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USMC

TRAINING & EDUCATION

INFORMATION MANAGEMENT

BUSINESS PROCESS IMPROVEMENT PROJECT

UNITED STATES MARINE CORPS
COMBAT DEVELOPMENT COMMAND

TRAINING & EDUCATION DIVISION

16 May 1994

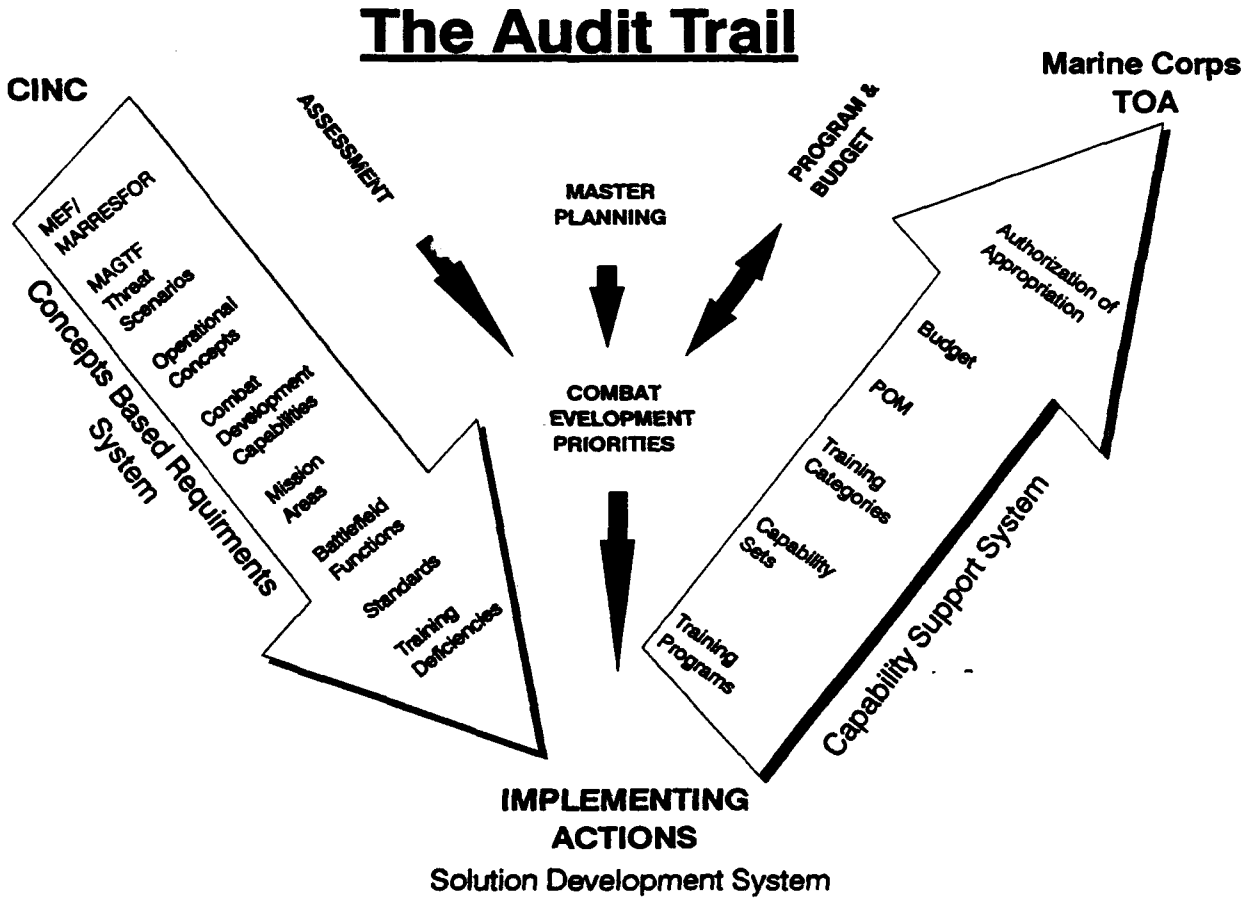
MCTRSS OVERVIEW FUNCTIONAL DESCRIPTION

PREFACE

MARINE CORPS TRAINING READINESS SUPPORT SYSTEM

The Marine Corps Training Readiness Support System (MCTRSS) is an integral part of the Combat Development Process. It will standardize training readiness assessment and link training resource allocation to warfighting requirements and training readiness. MCTRSS will allow users (HQMC, MEFs, MARRESFOR, and MCCDC) to objectively link training and education resource requirements to Operational Concepts, Marine Corps Mid-term Combat Development Capabilities, CINC Requirements, MAGTF mission essential tasks, mission performance standards, and training and education priorities.

MCTRSS will use current information systems and reside on existing Marine Corps hardware. This automated system will provide an audit trail that tracks Operational Forces and Supporting Establishment training and education requirements through Congressional Appropriation. The audit trail and the relationship of MCTRSS to the Combat Development Process are shown below:



MCTRSS will provide:

- An objective assessment of training readiness using existing information systems;
- An assessment of the relative impact of training and education deficiencies on the capability to support MEF and CINC missions;
- A means to determine the impact of funding training and education needs on Marine Corps Mid-term Combat Development Capability;
- A tool for decisionmakers to **quickly evaluate** the impact on training readiness of omnibus cuts in the Marine Corps training and education budget and perform interactive "what if" analysis; and
- Enhanced integration and standardization in reporting, collecting and utilizing training assessment data.

One of the most challenging aspects of assessment is to make the product acceptable to the users. If the Marine Corps spends millions of dollars on new programs, it is reasonable for budget and program analysts to challenge an assessment chronology that does not document increasing confidence in our ability to achieve capability objectives. In a changing environment the Marine Corps must be able to record the assessment even as the assessment process is changing. Essentially, MCTRSS provides an assessment and resource allocation tool that is:

- Sufficiently *dynamic* to meet the challenges of new missions, capability objectives, requirements, threats, and technology;
- Able to **present the rationale for past decisions in a concise, understandable manner.**

An improved Marine Corps training readiness assessment and resource allocation process will provide a solid training assessment continuum from FMF and Supporting Establishment T&E requirements submission to Congressional Appropriation.

MCTRSS Project Team

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1.1 PURPOSE OF THE OVERVIEW FUNCTIONAL DESCRIPTION

This Overview Functional Description for the Marine Corps Training Readiness Support System is written to provide an outline of:

- A preliminary description of systems requirements to be satisfied which will serve as a basis for mutual understanding between the user and the developer;
- Information on performance requirements, preliminary design considerations, and user impacts including man-year estimates of general developmental costs;
- A preliminary basis for development of system tests.

1.2 PROJECT REFERENCES

1.2.1 REFERENCES SUMMARY

The key documents applicable to the history and development of the project are the U.S. Marine Corps Combat Development Process (CDP) Version 1.1 Draft Model of March 10, 1994 and the USMC Training and Education Business Process Improvement Project Training Readiness Needs Analysis Report dated January 7, 1994. The CDP Draft Model provides a conceptual overview of the Marine Corps Combat Development Process. The Needs Analysis report analyzed current USMC training and education functions; determined potential business process improvement initiatives that will improve training readiness reporting; and developed a feasible business process alternative for providing the most efficient and effective training and education assessment and resource allocation structure.

The Mission Need Statement for Marine Corps Training Readiness Assessment Improvement Initiative documents the need for the business process improvement and represents Life Cycle Management for Automated Information System Milestone 0 approval for the project.

Since MCTRSS is an adaptation of Joint Decision Support System (JDSS) methodology which provides analytical support to the command, control, communications and computer (C4) planners of the Joint Staff and CINCs of Unified and Specified commands, the Joint Decision Support System User Manual is also an

important reference. The JDSS helps assess the relative impact of C4 deficiencies on the capability to support CINC missions and rank orders system solutions that will resolve deficiencies.

DoD, USMC and other Services directives, regulations and studies pertaining to training and education, automated information system life cycle management and Corporate Information Management Functional Process Improvement are applicable.

1.2.2 DOCUMENTS

The United States Marine Corps Combat Development Process, V. 1.1, Draft Model, March 10, 1994

All Marine Corps Orders in the 1553 series

MCO P1200.1	MOS Manual
MCO 1200.13	Marine Corps Front-End Analysis Program
MCO 1500.53	Marine Corps Air-Ground Task Force (MAGTF) Staff Training Program (MSTP)
MCO 1510.34	Individual Training Standard System
MCO 1550.3	Marine Corps Institute
MCO P3000.11	Marine Corps Automated Readiness Evaluation System, Logistics
MCO 3000.13	SORTS SOP
MCO P3121	Marine Corps Planning and Programming Manual
MCO 3500.13	Marine Corp Control System Training and Qualification
MCO 3500.14	Aviation Training and Readiness Manual, Volume One, Administration
MCO 3501.1	Marine Corps Combat Readiness and Evaluation System
MCO P3900.15	Marine Corps Combat Development Process
MCO 3902.1	The Marine Corps Mission Area Analysis Guide
MCO P4105.3	Integrated Logistics Support Manual
MCO P4790.1	Maintenance Training Management and Evaluation Program
MCO 5000.17	Marine Corps Lessons Learned System
MC0 5231.1	Live Cycle Management for Automated Information Systems (LCM-AIS)
MCO 5040.6	Inspections
MCO P5290.1	TAVSC
MCO 5320.15	Marine Corps System of OCCFLD Sponsors and MOS Specialists
MCO 5600.20	Marine Corps Warfighting Publications System
FMFM-1	Warfighting
FMFM-01	Unit Training Management Guide
FMFM-01A	How to Conduct Training

FMFM-1-2	Role of the USMC in National Defense
FMFRP 2-12	Marine Corps Air-Ground Task Force A Global Capability
OH-2	Marine Corps Air-Ground Task Force
DoD-STD-7935A	DoD Automated Information System (AIS), 31 October 1988
DoD 7920.2-M	AIS Life-Cycle Management Manual, March 1990
DoDD 8000.1	Defense Information Management (IM) Program, 27 October 1992.
DoDI 8020.1	Functional Process Improvement (Draft), 29 December 1992.
DoD 8020.1-M	Interim Management Guidance on Functional Process Improvement, 5 August 1992
DoD 8020.1-M C1	Interim Management Guidance on Functional Process Improvement, Change 1, 15 January, 1993
DoD CIM	Corporate Information Management, Functional Economic Analysis Guidebook, Version 1.0, 15 January 1993.
DOD-STD-7935A	DOD Automated Information Systems (AIS) Document Standards, 31 October 1988
FIPS PUB 184	Integration Definition for Information Modeling (IDEF1X) 21 December 1993

Training and Education Division, MCCDC, Training Readiness Needs Analysis Report, January 7, 1994

