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PROJECT MANAGER'S TRAINING DEVICE DATA GUIDE. VOLUME I.(U)
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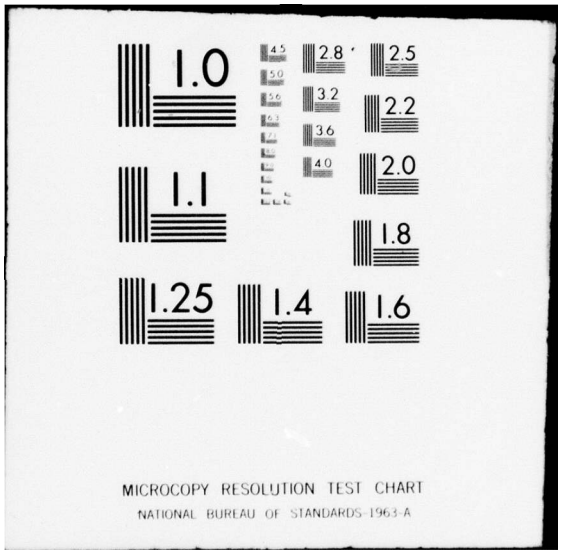
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# Project Manager's Training Device Data Guide

Volume I
September 30, 1978

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PM TRADE
Naval Training Equipment Center
Orlando, Florida 32813

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Orlando, Florida 32813

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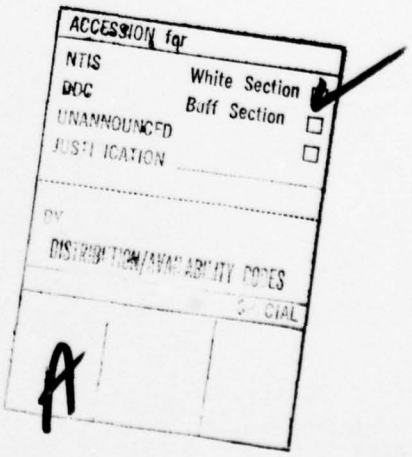
# FOREWORD

The data guide was developed to aid the weapon system project manager (PM) in procuring the minimum but complete set of data required for training device development. Section III of Volume I of the guide presents a procedure for accomplishing this objective. Application of the data limiting process is key to effective, efficient, and economical data management.

Section II of Volume I analyzes the training device development process as it relates to prime weapon system development and data requirements. It is particularly helpful for those individuals new to the policies of the Life Cycle System Management Model (LCSMM). Volume II contains supporting material designed to facilitate the successful application of the data guide. Concurrent development of weapon system and training devices has made the data procurement process more complex. The data guide can help the project manager overcome major data related problems.



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# SECTION I

# OVERVIEW

## WHY WAS THE DATA GUIDE DEVELOPED?

The data guide was developed to aid the weapon system project manager (PM) in procuring the minimum but complete set of data required for training device development and to assure timely delivery of that data.

The guide is not intended to deal with training devices for weapon systems for which data and performance characteristics are not defined or established until the system is approaching production or in production. An example of this type of training device is a flight trainer.

AR 1000-1 requires that training devices be available for evaluation as part of the total system during full-scale engineering development (FSED). Achieving this objective requires concurrent development of the weapon system and training devices. If training devices are not ready during FSED, the result may be a delay in approval for weapon system production. Programs that have attempted concurrent development have encountered problems, particularly with data procurement. The data guide will help the project manager avoid these difficulties.

Application of the guide does not guarantee concurrent development of the weapon system and its training device nor does it assure successful completion of full-scale engineering development phase testing. Much is

dependent upon the individual projects for which the guide is applied and on the determination with which one approaches the problem.

In addition to the process which allows the project manager's staff to determine the data required for development of the training device, Volume I also includes an overview of the guide and an analysis of the training device development process. For those users who feel that they are familiar with the training device development process, Sections I and II can be skipped.*

If the project is managed closely, training devices may be ready for testing during the weapon system Operational Test II.

## WHAT ARE THE PROBLEMS ASSOCIATED WITH CONCURRENT DEVELOPMENT?

Two major problems have been associated with concurrent development: (1) an inability to specify the type and amount of data necessary for training device development, and (2) a lack of procedures for contractually assuring that data are provided to the training device contractor when needed to meet the Operational Test II schedule. Of particular concern is the determination of the data package to be included in the training device procurement package and also the package to be included at contract award.

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* The DIDs listed in Tables 3, 6 and 9 in Section II should be procured to assure that data requested as part of the data limiting process are available.

Additional problems have arisen when the prime system contractor has claimed that required data are proprietary. Furthermore, identification of changes to the prime system data has been difficult because problems have arisen in trying to provide accurate change data to the training device contractor in a timely manner.

## WHAT HELP WILL THE DATA GUIDE PROVIDE TO SOLVE THESE PROBLEMS?

The data guide provides methods and procedures for:

- Determining the type and amount of data necessary for training device development,
- Determining the data package to accompany the training device RFP,
- Determining the data package to be supplied at training device contract award,
- Insuring that data are available in a timely manner,
- Obtaining and keeping current the weapon system data necessary for training device development, and
- Handling proprietary data.

## WHAT IS THE STRUCTURE OF THE DATA GUIDE?

The data guide is contained in two volumes. Volume I contains three sections:

I. Overview

II. Analysis of training device development process

III. Process for limiting data requirements

Volume II contains appendices with necessary supporting materials.

The contents of each volume are described below.

Volume I

Section I. Overview--The current section presents the purpose, approach, and structure of the guide.

Section II. Analysis of the Training Device Development Process--In Section II the weapon system development cycle and its relationship to the training device development process are reviewed. For each phase of development, the following information is provided:

- Training related objectives and command responsibilities for those objectives
- Data required to
  - Obtain and update necessary prime system data
  - Handle proprietary data
  - Ensure generation and availability of specific training support and weapon system data by prime contractor
- Schedule for data delivery or availability

The definition and application of types of data required to support training device development (basic data, training support data, and weapon system data) are also provided in Section II.

Section III. Process for Limiting Data Requirements--Section III is critical to application of this guide. Weapon system data item descriptions (DIDs) specified in Section II assure that data necessary for training device development are generated and available. The process described in Section III allows the project manager's staff to identify the data needed for any training device under development. The process results in the identification of only the minimum data required to successfully develop the training device.

Data can be limited in two ways. Data are limited in breadth by requesting data for only those weapon system equipment items to be represented in the training device; data are limited in depth by determining the degree to which the training device equipment items must approach the weapon system equipment in level of fidelity. By requesting data limited to the appropriate breadth and depth, considerable cost benefits can be realized.

The process described in Section III may be characterized as follows:

- Identify all units of equipment associated with performance of the tasks selected for training on the training device,
- Classify each equipment item into one of four levels of training device fidelity based on desired training characteristics,

- Specify required levels of data breadth and depth within nine categories of data, and
- Define and request the resultant data package and include it with RFP package and at contract award.

Volume II--Appendices

Two appendices of supporting material are provided:

- Appendix A: DIDs
  - A copy of each DID specified in Sections II and III
- Appendix B: Suggested Contract Clauses
  - Contract clauses to supplement DIDs

## SECTION II

## ANALYSIS OF TRAINING DEVICE DEVELOPMENT PROCESS

This section contains three chapters. Each chapter is described briefly below.

### CHAPTER 1: RELATIONSHIP OF WEAPON SYSTEM AND TRAINING DEVICE DEVELOPMENT

In this chapter the Army-approved developmental cycle is presented. In addition, the training objectives associated with each of the four phases of development are outlined.

### CHAPTER 2: DATA CLASSIFICATION DESCRIPTIONS

To support training device development, three classes of data are required. They are:

1. Basic data
2. Training support data
3. Weapon system data

The description and application of each class of data are presented in this chapter. The chapter describes data which are prerequisite to the data requirements presented in Chapter 3.

## CHAPTER 3: DATA REQUIREMENTS FOR DEVELOPMENTAL PHASES

For each phase of development, a basic data, training support data, and weapon system data package are defined. The schedule for delivery and availability of data is presented and the appropriate application of each data item is described.

# CHAPTER 1

## RELATIONSHIP OF WEAPON SYSTEM AND TRAINING DEVICE DEVELOPMENT

### WHAT IS THE RECOMMENDED WEAPON SYSTEM DEVELOPMENT CYCLE?

AR 1000-1, supported by DA pamphlet 11-25, establishes a four-phase model for weapon system development (Figure 1). The four phases (concept definition, validation, full-scale engineering development, and production) have milestones to ensure that required progress is made and to allow for phased release of funds based on that progress and projected system effectiveness.

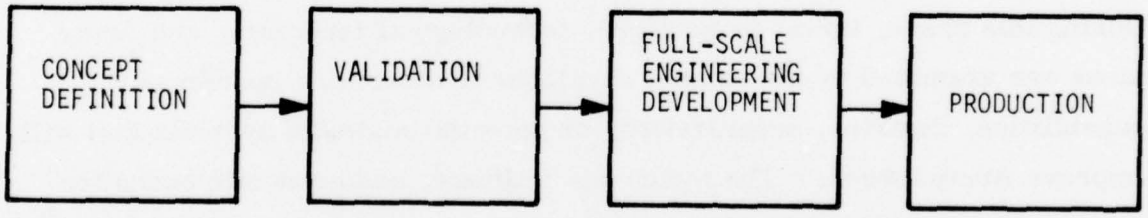


Figure 1. Four-Phase Model for Weapon System Development

The purpose and training-related objectives of each phase of development are described below. A flowchart of the weapon system development cycle and its relationship to training device development is also included.

Concept Definition Phase

The purpose of this phase is to:

- Formulate and define the parameters of a material concept,
- Determine if it warrants the commitment of additional resources, and
- Structure the effort necessary to further develop and evaluate the concept.

Figure 2 summarizes the major events occurring during the concept definition phase.

During this phase, threat projections, technological forecasts, and Army plans are examined by the combat developer to determine operational capabilities, doctrine, organization, or potential material systems that will improve Army forces. The technical, military, and economic bases for proposed systems are established and concepts are formulated through pertinent studies and through the development and evaluation of experimental hardware by the material developer. Critical technical issues, operational issues, and logistic support problems are identified for resolution in subsequent phases to minimize future developmental risks.[1]

[1] Life Cycle System Management Model for Army Systems, Department of the Army Pamphlet 11-25, May 1975.

