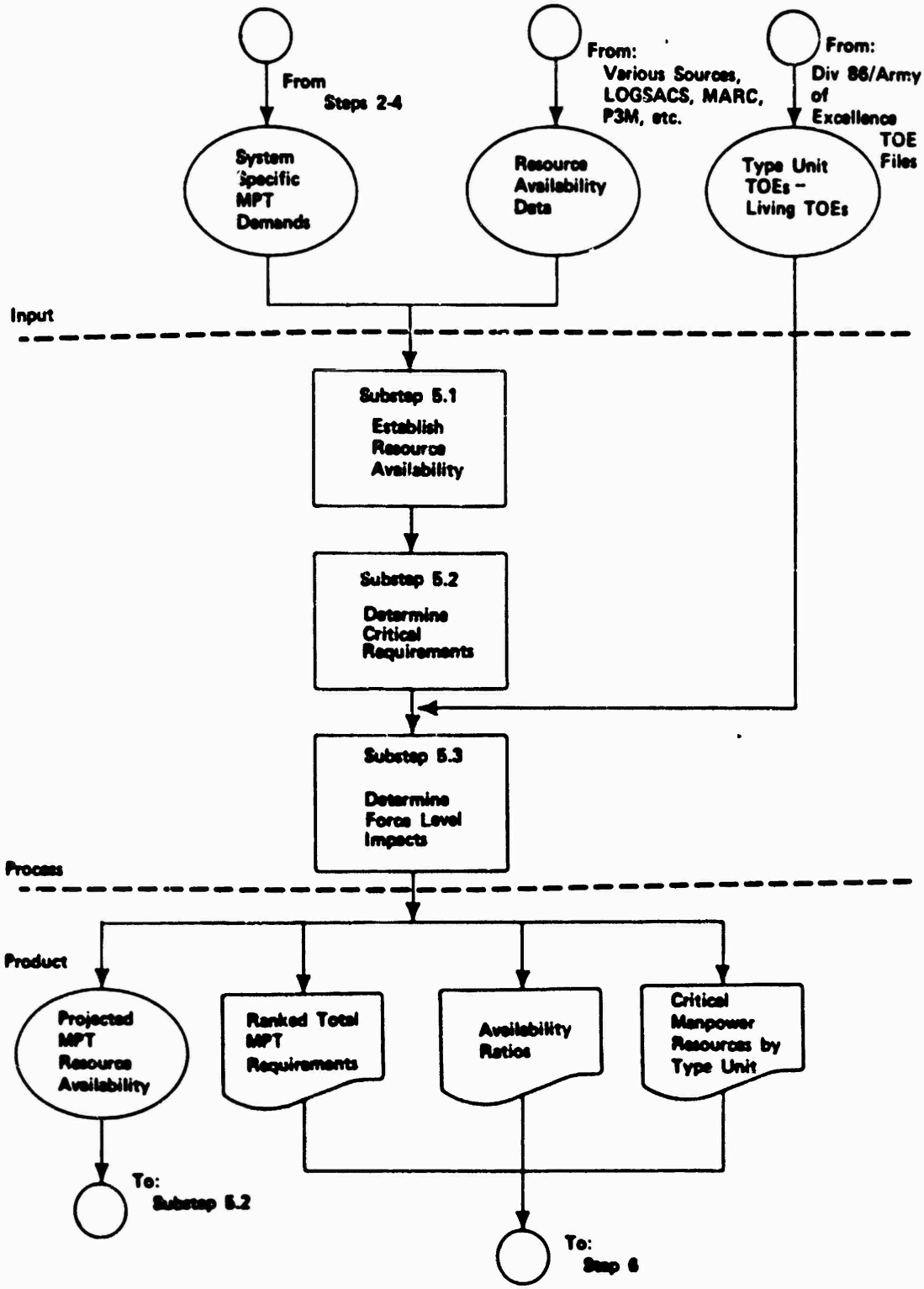


Figure 5-2. Logic flow for Impact Analysis.

This page intentionally left blank.

Establish Resource Availability

Objective

One of the basic purposes of Impact Analysis is to establish whether the Army's supply of manpower, personnel, and training (MPT) resources is sufficient to accommodate the new system's demand for those resources. Once the supply, or availability, of MPT resources is established, a supply/demand comparison can be made. The objective of this substep is to establish availability of the MPT resources so the supply/demand comparison can be made in Substep 5.2 (Determine Critical Resources).

Input

Input to this substep from other HARDMAN analyses includes the list of MOSs for the Predecessor, Baseline Comparison System, and Proposed System alternatives from Substep Group 2A (MOS/Grade Determination).

Establishing the availability of MPT resources depends on access to the Army data bases and analytic procedures which provide such information. These include a list of systems which a particular MOS operates or maintains. The list is developed from the soldier's manual and the trainer's guide for that MOS and official Army estimates of maintenance workload for each MOS, on a system-by-system basis, from various sources.

Examples of this include the Maintenance Man-hour Master Data Files, maintained by both the Materiel Readiness Support Activity (MRSA) and the Logistics Center (LOGCEN). Both files should be used in cross-checking.

Other data bases include official Army estimates of system density in TOE units for all materiel systems from various sources (e.g., the Logistics Structure and Composition System or LOGSACS); official Army estimates of total MOS operating strength and authorizations from various

sources (e.g., the Personnel Policy Project Model maintained by the Military Personnel Center or MILPERCEN); and official Army estimates of the availability of training resources from each proponent school for the MOS associated with each system alternative.

System density, operating strength, and authorization data are typically available on a year-by-year basis. Ideally, the year in which the system is scheduled to be deployed fully should be selected for estimating resource supply.

However, rarely do the short-term horizon of the resource projections and the long-term horizon of the system deployment schedule overlap, especially for systems early in the acquisition process. In this case, the analyst should select the year closest to the system deployment. Whatever year is selected, all resource data should come from that year.

Products

This substep produces estimates of the supply of MPT resources which could be made available to satisfy the new system's demand for those resources. Estimates of resource availability are used to make a supply/demand comparison in Substep 5.2 (Determine Critical Resources).

Logic

Authoritative estimates of the supply or availability of MPT resources rarely exist on a system-by-system basis. A new system is usually required to fit within the "footprint" of the Predecessor System, which the new system will replace. However, information on current MPT resources is typically indexed by MOS, not apportioned to specific materiel systems. Thus, to determine resource availability, the size and shape of the Predecessor System's footprint must be identified.

Determining resource availability can be a very simple matter. If no Predecessor System exists, one can assume that no resources are available. Conversely, if the Predecessor System has specific or unique operator or maintainer MOSs, then all of the resources associated with these MOSs may be available to support the new system.

However, system-specific or unique MOSs are the exception rather than the rule. More often, an MOS operates or maintains many systems, including the Predecessor System. The population of the MOS is a resource shared by these systems.

In this case, within the confines of fixed personnel end-strength and limited training resources, the MPT resources required to support a new system must be gained at the expense of other systems. Determining resource availability requires apportioning current resources into "fair shares" for each system, including the Predecessor.

Personnel authorizations is the resource category in which it is most useful to apportion. The proportion of total authorizations for an MOS which is devoted to the Predecessor may be expressed as a percentage which can then be applied to other categories as well.

The share of MPT resources currently devoted to the Predecessor System may not be an accurate representation of that which will be available when the new system is fielded. However, planning for the implementation of a new system usually proceeds up to and includes the point where a unit takes actual delivery of the system. Estimates of resource availability are continually updated and modified to account for changing circumstances.

Not only may there be multiple sources of supply for MPT resources — the "bill-payers" — there may be other systems — the "claimants" — whose demands must be met, along with those of the system under HARDMAN analysis. Thus, resources currently associated with the Predecessor System represent a conservative, and probable, estimate of future availability as well.

Figure 5.1-1 depicts the logic flow for determining the availability of MPT resources. As shown in the figure, this substep entails one action step. This substep need not be performed if no Predecessor System exists. In that case, no resources are assumed to be available to support introduction of the new system.

Action Step

Requirements

The analyst must identify the direct number of operators and maintainers associated with the Predecessor System. This in turn is the number available to support introduction of the new system. If the identification cannot be made directly, the analyst must determine the proportion of the total population of the MOS which represents the Predecessor System's "fair share."

Objective

The objective of this substep is to determine the availability of MPT resources for the operator and maintainer MOSs of the Predecessor System.

Procedures

1. If an operator or maintainer MOS is specific or unique to the Predecessor System, then, as a general rule, all of the authorizations and other MPT resources associated with the MOS are available to support the demands of the new system.

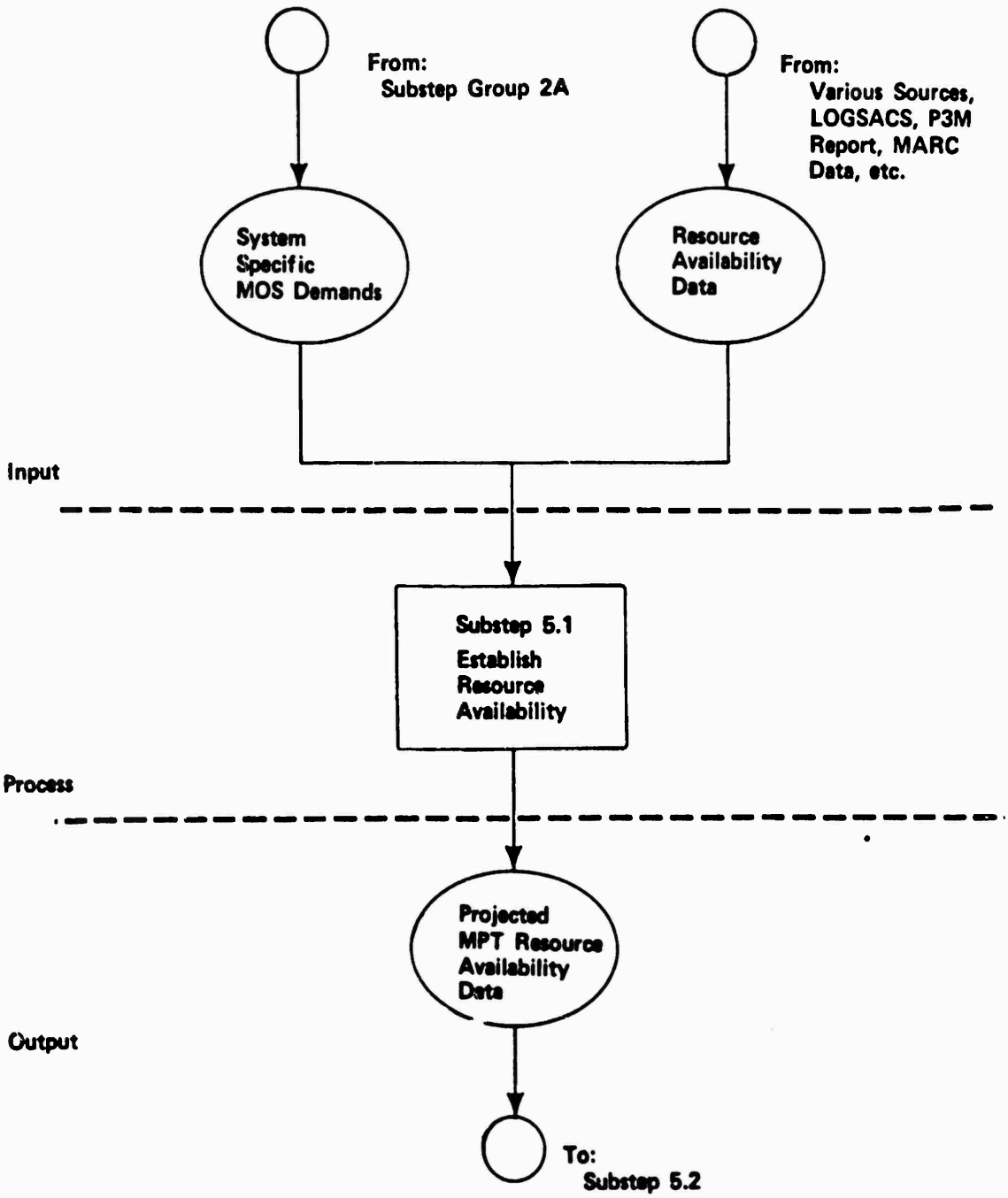


Figure 5.1-1. Logic flow for Resource Availability.

Some MOSs which appear to be Predecessor System-specific may be responsible for operating and maintaining other systems. The analyst should examine the soldier's manual and the trainer's guide for the MOS and consult subject matter experts at the MOS's proponent school to verify the assumption of specificity or uniqueness.

2. For an operator MOS which is not Predecessor System-specific, the analyst must determine the proportion of the MOS associated with the Predecessor. The analyst may use the ratio of Predecessor normalized graduates to the total number of normalized graduates for the courses of instruction required by the MOS. The number of Predecessor System normalized graduates and total graduates was established in Substep 3.12 (Determine Student Loads).

3. For a maintainer MOS which is not Predecessor System-specific, the analyst must determine the proportion of the MOS associated with the Predecessor. The analyst carries out the following derivation procedure.

(1) Identify all the systems for which the MOS is responsible by consulting the soldier's manual and/or the trainer's guide.

(2) Obtain estimates of the MOS workload, in annual maintenance man-hours, for the systems identified in (1). Workload estimates may come from the MARC Maintenance Man-hour Master Data Files maintained by MPSA and LOGCEN.

The LOGCEN MARC Maintenance Man-hour Master Data File is scheduled to change in the third quarter of fiscal year 1985. The change will be from "Annual Maintenance

Man-hours," which contain non-productive time, to "Direct Productive Maintenance Man-hours." The analyst will need to be aware of this change and make appropriate adjustments in the analysis.

(3) Multiply the workload estimates obtained in (2), which are for a system density of one, by the number of systems authorized in TOE units. System-density values may be obtained from LOGSACS and other sources.

(4) Add the products obtained in (3) for all the systems identified in (1). The result is the total workload for the MOS. Because workload and manpower are related by constants, this result is directly related to the total authorizations of the MOS.

(5) The proportional share of the total MOS authorizations associated with the Predecessor System is the ratio of the Predecessor System's workload, obtained in (3), to the MOS total workload, obtained in (4).

4. Total authorizations for an MOS may be obtained from the Personnel Policy Project Model maintained by the Military Personnel Center (MILPERCEN). To determine the authorizations associated with the Predecessor System, the analyst obtains the product of the total MOS authorizations and the ratios derived in Procedures 2 and 3 for operator and maintainer MOSs.

5. If the new system will not completely replace the Predecessor System, the analyst must adjust the ratios to reflect the distinction between the resources available to support the new system and those that must continue to support the density of Predecessor Systems that remain in the force structure.

Examples

Example 1

Situation. The Predecessor System is the Vulcan air defense gun system. The Vulcan is being replaced on a one-for-one basis by the new system. The analyst must determine the availability of the resources associated with MOS 16R, Air Defense Artillery Gunnery Crewmember; MOS 24M, Vulcan System Mechanic; and MOS 27F, Vulcan Repairer.

Result. The analyst believes that all of the MOSs are system-specific. The assumption is verified by checking the most recent edition of AR 611-201, published semiannually (December/January) in an update publication format. Soldier's guides for the MOS and subject-matter experts at the Air Defense School are also consulted. The analyst confirms that MOSs 16R and 27F are system-specific. The analyst assumes that all of the resources associated with the two MOS will be available to support introduction of the new system.

However, the analyst finds that, despite its title, MOS 24M maintains the Forward Area Alerting Radar (FAAR) in addition to the Vulcan. Resource availability for this MOS must be determined by another procedure.

Example 2

Situation. Although all Vulcans will be replaced eventually by the new system, the Air Defense School wishes to consider replacing the towed and self-propelled versions at different times. The Skill Level 1 16R course does not have tracks, but course personnel estimate that 15 percent of the graduates receive assignments to units containing the towed version.

Result. When responding to the Air Defense School, the analyst insures that 15 percent of the resources for MOS 16R are allocated to the towed version and the remaining 85 percent of the resources for MOS 16R are allocated to the self-propelled version.