Training and Education Division, MCCDC, Mission Need Statement for Marine Corps Training Readiness Assessment Improvement Initiative

Joint Staff/J6E, Joint Decision Support System User Manual (Version 3.0), January, 1993

USMC Concepts and Issues, 1993

Blueprint of the Battlefield, TRADOC Pamphlet 11-9, Final Draft

Blueprint of the Battlefield Computerized Analysis Tool (BOBCAT) Users Manual

MCAIMS Users Guide, Version 3.1.0, February 1, 1993

U. S. Systems Approach to Training (SAT) Guide, October 19, 1993

DoD Manpower Training Report, FY94

MCSAM Users Guide

CNA CIM145/June 1991, USMC Training: An Overview

CNA CRM91-89/September 1991, Marine Corps Training Concepts, Issues and Analyses

CJCS MOP11, 24 December 1992, Status of Resources and Training System (SORTS)

NAVMC 2779, Unit Training Management Guide, 21 August 1984

U. S. Marine Corps Programming Handbook, POM 1994-1999

Supporting Establishment Master Plan (SEMP), CMC 5000, LPM 10 October 1993

Marine Corps Master Plan (MCMP) 1994-2004, JULY 1993

Landing Force Training Command, Atlantic, Course Catalog, 13 November 1993

The Joint Staff Officers Guide, 1991

An Analysis of Marine Corps Training, The Naval War College Center for Advanced Research, June 1978

MCCDC Commanders' Program 1993, Volumes I-III

Marine Corps Training and Education Conference, 5-8 April 1993, Conference Handbook

1.3 PROJECT SPONSOR, USER AND OPERATING CENTERS

The project sponsor is the Director of Training and Education Division, MCCDC. The users will include Training and Education Division, Integration Division, and Marine Corps University at MCCDC; ACMC, M&RA, PP&O and IGMC at Headquarters Marine Corps; COMMARFORLANT; COMMARFORPAC; MARRESFOR; CG IMEF; CG IIMEF; and CG IIIMEF. Operating centers will be located at HQMC, MCCDC, Camp Pendleton, Camp Lejune, Camp Courtney, Camp Smith, and MARRESFOR New Orleans.

1.4 TERMS AND ABBREVIATIONS

Definitions and Acronyms are presented in Appendix A.

SECTION 2
SYSTEM SUMMARY

2.1 BACKGROUND

As stated in the U.S. Marine Corps Combat Development Process, Version 1.1, Draft Model dated March 10, 1994.

"The Marine Corps Combat Development Process (CDP) is a process which formulates battlefield requirements and produces combat-ready Marine Air-Ground Task Forces (MAGTFs) based upon fundamental concepts supported by interdependent systems for development of doctrine, training and education, organization, equipment, and facilities and support."

"The USMC is committed to improved integration of the Marine Corps Combat Development Process. The CDP encompasses all activities needed to produce combat-ready Marine Air-Ground Task Forces (MAGTF's)--from development of operational concepts to fielding and sustainment of resources. The CDP extends across virtually all organizations of the Marine Corps and other Service functions participating in the development of MAGTF's. The CDP also influences and is influenced by other Service combat development processes to ensure interoperability in the Joint arena."

The combat development process is composed of three functional, interdependent systems: Concept Based Requirement System (CBRS), Solution Development System (SDS) and the Capability Support System (CSS) as described in Figure 2-1.

COMBAT DEVELOPMENT PROCESS	
• CMC PLANNING GUIDANCE • DEVELOP THE CONCEPT • ESTABLISH/ASSESS CAPABILITIES • DETERMINE THE REQUIREMENT	CONCEPT BASED REQUIREMENTS SYSTEM (CBRS)
• MEET THE REQUIREMENT • Doctrine • Equipment • Training & Education • Organization • Facilities/Support	SOLUTION DEVELOPMENT SYSTEM (SDS)
• SUPPORT THE CAPABILITY • Update • Review • Maintain	CAPABILITY SUPPORT SYSTEM

Figure 2-1: THE COMBAT DEVELOPMENT PROCESS

The Marine Corps Training Readiness Support System Project (MCTRSS) was initiated by the Training and Education Division of the Marine Corps Combat Development Command (MCCDC) in an effort to better define and measure training readiness. MCTRSS is an integral part of the Combat Development Process. The MCTRSS audit trail and how it relates to the Combat Development Process is shown in Figure 2-2.

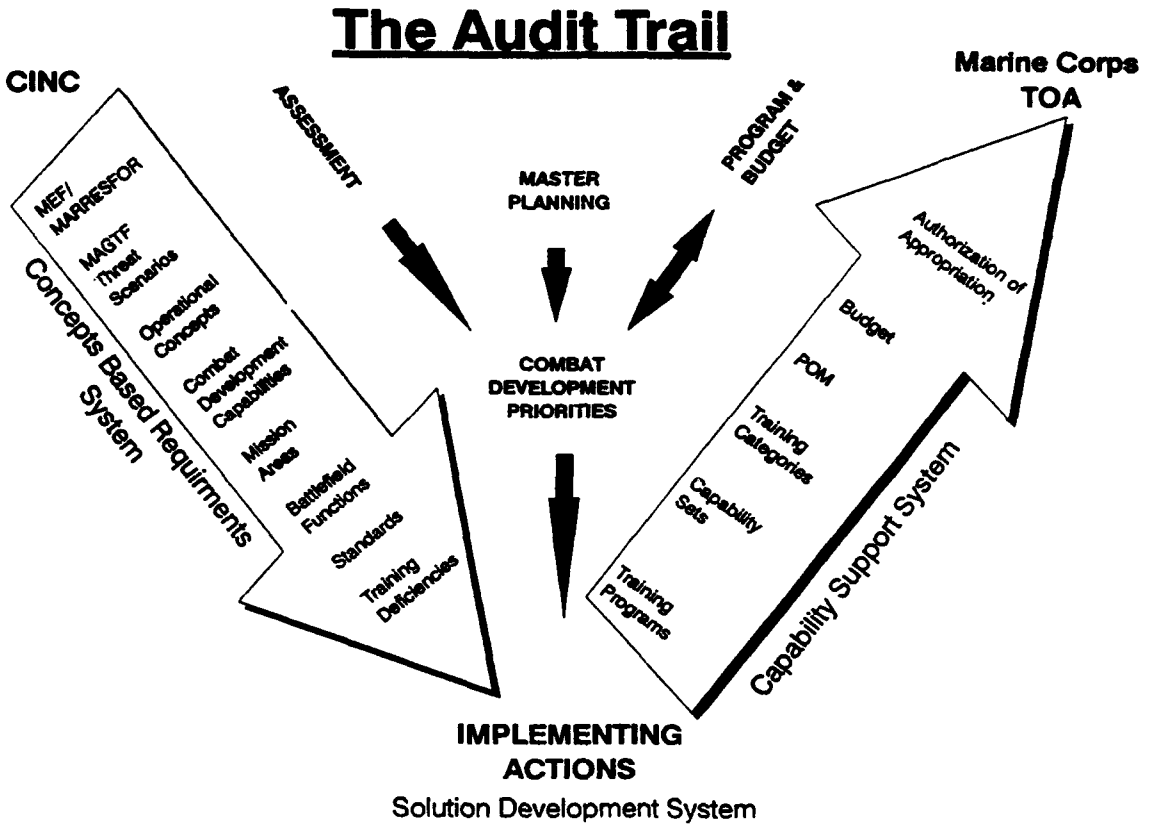


Figure 2-2: MCTRSS AND THE CDP

Because of concerns that the current and projected reductions in forces and funding may adversely affect force readiness, the Joint Staff, Congressional Budget Office, GAO and others are investigating ways to better define and measure readiness. The Joint Chiefs identified readiness as one of the four pillars of military capability and training as one of the categories in which readiness could be monitored.

The Director, Training and Education Division, MCCDC has determined that the allocation of training resources needs to be directly related to mission accomplishment and training readiness. In order to optimize available training resources and minimize the impact of the declining DoD budget on training readiness, it was decided to:

- Consolidate common functions to the maximum extent to achieve economies of scale;
- Maximize the utilization of existing assets through effective command and control;
- Capitalize on existing and emerging technology; and,
- Achieve the highest degree of readiness at least cost by reducing overhead expenses.

The Marine Corps Training Readiness improvement initiative, which defines and standardizes training readiness reporting, allocates training and education resources according to "value added" to warfighting capability objectives, and eliminates redundant automated information systems, accomplishes all four objectives. It also embodies a primary objective of Marine Corps training and education to maximize the transfer of learning and level of readiness through standardization of performance objectives.

The following capabilities are being developed concurrently:

- The Combat Development Process (CDP) Corporate Information Management Functional Process Improvement initiated by CG MCCDC to clarify the USMC Combat Development Process and provide framework for CDP management, education and improvement. MCTRSS will mirror the CDP and be an integral part of the process as it pertains to training and education;

- The USMC Information Technology Standards-Based Architecture project sponsored by C4I2 to foster information systems interoperability. MCTRSS will support the Standards-Based Architecture by more clearly defining training and education logical operations, information and application architectures;

- CNA Ground Training Readiness Study initiated to develop a means to measure training readiness of Marine battalions to better determine resources spent and readiness achieved. The results of the study will be evaluated for inclusion in the Assessment module of MCTRSS; and,

- Training and Education Division, MCCDC Training and Education Assessment study to established a data management system to correlate the Training and Education Divisions' efforts that support the Marine Corps Master Plan and the Supporting Establishment Master Plan. The results of the study will be evaluated for inclusion in both the Assessment and Resource Allocation Modules of MCCRES.

2.1.1 MCTRSS POTENTIAL USES

- Measuring the training readiness of MEFs or the Marine Corps by taking the output of selected sources of readiness data and linking the evaluation of unit performance to MCCRES Mission Performance Standards and/or T&E Programs.

- Showing how current training and education programs support Operational Concepts, Combat Development Capabilities, MAGTF Mission Areas, Battlefield Functions, and the expected effect on each of the sum total of all programming and budget actions taken during the previous POM cycle;

- Quantifying the effect of funding a T&E program according to an established assessment framework and priorities;

- Providing a quick method to evaluate the impact on training readiness of omnibus changes in the T&E budget;

- Providing a method to level resources across appropriation accounts, training categories, and training programs in accordance with CMC, MCCDC AND T&E priorities;

- Assessing the effect of adding resources to or deleting resources from specific T&E programs.

2.1.2 CURRENT ENVIRONMENT

The overall responsibility for training is vested in the Commandant. CG MCCDC/CG MARSCHOOL is the functional sponsor for training and education in the Marine Corps. He exercises operational control, technical direction and coordination of all Marine Corps formal schools and training centers. The Director Training and Education Division, MCCDC is delegated the authority to develop and implement policy, plans, and programs for training and educating all Regular and Reserve Marine Corps personnel and units. His mission is to provide superior military training and education through the aggressive and well-reasoned acquisition and application of resources for the MAGTF to win in combat.