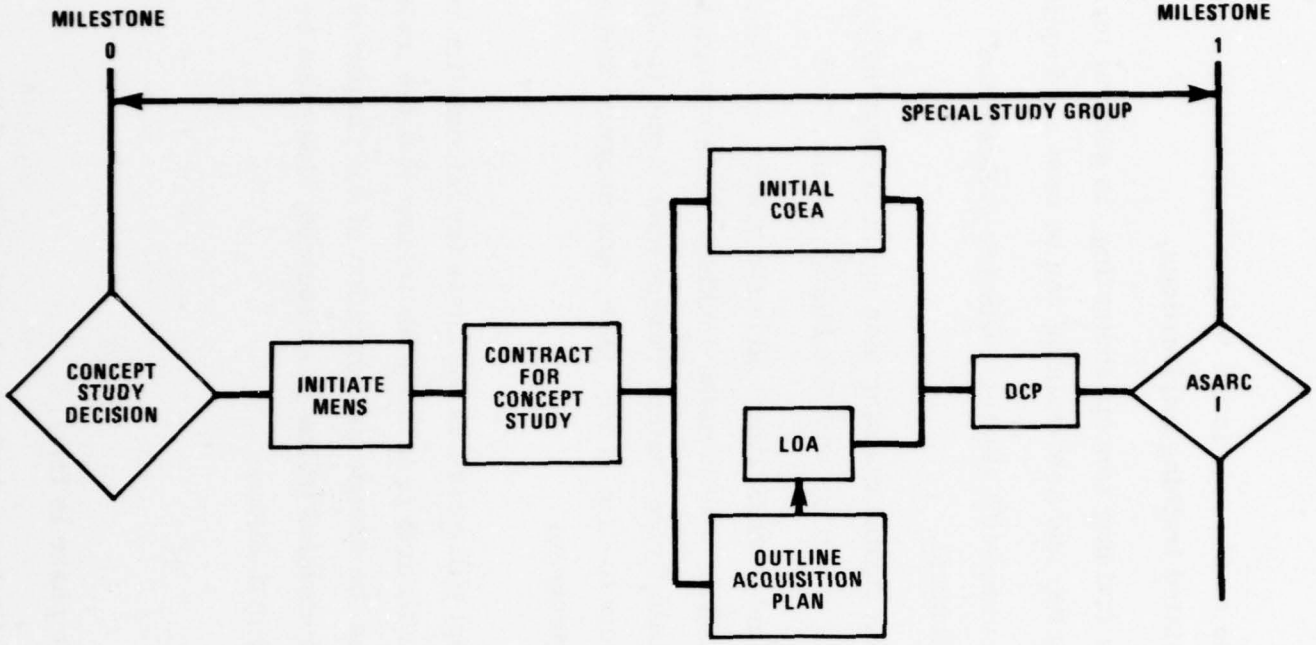


Figure 2. Major Events in Concept Definition Phase

The training-related objectives of the concept definition phase include the following:

- Determine man's role in the weapon system and identify the associated training implications,
- Develop a training concept indicating, in general terms, when, where, and how training can be best accomplished,
- Identify and specify studies needed to validate the training concept,
- Prepare an outline training plan summarizing the training concept, strategies, and development plans, and
- Prepare and provide inputs to basic system analyses, documentation, and decision-making events associated with the Life Cycle System Management Model (LCSMM), e.g., inputs to LOA, CFP, ODP, and program initiation decision process.

The training concept will serve as the basis for formulation training plans and activities and will help to identify the impact that the training requirements may place on the design and operation of the weapon system. (For example, if embedded training is required, this must be included in the weapon system design.)

Validation Phase

The purpose of this phase is to:

- Verify preliminary design and engineering of the weapon system,

- Accomplish necessary planning,
- Analyze tradeoff proposals,
- Resolve or minimize logistics problems identified in the conceptual phase, and
- Validate a concept for full-scale development.

Figure 3 summarizes the major events occurring during the validation phase. A validation phase will be conducted only when the effort comprised therein contributes directly to answering the key issues which remain in doubt. The validation process may be conducted by competitive or sole source contractors or by in-house laboratories.[2]

The training-related objectives of the validation phase include the following:

- Evaluate alternative training program designs,
- Specify draft training device requirements,
- Prepare the detailed training plan,
- Procure prototype training devices (as appropriate) for verification during the validation phase,
- Develop training device specification for procurement of the training device to support FSED testing,

[2] Life Cycle System Management Model for Army Systems, Department of the Army Pamphlet 11-25, May 1975.

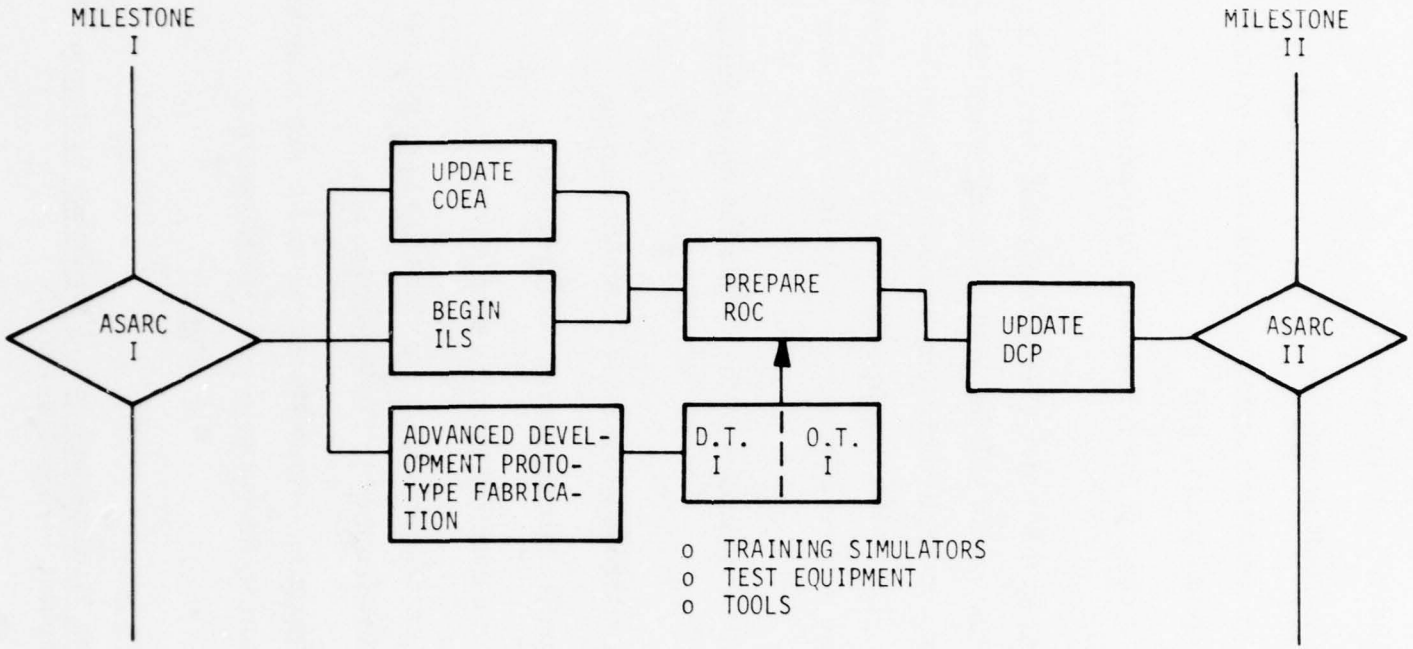


Figure 3. Major Events in the Validation Phase

- Develop procurement package for FSED prototype training device, and
- Provide inputs to basic system events occurring in this phase of the system life cycle.

Following the program initiation decision, training activities concentrate on detailing system training requirements and designing a program to meet those requirements. The validation phase is the key to achieving delivery of the training device for evaluation as part of the system during full-scale engineering development (FSED). Although final definition of training equipment requirements will not be available until the start of FSED sufficient information should be available to begin the initial phases of the planning and procurement process for the FSED prototype training equipment.

Full-Scale Engineering Development Phase

The purpose of this phase is to:

- Develop and engineer the weapon system, including all items necessary to support it,
- Fabricate and test the system,
- Decide whether the item is suitable to enter the inventory, and
- Develop non-materiel aspects required to field an integrated system.

Figure 4 summarizes the major events occurring during the full-scale engineering development phase. The training-related objectives of the full-scale engineering development phase include the following:

- Schedule the delivery of weapon system data to the training device contractor to minimize changes,
- Finalize training requirements,
- Contract for training devices,
- Fabricate training devices,
- Commence new equipment training, and
- Conduct test and evaluation of training devices.

Training activities in this phase are concerned with fabricating the training device and developing training program materials (courseware, media, etc.) consistent with the approved design, and validating the instructional program.

Production and Deployment Phase

The purpose of this phase is to

- Train operational units,
- Procure and distribute equipment,
- Provide logistic support, and
- Apply product improvements as required.

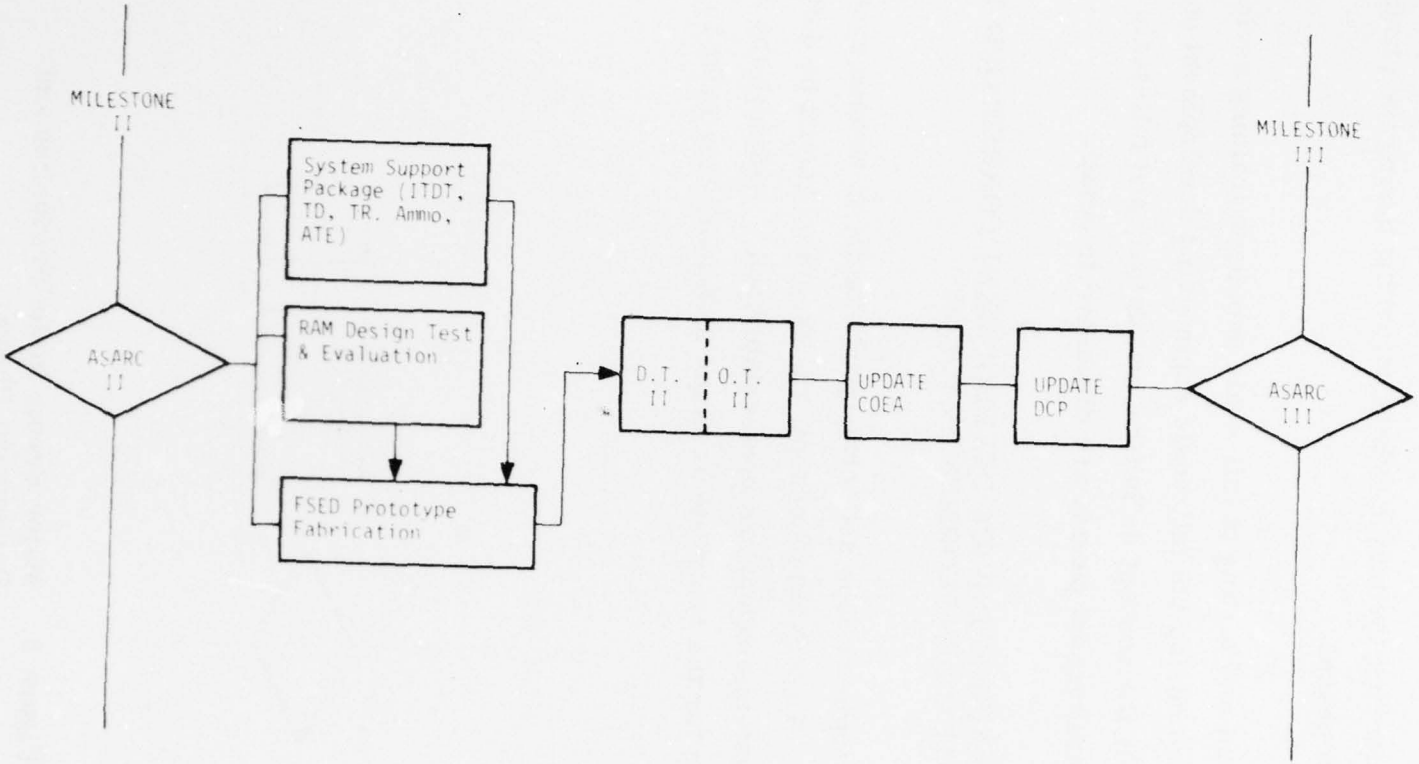


Figure 4. Major Events in the Full-Scale Engineering Development Phase

Figure 5 summarizes the major events occurring during the production and deployment phase.