Example 3

Situation. The analyst must determine the proportion of the resources associated with MOS 24M to be allocated to the Vulcan.

Result. The analyst consults the MARC data file maintained by MRSA and the system density information contained in LOGSACS and finds the following information:

Table 5.1-1. MARC/LOGSACS Information

System	Annual DPAMMH (MARC)	System Density (LOGSACS)
Vulcan	450.0	640
FAAR	807.0	250

The analyst obtains the product of the annual Direct Productive Annual Maintenance Man-Hours (DPAMMH) and the system densities for each system and adds the results:

Vulcan:

$$450 \frac{\text{DPAMMH}}{\text{System}} \times 640 \text{ Systems}$$

$$= 288{,}000 \text{ DPAMMH}$$

FAAR:

$$807 \frac{\text{DPAMMH}}{\text{System}} \times 250 \text{ Systems}$$

= 201,750 DPAMMH

Total DPAMMH for MOS 24M

= 288,000 + 201,750

= 489,750 DPAMMH

The proportion of total resources allocated to the Vulcan is expressed by the ratio of the Vulcan's workload to the total workload of the MOS.

$$\text{Vulcan's \%} = \frac{288{,}000}{489{,}750}$$

= .59

The analyst concludes that Vulcan's fair share of the resources associated with MOS 24M equals 59 percent.

Determine Critical Resources

Objective

In this substep, the MPT resource demands of each system alternative are compared to the present and likely future supply of those resources. The objective of this comparison is to determine which resource categories are critical, i.e., where the demand exceeds the supply. Critical resources are one way to represent the management risk associated the introduction of the new system.

To reduce this risk, users can investigate why the resources have high demand. Potential solutions for reducing the demand (or increasing the supply) are identified in Substep 6.1 (Identify Tradeoff Areas).

Input

Input to this substep from other HARDMAN substeps includes the MPT demands of each system alternative (Steps 2 through 4) and estimates of the supply of each MPT resource (Substep 5.1, Establish Resource Availability).

Product

Lists of the MPT demands of each system alternative, rank-ordered by MOS, are produced in the course of this substep. These lists identify which MOSs are high drivers of a particular resource category. The lists can be prepared for each type of output report from HARDMAN Steps 2 through 4.

The other significant product of this substep results from the supply/demand comparison. For personnel, this product takes the form of changes in the ratio of available personnel to those required, accounting for the introduction of the new system. In HARDMAN, this ratio is called the Availability Ratio.

These results are displayed in two types of Impact Analysis reports:

- Impact: Ranked (high driver) Requirements for the Appropriate MPT Demand Parameter
- Impact: Availability Ratio

Logic

MPT resource demands of each system alternative are estimated in previous HARDMAN analyses. Before being compared to the estimates of supply made in Substep 5.1 (Determine Resource Availability), these demands are analyzed to identify the MPT high drivers.

A high driver is any system element — not restricted to hardware or equipment — which consumes a disproportionate share of MPT resources compared to (1) the same element in other system alternatives or (2) other elements within the same system alternative. Because the resource demand by MOS for each system alternative is already computed, high drivers of this demand can be obtained simply by rank-ordering the values by MOS for each MPT parameter of interest.

When comparing MPT demand to present or projected supply, two outcomes are possible: (1) MPT demands of the system will be equal to or less than the projected supply, or (2) MPT demands will exceed the supply. When the latter case exists, the resource elements involved are termed "critical resources."

Critical resources represent the implementation or management risk associated with introduction of the new system. Management has two basic courses of action here. First, the supply of MPT resources may be increased by transfer or reallocation. In the case of personnel, recruitment and retention may be increased. The other course

of action is to reduce a system's demand for MPT resources, with the previously identified high drivers offering the greatest potential for significant reductions.

Figure 5.2-1 depicts the logic flow for determining critical resources. As shown in the figure, this substep has two action steps.

Action Steps

Action Step 1: Identify MOS High Drivers

Requirements

For each category or parameter of MPT demand, the analyst identifies the MOS high drivers by rank-ordering the information produced in previous HARDMAN steps.

Objective

The objective of this action step is to identify the MOS(s) responsible for the largest share of each category of MPT demand. This MOS (or group of MOSs) is called the "high driver" of that demand.

Procedures

1. This action step may be applied to any category or parameter of MPT demand which produces results arrayed by MOS. The analyst selects a resource category and obtains the HARDMAN output report for that category.

2. The analyst rank-orders each system alternative's output values from highest to lowest. These output values are listed separately for each system alternative.

3. The MOS with the largest share of the demand is the high driver of that demand. High drivers may differ across alternatives, or the same MOS may be the high driver for all alternatives.

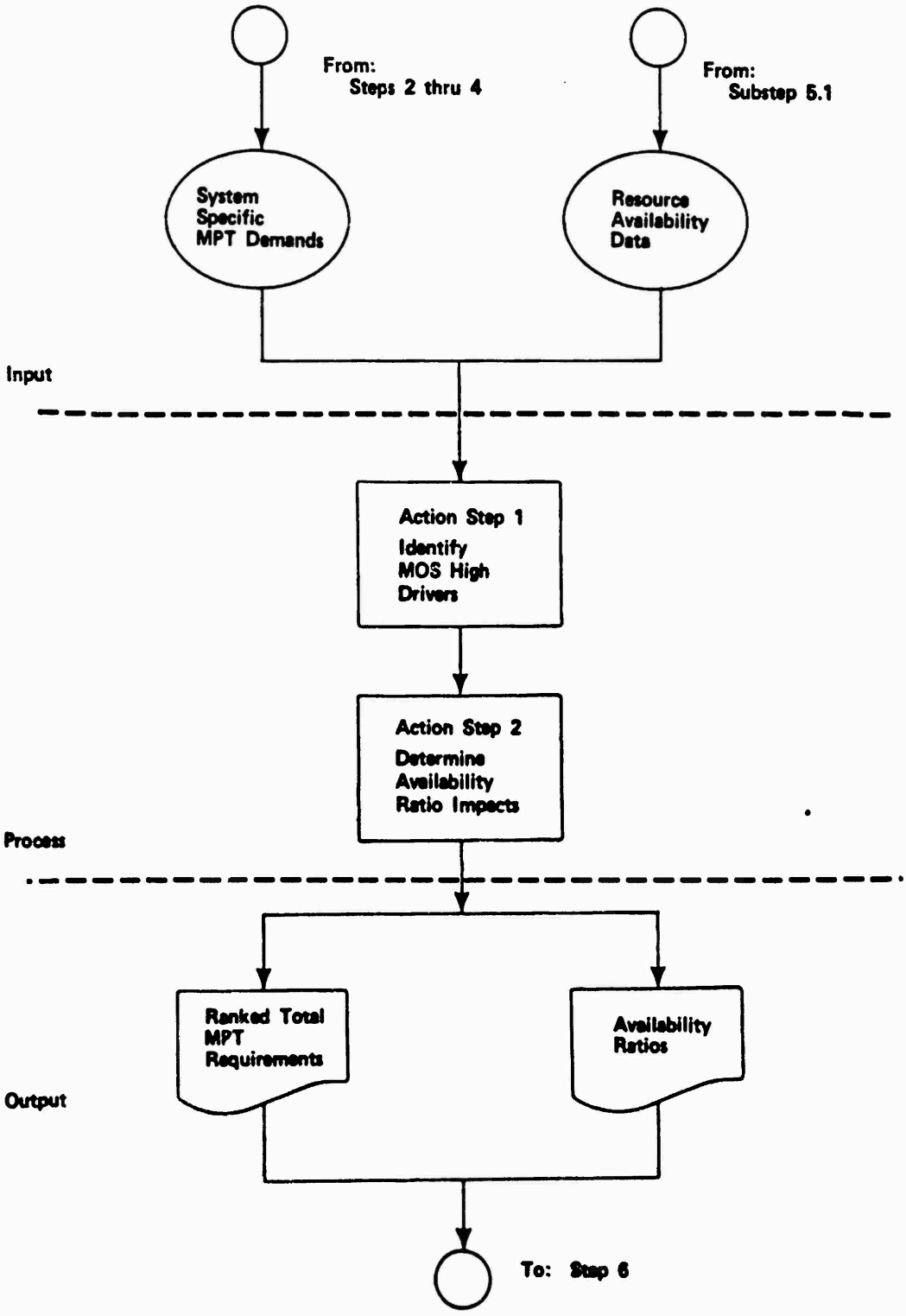


Figure 5.2-1. Logic flow for Determine Critical Resources.

Example

Table 5.2-1 contains examples of rank-ordering for the MPT demand parameter of Total Manpower Requirements. As shown in the table, MOS 13B is the high driver for all alternatives. However, the analyst should note that the next highest driver is different for each alternative.

Table 5.2-1. Rank-ordering MPT Demand

MOS	Predecessor	BCS	Alt 1	Alt 2
13B	12720	5936	10176	5936
31E	0	456	120	175
31V	1548	398	541	70

Action Step 2: Determine Availability Ratio Impacts

Requirements

The analyst must compare the existing supply of MPT resources to current demands for those resources. This comparison may be expressed in the form of a ratio, called an Availability Ratio (AR). The analyst then adjusts the MPT demands to account for the demand posed by the BCS and Proposed System Alternatives and determines the impact on the Availability Ratio.

Objective

The objective of this action step is to compare the supply and demand of MPT resources for each system alternative in order to determine which resources are critical.

Procedures

1. When a comparison is made between a system's demand for MPT resources and the availability of those resources, three outcomes are possible: (1) a surplus of resources, (2) a shortage of resources, or (3) resources are adequate.

For each MOS within a resource category, this comparison may be expressed in the form of a ratio, which in HARDMAN is called the Availability Ratio (AR). The AR has the following general form:

$$AR = \frac{\text{Available Resources}}{\text{Required Resources}}$$

When AR > 1, surplus
AR < 1, shortfall
AR = 1, adequate resources

2. For a particular resource category, the analyst selects an MOS and calculates an initial value for the AR using resource supply information on the MOS as a whole (see Substep 5.1, Establish Resource Availability). This information should be obtained for a year as close as possible to the year in which the system under analysis will be fielded.

3. If the system under analysis has no Predecessor, the analyst determines the impact of the new system's demand by obtaining a new AR value for the BCS or any of the Proposed System alternatives:

$$AR_{New} = \frac{\text{Available Resources}}{\text{Existing Requirements} + \text{BCS or Proposed Requirements}}$$

4. If a Predecessor exists, the analyst obtains the Predecessor's fair share of the existing requirements from Substep 5.1

(Establish Resource Availability). The analyst obtains a new value for the AR by adjusting the denominator of the AR expression to reflect the net result of subtracting the Predecessor requirements and adding the requirements of the BCS or Proposed System alternatives. The analyst should note that if a Predecessor System does not require resources for a particular MOS, the results are the same as in Procedure 3.

$$AR_{New} = \frac{\text{Available Resources}}{\text{Existing Requirements} - \text{Predecessor Requirements} + \text{BCS or Proposed Requirements}}$$

5. Critical resources may be identified by comparing the initial and new values of the AR for a particular system alternative, as shown in Table 5.2-2.

Table 5.2-2. Critical Resources Identification

If Initial AR is:	And New AR is:	Then Resources are:
> 1	> or = 1	Non-critical
> or = 1	< 1	Critical
< 1	<< 1	Critical

Examples

Example 1

Situation. A new system has manpower requirements in three MOSs: 13B, 31E, and 45D. The analyst must determine the intial value of the AR for this resource.

Results. The analyst obtained operating strength and authorization data from MILPERCEN in Substep 5.1 (Establish Resource Availability). To obtain the initial value of the AR for each MOS, the analyst divides the operating strength by the authorizations. Table 5.2-3 displays the results of this calculation.

(The distinction between authorizations and true "requirements" is understood. Authorizations express the demand of the existing or programmed force for available personnel resources, hence they are "required" by this force. That this force may not be the one "required" to meet the threat is a separate question.)

Table 5.2-3. Initial AR Example

MOS	Operating Strength	Authorizations	Initial AR (Op Str/Auth)
13B	20645	21492	.96
31E	1434	1424	1.01
45D	409	408	1.00

Example 2

Situation. The situation of the previous example is continued here. The analyst obtains the total manpower requirements of the new system from Substep 2.9 (Determine Manpower Requirements) and the Predecessor System's fair share of existing authorizations from Substep 5.1 (Establish Resource Availability). Table 5.2-4 contains this information.

Table 5.2-4. Resource Information Example

MOS	Manpower Requirements	Predecessor Authorizations
13B	5936	8820
31E	456	2
45D	176	343

Results. The analyst obtains new values for the AR as follows:

MOS 13B:

$$AR = \frac{20645}{21492 - 8820 + 5936}$$

$$= \frac{20645}{18608}$$

$$= 1.11$$

MOS 31E:

$$AR = \frac{1434}{1424 - 2 + 456}$$

$$= \frac{1434}{1878}$$

$$= .76$$

MOS 45D:

$$AR = \frac{409}{408 - 343 + 176}$$

$$= \frac{409}{241}$$

$$= 1.70$$

The analyst concludes that manpower resources associated with MOS 31E are critical resources.

Determine Force Level Impacts

Objective

Previous substeps in Impact Analysis identified the MOS high drivers and compared the new system's demand for MPT resources to their current or projected supply. These earlier substeps were performed on the basis of the MOS as a whole and for the total density of the new system to be deployed.

The objective of Substep 5.3 is to determine the impacts that introduction of a new system will have on the manpower requirements of each type force structure unit, which have smaller system densities.

Input

Input to this substep from previous substeps includes the system manpower requirements for each type force structure unit derived in Substep 2.9 (Determine Manpower Requirements). Other input includes the TOEs for each of these type units. The TOEs were also used in Substep 2.7 (Determine Force Structure) to identify the system densities required in each of the type units.

Product

The result of this step is the identification of critical manpower resources for each type unit required to support the introduction of the new system.

Logic

Figure 5.3-1 depicts the logic flow for determining force level impacts. The logic of this substep is the same as that of the previous two substeps, only on a smaller scale. As the figure shows, this substep has only one action step.

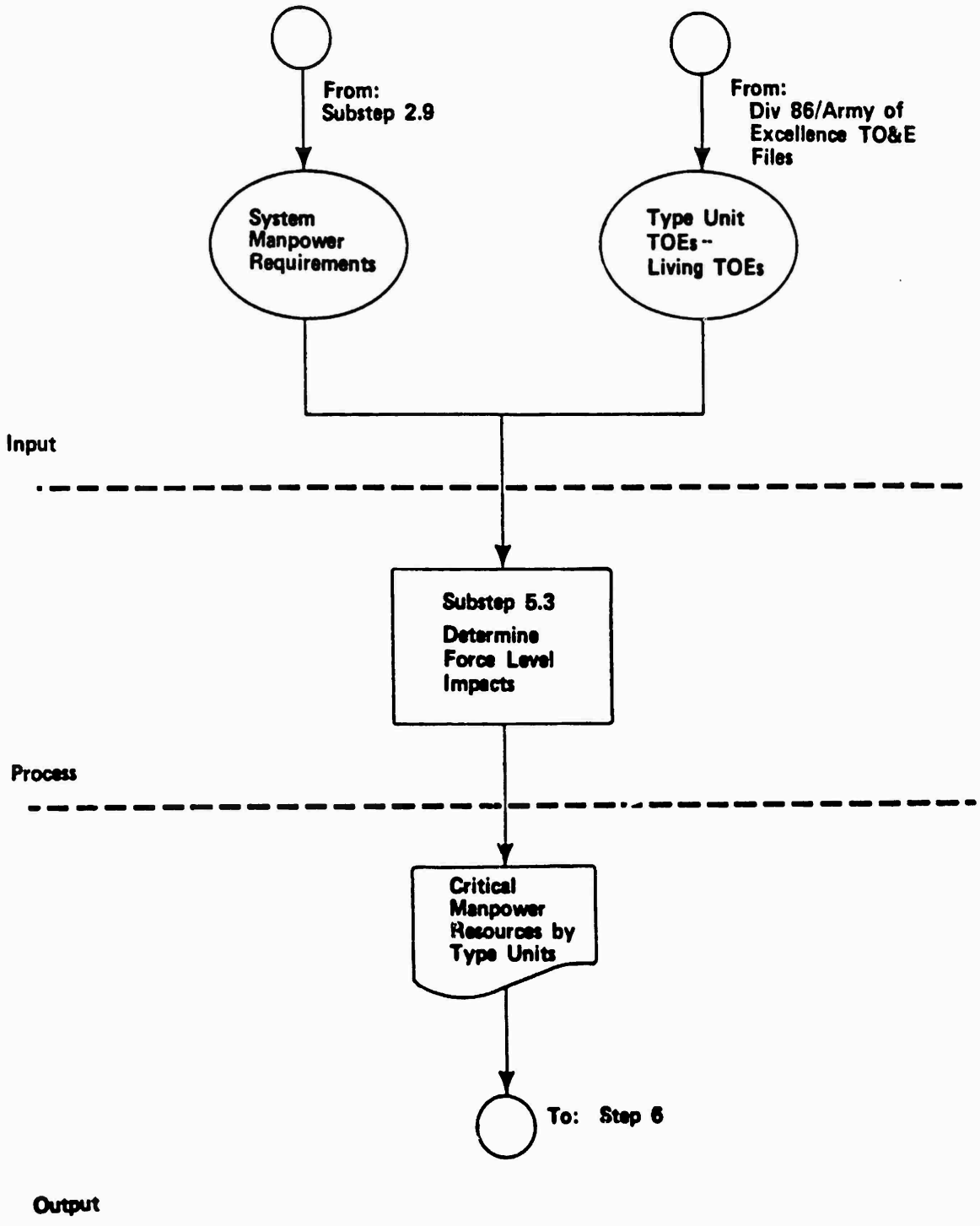


Figure 5.3-1. Logic flow for Determine Force Level Impacts.