COMMARFORLANT/PAC and COMMARRESFOR are responsible for planning, conducting and evaluating individual and collective training within their units. Installation commanders are responsible for the coordination of support activities and development of plans that facilitate tenant units' training. Major Subordinate Commanders provide trained Marines and Marine units to MEUs, MEBs, and MEFs. Battalion,

Squadron and separate company commanders are the principle training managers. Company-level commanders implement the training.

The purpose of training is to be able to defeat the enemy on the battlefield. Training in the future will be hampered by two trends, the reduction in the overall defense budget and the loss or encroachment of training areas, both at home and overseas. To counter these trends, imaginative and more cost effective training methods and devices, especially simulators and instrumented ranges, will be required.

The purpose of education is to strengthen the operational proficiency and enhance leadership development in our Marines. The educational focus is to promote creative thinking through Professional Military Education.

The Marine Corps retains its razor sharp, highly mobile, force-in-readiness character by continually evolving and adapting. Therefore, the Marine Corps is constantly reevaluating its capabilities, looking at more effective ways to prepare and train its personnel, and developing enhanced uses for it equipment. This innovative mindset ensures the Corps is always relevant and able to respond when the Nation's interests are challenged. The Corps efforts must be focused on ensuring the ability to deploy expeditionary forces and to execute Operational Maneuver from the Sea.

2.1.2.1 Information Resources Management Environment

The MCCDC Integrated Data Automation System (MIDAS) provides for integrating data and voice connectivity locally and worldwide via an enterprise base area network, as well as contracted services with the MCCDPA for network management. MCCDC uses a combination of mainframe computer resources, minicomputer-based information systems, LAN server-based systems, and microcomputers to support training and education mission, administrative, budgeting, financial accounting, supply, general correspondence, and instructional development and documentation requirements. Primary functions provided by staff support personnel include: the creation and manipulation of text, data and graphics; storage and retrieval of data; distribution of information; maintenance of calendars and tickler fires; scheduling of meetings events and resources; and the compilation of reports.

The Training and Education Division coordinates development of information systems to support training and education program requirements world-wide. The Division sponsors the Training Resource Requirements Management System (TRRMS), the Marine Corps Combat Readiness Evaluation System (MCCRES), the Marine Corps Automated Information Management System (MCAIMS), the Comprehensive Occupational Data Analysis Program (CODAP), the Automated Training Standards Development and Maintenance System

(ATSDMS), the Range Facility Management Support System (RFMSS), the Aviation Training and Readiness Information Management System (ATRIMS) and the Miles Automated Tracking System (MATS). The Training and Education Division also develops POM submissions for training and education delivery systems, automated information systems and data systems targeted for formal school and/or internal Division use.

Training which requires the use of mainframe computer assets is supported by the mainframe computers and commercial software of the MCCDPA. Computer-based training packages used by MCCDC have traditionally been purchased with MCCDPA or Training and Education Division funds.

Over 40 information systems that impact training readiness, some automated, were identified during a recent training readiness needs analysis. Details regarding the information systems are contained in the Training and Education Division Training Readiness Needs Analysis Report.

2.1.2.2 Unit Training Management Environment

A mission focus obliges commanders at all levels to use training management to plan, resource, conduct, and evaluate training requirements based on the real world probabilities of how and where units will enter combat. Figure 2-3 depicts the relationship of training to combat requirements.

A units highest priority is normally given to execution of operational plans and contingency missions contained in force campaign plans. Therefore, training management plans must be based on such priorities in order to provide the desired warfighting capabilities at the desired time for effective execution.

The commander's analysis of unit strengths and weakness will assist in the coordination with higher headquarters to determine priorities, to prepare a Mission Essential Task List (METL), and finally to implement and evaluate the training.

Operational headquarters above the battalion/squadron level use training management to provide guidance on, and evaluation of, the conduct of training. This is accomplished by issuing METL's, training strategies, goals, priorities, and other guidance to subordinate commands down to, and including, battalion and squadron level. These plans are derived from combat mission profiles which are contained in unit campaign plans.

Battalion and squadron commanders set priorities and defer/exempt training in the training plans and schedules when authorized by higher headquarters.

Company grade officers have the primary responsibility of executing the unit training plan and training the trainers. They determine what training standards and/or battle drills are best suited to correct unit deficiencies and prepare warplan missions. This results in a training schedule, supervision of individual training, and execution of collective training.

Staff noncommissioned officer and noncommissioned officer are the key trainers. They must be trained as leaders of Marines and possess the requisite skills to train others. They will primarily conduct individual training and integrate individual training requirements of Marines under their supervision into the unit training plan.

Prior to acquisition of training support resources, individual and collective training support requirements must relate directly to force campaign plans.

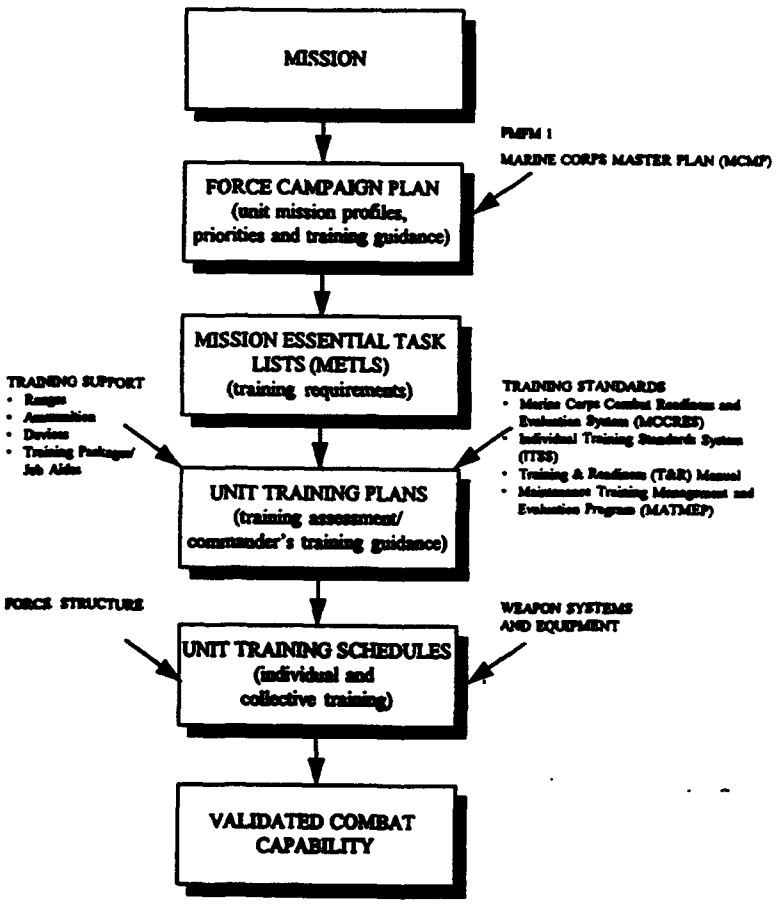


Figure 2-3: RELATIONSHIP OF TRAINING TO COMBAT REQUIREMENTS

2.1.2.3 Related Initiatives/Studies

The following related projects are ongoing:

- The GAO Audit #703021, "Army and Marine Corps Reserve Component Training."
- Congressional Budget Office Data Call of September 10, 1993, "Marine Corps Readiness Indicators."
- The Army Training Information Management Program (ATIMP) to include the Standard Army Training System (SATS) IDEF project and the Automated Systems Approach to Training (ASAT) project.
- Logistics Management Institute effort titled "Collective/Unit Training Resource Database and Analysis" sponsored by the Assistant Secretary of Defense for Personnel and Readiness. The objective of the study is to determine how to sustain unit training readiness through the development of a systematic methodology for tracking dedicated training resources through the programming, budgeting and execution process.
- Office of the Secretary of Defense for Reserve Affairs Reserve Component Institutional Training Management Initiative to develop a conceptual management plan for identifying the functional processes associated with the effective allocation, utilization and resourcing of formal school seats for individual reservists.

2.2 MCTRSS OBJECTIVES

The goal of MCTRSS is to better define and measure training readiness. The objectives of the system are to standardize training readiness assessment and link resource allocation to warfighting requirements and training readiness by:

- Standardizing training readiness assessment based on mission-oriented analysis;
- Reporting USMC training readiness as a DoD/POM supporting process;
- Allocating T&E resources according to "value added" to mission accomplishment;
- Mapping mission performance standards to combat development capability requirements and documenting deficiencies;
- Prioritizing current and new training programs in accordance with MCMP priorities; and,
- Performing cost-benefit analysis and allocating T&E resources in accordance with T&E priorities.

2.3 EXISTING METHODS AND PROCEDURES

See Appendix (B), Key Based Data Model, for the existing data relationships within the Training and Education System. See Appendix (C), Activity model for Develop/Modify/Conduct Training and Education, for inputs, controls, outputs and mechanisms impacting training and education.

2.3.1 COMBAT DEVELOPMENT PROCESS (CDP)

The Combat Development Process is evolving. It is a process which formulates battlefield requirements and produces combat ready MAGTF's based on fundamental concepts supported by interdependent systems for development of doctrine, training/education, organization, equipment and facilities/support. The process is employed by the Marine Corps to identify, obtain and support necessary combat capabilities. Moving from the abstract to the concrete, the CDP transforms ideas into programs. Combat development integrates planning, programming, budgeting, execution, and life cycle management. The CDP is composed of three functional, interdependent systems. The Concept Based Requirements System (CBRS) begins with the development of operational, functional and tactical concepts and leads to the identification of required combat capabilities. The Solution Development System (SDS) assesses and meets the requirements. The Capability Support System (CSS) reviews, maintains, and updates the capability throughout its life cycle.

2.3.1.1 Concept Based Requirements System

The CBRS translates ideas into stated requirements. It begins with the development of a concept. Concepts define how the Marine Corps operates now or how it will operate in the future. Guidance for concept development is derived from various documents including Defense Planning Guidance, National Military Strategy Document, Department of the Navy Consolidated Planning and Programming Guidance, and Commandant's Planning Guidance. Concepts are broad in scope and pertain to operational warfighting, the major functional areas and Supporting Establishment warfighting support.

Operational concepts describe the way in which the USMC conducts operations. They are broad statements of an idea in sufficient detail to provide the basis for determining new or revised doctrine, organization, training and education, equipment, or facilities and support. The three current major operational concepts are "Operational Maneuver from the Sea", "Sustained Operations Ashore" and "Other Expeditionary Operations."