The development and testing of full-scale prototype training devices must be accomplished during the full-scale engineering development phase. Therefore, only the concept definition, validation, and full-scale engineering development phases are discussed in detail.

## HOW WILL TRAINING DEVICE DEVELOPMENT CORRESPOND TO THE WEAPON SYSTEM DEVELOPMENT CYCLE?

Training development does not correspond exactly to weapon system development. The training concept, for example, cannot be defined until the weapon system concept has been established. Although the development schedule for the two systems is not identical, they must be well

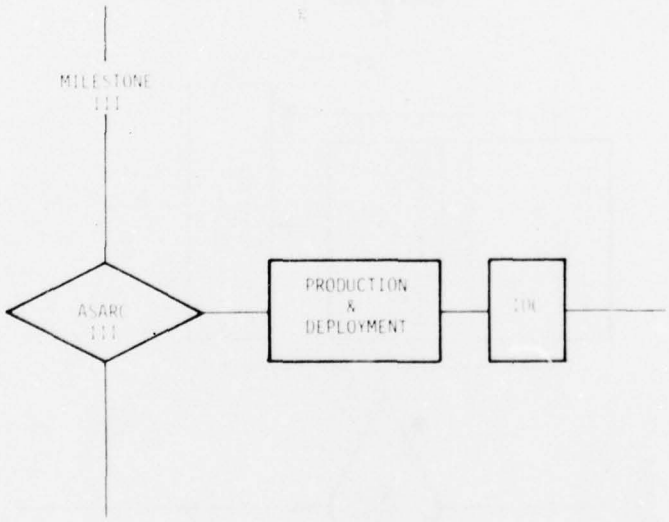


Figure 5. Major Events in the Production and Deployment Phase

coordinated to assure that training devices meet the training requirements of the weapon system.

Figure 6 represents the relationship between prime weapon system and training device development during each of the phases discussed above. This figure is adopted from the Technical Documentation and Training Acquisition Handbook (first draft 28 January 1977, revised 2 May 1977).

As indicated in Figure 6, responsibility for development of training requirements lies with TRADOC and the TRADOC system manager (TSM). DARCOM and the weapon system project manager (PM) are responsible for planning, budgeting, and contracting. Although the PM is not responsible for the development of training requirements, close coordination is required between TRADOC and DARCOM to ensure that the exchange of information is timely and accurate. It is important that the PM be aware that TRADOC requirements must be reflected in system development contracts for timely delivery of training devices. The PM should review the analyses that TRADOC is performing to become aware of the content and to make sure that the analyses are being completed and requirements generated. Specific responsibilities for each developmental phase are presented in subsequent sections.

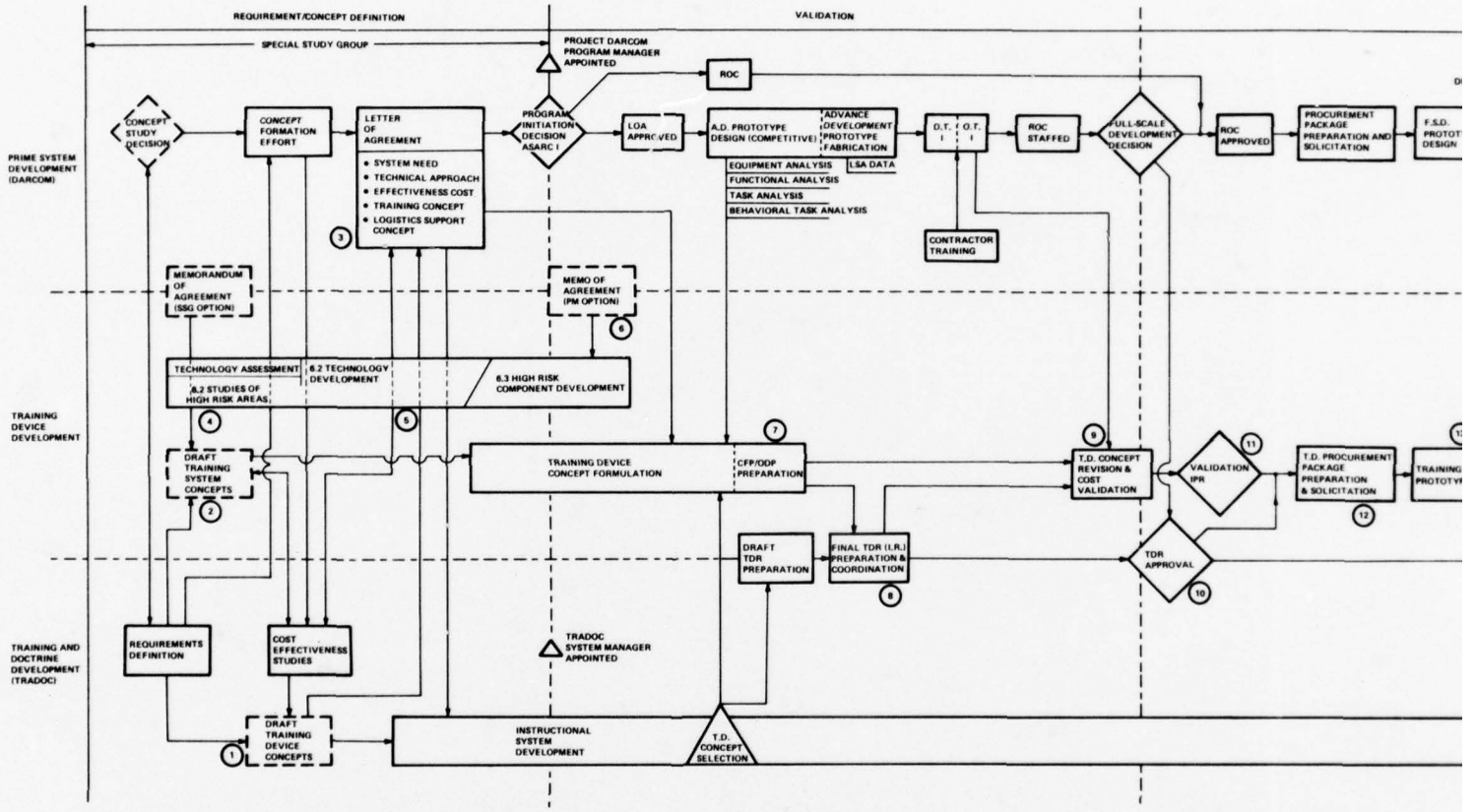


**Figure 6. Training System Acquis**



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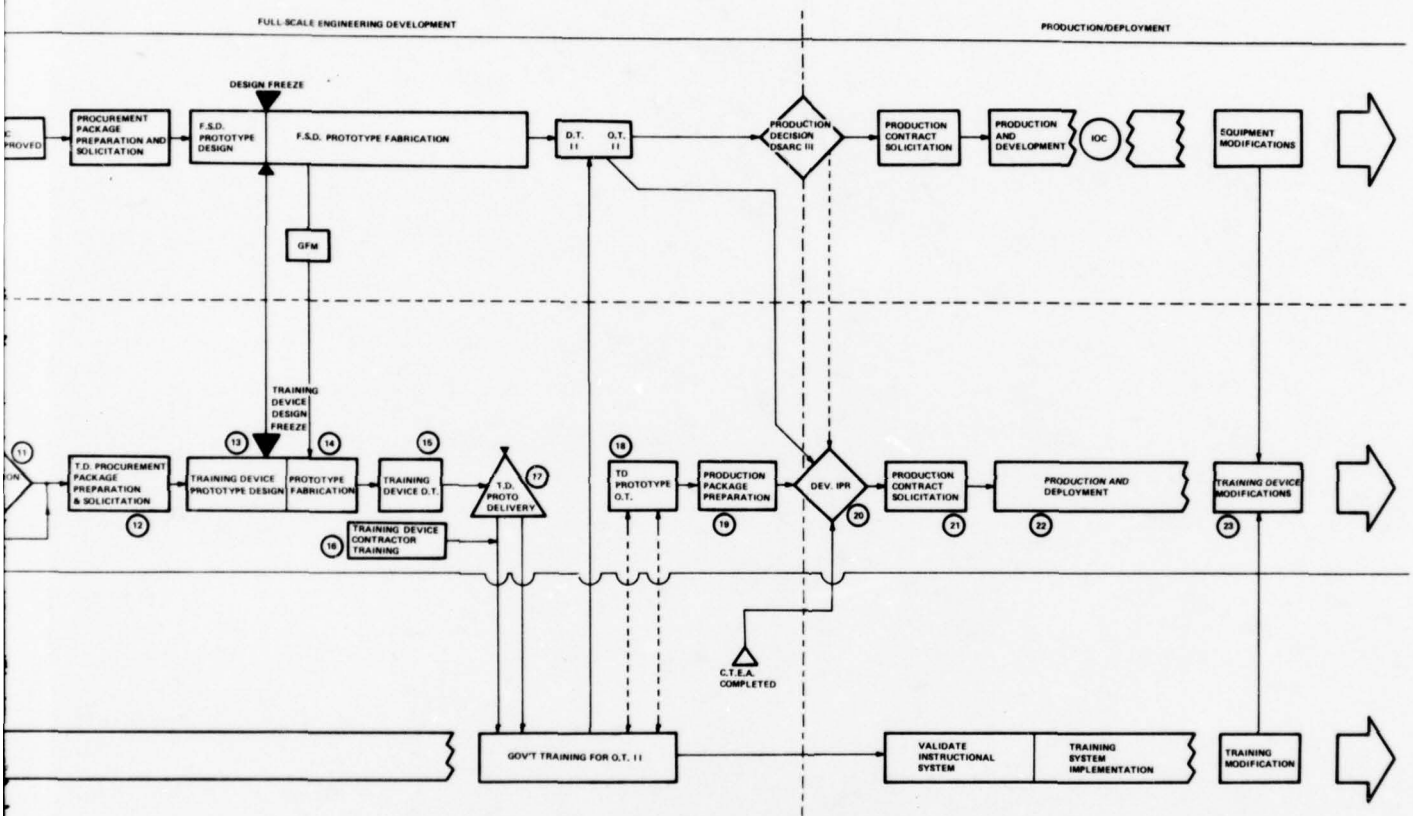


System Acquisition Schedule

# CHAPTER 2

## DATA CLASSIFICATION DESCRIPTIONS

Three classes of prime system development data are required to support training device development.* They are:

1. Basic data
2. Training support data
3. Weapon system data

The major applications of each data class are presented in this chapter. The individual data item descriptions (DIDs) in the basic data class are discussed in greater detail because of their importance to the data limiting process presented in Section III.

Chapter 3 of Section II specifies the DIDs within each class that are applicable to the concept definition, validation and full-scale engineering development phases. Therefore, Chapter 3 will integrate the information contained in this and the previous chapter. Table 1 lists all the DIDs included in the data guide. A copy of each DID is provided for easy reference in Volume II, Appendix A.