Action Step

Requirements

The analyst must determine impacts, in the form of critical manpower resources, for each type force structure unit for which manpower requirements were determined in Substep 2.9 (Determine Manpower Requirements). The analyst employs the same logic processes as described in Substeps 5.1 and 5.2.

Objective

The objective of this substep is to determine the impact the introduction of the new system will have on type force structure units.

Procedures

1. The logic of this substep is the same as that of the previous two substeps. Only a summary of the procedures will be provided here. The analyst may find it useful to compute force-level impacts when the previous substeps are performed.

2. The manpower resources available within each type force structure to support the introduction of the new system must be identified. These resources are the manpower requirements of the Predecessor System. For MOSs specific or unique to the Predecessor, the value in the Required column of the type TOE provides the Predecessor manpower requirements. This assumes, for planning purposes, that the units would be organized at Level 1, making requirements and authorizations equal.

3. To the extent that the Predecessor System shares manpower with other systems, the Predecessor's fair share must be established. System densities in the unit, rather than total system densities, would be used to allocate a fair share to the Predecessor System.

4. This share is compared to the manpower requirements of the new system provided from Substep 2.9 (Determine Manpower Requirements). Initial and new values for an Availability Ratio may be obtained, and critical resources may be identified.

This page intentionally left blank.

STEP 6
Conduct Tradeoff Analysis

Purpose

Tradeoff Analysis provides a set of procedures for systematically iterating the methodology to consider various changes to the system and the results these changes have on the system's MPT requirements.

Changes to the system include the total system. Therefore, tradeoff analyses are not necessarily limited to changes in system hardware. Aspects of the total system, such as the system's deployment, manning, operational scenario, training, recruiting, and other personnel factors, can be considered.

Objectives

The two major objectives of Tradeoff Analysis are:

- To identify alternatives which may reduce the system's MPT requirements
- To determine the effect these alternatives have on the identified MPT requirements

Tradeoff analysis is the objective for performing all the other steps. The goal of a HARDMAN application is to determine, with a good degree of accuracy, the manpower, personnel, and training requirements of a new system. However, the all-encompassing goal is not only to determine the requirements but to identify changes which could be effected. Potential MPT savings that could be attained by implementing any of the alternatives are then determined.

To determine that a system is going to be costly is one matter. To determine how this cost can be reduced or shifted through specific changes is quite another. Accomplishment of the two objectives stated for Tradeoff Analysis will insure that not only can system MPT requirements be made known, but the costs of alternatives can be made known to the decision makers as well.

Interrelationships

Figure 6-1 presents an overview of the relationship between Tradeoff Analysis and the other HARDMAN steps. Tradeoff Analysis necessarily involves all other steps of the methodology because: (1) it obtains all of its data input from the previous five steps, and (2) Tradeoff Analysis ultimately results in an iteration of the methodology which may involve any or all of the previous five steps.

Assumptions/ Constraints

The following assumptions and constraints apply to the HARDMAN Tradeoff Analysis:

- Tradeoff Analysis may include any or all of the following:
  - System Configuration (hardware alternatives)
  - Maintenance Concept
  - Operational and Organizational Concept
  - Training Concept
  - Force Structure (personnel alternatives)

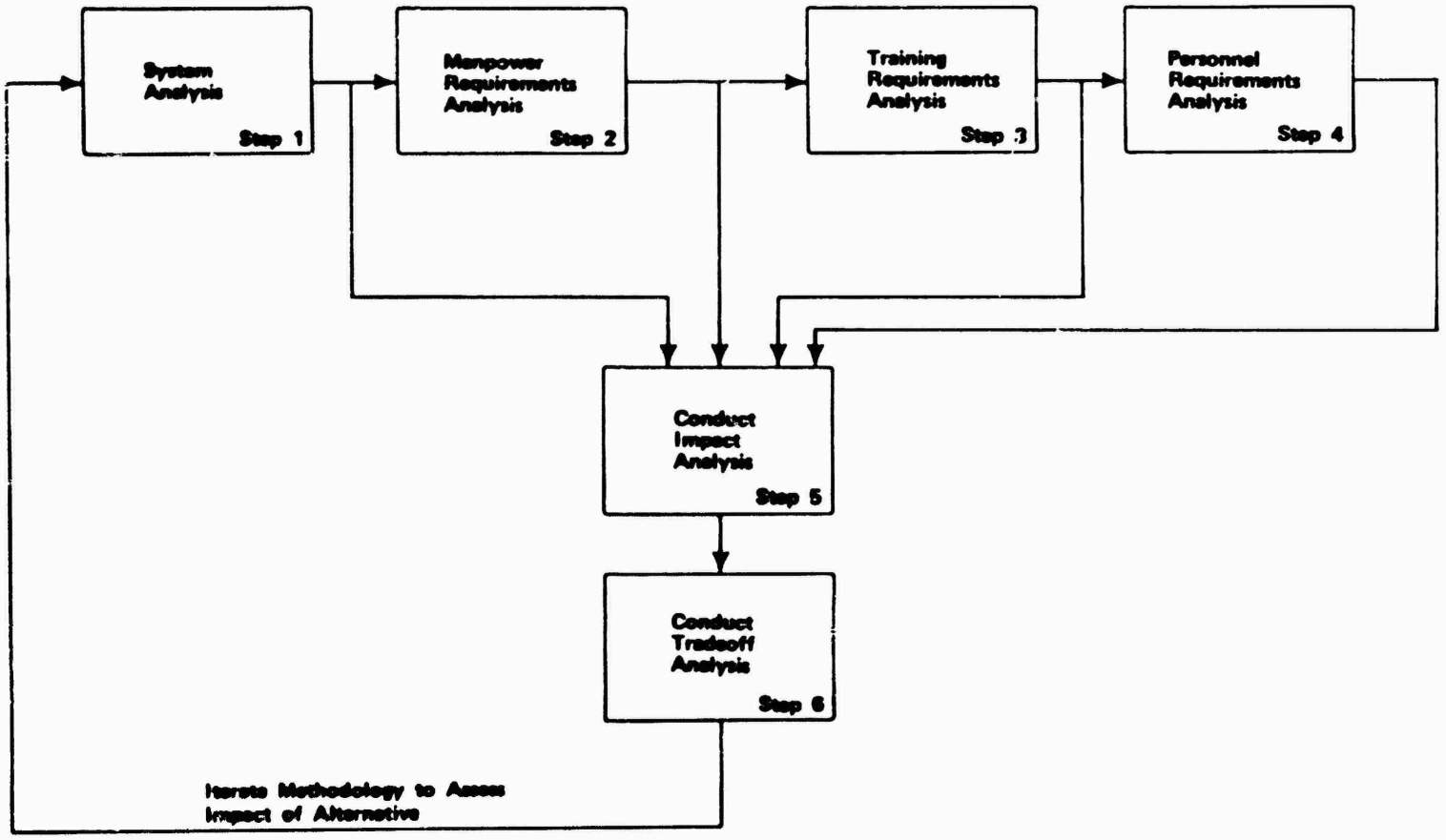


Figure 6-1. Relationship of tradeoff analysis to other HARDMAN steps.

- The numbers obtained from the initial HARDMAN analysis are valid.
- All assumptions and constraints applied to the previous five steps have a bearing on Tradeoff Analysis and should be understood by analysts and users.

Logic

The purpose of Tradeoff Analysis is to develop alternatives which have the potential to reduce the system's MPT impacts. The most critical MPT impacts occur in areas where Army resources are in short supply and the new system will create even more of a shortfall. These areas are usually the ones considered for Tradeoff Analysis.

The HARDMAN team, the program office, and other interested parties should be aware that sometimes the most severe impacts are the least resolvable. Experience has shown HARDMAN to be a great asset in reducing major MPT impacts. However, attention should be directed to equipment/components and training concepts which do not make the list of the top ten or twenty high drivers. Any reduction in MPT demand improves system supportability and benefits the Army.

Whether the MPT demand is great or small, certain areas are identified for Tradeoff Analysis. Next, data to substantiate the alternative are entered into the consolidated data base, and the methodology is iterated. Finally, the new MPT values, which are the result of the alternative approach, are generated and compared to the base values.

Figure 6-2 depicts the logic flow for Step 6 (Tradeoff Analysis). As shown in the figure, Step 6 consists of the following substeps:

Substep 6.1: Identify Tradeoff Areas

Substep 6.2: Establish Tradeoff Alternatives

Substep 6.3: Determine Tradeoff Results

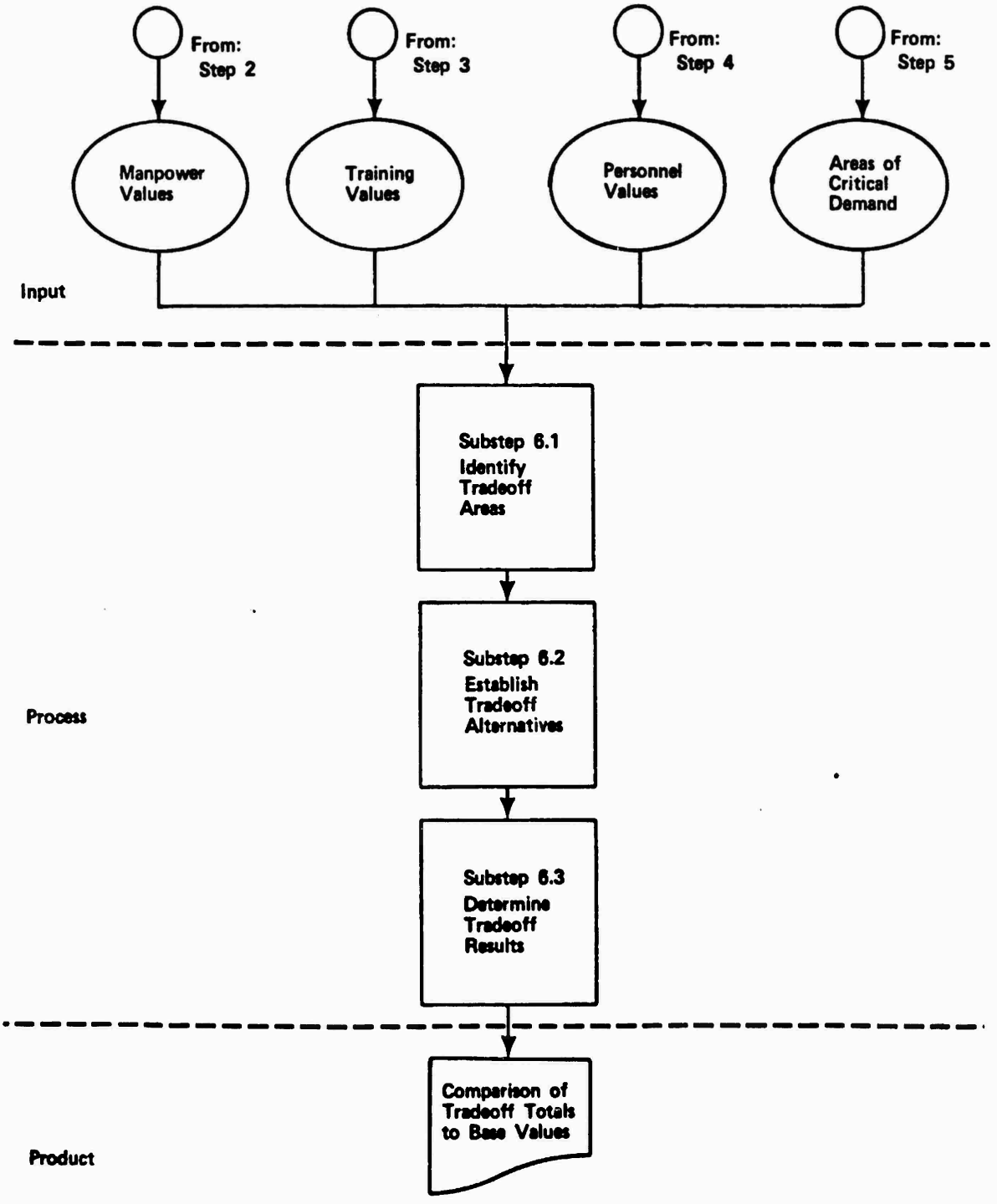


Figure 6-2. Logic flow for Tradeoff Analysis.

Identify Tradeoff Areas

Overview

Identification of tradeoff areas requires considerable information about the system. Therefore, all data produced by the previous five steps must be available. Particularly critical is the prioritized list of MPT high drivers developed during Step 5 (Impact Analysis).

All system data are gathered and analyzed. Those areas which produce the greatest MPT demand and/or those having the greatest likelihood of reducing MPT demands are identified for Tradeoff Analysis. The HARDMAN manager should, however, keep the scope of the analysis in mind.

Tradeoff analyses and their associated iterations of the methodology consume time and money. Consequently, the number of tradeoffs is usually limited. The exact number of tradeoffs depends on what is negotiated when the analysis scope is determined.

Objective

The objective of this substep is to identify potential tradeoff areas. To achieve this objective, the following tasks are completed:

- Collect the HARDMAN data output of each of the previous five steps
- Analyze these data to determine which areas present the greatest opportunity for reducing MPT impacts
- Select areas to be considered for tradeoff analysis (within the scope of the contract if applicable for study)

Input

Input to Tradeoff Analysis includes all products of HARDMAN Steps 1 (Systems Analysis), 2 (Manpower Requirements Analysis), 3 (Training Resource Requirements Analysis), 4 (Personnel Requirements Analysis), and 5 (Impact Analysis). The study scope is also needed, as it states the number of tradeoffs to be conducted.

Product

The areas to which Tradeoff Analysis will be applied are selected. Reasons for selecting each area are also noted.

Logic

Figure 6.1-1 displays the logic flow for Substep 6.1 (Identify Tradeoff Areas). All of the data produced by the initial application of the methodology to the Predecessor, BCS, and Proposed Systems are collected. Also collected at this time are the results of Step 5 (Impact Analysis).

Action Step

The analyst must carefully examine the list of high resource drivers, especially those associated with areas of critical supply. For instance, the Proposed System may require a large number of soldiers with an MOS which is already in short supply. This list of high drivers was developed during Step 5 (Impact Analysis).