Functional concepts describe the way in which the elements of the MAGTF (command, air combat, ground combat, combat service support) perform in support of each major operational concept.

Supporting Establishment concepts describe the way in which the Supporting Establishment supports the total force. These concepts are described in the SEMP as the "Commandant's intent" and are stated as follows:

- Focus planning and programming for and by the Supporting Establishment on operational imperatives--support of Marine Corps operating forces and preparation of Supporting Establishment personnel for contingency operational missions;

- Initiate a process to evaluate, prioritize, and fund Supporting Establishment "requirements" based primarily on cost vs. benefit to the operating forces; and,

- Encourage the application of Total Quality Leadership (TQL) throughout the Supporting Establishment.

Special concepts are all other concepts (including operational and functional subconcepts) needed to carry out the mission of the Marine Corps.

Concepts are developed in response to changes in the global threat, the National Military Strategy, and higher level guidance. The concepts are then broken down into specific capabilities which, in turn are further divided into detailed requirements. Potential solutions to capability shortfalls are examined. Recently, the National Security Strategy has shifted from a focus on a global threat to a focus on regional challenges and opportunities. The principal elements of this strategy are strategic deterrence/defense, forward presence, crisis response and reconstitution. The Navy and Marine Corps team are full participants in this strategy and have defined a new direction for the Naval Services in the Navy and Marine Corps White Paper "...From The Sea." Naval expeditionary forces, capable of joint operations, operating forward, from the sea, in the littoral areas of the world is the vision and becomes the essence for future planning. The Naval Services mission emphasis is no longer sea control but rather power projection ashore. In order for the Marine Corps to remain prepared, capable, and ready to execute the full range of assigned missions and tasks, its focus remains that of providing full support to the Fleet Marine Forces with quality, highly trained personnel, modern and well maintained equipment, and adequate supply and sustainment.

2.3.1.1.1 Capabilities

Capabilities are abilities to achieve objectives, actions or tasks that result from analyzing a concept. The Marine Corps' number one priority is strengthening its naval expeditionary capabilities to promote or defend

the national interests. Near to mid-term capability development is based on goals and capability objectives that are prioritized in the Marine Corps Master Plan and the Supporting Establishment Master Plan. This prioritized list of capability objectives is used as a basis for the prioritizing planning, programming, and budgeting of actions that must be taken to correct deficiencies and shortcomings. The PPBS is the means through which goals and objectives are translated into initiatives and merged into a comprehensive program for resource allocation and attainment. It identifies needs and prioritized them into a consolidated order-of-buy list used to develop the Program Objectives Memorandum (POM). The biennial POM process merges validated existing capabilities with new initiatives and matches resources to meet projected needs.

In addition to the near to mid-term capabilities and goals listed in the MCMP and SEMP, other, more general, capabilities are contained in various documents. These capabilities fall into three categories: operational capabilities, functional capabilities and special capabilities.

2.3.1.1.1.1 Marine Corps Master Plan Mid-Term Capabilities

The first ten of forty mid-term capabilities listed in the Marine Corps Master Plan 1994-2004 are listed below in priority order:

- Capability to conduct operational maneuver from the sea on short notice via air or surface means against distant inland targets;
- Capability to maintain, plan for and rapidly execute deployment of contingency forces sourced from any or all MEFs using various deployment options in support of joint operations;
- Capability to provide task organized special operations capable (SOC) forces from within the MEF;
- Capability to conduct MPF operations;
- Capability to plan, and conduct security assistance mobile training teams (MTTs), humanitarian assistance, peacekeeping, civil affair and counterdrug operations in support of national strategy;
- Capability to collect all-source intelligence and multi-disciplined counterintelligence threat information through organic MAGTF collection assets and produce and disseminate the intelligence product to widely dispersed subordinate elements;
- Capability to identify, designate, and engage targets;
- Capability to transmit, receive, process and manage essential logistics information;
- Capability to receive, process, and disseminate tailored, current, all-source intelligence, counterintelligence, and information from national, theater and other service sources; and,
- Capability to exploit appropriate DOD, national, civil, commercial and international space-based combat support capabilities in MAGTF operations and tactics.

2.3.1.1.1.2 Operational Capabilities

Operational capabilities are abilities to achieve the National Security Strategy responsibilities of the Marine Corps. The Marine Corps' has added four key operational capabilities that are needed to carry out the operational concepts identified in the White Paper "...From The Sea". The new capabilities are:

- Command, Control and Surveillance;
- Battlespace Dominance;
- Power Projection; and,
- Force Sustainment.

These new capabilities are in addition to the four traditional operational capabilities listed below:

- Forward Deployment;
- Crisis Response;
- Strategic Deterrence; and,
- Sealift.

2.3.1.1.1.3 Functional Capabilities

Functional capabilities are the abilities to achieve the Marine Corps Strategy set forth in the operational capabilities. MAGTF functional capabilities listed in FMFRP 2-12 are:

- Move forces into crisis areas without revelation of their exact destination or intentions;
- Provide continuous presence in international waters;
- Place America's "sword in the sheathe" over the horizon of a potential adversary ready to be drawn if necessary;
- Allow the opportunity for diplomacy to reach a peaceful resolution of a crisis before drawing the sword;
- Project measured levels of combat power ashore, if necessary;
- Introduce additional forces sequentially into theater;
- Operate independently of established airfields, basing agreements, and overflight rights;
- Conduct combat operations ashore using organic combat service support;
- Secure staging areas for introduction of follow-on Army and Air Force units;
- Withdraw rapidly at the conclusion of operations or remain to help restore stability in the region;

- Enter and exit a battle area at night;
- Operate under adverse weather conditions;
- Operate from over the horizon, without electronic emissions, by surface or air;
- Locate, land and fix the enemy;
- Engage, kill, or capture the enemy in a rural or urban setting;
- Operate in hostile nuclear, biological, and chemical environments;
- Plan and commence execution within six hours of receipt of the warning order; and
- Provide seabased sustainment.

2.3.1.1.1.4 Supporting Establishment Capabilities

Supporting Establishment capabilities are addressed in the context of peacetime activities, low or mid-intensity conflicts (involving active forces with limited augmentation or reinforcement with reserve forces) and high intensity conflicts (involving Full or Total Mobilization with subsequent deployment and/or land campaigns of all operating forces.) Supporting Establishment capabilities are listed in the SEMP under two categories:

- Capability to Support Expeditionary Forces (Figure 2-4); and,

SUPPORTING ESTABLISHMENT CAPABILITY TO SUPPORT EXPEDITIONARY FORCES MATRIX

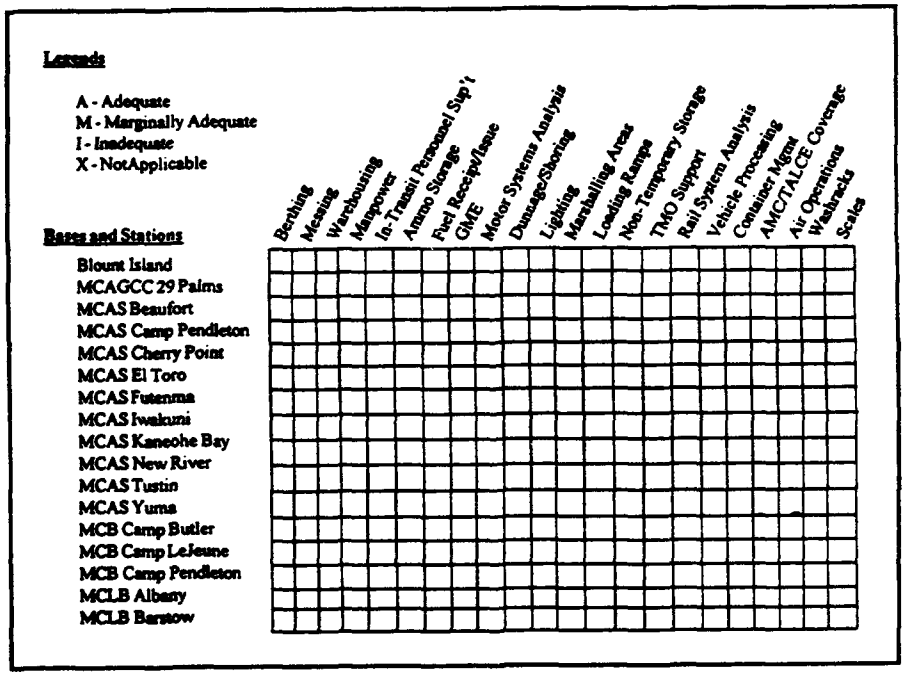


Figure 2-4: SUPPORTING ESTABLISHMENT CAPABILITY TO SUPPORT EXPEDITIONARY FORCES

- **Operational Functions/Mandated Actions/Quality of Life Initiatives (Figure 2-5).**

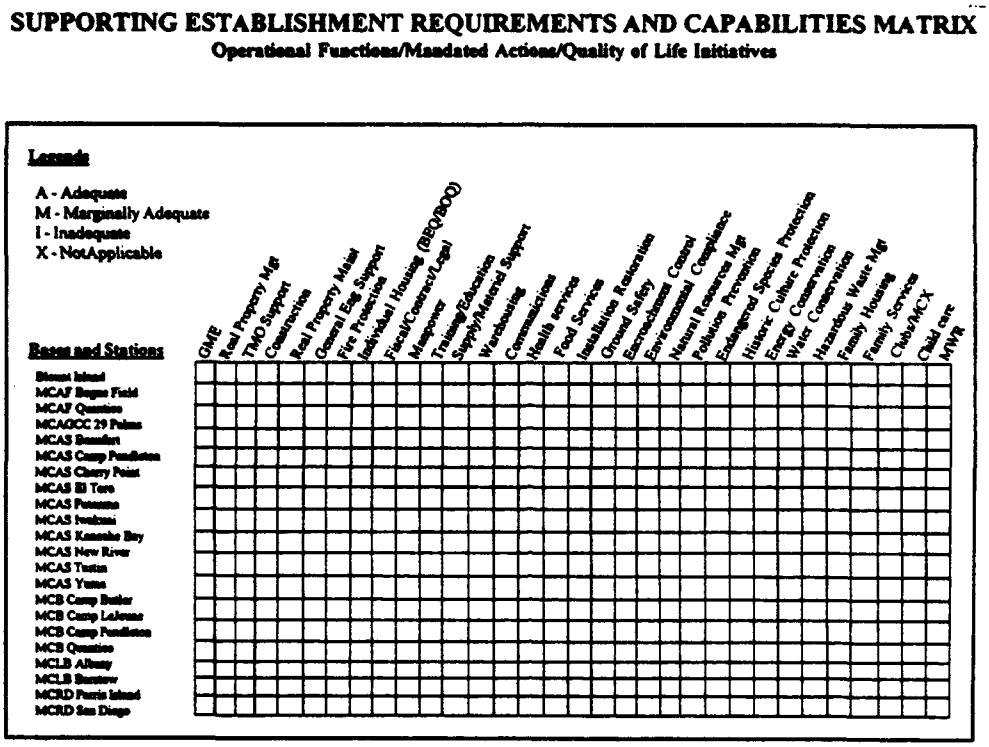


Figure 2-5: *OPERATIONAL FUNCTIONS/MANDATED ACTIONS/QUALITY OF LIFE INITIATIVES*

2.3.1.1.1.5 Special Capabilities

MAGTF (Special Operations Capable) units have the ability to achieve the following:

- Close quarter combat;
- Specialized breaching;
- Clandestine reconnaissance and surveillance;
- Tactical recovery of aircraft and personnel;
- In-extremis hostage rescue; and,
- Seizure and destruction of offshore oil production facilities.