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*One DID is required for the training device contractor to assure that the performance standards to which the training devices are being designed are frozen. The Criteria List DID (DI-H-2276/M) is contained in Vol. II, Appendix A.

TABLE 1. PRIME SYSTEM DATA CLASSIFICATIONS

| |
|---|
| BASIC DATA |
| Data Accession List/Internal Data |
| Master Engineering Document List |
| Engineering Change Proposals |
| Plan, Proprietary Data |
| TRAINING SUPPORT DATA |
| Report Task Analysis/Task Description |
| Personnel and Training Requirements |
| Mission Analysis Report |
| WEAPON SYSTEM DATA |
| Computer Program Development Specification |
| Computer Program Product Specification |
| Interface Specification |
| Functional Flow Diagrams |
| Technical Publications for Development Programs |
| Drawings, Engineering, and Associated Lists (Level 1) |
| Drawings, Engineering, and Associated Lists (Level 2) |
| Report, ITDT Front-End Analysis (Validation) |
| Report, ITDT Front-End Analysis (FSED) |
| Training Device Design, Data Requirements* |

*This DID does not require data to be generated until requested. Data that are generated under this DID are generally used only in developing highly modeled training devices. This DID should be imposed on the prime contractor if application of the data limiting process at the time the training device procurement package is being developed indicates a requirement for Level IV data.

## BASIC DATA PACKAGE

The basic data package contains four DIDs which are used to obtain and update data, handle proprietary data, and assist in project control. The DIDs included in the basic data package are:

- Data Accession List/Internal Data
- Master Engineering Documents List
- Engineering Change Proposals
- Proprietary Data Plan

Each application is detailed below.

### Obtaining Data

As a weapon system progresses through the developmental cycle, weapon system engineering data increase in both volume and level of detail. The data that are applicable to training device development are only a small subset of the total weapon data base.

Of all data generated as part of weapon system development, only weapon system engineering data are required to actually fabricate a training device.

Weapon system engineering data are unique to each weapon system and, as such, engineering data requirements are difficult to generalize from system to system. The type and level of detail of data depend on the characteristics of the specific weapon system. Nevertheless, a general procedure has been defined which allows the PM to limit the amount of data requested for training device development.*

Reasons for limiting data include the following:

- Data are not required on all pieces of equipment with a weapon system to develop a training device.
- The level of data detail required to build a training device differs from that required to build the weapon system.
- The level of data detail required will vary among training equipment items, depending on training and fidelity requirements.
- Too much data increases the risk of conflicting and inaccurate data being provided.

Two primary DIDs aid the project manager's staff to limit the level of weapon system engineering data required to support training device development. The DIDs are:

- Data Accession List/Internal Data
- Master Engineering Documents List

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*The section on the data limiting process, Section III, includes a procedure for limiting data.

The Data Accession List/Internal Data and Master Engineering Documents List are the key elements in identifying the information available from the prime system manufacturers. From these lists the exact drawing or document number of desired technical information can be extracted on request. By requesting only specific information, the amount of requested data is limited to those data which are necessary to procure the specific training device of interest.

Weapon system data item descriptions (DIDs) referred to later in this chapter and subsequent chapters are used to assure that basic engineering data are generated, suitably documented, and available if requested. As data for the weapon system are created, they must be listed on either the Data Accession List/Internal Data or the Master Engineering Documents List. These lists provide a means for obtaining any listed document in an expeditious manner. It must be emphasized that the specific DIDs referenced in subsequent chapters of this guide represent engineering documentation or analyses that are certainly within the scope of good engineering practice for any well-run weapon system development effort. These DIDs do not create additional burden or cost within a well-run program.

Updating Data

The training device criteria freeze--the freeze of performance standards to which the training device is designed--should be scheduled only after the critical design review (CDR) of the prime weapon system in order to minimize data changes and the associated cost. The Criteria List DID (DI-H-3276/M) must be imposed on the training device developer so that

the data on which the training device design is based is documented and the revision status of that data is known. If, however, there are design/data changes after this point, they can be identified by:

- Reviewing engineering change proposals (ECPs), or
- Comparing the criteria list submitted by the training device contractor with the monthly submission of the Data Accession List/Internal Data and Master Engineering Documents List.

Review of Engineering Change Proposals (ECPs)--At the time of their submission, Engineering Change Proposals are reviewed to determine their relevance to training device development. If they do not relate to training, no action is required. If the ECP affects training-related data and is approved, the updated data are provided to the training device contractor.

Comparison of Training Device Criteria List with Data Accession List/ Internal Data and Master Engineering Documents List DIDs --These lists are a means of determining if design data used by the trainer have changed from the baseline. The training device developer Criteria List should contain all documents that are used to establish the training device design data base. The Criteria List contains the revision status of the current design data source which could be verified against the Data Accession List/ Internal Data or Master Engineering Documents List to assure that the prime system source data document has not changed. The Criteria List freeze should occur after CDR of the prime system to assure the minimum amount of changes to the Training Device (TD). It is the PM's responsibility to monitor the lists to determine the state of flux of design data and to consider delaying development, if necessary.

By comparing the TD criteria list with the prime system Data Accession List/Internal Data and Master Engineering Documents List, changes are identified and data updates can be requested and supplied to the training device contractor at any point during the training device development process.

## Handling Proprietary Data

At the time of proposal submission, the prime system bidder is required by the Proprietary Data Plan DID to identify those data or the computer software he considers to be limited rights data or restricted rights software. The government can request evidence that the data or software are, in fact, proprietary and can request a work-around plan for proprietary data that is necessary for training device development. This method allows for identification of proprietary data with ample time to establish alternate methods for obtaining the data. Appendix B in Volume II contains contractual clauses appropriate for such contingencies.

## Assuring Project Control

The project manager can also use the Data Accession List/Internal Data and the Master Engineering Documents List as management tools for prime system project control. For example, the lists will indicate if design requirements imposed by hardware and software engineering specifications are actually meeting the technical objectives of the program. The lists can also be used to determine if drawing release dates are compatible with schedules presented by the contractor. Therefore, the PM can better forecast potential schedule delays. By closely monitoring

the monthly submittals of these lists, the PM can assure that the types of data required by specific DIDs are being listed. For this reason, the PM should require the prime system developer to submit a plan for the identification and listing of specified data.

## TRAINING SUPPORT DATA

Training support data provide information necessary for defining training and personnel requirements for the training concept developed during the concept definition phase.

The training support data required for each phase of development are the same for all weapon systems and, as such, can be predetermined. Data must be delivered to the government according to the schedules set forth in Chapter 3 to adequately support the training objectives of each phase of development.

## WEAPON SYSTEM DATA

As a weapon system progresses through its developmental cycle, weapon system engineering data increase in both volume and level of detail. Data that are required for training device fabrication are only a small subset of the total weapon system data base.

The data required through the weapon system DIDs presented in Chapter 3 assure that data necessary for training device development are generated and available when necessary. Specific DIDs referenced in the next chapter represent engineering documentation or analyses that are,

generally, required of prime developers and are certainly within the scope of good engineering practice for any well-run weapon system program. It must be emphasized that not all the data generated by application of weapon system data DIDs are delivered to the government or to the training device contractor. Only those that were identified as necessary through exercise of the data limiting process (Section III) and requested of the prime system contractor are delivered.

# CHAPTER 3

# DATA REQUIREMENTS FOR DEVELOPMENTAL PHASES

## CONCEPT DEFINITION DATA REQUIREMENTS

### Data Requirements

The data requirements for the concept definition phase are the same for all weapon systems. It is during this phase of development that one begins to identify training requirements through analysis of the characteristics of the weapon system.

Training requirements identified during the concept definition phase are critical for several reasons. They are used to:

- Establish specific training objectives,
- Define an overall training concept,
- Define prime weapon system data required for training device development, and
- Develop a performance specification for training device design decisions.

Unless the training device contributes to the attainment of training objectives, it will not be cost and training effective. The primary output of the concept definition phase, therefore, is a general definition of the

training concept. The concept will be elaborated upon and refined during the validation phase of development.

Table 2 summarizes the training objectives and responsible agencies* for the concept definition phase objectives.

TABLE 2. ALLOCATION OF RESPONSIBILITY FOR CONCEPT DEFINITION PHASE OBJECTIVES

| Objective | Responsibility |
|---|---|
| Determine man's role in the weapon system and identify the associated training implications. | DARCOM/TRADOC |
| Develop a training concept indicating, in general terms, when, where, and how training can best be accomplished. | TRADOC |
| Identify and specify studies needed to validate the training concept. | TRADOC |
| Prepare an outline training plan summarizing the training concept, strategies, and development plans. | TRADOC |
| Prepare and provide inputs to basic system analyses, documentation, and decision making events associated with the LCSMM. | DARCOM/TRADOC |

*Responsibilities were derived from AR1000-1 effective 15 May 1978.

Because the weapon system project manager is not assigned until the beginning of the validation phase, program direction between Milestone 0 and Milestone 1, as indicated in Figure 2, lies with either a Special Task Force (STF) under HQDA (DSCOPS) authority or a Special Study Group (SSG) reporting to TRADOC.

Table 3 presents a checklist of the data item description required to support the training objectives of the concept definition phase. As DIDs are included in the prime contract, they should be checked off in the "Requested" column in Table 3. Two types of data are requested:

- Basic data
- Training support data

TABLE 3. CONCEPT DEFINITION DID CHECKLIST

| DID | CDRL No. | Requested |
|---|---|---|
| BASIC DATA | | |
| Data Accession List/ Internal Data | CDRL-A001 | |
| TRAINING SUPPORT DATA | | |
| Report Task Analysis/Task Description | CDRL-A002 | |
| Personnel and Training Requirements | CDRL-A003 | |
| Mission Analysis Report | CDRL-A004 | |

Data included in the basic data package do not provide "hard" weapon system data. Their application in the concept definition phase will enable the PM to access only that data required to develop the training concept and to obtain this data in a timely manner. If the decision has been made to provide a training device during the validation phase, then these DIDs are applied in accordance with the data limiting process presented in Section III. Training support data provide information to be used in defining the training and personnel requirements for the training concept developed during the concept definition phase.

Table 4 provides the description and use of each DID included in the checklist.

Data Delivery

The initial submission of the Data Accession List/Internal Data occurs 30 days after contract award. This list and its monthly updates contain all reports generated that relate to the weapon system. Reviewing the list should reveal additional available data needed to support concept definition training development. The remaining data listed in Table 4 is delivered prior to the preparation of the letter of agreement (LOA). It is used in developing the training concept to be included in the LOA.

The data are also used by the Special Task Force (STF) or Special Study Group (SSG) to monitor training progress and to remain abreast of the concepts being developed.