In the Procedures section, the analyst examines the list of system-level impacts from Step 5 and asks the following questions:

- What resource values are high?
- Why are those values high?

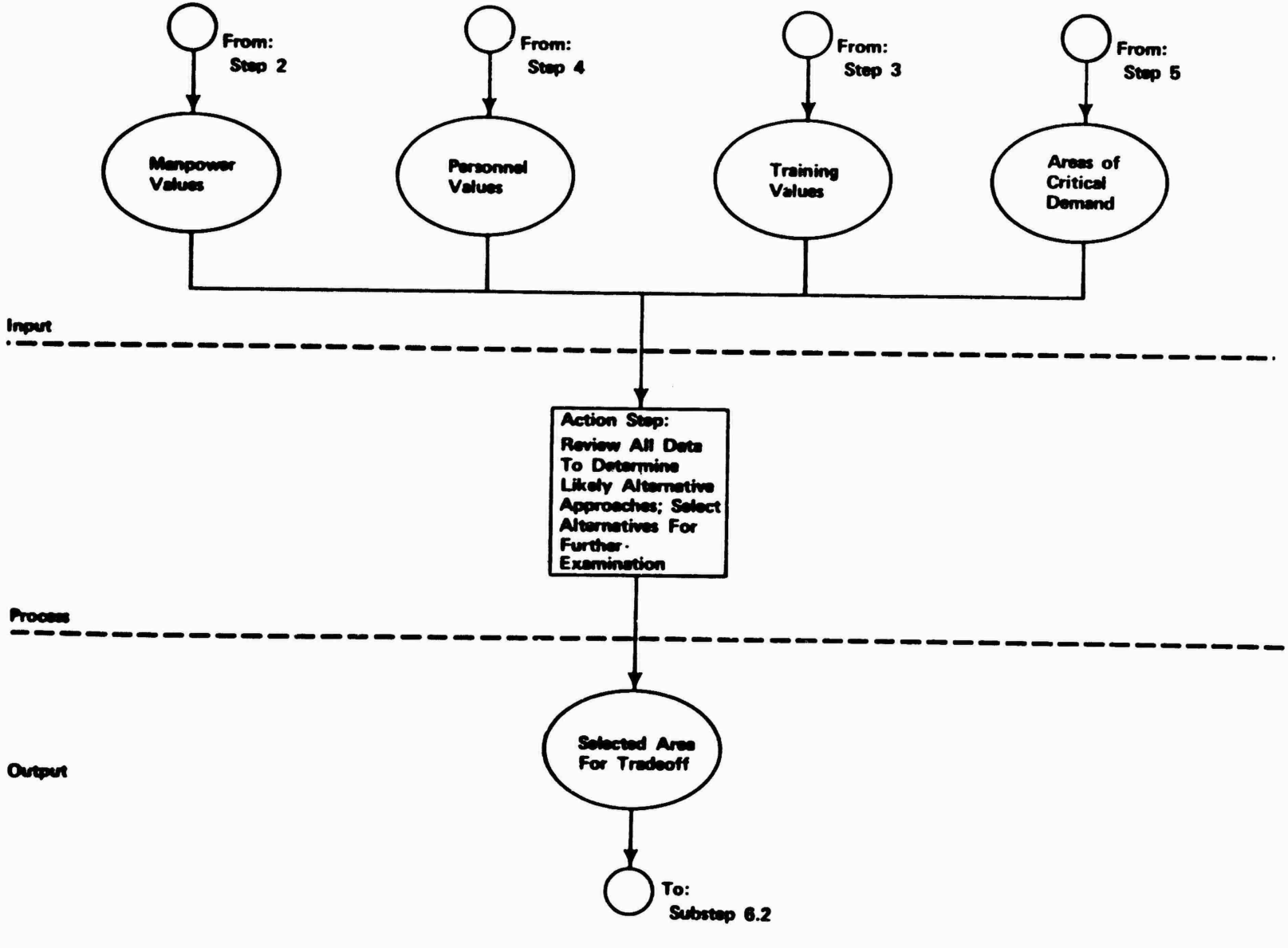


Figure 6.1-1. Logic Flow For Identify Tradeoff Areas

- How likely is it that an alternative approach will reduce the impact of those high values?

Requirements

The HARDMAN analyst examines the rank-order list of system impacts. Experience has shown that the top ten and certainly the top twenty system-level impacts provide ample areas for tradeoff analysis. The analyst should note that the selection of a single critical area for tradeoff analysis may lead to two or three separate tradeoffs.

The various categories of tradeoffs which can be conducted are discussed in Substep 6.2 (Establish Tradeoff Alternatives). As noted earlier, tradeoffs need not be limited to a list of the top ten high drivers.

Objective

The rank-order list of system impacts from Step 5 (Impact Analysis) gives the HARDMAN analyst a means of quickly determining the areas in which the new system is going to have the greatest impact on Army MPT resources. The objective of this substep is to identify areas where alternative approaches can probably be developed. A tradeoff is most valuable in areas which might lessen the impact on a critical Army resource.

Procedures

1. All of the values obtained in Steps 1 through 5 are examined closely. Particular attention is given to the areas of critical demand discovered during Step 5. Values which appear inconsistent or represent substantial

MPT increases between either the Proposed System and the BCS or between the BCS and Predecessor System are noted.

First the analyst asks "What resource values are high?" Any system level impact which increases the demand on a critical Army resource is probably too high. The analyst should compare the Predecessor System's demand for this resource to the Proposed System's demand for it.

Another approach for determining what is too high is to compare the Proposed System impacts to each other. This means that in considering the ten highest drivers of MPT resources, attention should be directed toward but not limited to the ten worst cases.

2. All of the critical areas of MPT impact or areas of substantial increase are reviewed again, this time in light of the probability that an alternative approach does exist. Here the analyst asks "Why are these values high?" Resolving this question helps develop the information needed to answer the next question because the HARDMAN analyst is required to exercise the audit trail function.

Asking "Why is the manpower requirement so high for this maintenance MOS?" may lead to the discovery that the real demand on the MOS, which works at both the Direct Support (DS) and the General Support (GS) maintenance level, is caused almost entirely by the workload at DS. By examining the workload analysis for each equipment maintained by that MOS at DS level, it may become clear that a certain subsystem (or even certain components in the subsystem) is responsible for the high DS workload.

Discovery of a personnel high driver would lead the HARDMAN analyst to examine the personnel pipeline first. Were the transition rates and TTHS rates used actual historical rates for this MOS, or were they estimated using comparability analysis? On examining the rates themselves, do they make sense, or are the data faulty? Is the high TTHS rate responsible for the overall poor characteristics of the pipeline for that MOS? If the TTHS rate is responsible, is that high rate in turn caused by a large number of training man-days required for the new system?

In checking the number of training man-days, the analyst must remember that total training man-days is the product of multiplying the number of soldiers times the course length in man-days. The number of training man-days can therefore be high due to:

(a) a large number of soldiers to be trained

(b) a smaller number of soldiers taking a long training course or

(c) a combination of (a) and (b)

The answer to this aspect of the problem can be obtained by examining the manpower requirement and the course length.

Justification for the course length can be found by exercising the audit trail through all of the Training Resource Requirements Analysis (Step 3). Reasons for the manpower requirement can be identified by tracking the audit trail for development of manpower back to workload, as detailed earlier.

3. Alternative approaches which appear to have real merit (i.e., they appear not only to have promise of reducing the MPT impact but also are implementable) are ranked for the final substep. Finally, the analyst asks "How likely is it that an alternative approach will reduce the impact of these high values?" This question really asks "What are our chances of reducing the impact on resources?"

Because not all drivers of MPT resources merit tradeoff analysis, selection of areas to be analyzed should involve the user and interested TRADOC/AMC agencies. The issue of impact reduction is best resolved at an in-process review (IPR) or by less formal communication among all of the essential parties, including the contracting officer's technical representative (COTR) if applicable, the program office, and other interested TRADOC and AMC agencies.

Critical mission requirements often demand components which are workload intensive. A hardware alternative to the component may not be acceptable, as it will not provide the performance required to assure mission success. A tradeoff which promises to reduce MPT requirements but which results in mission failure would be unacceptable. Similarly, some changes in the O&O Plan, the operational scenario, and personnel policy would ultimately be unacceptable by the Army and, therefore, not worth the cost of a tradeoff analysis.

If the real driver is workload, the analyst must ask the following question before expending the resources necessary to perform a tradeoff analysis: "Can workload actually be reduced?" Sometimes the realistic answer is "No."

In areas such as personnel policy, where change is much more difficult to accomplish, the expense of a tradeoff analysis is sometimes warranted to identify an alternative for consideration. Occasionally, a number of areas may be identified for tradeoff analysis.

After the tradeoff areas have been selected, the specific tradeoffs to be considered in each area must be determined. Substep 6.2 (Establish Tradeoff Alternatives) addresses this process.

Establish Tradeoff Alternatives

Overview

This substep establishes alternatives which promise to reduce the Proposed System's MPT impacts. The tradeoff areas identified in Substep 6.1 are considered in light of one more question. That question is "What can be done to reduce the MPT impact of the Proposed System?"

Objective

The objective of this substep is to develop logical alternatives in the area(s) of hardware/software configurations, maintenance, personnel, and training. These alternatives should hold real promise for reducing a particular MPT impact. The HARDMAN methodology is then iterated with the alternatives in place. A new set of values, reflecting the impact of each alternative, is obtained.

Input

Input to this process includes the areas identified for tradeoff analysis in Substep 6.1 (Identify Tradeoff Areas). Also required are all of the baseline data, including the values determined for manpower, personnel, and training requirements after initial development of the Predecessor, BCS, and Proposed Systems. The audit trail data which substantiate these initial values are also needed.

Product

The product of this step is a new set of manpower, personnel, and training values which reflect the effect alternatives selected for Tradeoff Analysis have on the values obtained initially.

Logic

Figure 6.2-1 depicts the logic flow for establishing tradeoff alternatives which promise to reduce the Proposed System's impacts on Army MPT resources. The key input consists of the areas selected for tradeoff in Substep 6.1.

The initial system configurations are modified to reflect the selected tradeoff alternative. The HARDMAN analysis is then iterated, yielding new data that show the impact of the tradeoff alternative on MPT resources. These data are input into Substep 6.3 (Determine Tradeoff Results).

Action Steps

Action Step 1: Establish Manpower Tradeoff Alternatives

Requirements

The list of tradeoff areas identified in Substep 6.1 (Identify Tradeoff Areas) is examined to determine whether any manpower-related factors are contributing to identified tradeoff areas. Sources of manpower-related high drivers include alternative manpower concepts and alternative manning policy. Hardware and software alternatives, a very direct means for changing manpower requirements, are discussed in Action Step 4.

Objective

The objective of this action step is to establish tradeoff alternatives for manpower-related high drivers, then to iterate the methodology with the alternative values in place.

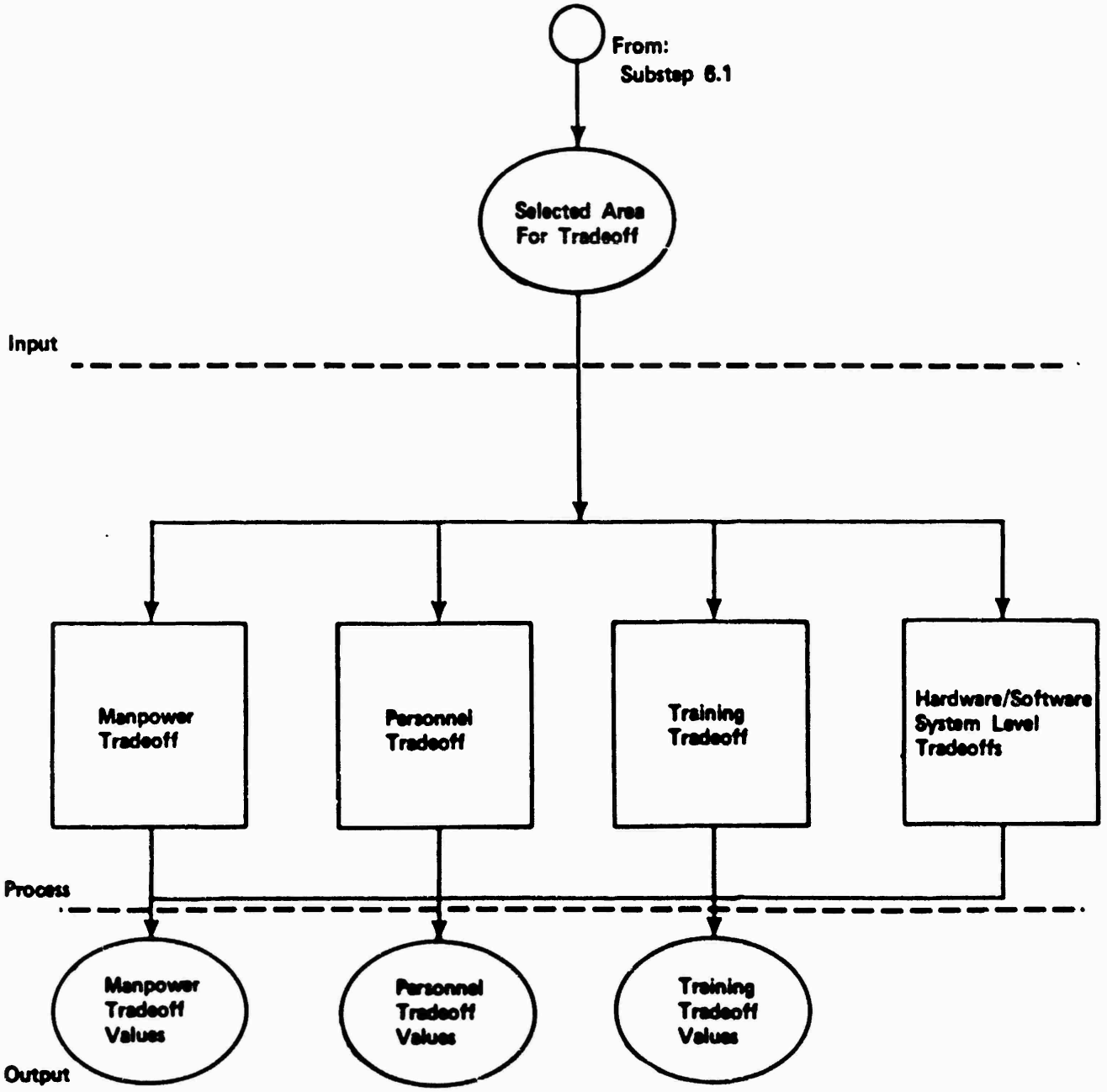


Figure 6.2-1. Logic flow for Establish Tradeoff Alternatives.

Procedures

The following questions are posed in this and all subsequent action steps in Substep 6.2:

1.) What alternatives can realistically be implemented?

2.) What alternatives present a real opportunity to reduce or shift MPT impacts?

The answers to those questions are established as the tradeoff alternatives.

Alternative manpower concepts or manpower policies which appear likely to reduce the impact of MPT drivers are established. An iteration of the methodology is then performed.

The alternative manpower and maintenance concepts result in a different distribution of workload. Perhaps a change in maintenance level or a change in maintenance responsibility from one MOS to another occurs. These alternatives are reflected by appropriate changes made to the workload analysis and, when the manpower has been computed, should reflect changes in the manpower values.

Alternative manpower policy can also be explored. However, it should be noted that changes in manpower policies or the manpower structures established in the O&O Plan are much more difficult to implement, even if Tradeoff Analysis demonstrates that these policy changes would reduce the manpower impact.

A policy change might be to increase an MOS's available productive maintenance time by altering the individual work

capacity of the MOS so that less time is spent on soldier tasks such as sentry or KP and more on maintenance duties. The problem with such solutions is that they run far beyond the scope of an individual program acquisition. For that reason, they are not usually worthwhile tradeoffs.

Action Step 2: Establish Personnel Tradeoff Alternatives

This action step deals with alternate personnel concepts which may present an opportunity to reduce the impact of personnel high drivers. A tradeoff area identified in Substep 6.1 is examined to determine if the personnel impact is attributable in all or in part to a particular personnel policy.