2.3.1.1.2 Deficiencies

A deficiency is a shortcoming in some aspect of a required capability as specified in the Marine Corps Master Plan, analysis, assessment or the formal studies program.

2.3.1.1.2.1 MAGTF Mission Area Analysis

Executive Order A-109 of April 5, 1976 states that "(d)etermination of mission need should be based on analysis of an agency's mission reconciled with overall capabilities, priorities and resources." The order further states that "(a) mission need may result from a deficiency in existing agency capabilities or the decision to establish new capabilities in response to technologically feasible opportunity."

DoD Instruction 5000.2 of April 23, 1991 directs that the DoD components's requirements generation systems focus on identifying deficiencies in current capabilities and opportunities to provided new capabilities. The instruction states that deficiencies and opportunities will be described in terms of broad operational capability needs and evaluated to determine if the can be satisfied by nonmaterial solutions including changes to operational doctrine, concepts, tactics, training, and/or organization.

Marine Corps mission area analysis (MAA) is the systematic examination of the Marine Corps' capability to execute its mission. Within 12 defined Mission Areas (MA), this analysis measures present and projected capabilities, identifies operational deficiencies/opportunities, prioritizes deficiencies, and recommends/categorizes corrective action. The mission area analysis process is a key component of the Marine Corps Combat Development Process. The purpose of Marine Corps' mission area analysis is to provide a structured approach to identify deficiencies/opportunities for doctrinal development, organizational realignment, training and education improvement and advancement, equipment acquisition, and support and facilities enhancement. Collectively these "root causes" behind a deficiency or opportunity are referred to as "DOTLS". Mission area analysis is defined as:

> *The examination of one of the MAs with the fundamental purpose of examining real world operations in the light of a standard threat, existing equipment, doctrine, training, force structure, and support and facilities to determine warfighting deficiencies and opportunities that currently exist in the MA or will develop--if corrective action is not taken--during the period of interest...*

Battlefield functions provide an operational framework of the battlefield. They provide continuity and a standard reference from which collective analysis of mission areas can be conducted. The seven Battlefield functions are:

- Maneuver;
- Fires;
- Air Defense;

- Command, Control and Support;
- Intelligence;
- Mobility , Countermobility and Survivability; and,
- Combat Service Support.

A typical mission area analysis consists of the following eight tasks:

- Initial literature search/threat technology assessment;
- Literature search;
- Data-collection and questionnaire development;
- Function and task development;
- Task validation seminar;
- Capabilities Review;
- Capabilities and deficiencies assessment conference; and,
- MA documentation production.

During mission area analysis the differences between required capabilities and current/existing and future/projected capabilities are identified as deficiencies and prioritized. Opportunities, the recognition of current or conceptual capability that if expanded upon would enhance battlefield success, are also identified and prioritized.

The Concepts Based Requirements System also depends on input from units and individuals in the FMF. Regardless of the source, inputs are evaluated and, when appropriate, requirements are generated to provide solutions.

2.3.1.2 Solution Development System (SDS)/Training Development Process (TDP)

During this stage of the CDP, concepts and requirements are turned into tangible warfighting capabilities. Each deficiency noted through mission area analysis, FMF input and other means is assessed from the perspective of doctrine, organization, training and education, equipment, and support and facilities. In each case, a needs statement will be developed, a recommended solution resulting from studies or analysis will be determined and a requirements document will be devised.

Solutions to training and education deficiencies, as identified by the Training Development Process, will be documented in a statement of requirement (SOR). SOR's that impact on training programs will remain within

the Training and Education Division for further development action. Those SOR's that impact education programs will be forwarded to the President, Marine Corps University for appropriate consideration and incorporation into professional military education programs. Those SOR's that result in changes to training equipment will enter the equipment solution system.

Training and education needs are processed through the Training Development Process. Like the CDP, the Training Development Process is also evolving. Depending on the magnitude of the need, various actions are initiated. A significant need would enter the Training Development Process and the following would occur:

- Training and Education Needs Statement drafted;
- Need analyzed;
- Need validated;
- Statement of requirement prepared and forwarded as appropriate
- Need approved by higher authority;
- Need placed in the Requirements Catalog;
- Intervention alternatives considered;
- Training and education intervention recommended;
- Training and education intervention approved by higher authority; and,
- Approved intervention enters PPBS.

2.3.1.2.1 Planning, Programming and Budgeting System (PPBS)

The Marine Corps PPBS organization and procedures are designed to reduce a complex, unstructured situation into its essential elements, organizing those elements into a logical and consistent format and communicating the results effectively. This system explicitly integrates the expertise and professional judgement of the military officer and senior defense executive with a rational decision process and applicable tools and techniques. The objective is to provide a framework for better decision making in a complex resource allocation problem.

The principal participants in the PPBS system are Headquarters, U.S. Marine Corps; Marine Corps Combat Development Command, Marine Corps Systems Command (MARCORSYSCOM); and the Fleet Marine Force and Supporting Establishment commanders. Each participant in the PPBS system performs specific roles in the plan-to-budget transition. MCCDC, MARCORSYSCOM and various HQMC agencies function as appropriation, functional, and occupational field sponsors, program managers and major claimants. Planning and programming guidance to these sponsors generates POM initiatives to met the difference between needs and capabilities. These sponsors then provide representatives to the POM Working Group (PWG), a standing committee of action officers that develops the draft POM.

2.3.1.2.1.1 Planning

In the simplest terms, plans, threat assessments and capability assessment identify warfighting requirements that become programming objectives. Although the POM process begins with publication of the MCMP and the SEMP, continuous planning by FMF and Supporting Establishment commanders is at the cornerstone of the PPBS. Planning is a commander's responsibility and requires a high degree of cooperation and coordination among various communities and interests, both internal and external to the Marine Corps. The MCMP and the SEMP provide guidance and direction to FMF and Supporting Establishment commanders in defining Supporting Establishment requirements that meet CMC objectives. The responsibility for basic Supporting Establishment planning lies primarily with the FMF commander. The needs of the FMF drive the priorities of the Supporting Establishment and provide it an operational focus. The Supporting Establishment commander must be attuned to the dynamics affecting the FMF requirements. Conversely, the FMF commander must also be sensitive to outside constraints which limit the Supporting Establishment's ability to support.

2.3.1.2.1.2 Programming

Planning forces and fiscal guidance constraints are translated into achievable packages called Programs. Programming finds the best match between warfighting requirements which have become programming objectives (mission requirements) and the means (financial, human, material) to fulfil them. The program priority determination, cost effectiveness and final program development processes are explained in the following sections.

2.3.1.2.1.2.1 General Program Priority Determination

- Prioritization is key feature.
- Begins with determination of relative benefits based solely on utility. Cost not considered at this point.
- Precursor to cost-effectiveness analysis and final program development leading to "order of buy".
- Based on "wisdom of multitude of counselors" (System is based on professional judgement).

2.3.1.2.1.2.2 Prioritization Methodology

- P&R call for initiatives in POM serials.
- P&R establishes details for relative benefit determination.

- Appropriation sponsors and functional sponsors establish program evaluation groups to rank order of merit by mission area. Formal criteria are optional but certain standards have been used successfully:
  - Degree of mission contribution;
  - Warfighting effectiveness;
  - Breadth of application;
  - Clarity and maturity of requirements and operational concepts;
  - Cost not considered;
  - Well defined program;
  - Ability to execute on schedule;
  - "Not directed";
  - Degree of technical risks; and,
  - Timeliness.
- Program Evaluation Group (PEG) develops a list ordered by merit and establishes "benefit numbers".
- Sampling technique used to merge lists.
- Decision authority approves.
- Next higher PEG uses same technique and then examines list for logic and rational consistency. - MCCDC, I&L and P&R prioritize.
- Core and dissimilar components are merged into one program.

2.3.1.2.1.2.3 Cost Effectiveness Analysis and Final Program Development

- POM Working Group (PWG) considers the program bases on CMC guidance and performs a detailed analysis of the entire program versus the available resources.
- "Green dollar" and Navy POM issues are considered separately.
- "Green dollar" programs undergo cost-effectiveness analysis which forces:
  - Consideration of small programs with high payoffs;
  - Comparison of large programs with groups of small programs;
  - ID of large, important programs that have been padded;
  - ID of essential, costly components not considered;
  - Development of alternative strategies;
  - Consideration of predicted R&D costs versus expected benefit; and,
  - Assessment of balance between consumption favoring readiness and investment favoring modernization and infrastructure.
- Following cost-effectiveness analysis, following is considered:
  - CMC guidance;

- Priorities in MCMP, SEMP and other plans;
- Coordination with Navy programs;
- Joint programs directed by Defense Planning Guidance (DPG);
- Balance between consumption and investment;
- CINC Integrated Priority Lists (IPLs);
- Future resource predictions;
- Program execution; and,
- Creation of complimentary but not redundant capabilities among the MAGTF elements.

• The recommended program is then passed to the Program Review Group (PRG) who consider Navy POM issues that impact the USMC, make appropriate changes and pass the program to the CMC's Committee for approval.

Training and Education funding levels are developed in the POM under four appropriations {Military Construction (MILCON), Procurement (PMC), Operations and Maintenance (O&M), Manpower (MP)}

2.3.1.2.1.3 Budgeting

Budgeting is the actual execution of plans and programs; the application of available resources to recruit, train, retain, equip and house Marines, and maintain the Marine Corps. It is an iterative process. Each decision or action in any phase affects all other phases.