TABLE 4. CONCEPT DEFINITION DID DESCRIPTIONS AND USE

| DID | DESCRIPTION | USE |
|---|---|---|
| BASIC DATA | | |
| Data Accession List/ Internal Data (CDRL-A001) | Lists all weapon system technical data generated. | Reviews report to determine additional data requirements. |
| TRAINING SUPPORT DATA | | |
| Report Task Analysis/ Task Description (CDRL-A002) | Lists tasks and skills necessary to operate and maintain the system. | Provides early assessment of tasks and skills needed to meet training requirements. |
| Personnel and Training Requirements (CDRL-A003) | Establishes operator and maintenance personnel requirements, skills, training programs, and equipment required. | Establishes personnel and training requirements for inclusion in training concept and LOA. |
| Mission Analysis Report (CDRL-A004) | Identifies mission objectives, typical scenarios, and definition of appropriate responses to achieve mission objectives under a variety of conditions and threats. | Provides mission objectives and identifies concepts and training requirements. |

At the discretion of the STF or SSG, the data may be given to an independent contractor to develop training analyses and requirements. They can draw on the knowledge and experience of these independent training device specialists, and their insights into design decisions can greatly impact the system's effectiveness and cost. The SSG or STF may also wish to employ independent training specialists when a developmental cycle has been compressed to ensure that the training requirements are determined in the required time frame.

The decision whether it is necessary to provide a training device for testing during validation must be made during this phase of development to ensure that the procurement package is complete at the beginning of the validation phase.

According to Army regulations, a training device is not required to support a weapon system during validation phase testing. In cases where high-risk tasks (tasks which are difficult to train and which have a significant impact on system performance) should be evaluated, a brassboard training device should be considered to validate the planned training approach and to minimize the risk associated with training in the FSED phase. Ideally, TD requirements have been established during this phase and modified as required early in the validation phase.

Product of the Concept Definition Phase

The training-related outputs of the concept definition phase support the concept formulation package (CFP), letter of agreement (LOA), and outline acquisition plan (OAP) that support the Milestone 1 program initiation decision. Support of LCSMM documentation takes the form of:

1. Training-related cost impact on the total program, and

2. Schedule impacts of the training development program.

In addition, if the decision has been made to provide a training device for OT I, the procurement package must be available at the conclusion of the concept definition phase.

## VALIDATION DATA REQUIREMENTS

### Data Requirements

Following the program initiation decision, training activities concentrate on detailing system training requirements and designing a program to meet those requirements. The validation phase is the key to achieving delivery of the training device for evaluation as part of the system at OT II. Although final definition of training equipment requirements will not be available until the start of full-scale engineering development (FSED), sufficient information should be available to begin the planning and procurement process for the development of FSED prototype training equipment.

In accordance with AR 1000-1, a weapon system project manager is assigned when the validation phase of weapon system development begins. The PM must provide the TRADOC system manager (TSM) with the data required to carry out training-related analysis in this phase. Close cooperation is required between the PM and the TSM to guarantee procurement and testing of training devices in the same time frame as the prime system. Although the TSM is required to do training-related

analyses and to develop requirements, the PM is responsible for assuring that TRADOC has the necessary data and must provide for contractual implementation of these requirements.

Table 5 summarizes the training objective and responsible agencies* for the validation phase training objectives.

TABLE 5. ALLOCATION OF RESPONSIBILITY FOR VALIDATION PHASE OBJECTIVES

| Objective | Responsibility |
|---|---|
| Evaluate alternative training program designs. | DARCOM/TRADOC |
| Specify training device requirements. | TRADOC |
| Prepare the detailed training plan. | TRADOC |
| Procure prototype training devices (as appropriate) for verification during validation phase. | DARCOM |
| Develop training device specification for procurement of TD. | DARCOM/TRADOC |
| Develop training device procurement package for FSED prototype training device. | DARCOM |
| Provide inputs to basic system events of this phase of system life cycle. | DARCOM |

*Responsibilities were derived from AR 1000-1 effective 15 May 1978.

Table 6 is a checklist of the DIDs required to support the training objectives of the validation phase. As DIDs are included in the prime contract, they should be checked off in the "Requested" column in Table 6. There are three classes of data:

- Basic data
- Training support data
- Weapon system data

DIDs that are included in the basic data package do not provide "hard" weapon system data. Their application enables the PM to (1) access only that "hard" data required to build the training device, (2) obtain change data that impact training device development, and (3) provide a means for handling proprietary data. The procedure for applying these DIDs is presented in Section III.

Training support data provide information to be used in defining the training and personnel requirements for the training device.

DIDs specified under weapon system data are required to ensure that weapon system data are generated and available in the time frame required for training device procurement and fabrication. The specific set of data required out of all the data generated by these DIDs is identified and requested by the process described in Section III. This process of identifying and requesting only the data necessary for fabrication of the training device based on its unique characteristics is the key element of this guide. If all the data in the DIDs presented in Table 6 are requested without first applying the data limiting process (Section III), too much data

TABLE 6. VALIDATION PHASE DID CHECKLIST

| DID | CDRL No. | Requested |
|---|---|---|
| BASIC DATA | | |
| Data Accession List/Internal Data | CDRL-B001 | |
| Master Engineering Document List | CDRL-B002 | |
| Plan, Proprietary Data | CDRL-B003 | |
| TRAINING SUPPORT DATA | | |
| Personnel and Training Requirements | CDRL-B004 | |
| Mission Analysis Report | CDRL-B005 | |
| WEAPON SYSTEM DATA | | |
| Report, ITDT Front End Analysis (Validation Phase) | CDRL-B006 | |
| Computer Program Development Specification | CDRL-B007 | |
| Interface Specification | CDRL-B008 | |
| Functional Flow Diagrams | CDRL-B009 | |
| Drawings, Engineering and Associated Lists (Level 1) | CDRL-B010 | |
| Technical Publications for Development Programs | CDRL-B011 | |

will be supplied to the training device contractor. Only through application of the data limiting process will the minimum necessary data package be supplied to the training device contractor.

Table 7 provides the description and use of each DID included in the checklist.

Data Delivery

Figure 7 traces four series of events:

1. The schedule for delivery or availability of data requested from the prime contractor at the beginning of the validation phase (Line 1),
2. Weapon system development events (Line 2),
3. The relationship between weapon system development and training-related activities (Line 3), and
4. The relationship between weapon system development and training-related activities necessary for a validation phase training device (if applicable)(Line 4).

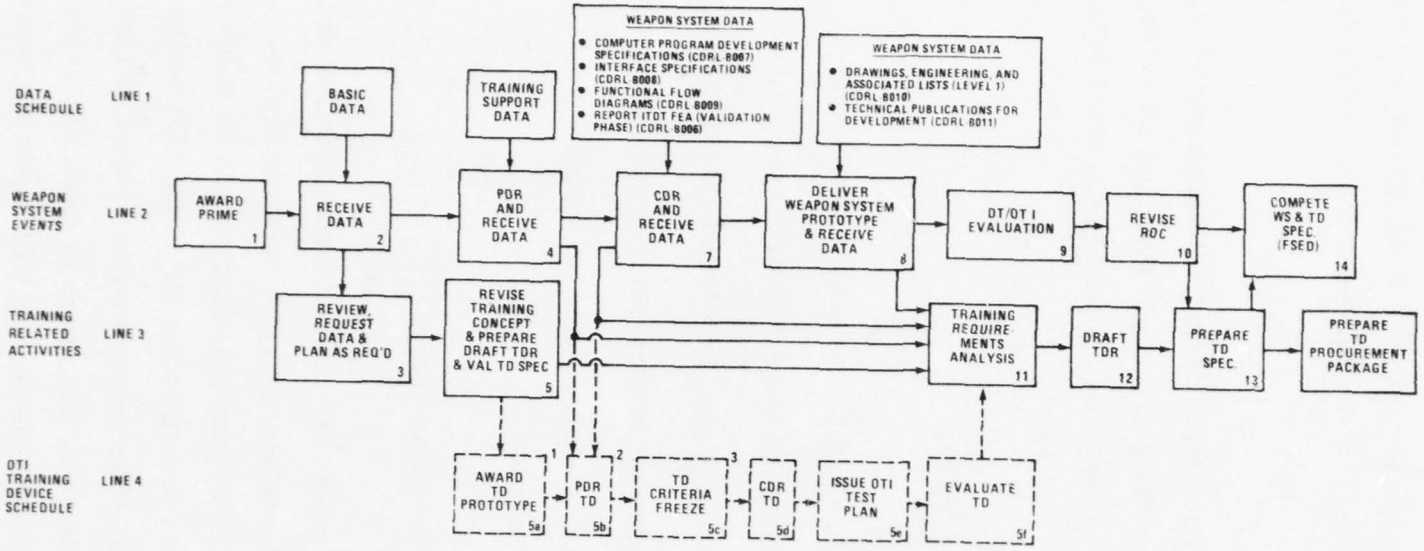
The basic data package and training support data are delivered to the government as specified on the Contract Data Requirement List (CDRL). As weapon system data are developed, they are listed on the Data Accession List/Internal Data or Master Engineering Documents List. Detailed data should not be requested by the government until after completion of the data limiting process. Availability and request of weapon system data is

## TABLE 7. VALIDATION PHASE DID DESCRIPTIONS AND USE

| DID | DESCRIPTION | USE |
|---|---|---|
| BASIC DATA | | |
| Data Accession List/Internal Data (CDRL-B001) | Lists all technical data associated with the weapon system. | Reviews monthly applicable data to be requested for development of specification and procurement package. |
| Master Engineering Documents List (CDRL-B002) | Lists all drawings, specifications, etc. necessary to support contract end item. Provides means of identifying required information and assuring delivery to the government as required in an expeditious manner. | Reviews to identify and request engineering information required for detail design and test information. Checks for changes in revision status on items contained in the TD developer's criteria list. |
| Plan, Proprietary Data (CDRL-B003) | Identifies all information to which the contractor is claiming the government has limited rights. Identifies this information early, so that workaround plans can be developed as required. | Reviews to determine whether work-around plans must be requested from prime because of proprietary data. |
| TRAINING SUPPORT DATA | | |
| Personnel and Training Requirements (CDRL-B004) | Establishes operator and maintenance personnel requirements, the skills, and the training programs and equipment required. | Confirms the training requirements and allows the trainer procurement process to start. |
| Mission Analysis Report (CDRL-B005) | Identifies mission objectives, typical scenarios, and definition of appropriate responses to achieve mission objectives under a variety of conditions and threats. | Verifies that the mission objectives are understood and that scenarios adequately address likely requirements and events. Identifies concepts, training requirements, omissions, or inconsistencies requiring discussion between TRADOC and DARCOM. |
| WEAPON SYSTEM DATA | | |
| Report, ITDT Front End Analysis (Validation Phase) (CDRL-B006) | Provides the information specified in MIL-M-63035 for the support of ITDT and the concurrent development of training equipment during the engineering development phase of a prime system. | Provides the necessary information for the development of the maintenance training device specification. |
| Computer Program Development Specification (CDRL-B007) | Provides description of computer programs without full documentation. | Reviews programs to understand them and their relationship to hardware elements of the system. Identifies primary functions that must be included in training device. Reviews interfaces that must be defined in training device specification. |

TABLE 7. VALIDATION PHASE DID DESCRIPTIONS AND USE (concluded)

| DID | DESCRIPTION | USE |
|---|---|---|
| Interface Specification (CDRL-B008) | Defines all mechanical, electrical, hydraulic, etc. interfaces between units. | Identifies interfaces requiring definition in training device specification. |
| Functional Flow Diagrams (CDRL-B009) | Provides information necessary for understanding system function and relationship to other approaches. | Explains the design approach so that training devices can be developed. |
| Drawings, Engineering and Associated Lists (Level 1) (CDRL-B010) | Provides preparation and delivery of drawings, engineering and associated lists to satisfy government requirements of Level 1. | Provides the necessary information for entering the first phase of FSED training procurement and defining TD requirements. |
| Technical Publications for Development (CDRL-B011) | Provides the necessary information for determining operation and maintenance procedures. | Verifies the training device specifications and requirements develcped while the prime system is built and tested. |




1. SHOULD BE AFTER PDR OF PRIME SO THAT MAJOR CHANGES OF PRIME SYSTEM ARE IDENTIFIED AND TRAINER CAN PROCEED WITH MINIMAL RISK.
2. SHOULD BE AFTER CDR SO THAT PRIME CHANGES ARE MINIMIZED.
3. CRITERIA LIST FREEZE (SEE PREVIOUS COMMENTS).