Requirements

The tradeoff areas identified in 6.1 are examined to determine whether personnel-related sources are responsible for all or part of the identified MPT impact.

Objective

The objective of this action step is to establish tradeoff alternatives for personnel-related high drivers, then to iterate the methodology with the alternative values in place.

Procedures

Personnel policies and structures contributing to an MPT impact previously identified are examined. An alternative personnel policy which is expected to reduce the MPT impact is developed. Next, changes are made in the historical personnel rates used to compute HARDMAN

personnel values. As noted in Action Step 1, policy changes are difficult to accomplish and exceed the scope of any individual program acquisition.

Nonetheless, the capability to examine the change a policy shift would have on personnel values does exist. Examination of alternate personnel structure is more appropriate. Obviously, the potential exists for overlap with alternative manpower concepts discussed in Action Step 1. The discussion here is limited to the exploration of personnel structures which result from different personnel flow rates rather than resulting from different (lower) manpower requirements.

An alternative of this kind would be a tradeoff analysis conducted to examine what a better retention rate would do to reduce the personnel and training impacts of a system. A reduction in the attrition rate from an MOS would clearly result in a more favorable personnel structure. Another tradeoff might be conducted to examine a change in TTHS rates.

A reduction of the percentage of personnel held in TTHS status in a particular MOS would also be expected to increase the number of assignable soldiers in an MOS and to reduce the personnel impact. The consideration of alternate TTHS rates and their affect on the personnel structure has implications for training tradeoffs, since trainees and students are the portions of TTHS flow factor which can reasonably be expected to be affected in the real world.

Action Step 3: Establish Training Tradeoff Alternatives

This action step considers tradeoffs of alternate training concepts. Each of the areas identified for tradeoff analysis in Substep 6.1 are examined to determine whether an alternative training concept might reduce MPT impacts of the weapon system under study.

Requirements

Tradeoff areas identified previously are examined to determine whether it is likely that an alternate training concept could reduce the MPT impact. After selecting a training tradeoff, the HARDMAN methodology is iterated, incorporating the alternate training concept. New personnel and training values are obtained which can, in Step 6.3, be compared to the base values from the initial HARDMAN application.

Objective

The objective of this action step is to establish tradeoff alternatives for training-related high drivers, then to iterate the methodology with the alternative values in place.

Procedures

Determination of alternate training concepts covers a wide range of possible alternatives for tradeoff analysis. Among these alternatives are: training sites (formal school or unit), student/teacher ratio, training media, and course length (due to changes to more effective course methods and/or media or perhaps a shift in the training of some tasks to the unit).

Any or all of these alternatives can be explored in a Tradeoff Analysis of alternative training concepts. Again, the interaction of manpower, personnel, and training on a specific impact must be noted. It should be clear to the HARDMAN manager and HARDMAN analysts that a change in training course length will affect the personnel structure of an MOS. It should also be clear that a shift in workload from one MOS to another may well require an alteration of the training for each of the two MOSs.

To accomplish a training concept tradeoff, the HARDMAN training analyst must go back through the audit trail and alter the existing course media or method. The analyst must then reflect the effect of this change on the number of instructors and course length. Finally, the analyst iterates the methodology to obtain the values this alternative would produce in training and personnel.

Action Step 4: Establish Hardware, Software, and System-Level Tradeoffs

This action step covers all the hardware, software, and system-level alternatives that could be considered during Tradeoff Analysis. Hardware/software alternatives include changes (usually assumed to be improvements) in Reliability and Maintainability. System-level alternatives include O&O Plan concepts, maintenance, and support concepts.

Each potential tradeoff is examined to determine whether hardware/software or system-level alternatives are logically attainable. Those selected are

scrutinized further by altering the system-specific values in the consolidated data base and iterating the HARDMAN methodology.

Requirements

The tradeoff areas identified in Substep 6.1 are now considered in light of any hardware, software, or system-level alternatives that might reduce the system's MPT impacts. In any of the tradeoffs, data to support the alternative equipment, O&O Plan, or maintenance concepts must be available.

Objective

The objective of this substep is to determine whether alternative equipment or an alternative method of deploying, maintaining, and supporting the system reduces MPT impacts. The real goal is to alter the system configuration or system support in a manner which reduces MPT impact without diminishing mission performance.

Procedures

A hardware/software alternative tradeoff requires a different component, subsystem, or software module to be configured in the system. This alternative may be a completely different device, or it may be a similar device with improved Reliability and Maintainability factors.

A component may be less complex and require less maintenance, or a component may have the same complexity but improved reliability. Both options have the potential to reduce the workload associated with them. Similarly, more sophisticated software may result in reduced operator workload, perhaps even enough to reduce crew size.

Although this approach is fairly straightforward in the area of reducing maintenance workload and therefore maintenance manpower, reductions in crew size cannot be done arbitrarily. Consideration must be given to all the tasks and duties the crew performs.

Ultimately, the improved software may result in improved operator, and therefore system, performance. No reduction in operator workload is accomplished — only an improvement in mission performance.

Changes in system maintenance concept present another opportunity for the "what if" questions posed during Tradeoff Analysis. One type of maintenance concept change might be to consider a disposable component. This would eliminate test/repair/calibrate tasks and associated workload for the component. Of course, other workload, such as fault diagnosis and remove/replace, would remain. Another "what if" question that can be addressed during tradeoff analysis is to examine the effects of a shift in workload from one maintenance level to another.

Support concepts and O&O concepts can be explored in similar ways. Perhaps a small reduction in the number of miles driven or rounds fired would lead to a significant reduction in maintenance workload. Of course, changes such as these cannot be considered if they would diminish mission performance. Conversely, an increase in miles driven or rounds fired may not result in a proportionate increase in workload and, therefore, should be examined.

Very often, the hardware, software, and system-level alternatives produce the greatest and most easily accomplished reduction in MPT impacts.

Determine Tradeoff Results

Overview

The purpose of Step 6 (Conduct Tradeoff Analysis) culminates in this substep. The objectives of the other two substeps are: (1) to identify, prioritize, and select alternatives for Tradeoff Analysis; and (2) to iterate the methodology to generate new MPT values which reflect the alternatives. In this substep, the analyst examines the new MPT values and compares them to the base values previously attained.

Objective

The objective of Tradeoff Analysis is to present to interested TRADOC/AMC agencies a clear comparison of base value numbers to the alternate MPT values obtained from a tradeoff. These values must be presented with a description of the tradeoff alternative investigated.

Input

The results of Substep 6.2, that is, new values obtained from the iteration of the methodology, are required. The base values which were generated from the initial application of the methodology are also required. The list of prioritized high drivers/impacts from Step 5 (Impact Analysis) is helpful here.

Products

Alternative MPT values for tradeoff alternatives are produced. These values are commonly reported with the base values. Actual difference (i.e., difference between base workload and that obtained for the tradeoff is frequently the way the products are displayed. Additional products can be

the percent of increase or reduction and other such calculations requested by a COTR (if applicable) or Program Office.

Logic

Figure 6.3-1 displays the logic flow for this final substep of Step 6. The previous two steps identified areas where MPT reductions should be sought. They also established possible alternatives which might accomplish these reductions and produced new values to reflect these alternatives.

This substep simply compares the new MPT values which are the result of the tradeoff alternatives to the base values previously obtained from the initial application of the methodology.

Action Step

Requirements

This final action step requires that the results of the first four steps of the HARDMAN methodology be compared to the tradeoff values generated in Step 6.2. Results of the first four steps are also reviewed in light of the degree to which they reduce the MPT impact determined in Step 5.

Objective

The objective of this substep is to produce a comparison of tradeoff values to base values, the results of the first four HARDMAN steps. Information on methods for reporting that comparison effectively is presented in Appendix B, Standard Information Transfer Methods (see Volume V).

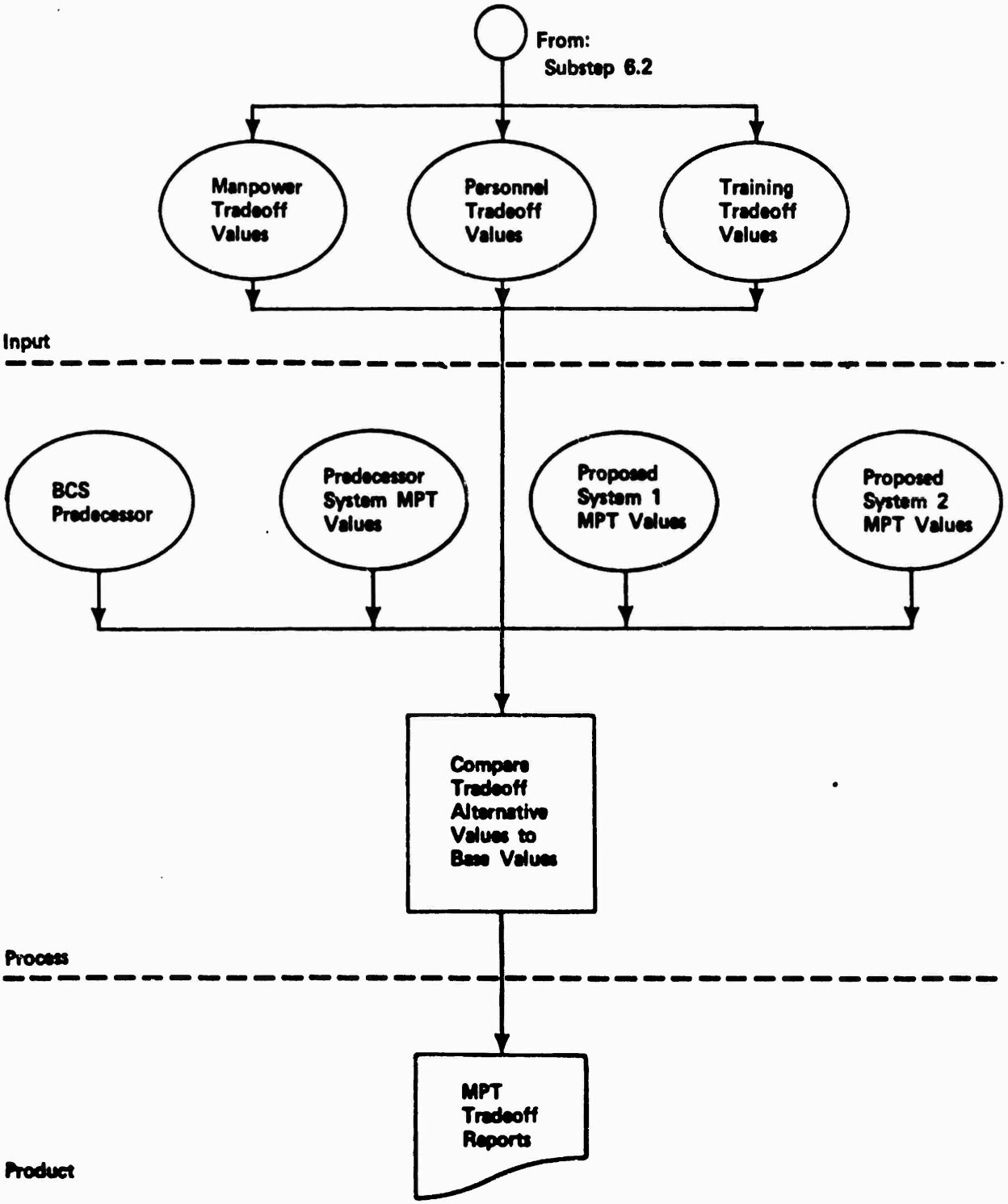


Figure 6.3-1. Logic flow for Determine Tradeoff Results.

Procedures

The values for each system, concept, and policy tradeoff established in Step 6.2 are compared to the initial or base value. The format used to display or repeat these two sets of results will vary depending on the nature and scope of the system variable(s) that are modified.

Examples

Example 1

If the maintenance man-hours for 63D were 1000 hours at DS level in the initial application but, due to a hardware tradeoff were reduced to 900 hours at DS, then the values would be displayed for the base (1000 hours), the tradeoff (900 hours), and for the actual change (a reduction of 100 maintenance man-hours at DS level for MOS 63D). Another way of reporting such a finding could be to state that the tradeoff resulted in a 10 percent reduction in maintenance manpower for 63D at the DS level.

Example 2

Table 6.3-1 displays a summary tradeoff report of Annual Training Course Costs. This tradeoff alternative iterated only the Proposed System configuration. The report shows the results of one tradeoff in relation to the results of Steps 1 through 4. (Typically, when such a report format is used, all of the MPT summary reports are displayed, not just Training Course Costs.)

Example 3

Another form of tradeoff would be to iterate all of the system configurations for the tradeoff alternative. The results of that tradeoff analysis would

be displayed for all system configurations (not just the Proposed System as shown in Table 6.3-1).

The above examples illustrate types of tradeoff reports that can result from the application of Step 6. Selection of the tradeoff alternatives described in these examples (and in any other form of tradeoff alternative) is determined by decisions made by the analysis manager and the program office. Section 3.3 of Volume I (Manager's Volume) presents detailed discussion of tradeoff issues as dealt with by the analysis manager and the program office.

Table 6.3-1. Comparison of Tradeoff Alternatives Results to Base Values (in $K)

MOS/ Course	Prede-cessor	BCS	Pro-posed	Proposed System Tradeoff Alternative
101-31E10	514,513	517,753	15,290	18,404
160-31S10	303,309	92,619	25,609	31,039
101-31V10	311,549	309,394	12,109	15,686
160-32G10	—	29,395	2,971	3,136
XXX-35C10	—	40,924	4,977	5,300
TOTAL	1,129,371	990,085	60,956	73,565

This page intentionally left blank.

Glossary

Action Rate The preventive maintenance action rate measured as the number of occurrences (i.e., demand) per life unit (calendar/clock time, miles/kilometers traveled, rounds fired or number of activations); (paraphrased from AR 570-2).

Additional Skill Identifier (ASI) A code added to the specialty/MOS to designate greater specialization (AR 351-1). For example, soldiers with either 11B, 12B, 19D MOS who receive Dragon Gunnery Training are assigned the ASI C2.

Administrative Time POI time allotted for administrative functions as opposed to course/training related functions.

Advanced Individual Training (AIT) Skill training given enlisted personnel after completion of basic training, so as to qualify them for the award of an MOS and to perform the basics of their job upon initial assignment to a unit (AR 351-1).

Noncommissioned Officer Course (ANCOC) A course that stresses MOS-related tasks with emphasis on technical and advanced leadership skills, and knowledge of military subjects required to train and teach other soldiers at the platoon and comparable level (AR 351-1).

Annex Logical divisions in a program of instruction (POI) that cluster tasks into blocks of instruction. Within each annex are lessons (identified by file numbers) which are designed to instruct the tasks.

Annual Accessions The number of individuals who must be recruited in a year.

Annual Costs Total cost of training computed on an annual basis.

Annual Course Costs Total course cost and individual course cost elements computed on an annual basis.

Annual Course Resources Products of Training Cost and Resources. Include number of instructors required, training cost, and training man-days.

Annual Instructor Requirements The number of instructors required to deliver all convenings of a course in a year.

Annual Training Man-Day Requirements Number of man-days per year that soldiers will be receiving a course of instruction and be unavailable for assignment to other duties.

Attrition Rate The rate at which individuals leave the Army at each paygrade within each MOS.

Audit Trail A systematic mechanism for tracking development of MPT requirements and for monitoring changes to the data, assumptions, or procedures which produce the MPT requirements.

Availability Ratio An estimate of availability of an MOS to support a Proposed System.

Base Operations Cost Cost to the base operations functional account adjusted by the total number of training man-weeks.

Baseline Comparison System (BCS) A current operational system, or a composite of current operational subsystems, which most closely represents the design, operational, and support characteristics of the new system under development (MIL-STD-1388-1A).

Basic Combat Training (BCT) Fundamentals of basic infantry combat given to enlisted Active Army and Reserve personnel without prior military service (AR 310-25).

Basic Noncommissioned Officer Course (BNCOC) A course that prepares career soldiers in Grade E5 (Skill Level 2) for duties at grade E6. Performance-oriented training is stressed (AR 351-1).