Once the Marine Corps POM has been approved by the Navy and the OSD program offices, T&E commands prepare budget submissions based on the approved program. Budget submissions are forwarded to the Department of the Navy for review. Once approved by the Secretary of Defense, the DoD Budget is forwarded to the President for signature and then to Congress for authorization and appropriation. After Congress appropriates funds, the Services issue funding apportionments to T&E commands who execute the budget. As the budget is executed, and unprogrammed, emergent requirements surface, resource issues are developed and forwarded, via the chain of command for funding relief. Resource issues that are not resolved in execution are evaluated during planning and programming for the next POM/budget cycle.

2.3.1.3 Capability Support System (CSS)/Training and Education Assessment Process

The Capability Support System provides and maintains the resources needed for FMF and Supporting Establishment operations. It includes the Life Cycle Management Process, Systems Approach to Training, and the evolving Training and Education Assessment Process. During this step in the CDP, systems are monitored

to ensure that they remain relevant and that combat capabilities remain fully integrated. At a minimum, all requirements will be assessed every 2 years through either mission area analysis or the Marine Corps Master Plan.

2.3.1.3.1 Training and Education Assessment Process

The Training and Education Assessment Process is supported by a data management system established to follow the progress of Training and Education Divisions efforts to support the Marine Corps Master Plan and the Supporting Establishment Master Plan and other training and education needs. The Process tracks training needs from their identification through solution. The Assessment Process includes Training and Education Assessment Templates and Profile and Database entries to ensure that designated action officers use a standardized process for the tracking of Training and Education items which have been deemed to be of significant interest to the Marine Corps. The Training and Education Assessment Template is a comprehensive summary tracking document that includes general overview, budget, manpower, equipment, deficiencies, resources and related paragraphs.

2.3.1.3.2 Systems Approach to Training (SAT)

The Systems Approach to Training, based on Instructional Systems Development (ISD), was established to manage the process of analyzing, designing, developing, implementing and evaluating instructional programs. SAT is the methodology used for all training and education conducted by Marine Corps operating forces, supporting establishment and training institutions. Key products of SAT are training standards. Training standards are a measure of collective or individual performance. As a minimum, both individual and collective training standards consist of a task, the condition under which the task is to be performed, and the evaluation criteria which will be used to verify that the task has been performed to a satisfactory level. Training standards are listed in The Marine Corps Combat Readiness Evaluation System (MCCRES), Individual Training Standard System (ITSS), Training and Readiness Manual (T&R Manual) and the Maintenance Training Management and Evaluation Program (MATMEP).

The Automated Training Standards Development and Maintenance System supports the development and maintenance of Individual Training Standards (ITSs), Mission Performance Standards (MPSs), the Maintenance Training Management and Evaluation Program (MATMEP), and the Military Occupational Specialties Manual (MOSMAN). The system provides for ease in editing and publishing applicable Marine Corps Orders. The associated FOCUS database provides a training analysis capability.

The entire training system and all training programs are built around standards. Training standards establish the tasks that units and individual Marines are expected to be capable of performing , define proficiency, and serve as a means of diagnosing training deficiencies. Since all training standards are derived from the specific mission requirements of the Marine Corps and developed using current doctrine, they ensure that all Marines are being trained to perform activities which are oriented towards actual combat. Figure 2-4 illustrates the hierarchical breakdown of training standards, and the relationship of mission requirements, training standards, training requirements and unit training programs.

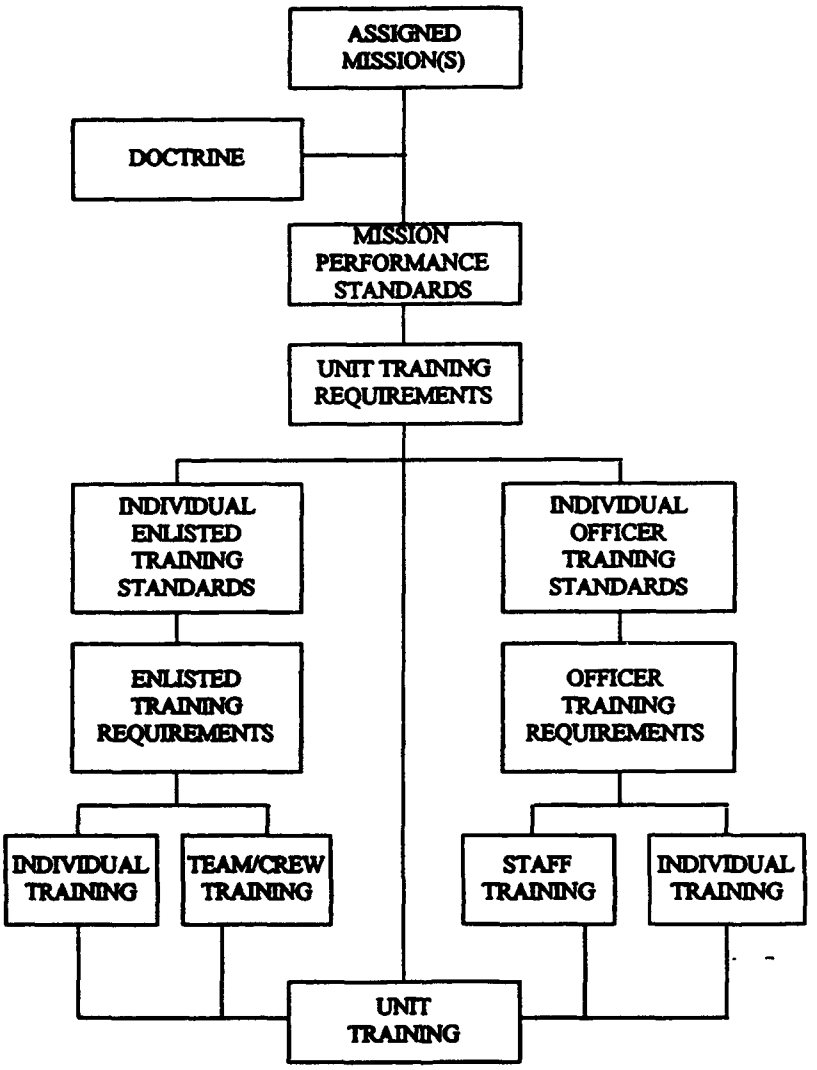


Figure 2-6: TRAINING STANDARDS SYSTEM

2.3.1.3.3 Life Cycle Management (LCM)

Life Cycle Management is the coordinated process of managing the development, acquisition, testing, fielding, utilization and support of an item from need justification throughout all phases of its useful life.

The life cycle of weapons and equipment systems begins when an acquisition program is initiated and continues until the system is retired from the inventory. Life cycle management applies to a system over its entire life, with emphasis on strengthening early decisions which shape costs and utility. Life cycle management includes the acquisition of additional systems, the acquisition of spare parts, configuration control of the fielded systems, modification of the systems, acquisition/modification of requisite training devices that support fielded systems, the collection and analysis of maintenance data, and disposal of the system once it is retired from inventory. Figure 2-7 outlines the LCM process.

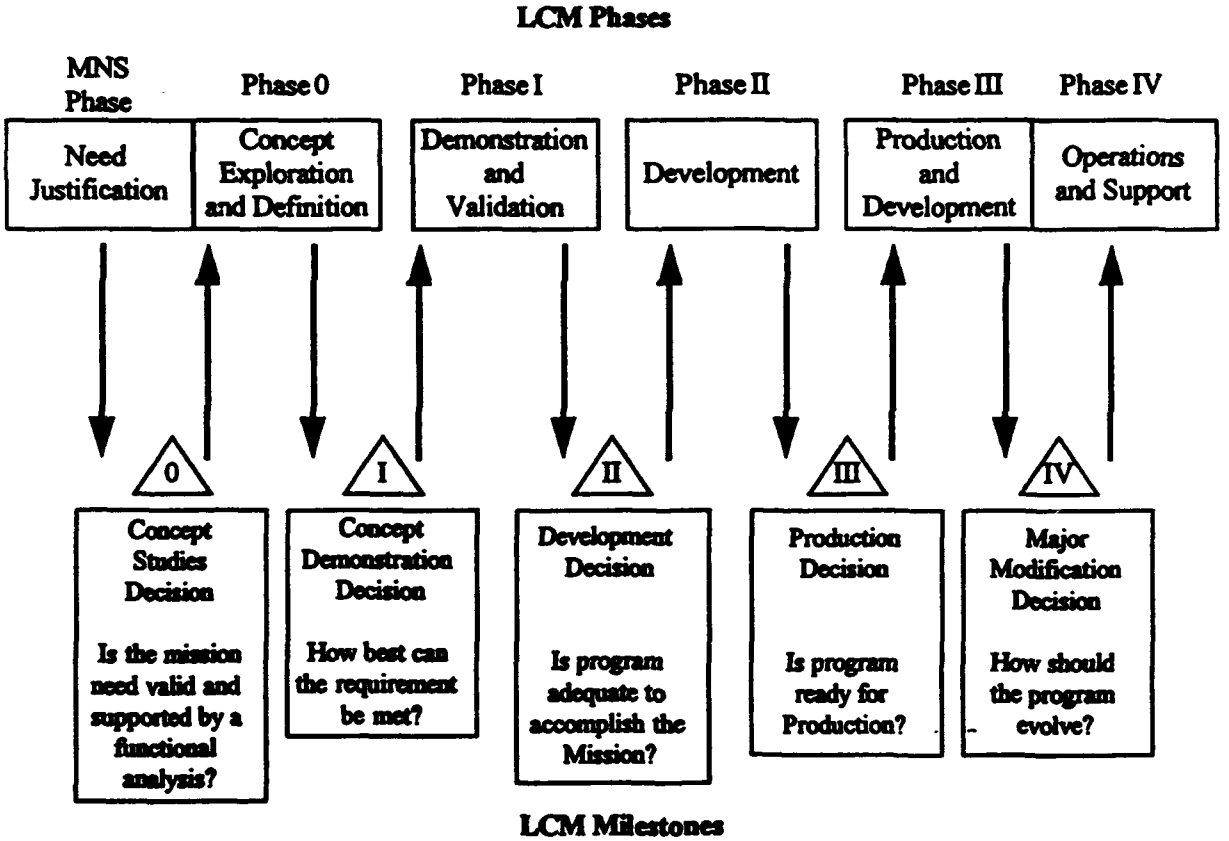


Figure 2-7: LCM PROCESS

2.3.1.4 Training Readiness Assessment Information Systems

The following, for the most part unconnected, systems are sometimes used to measure training readiness.

2.3.1.4.1 Battalion Field Training Days (BFTD)

BFTD is a day of training by ground units in furtherance of a unit's mission training program within the following guidelines:

The training is conducted in the field away from garrison or debarked from amphibious shipping. The training is between 8 and 24 hours in duration.

In cases involving more than 1 day of training, the subsequent days begin at 0600. One-half of a BFTD can be credited for 4 to 8 hours of training.