Figure 7. Validation Phase Data Delivery Schedule

timed so that it may be included with the FSED prototype training device RFP (during the early stages of the full-scale engineering development phase).

If a training device is to be tested during validation phase testing, the TD contract is awarded after Weapon System PDR and all selected data supplied by the prime contractor to this point are provided to the prototype TD contractor.

Product of the Validation Phase

The training-related outputs of the validation phase are:

- Draft specification for the FSED prototype training device
- Draft procurement package for FSED prototype training device
- Results of validation training verification (as appropriate)
- Updated LCSMM documentation, to include:
  - Developmental plan
  - COEA
  - Decision coordination paper

The key outputs of this phase are the draft specification and procurement package for the FSED prototype operator training device. After the validation phase evaluation, recommendations should be made regarding any changes to prime system specification for FSED that would improve the integrated performance of the prime weapon system and its support functions. The work completed in this phase is essential to meeting the AR 1000-1 objectives for the subsequent full-scale engineering development

phase. The analyses completed in the validation phase will result in improved integrated performance of the prime system and its supporting training devices. By including all identified equipment and support requirements in FSED specifications for the prime system and training devices, operational performance of the system will be improved. In addition, life cycle costs will be reduced.

## FULL-SCALE ENGINEERING DEVELOPMENT DATA REQUIREMENTS

### Data Requirements

Training activities in this phase are concerned with fabrication of the training device, developing training program materials (courseware, media, etc.) consistent with the approved design, and validating the instructional program.

The primary objectives in this phase are to:

- Schedule the delivery of weapon system data to the TD contractor to minimize changes, and
- Monitor the prime contractor for data changes and expedite the transmittal of these data to the TD contractor to minimize impact on the program.

Data in the full-scale engineering development phase serve two functions:

1. They support TRADOC (or the PM's independent contractor) in its refinement of training requirements; and

- They provide data required for training device fabrication to the TD contractor.

Table 8 summarizes the training objective and responsible agencies* for the full-scale engineering development phase objectives.

TABLE 8. ALLOCATION OF RESPONSIBILITY FOR FULL-SCALE ENGINEERING DEVELOPMENT PHASE OBJECTIVES

| Objective | Responsibility |
|---|---|
| Finalize training requirements. | TRADOC |
| Contract for training devices. | DARCOM |
| Fabricate training devices. | DARCOM |
| Commence new equipment training. | TRADOC |
| Conduct test and evaluation of training devices. | DARCOM/TRADOC |

Table 9 is a checklist of the DIDs required to support training objectives of the full-scale engineering development phase. As DIDs are included in the prime contract, they should be checked off in the "Requested" column in Table 9. Three types of data are requested:

- Basic data
- Training support data
- Weapon system data

*Responsibilities were derived from AR 1000-1 effective 15 May 1978.

TABLE 9. FULL-SCALE ENGINEERING DEVELOPMENT DID CHECKLIST

| DID | CDRL No. | Requested |
|---|---|---|
| BASIC DATA | | |
| Data Accession List/Internal Data | CDRL-C001 | |
| Master Engineering Documents List | CDRL-C002 | |
| Plan, Proprietary Data | CDRL-C003 | |
| Engineering Change Proposals (ECPs) | CDRL-C004 | |
| TRAINING SUPPORT DATA | | |
| Personnel and Training Requirements | CDRL-C005 | |
| WEAPON SYSTEM DATA | | |
| Computer Program Development Specification | CDRL-C006 | |
| Interface Specification | CDRL-C007 | |
| Functional Flow Diagrams | CDRL-C008 | |
| Training Device Design, Data Requirements | CDRL-C009 | |
| Report, ITDT Front-End Analysis (FSED Phase) | CDRL-C010 | |
| Computer Program Product Specification | CDRL-C011 | |
| Drawings, Engineering and Associated Lists, (Level 2) | CDRL-C012 | |

Data included in the basic data package do not provide "hard" weapon system data. Their application enables the PM to (1) access only that "hard" data required to build the training device, (2) obtain change data that impact training device development, and (3) provide a means for handling proprietary data. The procedure for applying these DIDs is presented in Section III.

DIDs specified under weapon system data are required to ensure that weapon system data are generated and available in the time frame required for training device procurement and fabrication. The specific data required from that generated by these DIDs are identified and requested in the process described in Section III. This process of identifying and requesting only the data necessary for the fabrication of the training device based on its unique characteristics is the key element of this guide. If the DIDs presented in Table 8 are bought without applying the data limiting process (Section III), far too much data will be supplied to the training device contractor. Only through application of the data limiting process will the minimum necessary data package be supplied to the training device contractor.

Table 10 provides the description and use of each DID included in the checklist.

Data Delivery Schedule

Figure 8 traces four series of events:

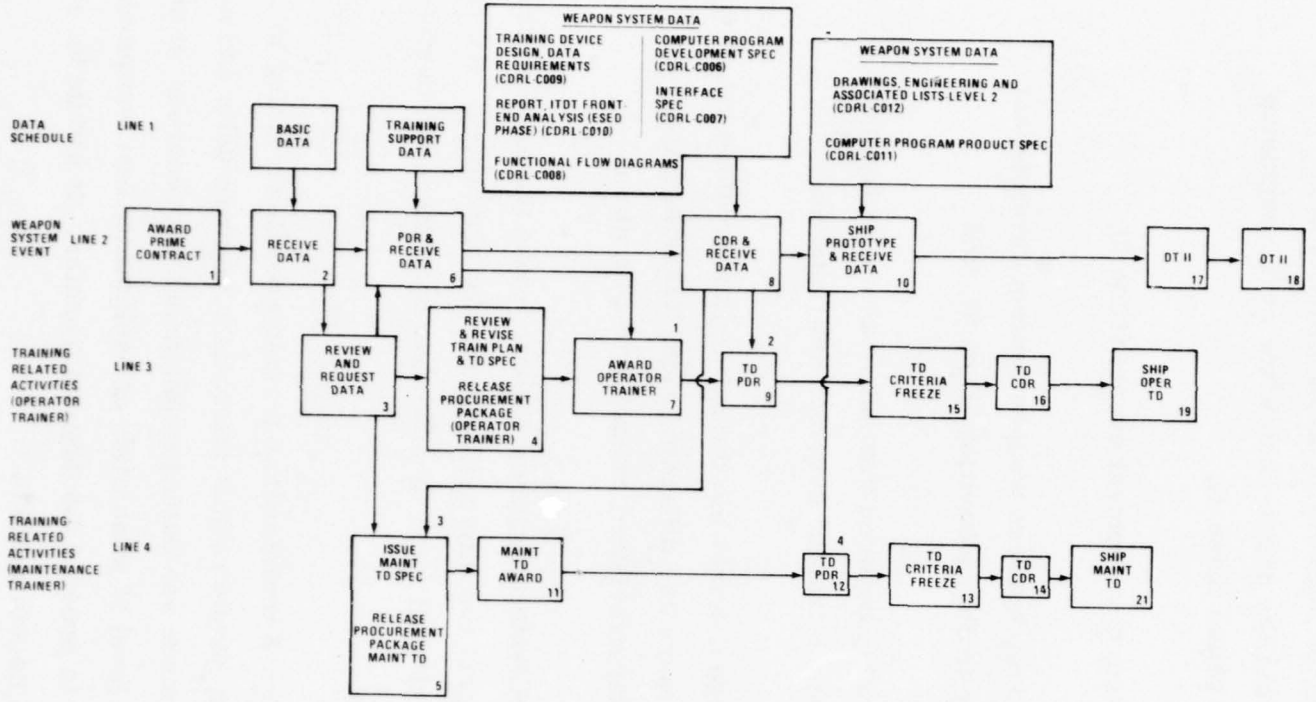
## TABLE 10. FSED PHASE DID DESCRIPTIONS AND USE

| DID | DESCRIPTION | USE |
|---|---|---|
| BASIC DATA | | |
| Data Accession List/ Internal Data (CDRL-C001) | Lists all technical data and a means of obtaining applicable data in a timely manner. | Reviews monthly to identify and require new information about training device development or changes in data currently included in the TD developer's criteria list. After criteria freeze, PM or designate must monitor changes to items on the criteria list. |
| Master Engineering Documents List (CDRL-C002) | Same as validation phase. | Reviews to identify and request engineering information required for detail design and test information. Checks for changes in revision status on items contained in the TD developer's criteria list. |
| Plan, Proprietary Data (CDRL-C003) | Identifies all information to which the contractor is claiming the government has limited rights. Identifies this information early, so that work-around plans can be developed as required. | Reviews to determine whether work-around plans must be requested from prime contractor because of proprietary data. |
| Engineering Change Proposals (ECPs) and Requests for Deviation and Waiver (CDRL-C004) | Provides documentation and supporting data describing a change in format of a configuration item after configuration identification is established. | Provides notice of proposed changes occurring after CDR. |
| TRAINING SUPPORT DATA | | |
| Personnel and Training Requirement (CDRL-C005) | Establishes operator and maintenance personnel requirements, the skills, and the training programs and equipment required. | Confirms the training requirements and allows the operator trainer procurement process to start. |
| WEAPON SYSTEM DATA | | |
| Computer Program Development Specification (CDRL-C006) | Establishes scope, documents, requirements, and quality assurance provisions for all computer program configuration items developed under terms of the contract. | Provides to TRADOC and the TD developer the description, performance, and test requirements for all computer programs required by the system. Should apply to programmable elements whether via software or firmware. Would include special purpose hardware processor, microprocessor, and other similar devices in addition to computers. |

## TABLE 10. FSED PHASE DID DESCRIPTIONS AND USE (concluded)

| DID | DESCRIPTION | USE |
|---|---|---|
| Interface Specification (CDRL-C007) | Defines all mechanical, electrical, hydraulic, etc. interfaces between units. | Represents a resubmission of information generated during the validation phase. Resubmissions should identify and clarify changes in the design approach affecting the training devices; they should be provided to the TD developer prior to the TD PDR. |
| Functional Flow Diagrams (CDRL-C008) | Provides information necessary for understanding system function and relationship to other approaches. | Represents a resubmission of information generated during the validation phase. Resubmissions should identify and clarify changes in the design approach affecting the training devices; they should be provided to the TD developer prior to the TD PDR. |
| Training Device, Design, Data Requirements (CDRL-C009)[a] | Provides expanded design information and audio-visual data for full fidelity simulator. | Imposes strict requirements for a full fidelity simulation of a sophisticated weapon system requiring simulation of motion and controls. For less stringent training devices, care should be taken to apply selectively the detailed requirements, by paragraph, in an addendum to the DD 1423 form. |
| Report, ITDT Front-End Analysis (CDRL-C010) | Provides the information specified in MIL-M-63035 for the support of ITDT and the concurrent development of training equipment during the engineering development phase of a prime system. | Provides the necessary task information for the development of the maintenance and operator training device specifications. |
| Computer Program Product Specification (CDRL-C011) | Provides complete program documentation for reference for maintenance trainer and operator training modifications. | Provides detailed information for development of the maintenance trainer and the operator trainer. Used as a reference document for future prime system on trainer modifications. |
| Drawings, Engineering and Associated Lists (Level 2) (CDRL-C012) | Provides preparation and delivery of drawings, engineering and associated lists to satisfy government requirements of Level 2. | Reviews to assure that the system is suitably documented to provide the necessary information for entering the first phase of FSED training procurement. |

[a] This DID does not require data to be generated until requested. Data that are generated under this DID are generally used only in developing highly modeled training devices. This DID should be imposed on the prime contractor if application of the data limiting process at the time the training device procurement package is being developed indicates a requirement for Level IV data.