Basic Technical Course (BTC) A course that focuses on training critical tasks listed in the Skill Level 3 Soldier's Manual for a given MOS (AR 351-1).

Basis of Issue Plan (BOIP) A plan which indicates the quantity of new or modified equipment planned for each type organization and the planned changes to personnel and supporting equipment (AR 70-27).

Bill Payer An older system that is currently consuming MPT resources and that will be phased out of the inventory upon introduction of the new system.

Career Management Field (CMF) A list of operator or maintainer Military Occupational Specialties for one functional branch area.

Class Frequency Average number of times a Program of Instruction is offered each year (averaging across locations).

Class Length Length of a course of study, usually stated in weeks.

Comparability Analysis Process by which estimates of the human resource requirements of an emerging weapon system are derived from the known requirements of similar operational systems and subsystems.

Comparable Task The task closest to a new task in terms of task criticality and similarity to type or class of task.

Corrective Maintenance (CM) All actions performed as a result of failure to restore an item to a specific condition (MIL-STD-1388-1A).

Cost and Training Effectiveness Analysis (CTEA) The sole Army process used to assess the training cost and effectiveness of developing weapon systems.

Course Attrition The number of students failing to graduate from a course of instruction.

Course Number An alphanumeric code used to designate a Program of Instruction.

Course Module A component instruction which teaches a specific task; can exist at course, annex, or file level.

Course, System-Specific (1) The Advanced Individual Training (AIT) and Additional Skill Identifier (ASI) courses for all MOSs assigned to equipment in the Predecessor, Baseline Comparison, and Proposed Systems; and (2) the Noncommissioned Officer Education System (NCOES), warrant and commissioned officer courses providing direct instruction on system-specific equipment.

Crew Maintenance Maintenance actions that are performed by the personnel whose principal duty is operation of a system.

Critical Resources The implementation or management risk associated with the introduction of a new system. This risk

involves manpower, personnel, and training demands created by the new system compared to the present or projected supply.

Data Management Structure A systematic, consistent method of organizing information.

Delta The Greek letter; symbolizes an expected change in the manpower, personnel, and training requirements cited in output reports.

Dependency The relationship (dependency) between a specific maintenance action and a specific metric. For example, maintenance actions associated with automotives usually depend on the number of miles driven, maintenance associated with an artillery tube depends on rounds fired, and electronic equipment depends on hours operated.

Depot Maintenance Maintenance involving the overhaul of economically repairable materiel to augment the procurement program in satisfying the overall Army requirements and when required to provide for repair of materiel beyond the capability of general support maintenance organizations (AR 310-25).

Design Differences Differences in design between projected equipment and comparable existing equipment used in the Baseline Comparison System.

Design Freedom The absence of a detailed design at the beginning of a weapon system's development.

Direct Cost Operational and Maintenance, Army (OMA), Military Personnel, Army (MPA) and Procurement Account (PA) cost elements that are directly contributable to the cost per graduate for a specific course or group of courses. The following direct costs are listed in TRADOC Cost Analysis Program Reports (MOS Training Costs), ATRM-159 (R1): direct mission, troop support, ammunition, equipment item depreciation, student pay and allowances, travel pay to course, per diem at course.

Direct Maintenance Effort expended by maintenance personnel in the actual performance of maintenance on the hardware in accordance with the prescribed procedures contained in the applicable technical manuals (DA PAM 700-127).

Direct Mission Cost Operational and Maintenance, Army (OMA) and Military Personnel, Army (MPA) cost of the instructional

department's costs, plus the flying hours costs plus any other costs all computed on a per graduate basis. Algorithms for computing these costs are contained in Cost Analysis Program Reports (MOS Training Costs) ATRM-159 (R1) documents.

Direct Support Maintenance (DS) Normally authorized and performed by designated maintenance activities in direct support of using organizations. This category of maintenance is limited to the repair of end items or unserviceable assemblies in support of using organizations on a return to user basis (AR 310-25).

Duty Position A group of closely related tasks and responsibilities which are normally assumed by one individual (AR 310-25).

End-Item Equipment A final combination of end item products, components, parts and/or materials that is ready for its intended use, e.g., ship, tank, mobile machine shop, aircraft (MIL-STD-1388-1A).

Engineering Comparability Analysis A structured analytic process utilizing principles of reliability/maintainability (R/M) engineering, logistics engineering, industrial engineering, and statistical extrapolation to predict the reliability and maintainability of new systems based upon the R/M characteristics of existing systems.

Environmental Variables Environmental factors such as heat, cold, snow, mud, desert conditions, etc., which may impact the operating scenario of the proposed weapon system.

Equipment Depreciation Cost Cost of equipment dedicated to a course, non-dedicated departmental equipment, and school overhead equipment amortized over a ten-year period and applied to Course Cost.

Equipment Identification Code (EIC) An alphanumeric coding scheme used to identify specific pieces of equipment. May equate to Functional Group Codes, Work Unit Codes, or Logistic Support Analysis Record numbers.

File The lessons within an annex of a program of instruction (POI) in which tasks are taught.

First Unit Equipped (FUE) The first troop unit to be equipped with the first production items/systems (DA PAM 700-127).

Footprint The resources of an earlier system within which a new system must fit or closely match.

Frequency The number of times the task is performed per period of time.

Front-End Analysis The process of assessing what impacts the manpower, personnel, and training requirements of an emerging system will have on present and projected resources.

Function A broad category of activity performed by a man-machine system (Draft MIL-STD on Task Analysis, Feb. 1980). For example, upper level functions of a self-propelled howitzer would be to shoot, move, and communicate. The requirement to shoot would have lower level functions such as direct and indirect fire.

Functional Allocation The categorization of the activities (functions) performed by a man-machine system into who or what will perform them. The performance categories include hardware, software, human (operator, maintainer, or support), or a combination of these.

Functional Group Code (FGC) A standard indexing system which parcels the weapon system into its functional systems, subsystems, components/assemblies, and parts.

Functional Hierarchy Functional structure which first identifies the major functions and subsequently each of the lower level functions a system is expected to perform. These functions are arranged in a hierarchical structure to aid in the identification of components from which lower level functions and their sequence are determined and described.

Functional Requirements Functions or activities required of a proposed weapon system. These required functions are developed and stated in DoD and Army threat studies, mission area analyses, how-to-fight manuals, use studies, and system concept papers.

General Support Maintenance (GS) The maintenance authorized and performed by designated Table of Organization and Equipment (TOE) and Table of Distribution and Allowance (TDA) organizations in support of the Army Supply System. Normally, these organizations will repair or overhaul materiel to required maintenance standards in a

ready-to-issue condition based upon applicable supported Army area supply requirements (AR 310-25).

Generic System A description of the general configuration of equipment, software, and duty positions required to fulfill all system functional requirements stated in Army Mission Area Analyses and System Concept Papers.

Hardware Function An activity (function) accomplished principally by the equipment.

High Driver A system element which consumes a large proportion of MPT resources.

Indirect Cost A cost which, because of its incurrence for common or joint objectives, is not readily subject to treatment as a direct cost (AR 310-25).

Indirect Maintenance Also stated as Indirect Productive Time (IPT); the time required for normal performance of the maintenance tasks but that does not in and by itself result in the total time required to accomplish the tasks. Indirect maintenance will not exceed a ratio of 1 to 0.4 (direct to indirect) for organizational and direct support maintenance. For general support, indirect maintenance will not exceed a ratio of 1 to 0.22 (direct to indirect).

Individual and Collective Training Plan (ICTP) The primary resource and planning document for developing training subsystems for new Army systems. The ICTP describes the integration of training subsystems into the development of the total system as well as integration of the developing system into ongoing training programs.

Individual Work Capacity The available productive man-hours (available for MOS duties). Excludes all non-available time factors such as security, kitchen patrol, work details, messing, casualties, personal needs, and unit movement (AR 570-2).

Induced Maintenance See Unscheduled Maintenance, Induced.

Inherent Maintenance See Unscheduled Maintenance, Inherent.

Instructional Department Cost Includes Operations and Maintenance, Army (OMA) and Military Personnel, Army (MPA) costs of the academic department's cost per graduate. It also includes pay and allowances of instructors and academic department staff, consumable supplies and equipment, and

contractual services. The method used to compute Instructional Department Cost can be found in the Cost Analysis Program (MOS Training Costs) documents [ATRM-159 (R1)].

Instructional Systems Development A systems engineering approach to developing a training program based on task analysis. ISD includes five phases: analyze, design, develop, implement, and control.

Instructor Contact Hours (ICH) Instructor manhours required to present course material and to provide assistance to students during the actual presentation of course of instruction (DA PAM 570-558).

Intake to Paygrade The number of individuals who must be assessed or promoted into a paygrade.

Line Item Number A number identifying the position which end-line equipment or a component thereof holds in the equipment hierarchy.

Logistic Support Analysis An analysis supplied during the acquisition process in order to insure supportability and other Integrated Logistic Support (ILS) objectives. The analysis consists of iterative definition, synthesis, tradeoff, and test/evaluation (MIL-STD-1388-1A).

Maintainability A system's or its component's requirement for maintenance, both planned and corrective determines its maintainability. Maintainability is a product of the frequency of planned maintenance actions and corrective maintenance actions multiplied by the time these actions take to complete.

Maintenance, Corrective See Corrective Maintenance.

Maintenance Level The four basic levels of maintenance into which maintenance activity is divided. They include organizational, direct support, general support, and depot (DA PAM 700-127).

Maintenance Manhours Per Maintenance Action A measure of the maintainability parameter related to item demand for maintenance manpower: the sum of maintenance man-hours divided by the total number of maintenance actions (preventive and corrective) during a stated period of time (MIL-STD-721C).

Maintenance, Preventive See Preventive Maintenance.

Maintenance Ratio A measure of the total maintenance manpower burden required to maintain a system. It is expressed as the cumulative number of manhours of maintenance expended in direct labor during a given period of time divided by the cumulative number of end items' operating hours during the same time (DA PAM 700-127).

Manpower The total demand, expressed in terms of the number of individuals, associated with a system. (MIL-STD-1388-1A). Includes the number of individuals in each MOS/ASI, skill level, and paygrade required to operate and maintain a system.

Manpower Losses Per Year Losses in productive manpower at each paygrade in an MOS due to promotion, attrition, and application of the Transients, Trainees, Holdees, and Students (TTHS) percentage to the manpower requirements over the course of a year.

Manpower Requirements An emerging weapon system's qualitative and quantitative manning needs.

Manpower Requirements Criteria (MARC) The manpower requirements of positions for Army units as defined in AR 570-2.

Mean Time to Repair (MTTR) A basic measure of maintainability. MTTR is calculated by summing corrective maintenance actions times for a particular item and dividing this sum by the total number of failures of that item at a specified maintenance level.

Military Occupational Specialty (MOS) A group of duty positions that require closely related skills such that a person qualified in one duty position in an MOS can, with adequate on-the-job training (OJT), perform in any of the other positions that are at the same level of difficulty.

Military Occupational Specialty Code (MOSC) A specific occupational identification identifying type and level of skill, level of proficiency, and/or scope of responsibility (AR 611-201); stated in terms of MOS and skill level.

Military Personnel, Army (MPA) An appropriation that provides for pay, allowances, individual clothing, subsistence, interest on deposits, gratuities, permanent change of station travel, per diem portion of temporary duty travel between permanent duty stations for members of the

Army on active duty and military academy cadets. Also includes expenses of apprehension and delivery of deserters, prisoners, and members absent without leave (AR 37-100-80).

Mission A clear, concise statement of a task or tasks to be accomplished.

Mission Area A broad subdivsion of the Army's overall mission, which is to prepare for, engage in, and win land wars.

Mission Area Analysis Process by which a threat is analyzed and a counter to this threat (i.e., the mission) is postulated. The mission is stated in the Mission Area Analysis's Studies and System Concept Papers.

Characteristics Threat and environment impacts define specific mission characteristics. Frequently, mission characteristics require specific performance requirements of a system.

Mission Name Name assigned to a specific mission that a system is expected to accomplish. For example, Defeat Enemy Armor is a mission that could be assigned to armored units, aviation units, and infantry equipped with anti-armor systems.

Mode/Concept Details the maintenance concept, organizational concept, and the operational mode/concept proposed for a system. Firing 40 rounds per hour, moving three times a day, fixing forward, and performing all organizational maintenance actions within 30 minutes are examples of modes and concepts.

New Technologies The additional technologies (in addition to technologies incorporated in current systems) that a system needs to meet stated performance requirements.

Normalized Graduates The number of students who satisfactorily completed the course (graduate), as adjusted for carryovers. Norm grads equal the number of actual grads minus one-half the number of students in training in the beginning of the fiscal year plus one-half the number of students in training at the end of the fiscal year.

Number of Acquisitions The total number of systems to be purchased. Includes TOE as well as systems purchased for Reserve Forces and operational floats. Also includes systems purchased to be pre-positioned but not manned.

One-Station Unit Training (OSUT) Training conducted at one location; includes both basic and advanced individual training for combat arms MOS and selected combat support MOS. Training is conducted in one unit with the same cadre and one program of instruction (POI) (AR 351-1 and PM 25-1).

Operating Strength The present and absent strength of an organization classified under the item "personnel status" of the morning report heading as "permanent party". Does not include "intransit" strength (AR 310-25).

Operational Environment Characteristics Environmental and operational factors that will impact the operating scenario of the proposed weapon system. Includes environmental variables as well as operational and scenario dependent variables such as smoke, NBC, and night operations.

Operational Manning (OM) The number of personnel required to operate a system in an operational environment.

Operations and Maintenance, Army (OMA) An appropriation that provides for the operation and maintenance of all organizational equipment and facilities of the Army; procurement or requisite equipment and supplies; production of audiovisual instructional materiel and training devices; operation of service-wide and establishment-wide activities; operation of depots, schools, training, and programs related to the operation and maintenance of the Army (AR 37-100-80).

Optimum Class Size The number of students designated for a class which, due to instructional considerations, is considered optimum.

Organizational Maintenance (ORG) Maintenance authorized for and performed by a using organization on its own equipment (AR 310-25).

Paygrade (PGD) The statutory paygrade established in the Career Compensation Act of 1949, as amended (AR 310-25).

Per Diem at Course The students' daily expenses which are costed for courses that are less than twenty weeks in length [ATRM-159 (R1)].

Performance Measure The qualitative description of how the function's performance will be assessed.

Performance Standard An established number of man-hours needed to accomplish a unit of work (AR 310-25).

Period Reported The period of time, in days, that the system is to maintain continuous operation and for which workload and manpower requirements are to be determined.

Personnel Flow Rates The rates of progression of individuals through the military personnel system. Includes promotion, attrition, and TTHS rates.

Personnel Pipeline The personnel structure that must be maintained to insure that required manpower requirements are met.

Personnel Requirements The number of people who must be carried in a personnel pipeline to satisfy stated manpower requirements. This number must also offset manpower losses that result from attrition, advancement, and non-availability.

Perturbation Value A quantitative representation of the impact of the design differences between the Baseline Comparison System and the Proposed System.

Phased Schedule A schedule that lists the number of new systems to be placed in service per year.

Planned or Estimated Schedule The planned or estimated schedule for a new system progressing through the acquisition process.

Predecessor System An Army system that is performing mission(s) that will eventually be performed by the new system.

Prepositioned Materiel Configured to Unit Sets (POMCUS) Equipment that has been procured but is held, unmanned, in readiness for future use.

Preventive Maintenance (PM) All actions performed in order to retain an item in specified condition. Involves systematic inspection, detection, and prevention of incipient failures (MIL-STD-1388-1A).

Primary Leadership Course (PLC) A leadership, supervisory, and management course built around the environment in which combat support/combat service support leaders perform their duties (AR 351-1).

Primary Noncommissioned Officer Course (PNCOC) A non-MOS specific, field-oriented course built around basic soldier

skills and tasks that prepares E4 soldiers for duties at the E5 level (AR 351-1).