A BFTD requires the training of a majority of a unit's strength. Since many units may not normally conduct training at the battalion level, BFTDs are computed based on equivalents relative to the subordinate unit's size.

2.3.1.4.2 IGMC Inspection Results/Reports

A narrative report is submitted by major subordinate commands (MSCs) to CMC (IG) via the chain of command by October 15 annually. The report summarizes significant findings of inspections conducted by the command. Commands submit with their annual reports the results of Marine Corps Combat Readiness Evaluation System (MCCRES) evaluations conducted during the reporting period.

The IGMC conducts Readiness Assessment Team (RAT) visits. The purposes of RAT visits are to validate reported unit status, gauge preparedness to deploy/employ rapidly and to detect trends impacting readiness. Included in the functional areas assessed are training management and SORTS. Two or three units from each Marine Division per year are visited. These short, no notice visits result in written reports being provided to the division, wing and FSSG visited and issues briefed at the appropriate command levels for corrective action.

2.3.1.4.3 Maintenance Training Management and Evaluation Report (MATMEP).

A standardized, documentable, level progression, technical skills, training management and evaluation program in Occfields 59, 60, 61, 63, 64, 65 and 70. MATMEP is used in lieu of the Individual Training Standards System (ITSS) for the occupational fields identified above.

2.3.1.4.4 Marine Corps Lessons Learned System (MCLLS)

MCLLS provides the capability to collect, process, and disseminate lessons learned and related information from after action reports (AARs). AARs provide the official description of operations, exercises, and other reportable occurrences which identify significant lessons learned. AARs are required after most unit exercises, operations, significant events and special occasions. MCLLS is a responsive method for initiating action to correct deficiencies or shortfalls noted through the analysis of after action reports in the areas of doctrine, organization, training and education, and equipment.

MCLLS interfaces with other lessons learned centers including the Joint Center for Lessons Learned (JCLL) and the Center for Army Lessons Learned (CALL).

One of the elements of MCLLS is a Marine Corps-wide Remedial Action Program (RAP). RAP uses the analysis of AARs to identify deficiencies or shortcomings in current doctrine, organization, training and education, and equipment. RAP uses the MCLLS software to assist in tracking corrective actions. RAP works in a continuous cycle. This cycle identifies remedial action (RA) items through the analysis of AARs, assigns an Office of Primary Responsibility (OPR) who develops a plan to correct the deficiency, monitors the progress of the corrective action, validates the corrective action through testing, and closes the RA item once a suitable solution has been achieved.

2.3.1.4.5 Status of Resources and Training System (SORTS)

SORTS is an internal management tool for use by the Chairman of the Joint Chiefs of Staff, Services and combatant commands. It is the single, automated reporting system within the Department of Defense that functions as the central registry of all operational units of the U.S. Armed Forces and certain foreign organizations. For specified registered units, SORTS indicates, at a selected point in time, the level of selected resources and training status required to undertake the mission(s) for which the unit was organized or designed.

As a resource and unit monitoring system, SORTS is designed to support, in priority order, information requirements related to crisis response planning; deliberate or peacetime planning; and management responsibilities to organize, train, and equip forces for use by the CINCs.

Marine Corps units to be reported in SORTS include: MAGTFs (MEF, MEB, and MEU), MAGTF elements (CE, GCE, ACE, AND CSSE), battalions, squadrons, and separate deployable or deployed companies, batteries, or detachments. The Marine Corps SORTS Analysis Module (MCSAM)is an automated tool used to revise, correlate and analyze SORTS data.

Regarding training:

- Units will report the present level of training as compared to the standards for a fully trained unit as defined by Joint and Service directives. Language requirements will be considered where appropriate. Training status levels (T-1 through T-4) are assigned according to days of training required, percentage of operationally ready aircrews for assigned personnel and percentage of mission essential tasks trained for assigned personnel.

- To ensure useful, consistent, and accurate information is provided to the decisionmaker, assessing and reporting unit training status in SORTS will be based on Service-identified training events that must be completed within specified intervals for a fully trained unit.

Commanders provide a subjective assessment of that portion of the unit's full wartime mission it is expected to be able to perform, if alerted or committed, within the next 72 hours. In crisis or wartime, the subjective assessment will be based only on that portion of the mission for which the unit was alerted or committed. Service responsibilities and bands of unit effectiveness percentages and associated unit capability descriptions are specified in Joint Pub 1-03.3.

2.3.1.4.6 Training and Readiness Manual (T&R MANUAL)

The manual prescribes the number of flights/events, the tasks to be accomplished on each flight/ event and the refly factor for skill retention. The purpose of the manual is to standardize the aircrew and MACCS Personnel Training Syllabi in the Marine Corps and to specify performance requirements for flight and non- flight qualifications.

2.3.1.4.7 Universal Joint Task List (UJTL)

CJCS MOP 26 requires CINCs to state their joint training requirements in the form of a Joint Mission Essential Task List. All CINC Joint Mission Essential Tasks (JMET) were incorporated in a strawman Universal Joint Task List (UJTL). The UJTL contains all CINC joint training requirements so that all CINCs can use a common language set to define required operational capabilities, describe resource requirements, and also to define joint force training requirements.

2.3.1.4.8 Marine Corps Combat Readiness Evaluation System (MCCRES)

MCCRES was developed to provide timely and accurate determination of the combat readiness of FMF units. The system was designed to provide FMF commanders with a comprehensible set of mission performance standards from which training programs can be developed, and through which the efficiency and effectiveness of training can be evaluated. MCCRES is composed of four interdependent yet distinct components:

- Mission performance Standards (MPSs). MPSs are mission-oriented, collective training standards that establish minimum acceptable operational performance criteria for Marine units and elements. MPSs are currently organized into a series of 12 volumes. As new missions are identified and/or new units established, new volumes will be added.

- Mission Performance Evaluation System. The primary purpose of the MCCRES system is to provide training feedback. It is intended as a tool for evaluating the training readiness of a unit and to formulate future training requirements.

- Reporting System. The MCCRES report is used by MCCDC to conduct trend analysis on manning, equipment and formal training, revise and update MPSs and provide CMC with a readiness assessment of all units.

- MCCRES Software Program. The MCCRES software has been designed to provide an effective training management tool for accurately assessing the unit's ability to perform the tasks contained within its mission essential tasks list. Identifiable trends are analyzed for future updates in equipment, manning, and formal training.

2.3.1.4.9 Individual Training Standards System (ITSS)

ITSS is a document that provides guidelines relating to tasks that individual Marines should be able to accomplish within a given grade for a particular MOS or particular billet requirement. The ITSS provides common training standards (task, condition, standard) for all Marines within a given occupational field; specific training standards for all Marines in a given MOS by grade; an optimal list of training references, training support ammunition requirements; and correspondence courses to support training standards; and a way to evaluate training.

2.3.1.4.10 Aviation Training Readiness Information Management System (ATRIMS)

ATRIMS is a special purpose training management tool that automates the management of the T&R syllabi. ATRIMS is based on the aircrew training syllabi contained in the Aviation Training Readiness Manual. It can be used to analyze aircrew syllabi effectiveness, to evaluate aircrew performance and to project the most efficient use of training flight hours at the lowest command levels. Input is primarily through NAVFLIRS daily transaction log. ATRIMS facilitates historical aircrew record keeping, Combat Readiness Percentage (CPR) tabulation, currency and summary/forecasting reports useful to aircrew training management.

2.3.1.5 Capability Review System (CRS)

The CRS is a proposed automated data system that is intended to automate the Combat Development Process. The Requirements Catalog will be contained within the CRS and will track programs approved for development. When fielded, it will provide continuous feedback and interaction between developers of new systems, doctrine and training, and operators in the field. Figure 2-8 depicts the Capability Review System.

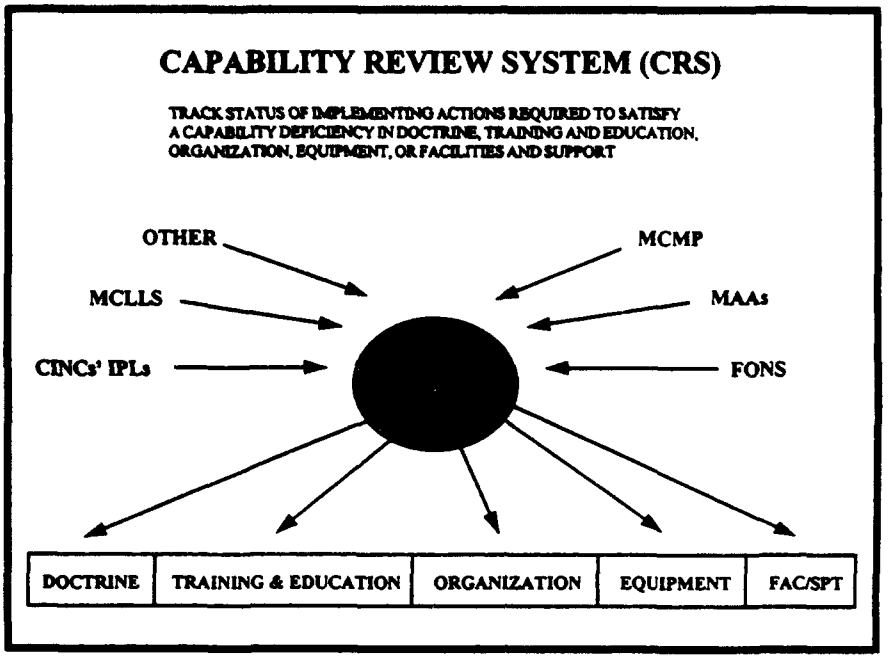
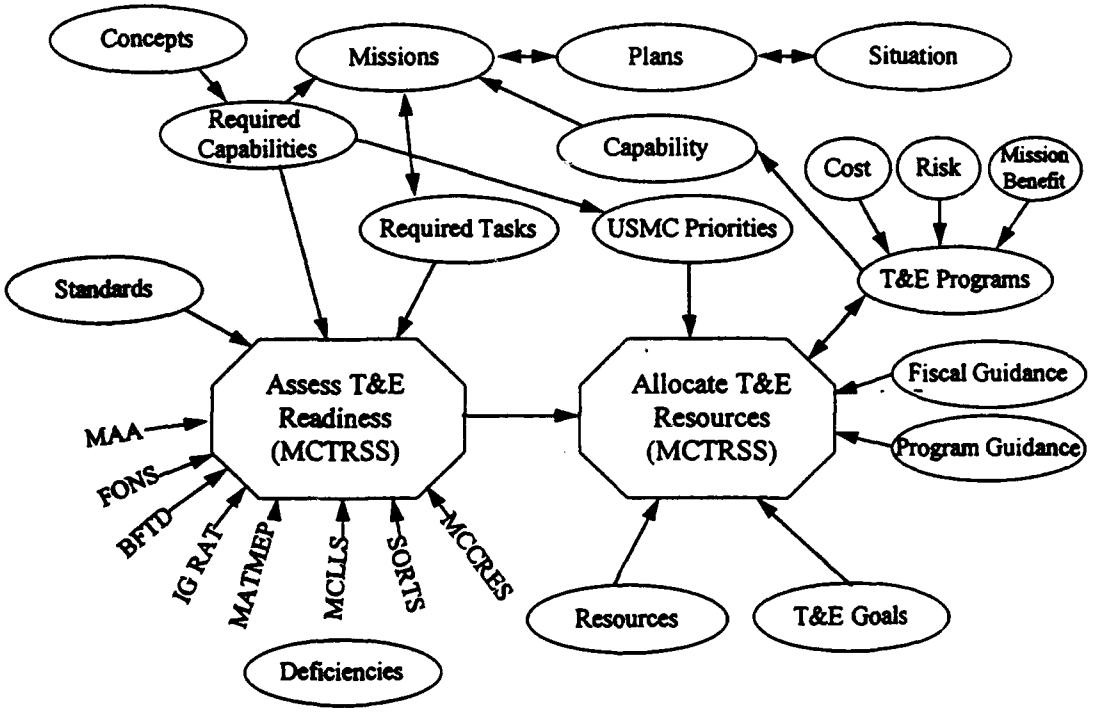