1. SHOULD BE AFTER PRIME PDR SO THAT MAJOR CHANGES OF PRIME SYSTEM ARE IDENTIFIED AND TD FABRICATION CAN PROCEED WITH MINIMAL RISK.
2. SHOULD BE AFTER PRIME CDR SO THAT PRIME CHANGES ARE MINIMIZED.
3. RELEASE PROCUREMENT PACKAGE (MAINTENANCE TRAINER).
4. AFTER ITDT DELIVERY.

Figure 8. Full-Scale Engineering Development Phase Data Delivery Schedule

1. The schedule for delivery or availability of data requested from the prime contractor at the beginning of the FSED phase (Line 1),

2. Weapon system development events (Line 2),

3. The relationship between weapon system development and operator trainer activities (Line 3), and

4. The relationship between weapon system development and maintenance trainer development (Line 4).

It is evident from Figure 8 that the time lines for development of operator and maintenance trainers are different. The following paragraphs summarize the major characteristics of each type of trainer.

Operator Trainer--An operator/crew trainer trains the tasks necessary to operate and interpret the information from the equipment. All controls, displays, and other stimuli must be sufficient to achieve the desired level of training transfer.

Maintenance Trainer--A maintenance trainer provides training in fault isolation and repair. It should reflect interaction between units and components in the failure mode and during maintenance procedures. It should provide a sufficient level of simulation of equipment, test equipment, displays, and controls to provide the desired transfer. It should be compatible with ITDT technical documentation.

The operator trainer, in general, reflects the prime system appearance and performance only in terms of operator man-machine interfaces. The maintenance trainer, however, may be required to simulate specific test points, disassembly procedures, etc. that must resemble more exactly the final prime system configurations.

The generic classification of training devices being fabricated during FSED should be kept in mind in developing FSED test schedules.

The basic data package is delivered to the government as specified on the FSED CDRL. As weapon system data are developed, they are listed on the Data Accession List/Internal Data or Master Engineering Documents List. Detailed data from these lists should not be requested by the government until after completion of the data limiting process (Section III). Availability of data is timed to provide the most mature data possible with the training device contract award data package and still allow for the earliest possible completion of training devices. Mature data insure that the training devices are compatible with the weapon system they support and minimize the need for design changes.

Product of the FSED Phase

The initial outputs of this phase are final revision of the operator trainer specifications (generated as the result of the validation phase) and the final specification procurement package for the maintenance trainer. After fabrication of the operator and maintenance training devices, these devices are tested with the weapon system.

# SECTION III

# DATA LIMITING PROCESS

This section describes the process of identifying and requesting only the minimum data necessary for the procurement and fabrication of a training device. Application of this process enables the project manager to define data requirements responsive to the specific characteristics of the training device.

The data limiting process is applied to determine data requirements for the preparation of specifications, request for proposal (RFP) data package, and contract award data packages for a training device. The need for determining these data requirements occurs at two points in the weapon system development cycle:

1. If there are tasks which are difficult to train and they have a significant impact on system performance, a decision may be made to evaluate prototype training devices during the validation phase. This decision necessitates use of the data limiting process to determine data requirements. Validation phase training device specifications, RFP data packages, and contract award data packages should be prepared at the beginning of the validation phase of weapon system development.

2. Near the end of the validation phase of weapon system development, it is necessary to apply the data limiting process in



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anticipation of preparation of FSED prototype training device specifications, RFP data packages, and contract award data packages.

Two data item descriptions (DIDs) aid the project manager's staff in limiting the level of weapon system engineering data required to support training device development:

1. Data Accession List/Internal Data
2. Master Engineering Documents List

The Data Accession List/Internal Data and Master Engineering Documents List are the key elements in identifying the information available from the prime system manufacturers. From these lists the exact drawing or document number of desired technical information can be extracted on request.

The data limiting process is used by the project manager's staff to determine which specific data documents from these lists should be requested. Major reductions in necessary data documents result from:

- Eliminating pieces of equipment not associated with tasks selected for training on a training device,
- Identifying data requirements for individual pieces of equipment rather than defining data requirements for the entire training device, and
- Defining distinct data requirements based on different levels of training and fidelity requirements.

The following paragraphs outline the procedure for implementing the data limiting process. The major steps are:

1. Obtain list of tasks selected for training
2. Develop a task by equipment chart
3. Develop a non-redundant equipment list
4. Determine training equipment fidelity level
5. Determine data requirements
6. Determine specific data documents requirements
7. Request specific data documents

The process must be applied separately for each training device to be developed. This is necessary because different devices will serve different training requirements, and these differences in training requirement impact upon data requirements.

STEP 1. OBTAIN LIST OF TASKS SELECTED FOR TRAINING

Inventories of job tasks necessary for proper maintenance and operation of the weapon system are developed as part of the prime system front end analysis (FEA) during the early stages of the validation phase. The inclusion of the ITDT Front End Analysis DID, referred to in Table 7, insures that these task lists will be generated and available in the time frame required for training device procurement.

If this list of tasks has been further reduced to only those tasks requiring training (or even better, only those tasks requiring training on a training device), then the overall FEA inventory of job tasks need not be consulted. Sources that may contain such reduced task lists include:

- Personnel and training requirements reports
- Study reports on high risk tasks
- Draft training device requirements (TDR) documents

The initial input to the data limiting process is the identification of the most recent and precisely defined list of tasks required for training on the training device to be developed. If no such list exists, then the task list from the ITDT FEA must be used. Keep in mind that the systematic reduction of tasks can result in a training device tailored to training requirements; it also greatly reduces requirements for prime system data.

STEP 2. DEVELOP A TASK BY EQUIPMENT CHART

For each task included in the training task list, identify the pieces of equipment associated with performance of that task from the ITDT Front End Analysis DID. Table 11 is used to record this information.

STEP 3. DEVELOP A NON-REDUNDANT EQUIPMENT LIST

It is highly likely that in many cases more than one task is associated with a piece of equipment. Therefore, many pieces of equipment may be listed several times in Table 11. The objective of the present step in the

TABLE 11. TASK BY EQUIPMENT CHART

| TASK TRAINING LIST | ASSOCIATED EQUIPMENT PIECES |
|---|---|
| 1. | |
| 2. | |
| 3. | |
| 4. | |
| 5. | |
| 6. | |
| 7. | |
| 8. | |
| 9. | |
| 10. | |
| 11. | |
| 12. | |
| 13. | |
| 14. | |

process is to develop a non-redundant equipment list, i.e., list each equipment piece included in column 2 of Table 11 only once. Table 12 is to be used for this purpose. List all equipment items associated with tasks required for training in column 1 of Table 12. Column 2 of Table 12 will be filled in later.

STEP 4. DETERMINE TRAINING EQUIPMENT FIDELITY LEVEL

A decision aid has been developed to assist the PM staff in determining the minimum data necessary for the procurement and fabrication of each equipment piece. Table 13 is to be used for making these determinations. Four levels of training equipment fidelity or sophistication are listed along the top of the table. Six characteristics of tasks and training device equipment are listed along the left side of the table. For each characteristic, a brief descriptive statement is given for four fidelity levels. Reading from left to right, each descriptive statement corresponds to aspects of training device equipment which generally correspond to increasing levels of fidelity or sophistication of equipment needed for training. By determining which descriptive statement within each characteristic best applies to the equipment envisioned for training, it is possible to specify the level of fidelity required in the equipment to achieve training objectives. For this purpose, Table 13 is used as follows:

1. Enter the name of the first equipment piece from Table 12.

2. Select the first characteristic (Task Proceduralization) and read, from left to right, the four descriptions.

TABLE 12. EQUIPMENT PIECE AND ASSOCIATED DATA REQUIREMENT LEVEL

| EQUIPMENT PIECE | DATA REQUIREMENT LEVEL |
|---|---|
| 1. | |
| 2. | |
| 3. | |
| 4. | |
| 5. | |
| 6. | |
| 7. | |

# TABLE 13. LEVELS OF EQUIPMENT FIDELITY

Equipment Piece _____

| | Levels of Fidelity Requirements | | | |
|---|---|---|---|---|
| Characteristics | Level I | Level II | Level III | Level IV |
| Task Proceduralization | Performance of tasks requires only linear sequential procedures. | Within limits, tasks may be correctly performed using alternate linear procedures. | Within limits, tasks may be correctly performed using alternate nonlinear (branching) procedures. | Tasks may be correctly performed using any of several (unlimited) procedures. Correct or incorrect performance is hard to define. |
| Task Decision Requirements | The sequence of task performance is the same regardless of system response. | Alternate performance paths can be specified in manuals based on predictable system responses. | Performance paths are determined by display values. | Performance paths are determined by realistic interaction of controls and displays. |
| Task Complexity | Tasks are simple, discrete, and may be evaluated on simple yes/no criteria. | Performance errors may occur when otherwise correct procedures are performed at the wrong time. | "Eye-hand" coordination is required to accomplish the task. Must sense and respond to changes in the system. Error tolerance is relatively large. | Precise skill and coordination are required for task performance. Must be able to accurately sense and respond to subtle changes in the system. Error toferance is small. |
| Complexity of Controls and Displays | Controls and displays require no interpretation. Information presented in displays is "go/no go," "start/stop," etc. | Controls and displays require minimal interpretation. More than two discrete states can exist for a control or display. | Dynamic (continuous) responses of controls and displays are similar but not identical to system equipment. Training equipment may be faster, slower, tighter, looser, etc. than weapon system equipment. | Dynamic responses of controls and displays in training equipment are identical to that of weapon system. |
| Spatial Relationship of Controls and Displays | Relative location of controls and displays is not important for training. | Relative location of some controls and displays affects task performance. | Relative location of all controls and displays affects performance. | Relative location of all controls and displays is critical to proper task performance. |
| Modeling Complexity of Training Equipment | Controls and displays are defined by discrete (on/off) values. | Controls and displays contain multiple, discrete values. | Continuous range of values is significant for controls and displays (e.g., voltmeter). | Functions of controls and displays in training equipment must precisely duplicate those of the weapon system. |
| Total | | | | |

3. Select the one description that most closely approximates the maximum requirements for the piece of equipment under consideration.