Primary Technical Course (PTC) A course that focuses on training critical tasks listed in the Skill Level 2 Soldier's Manual for a given MOS. Training is provided in resident and extension modes.

Procurement Appropriation (PA) Five continuing (multi-year) appropriations that provide funds for procurement, manufacture, and conversion of major items of combat and support equipment, including ammunition, aircraft, missile systems, weapons, combat and support vehicles.

Program of Instruction (POI) The training management document that specifies the purpose, prerequisites, content, duration, and sequence of instruction for normal resident and non-resident courses (AR 310-25).

Promotion Rate The rate at which individuals advance from one paygrade to another.

Proposed System An analytic construct used to determine the functional requirements of a new system. It incorporates the technological advances likely to exist before the system's projected initial operational capability date.

Quasi-Program of Instruction A partial program of instruction designed to evaluate the impact of emerging system designs on existing courses of instruction. It also helps determine requirements for new courses of instruction.

Reliability Can be defined as (1) the duration or probability of failure-free performance under stated conditions, or (2) the probability that an item can perform its intended function for a specified interval under stated conditions (MIL-STD-1388-1A).

Reliability, Availability, Maintainability (RAM) A measure of reliability or maintainability that includes the combined effects of item design, quality, installation, environment, operation, maintenance, and repair (AR 702-3).

Replacement Year Year when the predecessor system is scheduled to be totally replaced by the new system.

Scope See Scope, System.

Scenario A brief description of the theater, environment and

threat factors that are likely to be associated with the system missions.

Scenario Usage Rate The utilization rate that is the planned or actual number of life units expended or missions attempted during a stated interval of time (MIL-STD-721C). Life unit is the duration of applicable use, i.e., operating hours, cycles, distance, rounds fired.

Scheduled Maintenance Preventive maintenance performed at prescribed points in the item's life (MIL-STD-1388-1A).

Scheduled Unit Training Training of an entire unit that occurs at regularly scheduled times. Unit training provides reinforcement of previous training as well as new training in group and unit tasks.

Self-Study Individual study by which the soldier learns new skills or reinforces skills already learned (AR 350-1).

Senior Noncommissioned Officer Course (SNCOC) Senior level training that prepares soldiers in grades E8 and E9. It consists of resident and extension training as well as on-the-job experience (AR 351-1).

Sergeants Major Academy (SGMA) The capstone of enlisted training. Master and first sergeants (E-8) are prepared for high-level responsibilities in both troop and senior staff assignments (AR 351-1).

Service School Institutional training, either individual or collective, conducted in Army schools or Army training centers; uses instructional systems development materials.

Skill Level (1) Level of proficiency required for performance of a specific military job, (2) the level of proficiency at which an individual qualifies in that military occupational specialty (AR 351-1).

Student Pay and Allowance Cost Weekly rate of pay for the model grade of a student based upon the Composite Standard Rates for Existing Military Personnel Services (AR 37-108). This weekly rate multiplied by the course length in weeks is used to compute cost per graduate [ATRM-159 (R1)].

Supervised On-the-Job Training Structured training accomplished while a person is working in a particular skill level and MOS (AR 351-1).

Support Cost That portion of total indirect cost not included in base operations cost per graduate. These are installation costs that include training aids, base communications, medical, and family housing on a pro-rate share of school's military man-years (MMY) supported as a percent of the total benefiting tenant MMY [ATRM-159 (R1)].

System The combination of people, hardware, and information which, when interacting as a whole, is capable of performing a required mission on the battlefield.

System Functional Requirement The attributes or capabilities required to be present in the system elements so that each element and the system as a whole can accomplished assigned actions.

System Scope A precise definition of the range and depth of a weapon system, including (1) number of missions assigned, (2) number of materiel commodities incorporated, and (3) number of distinct platforms and/or components comprising the system.

System Density The quantity of systems requiring maintenance and supply support in a unit, group of units, or at a maintenance level. Stated in terms of the Basis of Issue for units.

System Performance Goals A description of the goals that must be achieved for each system performance measure.

System Performance Measures Measures that describe the performance capabilities that must be achieved for each system function. System performance measures usually consist of speed, rate of fire, etc.

Systems Analysis An orderly approach to helping a decision maker choose a course of action. Its basis is a model or idealized description of the situation under analysis.

Table of Organization and Equipment (TOE) A table that prescribes the normal mission, organizational structure, personnel, and equipment requirements for a military unit. If forms the basis for an authorization document (AR 310-25).

Task A unit of work activity that constitutes a logical and necessary step in the performance of a job/duty. It is the smallest unit of behavior in a job that describes the performance of a meaningful function in the job under consideration.

Task Description Concise wording, usually verb-object form, that describes a task.

Task Number A numerical code used to designate a task.

Threat Characteristics The specifics of an enemy threat as determined in a Threat Analysis and stated in a Threat Study (see also Mission Analysis and Mission Characteristics).

Threat Variables The range and complexity an enemy threat can take. Includes the consideration given in a Threat Analysis to the compounding of threat that a new enemy capability can have in concert with other new or existing threats. Also includes consideration of current weakness in countering the new and combined enemy threat.

Training Aids Cost Cost of installation-support training aids adjusted by the total number of training man-weeks.

Training Man-Days The length of class time needed to train an individual student in a course.

Training Resource Requirements Analysis (TRRA) A process used to estimate systematically the training requirements for Army weapon systems during the earliest phases of their development. These requirement estimates include specification of the system's task, course, and resource requirements.

Transients, Trainees, Holdees, and Students Rates (TTHS) The percentage of personnel in a paygrade who are unassignable and are therefore unable to contribute to the work associated with the weapon system.

Travel Pay to Course The travel cost per graduate computed on a standard cost per mile. The cost per mile is multiplied by a class average one-way mileage, which is obtained from a sample of student records.

Type of Instruction Type of instruction used for a training course. Typical categories are conference, demonstration, practical exercise, etc. (TRADOC CIR 351-12).

Unscheduled Maintenance, Inherent Those maintenance actions (or events) necessary for restoring an item to a specified condition when the failure has been caused by a condition resulting from an inherent fault in design or strength of material specified.

Unscheduled Maintenance, Induced Those maintenance actions (or events) necessary for restoring an item to a specified condition when the failure has been induced by a condition (including environmental) not resulting from an inherent fault of an item.

Unscheduled Maintenance, Other Those maintenance actions (or events) necessary for restoring an item to a specified condition that was not caused directly by induced or inherent failures. Causes include removal to gain entry, cannot duplicate reported descrepancy, cannibalization, unscheduled inspections, etc.

Workload The amount of work, stated in predetermined work units, that organizations or individuals perform or are responsible for performing (AR 310-25).

This page intentionally left blank.

References

Andrews, Walter (1983, March 16). Weapons maintenance seems costly. Washington Times.

Army Science Board (1980). Ad Hoc study group on human issues. Department of the Army, Assistant Secretary of the Army Research, Development and Acquisition. Washington, DC.

Baker, James D., and Shields, J. (1981, May). Personnel affordability: The Army's odessey into the year 2000. Paper presented at ORSA/TIMS Meeting, Toronto, Canada.

Chief of Naval Materiel (series). Ship's maintenance and materiel management program (OPNAVIST 4790.4). Washington, DC.

Chief of Naval Materiel, Ship's Parts Control Center (series). Consolidated shipboard allowance list preparation. Washington, DC

Chief of Naval Operations (1979). Application of the HARDMAN comparability methodology to VTXTS flight vehicle maintenance manpower requirements. Office of CNO, HARDMAN Project Office (OP-112C) Contractor: Dynamics Research Corporation, Contract No. N61339-80-D005.

Chief of Naval Operations (1980). HARDMAN methodology handbook, Vol. II: User's manual preliminary draft. Office of CNO HARDMAN Project Office (OP-112C). Contractor: Dynamics Research Corporation, Contract No. N61339-80-D005. Washington, DC.

Chief of Naval Operations (1983). HARDMAN methodology handbook (draft). Office of CNO HARDMAN Project Office (OP-112C). Contractor: Dynamics Research Corporation, Contract No. N61339-80-D005. Washington, DC.

Coleman, Herbert J. (1981, February 16). Weapons maintainability guidance sought by GAO. Aviation Week & Space Technology.

Cushman, Jack (1981, July 27). Troublesome tank: TAO still unhappy with M-1 results. Defense Week.

Department of the Air Force (1975). Air Force audiovisual directory (AFR 95-2). Washington, DC

Department of the Air Force (1982). Airman specialty vehicle mechanic (AFR 39-1). Washington, DC.

Department of the Air Force (1979). Maintenance management policy (AFM 66-1). Washington, DC.

Department of the Air Force (1984). USAF formal schools (AFR 50-5). Washington, DC.

Department of the Army (1984). Army personnel selection and classification: Enlisted career management fields and military occupational specialties (AR 611-201). Washington, DC.

Department of the Army (1981). Basic policies for systems acquisition. Washington, DC.

Department of the Army (quarterly). Chief of Personnel Operations 45 Report (COPO 45 Report). Washington, DC.

Department of the Army (1968). Combat, tactical, and support vehicles and special-purpose equipment (TB 750-93-1). Washington, DC.

Department of the Army (1984). Consolidated index of Army publications and blank forms (DA Pam 310-1). Washington, DC.

Department of the Army (1982). Consolidated MOS catalog (DA Pam 350-100). Washington, DC.

Department of the Army (1979). Dictionary of United States Army terms (AD)(AR 310-25). Washington, DC.

Department of the Army (1981). EPMS master training plan (DA Pam 351-9). Washington, DC.

Department of the Army. Extension training material catalogs (series) (DA Pam 350-XXX-X). Washington, DC.

Department of the Army (1981). Field artillery battalion, lance (DA Pam 350-106-3). Washington, DC.

Department of the Army (1981). Field artillery units, 155mm self-propelled (DA Pam 350-106-4). Washington, DC.

Department of the Army (1983). Fire support in combined arms operation (FM 6-20). Washington, DC.

Department of the Army (1973). Guide for using existing programmed structural materials (DA Pam 690-22). Washington, DC.

Department of the Army (1980). Index and description of Army training devices (DA Pam 310-12). Washington, DC.

Department of the Army (1979). Index of Army motion pictures and related audio-visual aids (DA Pam 108-1). Washington, DC.

Department of the Army (1980). Index of doctrinal, training, and organizational publications (DA Pam 310-3). Washington, DC.

Department of the Army (1979). Integrated logistic support management model and glossary (DA Pam 700-127). Washington, DC.

Department of the Army (1975). Life cycle system management model for Army systems (DA Pam 11-25). Washington, DC.

Department of the Army (1983). Manpower and equipment control: Organization and equipment requirements tables (AR 570-2). Washington, DC.

Department of the Army (1969). Organization and equipment authorization tables: Personnel (AR 570-2DA). Washington, DC.

Department of the Army (1980). Reliability and maintainability (AR 702-3). Washington, DC.

Department of the Army (1982). Sample data collection: The Army maintenance management system (AR 750-37). Washington, DC.

Department of the Army (1979). Staffing guide for US Army service schools (DA Pam 570-558). Washington, DC.

Department of the Army (1983). US Army correspondence course program catalog (DA Pam 351-20). Washington, DC.

Department of the Army (1984). US Army formal schools catalog (DA Pam 351-4). Washington, DC.

Department of Defense (1983). Acquisition and management of integrated logistic support for systems and equipment (DoD Directive 5000.39). Washington, DC.

Department of Defense (1983). Major system acquisition procedures (DoD Directive 5000.2). Proposed revision, October 30, 1982; March 8, 1983. Washington, DC.

Department of Defense (1982). Major system acquisition (DoD Directive 5000.1). Washington, DC.

Department of Defense (1983). Logistic support analysis (MIL-STD-1388-1A). Washington, DC.

Department of Defense (1983). Logistic support analysis record data elements and requirements (MIL-STD-1388-2A). Washington, DC.

Department of Defense (1975). Work breakdown structure for defense materiel items (MIL-STD-881A). Washington, DC.

DePuy, William, E. and Bonder, Seth (1982). Integration of MPT supply and demand and system acquisition process. US Army Research Institute, Research Note 82-1. Washington, DC.

Eckstrand, Gordon A. (1980, October). Product support -- A changing challenge. Manpower Factors in System Acquisition Aerospace Industries Symposium. Seattle, WA.

Eckstrand, G. (1980, August) Technology projection: Manpower and logistics factors in weapon system development. NTIS.

Kerwin, Gen. Walter T. and Blanchard, George S. (1980, August). Man/machine interface -- A growing crisis. U.S. Army Materiel Systems Analysis Activity.

Kuhn, George W.S., (1983). Ending defense stagnation. In Richard N. Holwill (Ed.), A mandate for leadership report -- Agenda '83. The Heritage Foundation.

Office of Management and Budget (1976). Major systems acquisition (OMB Cir A-109). Washington, DC.

Quade, E.S. (1975). Analysis for public decisions. Elsevier Science Publishers. New York.

Ritchie, M. (1974, February). Manpower implications in the design of Air Force equipment. NTIS.

Smith, CPT John (1984, March/April). HARDMAN: New asset for TRADOC systems managers. Soldier Support Journal.

US Air Force Audio-Visual Services (1980). USAF audio-visual resources and functions (AFR 95-1). Norton AFB, CA.

US Air Force Human Resources Laboratory (1982). ASSET user's guide (application). Contractor, Westinghouse Electric Corporation, Contract No. F33615-79-C-0330.

US Air Force Logistics Command (1980). USAF Maintenance Management (AFM 66-1). Andrews AFB, MD.

US Air Force Manpower Personnel Center (1982). Airman Classification Regulation (AFR 39-1). Randolph AFB, TX.

US Air Force Manpower Personnel Training Section (1981). USAF Formal Schools Catalog (AFR 50-5). Randolph AFB, TX.

US Army Materiel Command/Training and Doctrine Command (1982). Reliability, availability, and maintainability rationale report handbook (AMC/TRADOC Pam 70-11). Fort Monroe, VA.

US Army Soldier Support Center (1984). "What to do" booklet: A road map for addressing MPT in the acquisition process. Alexandria, VA.

US Army Training and Doctrine Command (1983). Armywide training and doctrinal literature (TRADOC Pam 310-3). Fort Monroe, VA.

US Army Training and Doctrine Command (1981). Combat developments studies (TRADOC Reg 11-8). Fort Monroe, VA.

US Army Training and Doctrine Command (1980). Common job and task management (TRADOC Cir 351-1). Fort Monroe, VA.

US Army Training and Doctrine Command (1984). Cost analysis program (MOS/FMS) training costs (TRADOC Reg 11-5). Fort Monroe, VA.

US Army Training and Doctrine Command (1976). Educational video tape catalog (TRADOC 350-33). Fort Monroe, VA.

US Army Training and Doctrine Command (1983). ICH computation worksheet (TRADOC Form 377-R). Fort Monroe, VA.

US Army Training and Doctrine Command (1979). Job and task analysis handbook (TRADOC 351-4). Fort Monroe, VA.

US Army Materiel Command/Training and Doctrine Command (1984). Materiel acquisition handbook (AMC/TRADOC Pam 70-2). Fort Monroe, VA.

US Army Training and Doctrine Command (1982). Training devices for Armywide use (TRADOC 71-9). Fort Monroe, VA.

US Army Training and Doctrine Command (1984). Training requirements analysis system (TRAS) (TRADOC Reg 351-1). Fort Monroe, VA.

US Army Training Support Center (1981). US Army comprehensive plan for training devices. Fort Eustis, VA.

US Marine Corps (1981). Marine Corps formal schools catalog (MCO P1500.12L). Washington, DC.

US Marine Corps (1982). MOS manual (MCO P11200.70). Washington, DC.

US Naval Education and Training Command (1984). Catalog of Navy training courses (CANTRAC) (NAVEDTRA 10500).

US Naval Military Personnel Command (1976). Manual of Navy enlisted manpower and personnel classifications and occupational standards, Sections I (updated semiannually) and II (updated quarterly).

Zimmerman, W., Butler, R., Grey, V., Rosenberg, L., and Risser, D. (1984, July). Evaluation of the HARDMAN comparability methodology. ARI Technical Report (Draft). Washington, DC.

References by Number

AMC/TRADOC Pam 70-2	Materiel Acquisition Handbook
AFM 50-5	USAF Formal Schools Catalog
AR 570-2	Manpower and Equipment Control: Organization and Equipment Requirements Tables
AR 611-201	Army Personnel Selection and Classification -- Enlisted Career Management Fields and Military Occupational Specialties
AR 702-3	Reliability and Maintainability
AR 750-37	Sample Data Collection: The Army Maintenan Management System
Ar 1000-1	Basic Policies for Systems Acquisition
ATRM 159	MOS Course Cost Report
COPO 45 Report	Chief of Personnel Operations 45 Report (published quarterly by MILPERCEN)
DA Pam 11-25	Life Cycle System Management Methods for Army Systems
DA Pam 108-1	Index of Army Motion Pictures and Related Audio-Visual Aids
DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms
DA Pam 310-12	Index and Description of Army Training Devices
DA Pam 350-100	Consolidated MOS Catalog
DA Pam 350-XXX-X	Extension Training Material Catalogs (series)
DA Pam 351-4	U.S. Army Formal Schools Catalog

DA Pam 351-9	EPMS Master Training Plan
DA Pam 351-20	Army Correspondence Course Program Catalog
DA Pam 570-558	Staffing Guide for U.S. Army Service Schools
DA Pam 690-22	Guide for Using Existing Programmed Instructional Materials
DA Pam 700-127	Integrated Logistic Support Management Model and Glossary
FM 6-20	Fire Support in Combined Arms Operation
MCO P11200.7D	MOS Manual
MCO P1500.12K	Marine Corps Formal Schools Catalog
MIL-STD 881	Work Breakdown Structure for Defense Materiel Items
MIL-STD 1388-1A	Logistics Support Analysis
MIL-STD 1388-2A	LSAR Data Elements and Requirements
NAVEDTRA 10500	Catalog of Navy Training Courses (CANTRAC)
NAVPERS 18068D	Manual of Navy Enlisted Manpower and Personnel Classifications and Occupational Standards, Sections I (updated semiannually) and II (updated quarterly)
NMSOINST 4790.2	Integrated Logistic Support Instruction
OMB Cir A-109	Major Systems Acquisition
OPNAVIST 4790.4	Ship's Maintenance and Materiel Management Program
SPCCINST 4790.4	Consolidated Shipboard Allowance List Preparation
TB 750-93-1	Functional Grouping Codes: Combat, Tactical, and Support Vehicles and Special-Purpose Equipment

TRADOC Cir 351-1	Common Job and Task Management
TRADOC Form 377-R	ICH Computation Worksheet
TRADOC Form 812-R	Cost Analysis Program MOS/FMS Training Costs
TRADOC Pam 71-9	Catalog of TASO Training Devices
TRADOC Pam 310-3	TRADOC Armywide Training and Doctrinal Literature
TRADOC Pam 350-33	Educational Video Tape Catalog
TRADOC Pam 351-4	Job and Task Analysis Handbook
TRADOC Reg 11-5	Cost Analysis Program (MOS/FMS) Training Costs
TRADOC Reg 11-8	Combat Development Studies
TRADOC Reg 351-1	Training Requirements Analysis System (TRAS)
TRADOC/AMC Pam 70-11	Reliability, Availability, Maintainability Rationale Report Handbook

This page intentionally left blank.

Acronyms and Abbreviations

A

AETIS	Army Extension Training Information System
AFB	Air Force Base
AFHRL	Air Force Human Resources Laboratory
AFLC	Air Force Logistic Command
AFM	Air Force Manual
AFMPC	Air Force Military Personnel Center
AFR	AIr Force Regulation
AFSC	Air Force Specialty Code
AIT	Advanced Individual Training
AMC	Army Materiel Command
ANCOC	Advanced Noncommissioned Officer Course
AOSP	Army Occupational Survey Program
AR	Army Regulation
AR	Availability Ratio
ARI	Army Research Institute
ARTEP	Army Training and Evaluation Program
ASARC	Army System Acquisition Review Council
ASI	Additional Skill Identifier
ASSET	Acquisition of Supportable Systems Evaluation Technology
ASVAB	Armed Services Vocational Aptitude Battery

ATRM	Army TRADOC Resource Management
ATRRS	Army Training Requirements and Resources System
ATSC	Army Training Support Center

B

BCS	Baseline Comparison System
BITE/PITE	Built-In/Plug-In Test Equipment
BNCOC	Basic Noncommissioned Officer Course
BOI	Basis of Issue
BOIP	Basis of Issue Plan
BTC	Basic Technical Course

C

CANTRAC	Catalog of Navy Training Courses
CD	Combat Developer
CDB	Consolidated Data Base
CDRL	Contract Deliverable Line Item
C-E	Concept Evaluation
CFE	Contractor-Furnished Equipment
CHRT	Coordinated Human Resource Technology
CMF	Career Management Field
CM	Corrective Maintenance
CNET	Chief of Naval Education and Training

CNATRA	Chief of Naval Air Training
CNM	Chief of Navy Materiel
CNMPC	Chief of Naval Military Personnel Command
CNO	Chief of Naval Operations
CNTECHTRA	Chief of Naval Technical Training
CODAP	Comprehensive Occupational Data Analysis Program
COEA	Cost and Operational Effectiveness Analysis
COI	Course of Instruction
COMTRALANT	Commander, Training Command, Atlantic
COMTRAPAC	Commander, Training Command, Pacific
COPO	Chief of Personnel Operations
COR	Contracting Officer's Representative
COTR	Contracting Officer's Technical Representative
CPU	Central Processing Unit
CSWS	Corps Support Weapon System
CTEA	Cost and Training Effectiveness Analysis

D

D&V	Demonstration and Validation
DA	Department of the Army
DCD	Directorate of Combat Developments
DCS	Deputy Chief of Staff
DDI	Design Difference Index

DEP	Draft Equipment Publication
DMDC	Defense Manpower Data Center
DoD	Department of Defense
DOTD	Directorate of Training and Doctrine
DPAMMH	Direct Productive Annual Maintenance Man-Hours
DS	Direct Support Maintenance
DSARC	Defense System Acquisition Review Council
DSWS	Division Support Weapon System
DT/OT	Developmental Testing/Operational Testing
DTIC	Defense Technical Information Center

E

EIC	Equipment Identification Code
E-O	Electro-optical
EPMS	Enlisted Personnel Management System
ETM	Extension Trainig Materials
EW	Electronic Warfare

F

FEA	Front-End Analysis
FGC	Functional Group Code
FLIR	Forward-Looking Infrared Radar
FM	Field Manual
FRE	Frequency

FSD	Federal Supply Document
FSED	Full-Scale Engineering Development
	G
GFE	Government-Furnished Equipment
GP	Group-Paced
	H
HARDMAN	Hardware vs. Manpower
HCM	HARDMAN Comparability Methodology
HIP	Howitzer Improvement Program
HIPO	Hierarchical and Input/Process/Output Techniques
HMPT	Human Factors, Manpower, Personnel, and Training
	I
I/S	Intructor-to-Student Ratio
ICH	Instructor Contact Hours
ICTP	Individual and Collective Training Plan
IEP	Independent Evaluation Plan
IET	Initial Entry Training
IFF	Identification, Friend or Foe
IKP	Instructor and Key Personnel
ILS	Integrated Logistic Support
IOC	Initial Operational Capability
IPR	In-Progress Review

IPT	Indirect Productive Time
ISD	Instructional Systems Development
	J
JPL	Jet Propulsion Laboratory
JMSNS	Justification for Major System New Start
	L
LCC	Life Cycle Costs
LCN	LSA Control Number
LIN	Line Item Number
LCSMM	Life Cycle System Management Model
LOA	Letter of Agreement
LOGCEN	Logistics Center
LOGSACS	Logistics Structure and Composition System
LRU	Lowest Replaceable Unit
LSA	Logistic Support Analysis
LSAR	Logistic Support Analysis Record
LSI/VLSI	Large or Very Large Scale Integrated Circuits
	M
MAA	Mission Area Analysis
MAC	Maintenance Action/Allocation Chart
MAP	Materiel Acquisition Process
MARC	Manpower Requirements Criteria

MCO	Marine Corps Order
MEEI	Minimum Essential Elements of Information
MFP	Materiel Fielding Plan
MIL-STD	Military Standard
MILPERCEN	Military Personnel Center
MMH	Maintenance Man-hours
MMH/MA	Maintenance Man-hours Per Maintenance Action
MOS	Military Occupational Specialty
MOSB	MOS Training Cost Handbook
MOSC	Military Occupational Specialty Code
MP/OMS	Mission Profile/Operational Mode Summary
MPA	Military Personnel, Army
MPT	Manpower, Personnel, and Training
MR	Maintenance Ratio
MRC	Maintenance Requirement Cards
MRSA	Materiel Readiness Support Activity
MTBF/MTBMA	Mean Time Between Failure/Mean Time Between Maintenance Action
MTTR	Mean Time to Repair
MTTR/MA	Mean Time to Repair Per Maintenance Action

N

NASA	National Aeronautics and Space Administration

NATO	North Atlantic Treaty Organization
NAVMMACLANT	Navy Manpower and Materiel Analysis Center, Atlantic
NAVEDTRA	Naval Education and Training
NAVPERS	Naval Personnel
Navy 3M	Materiel Maintenance Management
NBC	Nuclear, Bacteriological, Chemical
NCOES	Noncommissioned Officer Educational System
NEC	Naval Enlisted Classification
NEPDIS	Navy Enlisted Professional Development Information System
NET	New Equipment Training
NETP	New Equipment Training Plan
NITRAS	Navy Integrated Training Resources and Administration System
NMSO	Navy Maintenance Support Office
NODAC	Navy Occupational Development and Analysis Center
NOTAP	Navy Occupational Task Analysis Program
NTEC	Naval Training Equipment Center
NTP	Navy Training Plans

O

O&O	Organizational and Operational Plan
OCS	Optimal Class Size
OM	Operational Manning

OMA	Operations and Maintenance, Army
ORSA	Operations Research/Systems Analyst
OSUT	One Station Unit Training
OT	Operational Test

P

Pam	Pamphlet
PERT	Program Evaluation Review Technique
PGD	Paygrade
PIB	Program Information Brief
PLDC	Primary Leadership Development Course
POE	Projected Operational Environment
POMCUS	Prepositioned Materiel Configured to Unit Sets
PM	Preventive Maintenance
PM	AMC Program/Project/Product Manager
PM TRADE	Project Manager for Training Devices
PNCOC	Primary Noncommissioned Officer Course
POE	Projected Operational Environment
POI	Program of Instruction
PQS	Position Qualification Standards
PTC	Primary Technical Course
PV	Perturbation Value

	Q
QQPRI	Quantitative and Qualitative Personnel Requirements Information
Quasi-POI	Quasi-Program of Instruction
	R
R&M	Reliability and Maintainability
RAM	Reliability, Availability, and Maintainability
Reg	Regulation
ROC	Required Operational Capability
RPV	Remotely P.loted Vehicle
	S
SAT	Systems Approach to Training
SDC	Sample Data Collection
SEAD	Suppression of Enemy Air Defense
SGMA	Sergeants Major Academy
SINCGARS	Single Channel Ground/Airborne Radio System
SME	Subject-Matter Expert
SOJT	Supervised On-the-Job Training
SP	Self Paced
SPH	Self-Propelled Howitzer
SPT	Support
SQT	Skill Qualification Test
SSC	Soldier Support Center

SSG	Special Study Group
SSI	Specialty Skill Identifier
SSPO	Strategic Systems Project Office
STP	Soldier Training Publication
SUBLANT	Submarines Atlantic
SUBPAC	Submarines Pacific

T

TAMMS	The Army Maintenance Management System
TASC	Training and Audiovisual Support Center
TASO	Training Aids Support Office
TB	Technical Bulletin
TCA	Task Comparability Analysis
TD	Training Developer
TDIS	Training Development Information System
TDLR	Training Device Letter Requirement
TDR	Training Device Requirement
TEA	Training Effectiveness Analysis
TFR	Trouble Failure Reports
TLR	Top Level Requirements
TM	Technical Manual
TOE	Table of Organization and Equipment
TQQPRI	Tentative Qualitative and Quantitative Personnel Requirements Information

TRADOC	Training and Doctrine Command
TRAMEA	TRADOC Management Engineering Activity
TRAS	Training Requirements Analysis System
TTHS	Transients, Trainees, Holdees, and Students
TRRA	Training Resource Requirements Analysis
TSM	TRADOC Systems Manager
	U
UHF	Ultra-High Frequency
USAMARDA	US Army Manpower Requirements and Documentation Agency
	V
VHF-FM	Very High Frequency/Frequency Modulated
	W
WBS	Work Breakdown Structure
WQEC	Weapons Quality Engineering Center
WUC	Work Unit Code
WSAP	Weapons System Acquisition Process

Index

Volume I

Volume II - IV

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: Research Product 85-19 Thru 85-23

2. GOVT ACCESSION NO.: AD-A156 790

3. RECIPIENT'S CATALOG NUMBER:

4. TITLE (and Subtitle): HARDMAN Comparability Analysis Methodology Guide (5 Volumes)

5. TYPE OF REPORT & PERIOD COVERED: Final

6. PERFORMING ORG. REPORT NUMBER:

7. AUTHOR(s): Thomas E. Mannle, Jr.
Robert V. Guptill
Daniel T. Risser

8. CONTRACT OR GRANT NUMBER(s): MDA903-81-C-0561

9. PERFORMING ORGANIZATION NAME AND ADDRESS: Dynamics Research Corporation
60 Concord Street
Wilmington, MA. 01887

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 2Q263731A793

11. CONTROLLING OFFICE NAME AND ADDRESS: U.S. Army Research Institute
5001 Eisenhower Avenue
Alexandria, VA 22333

12. REPORT DATE: April 1985

13. NUMBER OF PAGES: 1077

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): U.S. Army Soldier Support Center-National Capitol Region
200 Stovall Street
Alexandria, VA 22332

15. SECURITY CLASS. (of this Report): Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:

DTIC COPY INSPECTED
DTIC TAB
Unannounced
Justification
By
Distribution/
Availability Codes
Avail and/or
Dist Special
A-1

16. DISTRIBUTION STATEMENT (of this Report):

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report):

18. SUPPLEMENTARY NOTES: 5 Volumes-Volume I-Manager's Guide; Volume II-Problem Definition, Step 1-Systems Analysis; Volume III-Requirements Analysis, Step 2-Manpower Requirements Analysis, Step 3-Training Resource Requirements Analysis, Step 4-Personnel Requirements Analysis; Volume IV-Interpretation and Evaluation, Step 5-Impact Analysis, Step 6-Tradeoff Analysis;Volume V-Analysis Support Information

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Alternatives and Tradeoff Analysis	Manpower Cost and Readiness Drivers
Comparative Analysis	Manpower Support Inputs
Functional Requirements Identification	Support System Standardization
Human Resources in LCSMM	Task Description
Logistics Analysis	Training Requirements Estimation

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
This is the first edition of the Army HARDMAN Comparability Analysis Methodology Guide. The five volumes constitute a detailed specification of the methodology as applied to major materiel systems. HARDMAN is a structured approach to the determination of the Manpower, Personnel and Training (MPT) requirements of a weapon system in the earliest phases of its development. The basic analytic approach is comparability analysis, that is, the use of knowledge about similar existing systems to project the MPT requirements of proposed (new) systems. The

Block 20 -

Army HARDMAN Methodology Guide attempts to satisfy the requirements of the Army by 1) providing details of analytic procedures to a level which permits analysts to execute the HARDMAN Methodology in an actual operational environment, 2) providing a stand-alone guide with maximum flexibility to appeal to different types of users, 3) incorporating field-tested procedures which have proven to reflect actual MPT costs, 4) incorporating lessons learned with the Army data environment to reflect the real constraints in that area and 5) contributing to the Logistics Support analysis performed in accordance with MIL-STD-1388-1A (Logistics Support Analysis Data Element Definitions).