4. Enter a " ✓ " in that box.

5. Select the second characteristic (Task Decision Requirements) and read, from left to right, the four descriptions.

6. Select the one description that most closely approximates the maximum requirements for the piece of equipment under consideration.

7. Enter a " ✓ " in that box.

8. Repeat Steps 2, 3, and 4 for each of the four remaining characteristics.

9. Review the six descriptions selected and determine if you are confident in your choices. If you are not confident in a selection, repeat the procedure for that corresponding characteristic.

10. Total the number of descriptions selected under each level of fidelity.

11. Enter the totals in the bottom row of Table 13.

12. Circle the fidelity level value (I, II, III, or IV) with the highest total. If a tie exists, circle the fidelity level value of the highest fidelity level among the tied values. It is most likely that all check

marks will fall within only one fidelity level. However, if it should occur that most checks are within one level (e.g., Level II) and one or two checks are in a higher level (e.g., Level III), then you should reexamine your selection of descriptions. Such a discrepancy could indicate inconsistency in using the table. If, upon reexamination, the discrepancy still exists, select the fidelity level value with the highest total number of checks but make a note that you may later need additional weapon system data for that particular type of information indicated in the discrepant descriptions (see procedures below for determining data requirements).

13. Enter the selected fidelity level for the piece of equipment in column 2 of Table 12.

14. Repeat steps 1 through 13 for each remaining piece of equipment listed in Table 12.

STEP 5. DETERMINE DATA REQUIREMENTS

Once each piece of equipment has been assigned a fidelity level value in column 2 of Table 12, the associated data requirements for that piece of equipment can be defined. Tables 14 through 18 are used to specify data requirements. Tables 14 through 17 specify data required for an RFP and for contract award. Table 18 lists additional data appropriate for development of a specification. If the data specified in Table 18 have been considered in the preparation of the specification, then they need not be considered again for the RFP or the contract award data package. However, those subcategories of data listed in Table 18 that

TABLE 14. LEVEL I DATA FOR RFP AND CONTRACT AWARD

| Manufacture and Test Drawings | Design Drawings | Engineering Reports | Systems Engineering | Human Factors | Integrated Logistics Support | System Safety | Maintain-ability | Photography Motion Pictures |
|---|---|---|---|---|---|---|---|---|
| • Assembly drawings (First Indenture) | • Block diagrams<br>• System flow diagrams | | | | | | • Daily readiness procedures | |

## TABLE 15. LEVEL II DATA FOR RFP AND CONTRACT AWARD

| Manufacture and Test Drawings | Design Drawings | Engineering Reports | Systems Engineering | Human Factors | Integrated Logistics Support | System Safety | Maintainability | Photography Motion Pictures |
|---|---|---|---|---|---|---|---|---|
| • Assembly drawings (First Indenture) | • Block diagrams<br>• System flowcharts | | | | | | • Daily readiness procedures | |
| • Assembly drawings (Second Indenture) | | • Performance requirements | • Test procedures | • Control studies | • Training device requirements studies | • Safety report | • Built-in test equipment (BITE) analysis | • Equipment pictures |
| • Detailed drawings (dimensional relationships) | | | | • Interface specifications | | | | |
| • Specifications | | | | | | | | |

## TABLE 16. LEVEL III DATA FOR RFP AND CONTRACT AWARD

| Manufacture and Test Drawings | Design Drawings | Engineering Reports | System Engineering | Human Factors | Integrated Logistics Support | System Safety | Maintainability | Photography Motion Pictures |
|---|---|---|---|---|---|---|---|---|
| • Assembly drawings (First Indenture) | • Block diagrams<br>• System flow diagrams | | | | | | • Daily readiness procedures | |
| • Assembly drawings (Second Indenture)<br>• Detailed drawings (dimensional relationships)<br>• Specifications | | • Performance requirements | • Test procedures<br>• Interface specifications | • Control studies | • Training device requirements study | • Safety report | • Built-in test equipment (BITE) analysis | • Equipment pictures |
| • Assembly drawings (Third Indenture)<br>• Schematic diagrams<br>• Wiring/cable diagrams<br>• Logic diagrams | • Access drawings<br>• Field of view drawings<br>• One function diagrams<br>• Functional schematics | • Concept report<br>• Tables and charts of data or performance | • Hardware development specifications<br>• Software development specifications<br>• Computer storage analysis<br>• System timing analysis | | • Reliability/maintainability analysis<br>• Facility requirements report | | • Maintenance engineering analysis | |

# TABLE 17. LEVEL IV DATA FOR RFP AND CONTRACT AWARD

| Manufacture and Test Drawings | Design Drawings | Engineering Reports | System Engineering | Human Factors | Integrated Logistics Support | System Safety | Maintainability | Photography Motion Pictures |
|---|---|---|---|---|---|---|---|---|
| • Assembly drawings (First Indenture) | • Block diagrams<br>• System flow diagrams | | | | | | • Daily readiness procedures | |
| • Assembly drawings (Second Indenture)<br>• Detailed drawings (dimensional relationships)<br>• Specifications | | • Performance requirements | • Test procedures<br>• Interface specifications | • Control studies | • Training device requirement study | • Safety report | • Built-in test equipment (BITE) analysis | • Equipment pictures |
| • Assembly drawings (Third Indenture)<br>• Schematic diagrams<br>• Wiring/cable diagrams<br>• Logic diagrams | • Access drawings<br>• Field of view drawings<br>• One functions diagram<br>• Functional schematics | • Concept report<br>• Tables and charts of data or performance | • Hardware development specifications<br>• Software development specifications<br>• Computer storage analysis<br>• System timing analysis | | • Reliability/maintainability analysis<br>• Facility requirements report | | • Maintenance engineering analysis | |

TABLE 17. LEVEL IV DATA FOR RFP AND CONTRACT AWARD (concluded)

| Manufacture and Test Drawings | Design Drawings | Engineering Reports | System Engineering | Human Factors | Integrated Logistics Support | System Safety | Maintainability | Photography Motion Pictures |
|---|---|---|---|---|---|---|---|---|
| • Test procedural specifications | • Timing diagrams | • System evaluation report<br>• System test report<br>• Design report | • Design verification test<br>• Math model descriptions<br>• Data base development models<br>• Design data source reports<br>• Design data<br>• Design reports (documentation of key design assumptions) | • Human factor test reports<br>• Display studies<br>• Configuration studies<br>• Personnel reports | • Support equipment analysis<br>• Repair level study | | • Sensor/display pictures | |

TABLE 18. ADDITIONAL LEVEL I DATA FOR SPECIFICATIONS

| Manufacture and Test Drawings | Design Drawings | Engineering Reports | System Engineering | Human Factors | Integrated Logistics Support | System Safety | Maintainability | Photography Motion Pictures |
|---|---|---|---|---|---|---|---|---|
| • Arrangement drawings | | | • Interface control document<br>• Mission analysis | • Task analysis studies<br>• Performance aids | • Personnel and skill requirements<br>• Critical task study | • Interlock study | | |

were not considered in the specification should be included in the RFP and contract award data packages.

Each of the tables lists nine major categories of data:

1. Manufacture and Test Drawings
2. Design Drawings
3. Engineering Reports
4. Systems Engineering
5. Human Factors
6. Integrated Logistics Support
7. System Safety
8. Maintainability
9. Photography and Motion Pictures

Specific types of data are listed as subcategories of the nine major categories.

If a piece of equipment was determined in Step 4 to be Level I (II, III, IV), then the specific data requirements are defined as those listed in the Level I (II, III, IV) table (Tables 14, 15, 16, 17 respectively).

Notice that the data requirements are cumulative; that is, those for Level II include those for Level I, those for Level III include those for Levels I and II, and those for Level IV include those for Levels I, II, and III.

By repeating this procedure for each piece of equipment, the data requirements for a training device may be determined based on the characteristics of the pieces of equipment to be represented in the device.

STEP 6. DETERMINE SPECIFIC DATA DOCUMENT REQUIREMENTS

As a result of Step 5, you now know what subcategories of information you need for each piece of equipment to be represented in the training device. Step 6 indicates how you should use this information to determine which specific data documents you should request for each piece of equipment. The procedures of Step 6 are as follows:

1. Begin by obtaining the most recent updates of (a) the Master Engineering Documents List and (b) the Data Accession List/Internal Data.

2. Select one piece of equipment at a time, from Table 12, to analyze for specific data document requirements. The process is to be repeated separately for each piece of equipment listed in Table 12.

3. Referring to the subcategories of information required for a specified piece of equipment (from Step 6), examine the Master Engineering Documents List and Data Accession List/Internal Data for listings of data documents which are subsumed under the subcategories. You are interested only in those subcategories of information which pertain to specified

equipment. Your review of the data document listing should proceed in a systematic fashion (i.e., look for data documents related to one subcategory at a time).

4. As you review the Master Engineering Documents List and the Data Accession List/Internal Data, record all appropriate data document numbers and titles in the right-hand column of Table 19 (Data Document Requirements List) next to the name of the corresponding piece of equipment.

5. Repeat this process for each piece of equipment listed in Table 19.

6. When Step 6 is completed, Table 19 will contain a list of all equipment to be represented in the device and a complete list of all data document numbers and titles to be requested for each piece of equipment.

STEP 7. REQUEST SPECIFIC DATA DOCUMENTS

A letter from the office of the PM to the Weapon System Contractor should be used to request data documents. Enclose a copy of Table 19, Data Document Requirements List, with the letter of request.

TABLE 19. DATA DOCUMENT REQUIREMENTS LIST

| Equipment | Data Document No. and Title |
|---|---|
| | |
| | |
| | |
| | |

After the data limiti ng process has been completed and the data requested and received, the PM and his staff may identify subsequent data needs. By reviewing the Data Accession List/Internal Data and the Master Engineering Documents List, the PM can request and receive the additional required data.

## LIST OF ACRONYMS

| | |
|---|---|
| ASARC | Army Systems Acquisition Review Council |
| ATE | Automated test equipment |
| CDRL | Contract data requirements list |
| CFP | Concept formulation package |
| COEA | Cost and operational effectiveness analysis |
| DARCOM | Development and Readiness Command |
| CDP | Decision coordinating paper |
| DCSOPS | Deputy Chief of Staff for Operations and Plans |
| DID | Data item description |
| DSARC | Defense System Acquisition Review Council |
| DT | Developmental test |
| DT (I, II, III) | Development Test (I, II, III) |
| FSED | Full-scale engineering development |
| ILS | Integrated logistics support |
| IOC | Initial operational capability |
| ITDT | Integrated technical documentation and training |
| LCC | Life cycle costs |
| LCSMM | Life cycle system management model |
| LOA | Letter of agreement |
| MENS | Mission element needs statement |
| NET | New equipment training |
| ODP | Outline development plan |
| OT | Operational test |
| OT (I, II, III) | Operational Test (I, II, III) |
| PM | Project manager |
| RAM | Reliability, availability, maintainability |
| RFP | Request for proposal |
| ROC | Required operational capability |
| SSG | Special study group |
| STF | Special task force |
| TDR | Training device requirement |
| TOA | Trade-off analysis |
| TRADOC | U.S. Army Training and Doctrine Command |
| TSM | TRADOC system manager |