Figure 2-8-: THE CAPABILITY REVIEW SYSTEM

2.3.2 T&E ASSESSMENT/RESOURCE ALLOCATION CONTEXT DIAGRAM

Figure 2-9 shows the context diagram for T&E assessment and T&E resource allocation.

MCTRSS CONTEXT DIAGRAM



2.3.3 TRAINING AND EDUCATION DEFICIENCIES

Deficiencies in training and education readiness assessment and resource allocation were identified in the Training and Education Division Training Readiness Needs Analysis Report dated January 7, 1994:

- There is no objective process that assesses training readiness;
- The impact of funding training and education needs on warfighting capability can not be demonstrated;
- Training and Education financial managers do not have a quick method of evaluating the impact, on training readiness, of omnibus cuts in the Marine Corps training and education budget;
- There is a lack of integration and standardization in reporting, collecting and utilizing training assessment data; and,
- There is significant redundancy in training and education specific and other information systems that contain training and education information.

2.4 PROPOSED METHODS AND PROCEDURES

2.4.1 SUMMARY OF IMPROVEMENTS

The Training and Education Division will have the ability to objectively link Training and Education resource requirements to CINC warfighting requirements, MAGTF mission essential tasks, mission performance standards, CMC priorities, CG MCCDC priorities and T&E priorities. Decision makers will be able to rapidly assess the impact of resource decisions. This will result in improved T&E input to the Marine Corps POM process and ultimately result in better utilization of available resources. An improved Marine Corps training readiness assessment and resource allocation process will provide a solid training assessment continuum from FMF and Supporting Establishment T&E requirements submission to Congressional Appropriation.

The resource allocation module will interface well with the current Marine Corps Planning and Programming System. The ability to quantify the effect of funding a T&E program according to the established assessment framework and priorities is a solid cost-benefit analysis that will be useful at all levels during the POM-budget cycle and to the PEG and PWG for their overall cost-benefit analyses. Resource allocation is based on the concept that the prioritization order in the system determines the value or importance of the project. This is referred to as Value Based Budgeting.

The following specific benefits will be obtained and required capabilities will be satisfied by MCTRSS:

- An objective process that assesses training readiness using existing information systems;
- An assessment of the relative impact of training and education deficiencies on the capability to support MEF and CINC missions;
- A means to determine the impact of funding training and education needs on Marine Corps Mid-term Combat Development Capability;
- A means to determine the impact of funding training and education needs on warfighting capability;
- A tool for decisionmakers that will quickly evaluate the impact on training readiness of omnibus cuts in the Marine Corps training and education budget; and
- Enhanced integration and standardization in reporting, collecting and utilizing training assessment data.

2.4.1.1 Perform T&E Assessment

One of the most challenging aspects of assessment is to make the product acceptable to the users. If the Marine Corps spends millions of dollars on new programs, it is reasonable for the budgeteers and program analysts to challenge an assessment chronology that does not indicate increasing confidence in our ability to achieve capability objectives. In fact, that is not an uncommon occurrence in a changing environment, and the Marine Corps must be able to record the assessment even as the assessment process is changing.

That requires a method of configuration control to freeze the analyses in incremental time frames. Essentially, MCTRSS must not only be sufficiently dynamic to meet the challenges of new missions, capability objectives, requirements, threats, and technology; it must also be able to present the rationale for past decisions in a concise, understandable manner.

The objective of the T&E Assessment is to analyze capabilities of current and mid-term T&E programs in order to assess how well task level capability objectives are currently being achieved, or will be achieved. The degree to which task level capability objectives can be met by the T&E programs is depicted by an assessment color indicator Green - Fully Capable; Yellow - Capable, Not to Standard; Red - Not Capable. (See Appendix D for a more detailed explanation of this process). This assessment is made by the T&E Program Manager.

The MCTRSS T&E assessment hierarchy is structured with two assessment frameworks selectable by the MCCDC user. The MEF/MARRESFOR user is restricted to the Service mode. The Service framework rolls up through MAGTF Threat Scenarios, to the MEFS/MARRESFOR assessment level. The Joint framework rolls up through Warfighting Environments, and CINCs.

Service Mode	Joint Mode
MEF (3)/MARRESFOR	CINC (5)
MAGTF THREAT SCENARIOS	WFE (5)

OPERATIONAL CONCEPTS (3)
MID-TERM COMBAT DEVELOPMENT CAPABILITIES (40)
MISSION AREAS (12)
BATTLEFIELD FUNCTIONS (7)
TASK LEVEL CAPABILITY OBJECTIVES

Marine Expeditionary Force (MEF): MCTRSS will perform T&E assessments for the three MEFs; I MEF, II MEF, and III MEF. Marine Reserve Force (MARRESFOR)is included at this level.

MAGTF Threat Scenarios: MAGTF scenario vignettes represent potential threat environments to the MAGTF. The scenarios provide a basis from which to measure MAGTF capability to execute missions under a variety of threat conditions supporting current warplans.

Operational Concepts: MCTRSS will consider the following three operational concepts that form the basis of current Marine Corps strategic planning; Operational Maneuver from the Sea, Sustained Operations Ashore, and Other Expeditionary Operations.

CINCs: Marine Corps support to the Unified Combatant Commands is provided by the MEF/MARRESFOR according to the nature of the warfighting requirement. MEF assessments are developed by the MEFs whereas the CINC assessments are developed by MCCDC based on CINC and FMF inputs. The Joint Combatant Commands are: Pacific Command, USA Command, European Command, Central Command, and Southern Command.

Warfighting Environments: The anticipated conflict environment is a critical part of MCTRSS. Requirements for many of the necessary attributes associated with each mission are directly affected by the anticipated threat for a particular warfighting environment; requirements at the lower end of the conflict spectrum are completely different from the higher, nuclear end of the conflict spectrum. The basic mission tasks to be performed and their criticality are dependent on the warfighting environment. The spectrum of conflict is divided into a series of warfighting environments. These characterizations can change periodically and will be published in the CJCS MOP 50 updates. The current five warfighting environments are; Peace

Through Confrontation (PTC), Lesser Regional Confrontation (LRC), Major Regional Confrontation (MRC), Theater Nuclear War (TNW), and General Nuclear War (GNW).

Mid-Term Combat Development Capabilities: The Mid-term Combat Development Capabilities required to support Marine Corps operational concepts are listed and prioritized in the Marine Corps Master Plan (MCMP). Marine Corps mid-term combat development is based on operational concepts developed in response to changes in the global threat, the National Military Strategy and higher level guidance. These concepts in turn are analyzed to determine those capabilities that will be required to implement the concept.

Mission Areas: MCTRSS will perform T&E assessment in the following 12 mission areas: C2 & C2 Support, Intelligence, Direct Fire/Maneuver, Fire Support, Engineering, Antiair Warfare, C2 of A/C & Missiles, Electronic Warfare, Supply and Maintenance, Transportation, Health Service, and Services.

Battlefield Functions: MCTRSS will build on T&E assessments in the following seven battlefield functional areas; Maneuver, Fires, Air Defense, Command/Control/Support, Intelligence, Mobility/ Countermobility/Survivability, and Combat Service Support.

Task Level Capability Objectives: The basic building blocks of the MCTRSS are the task level capability objectives. Task level capability objectives are T&E requirements supporting a mission need and are derived from Universal Joint Tasks, Mission Essential Tasks, Mission Performance Standards, and Mission Area Analysis validated task lists.

The essence of MCTRSS is to ensure that the assessment process provides a valid assessment of capabilities with a repeatable audit trail. The MCTRSS approach is based on the specification of criteria that define what must be done (task level capability objectives) under what conditions and to what performance level (standards). To make the assessment meaningful, a relational structure between capability requirements, standards and programmed solutions (T&E programs) is developed.

The algorithms for carrying out the rollup of task level capability assessments into a MEF/Marine Corps training readiness assessment are presented in five models selectable by the user: nominal optimist, nominal pessimist, weighted average, bias toward red, and bias toward green. The names generally describe the type of rollup produced by each of the models.

A detailed discussion of the assessment process and roll-up algorithms is presented in Appendix D.

2.4.1.2 Rank T&E Programs

This function includes necessary actions and decisions to rank T&E programs which have been entered as mid-term T&E programs in the assessment function of MCTRSS and that have the greatest impact on increasing T&E readiness. Programs shall be ranked based on certain aspects of a program (i.e. criteria values) and weights assigned to these criteria. The criteria values for programs are determined by the assessment rollup which is performed on the MEF/CINC Mission Structure.

Six criteria are used in the prioritization of T&E programs according to mission benefit:

(1) Criterion based on number of task level capability objectives a program contributes to;
(2) Relative importance of the task level capability objective;
(3) Seriousness of the current deficiency;
(4) Improvement in capability over the FYDP;
(5) Impact of program across MCMP Mid-term Capability Objectives; and,
(6) Impact of program across MEFs (MCCDC user only).

Criteria 1, and 2, 3, or 4 can be used in the prioritization by both the MCCDC and MEF user. Criteria 2, 3, and 4 are three different versions of a single criterion. It is intended that only one of the three criteria be assigned a nonzero weight at any given time by setting the weight for the other two criteria to zero. Criterion 6 is applicable only for the MCCDC user.

Ranking options are discussed in paragraph 3.2.2. Ranking algorithms are discussed in Appendix E.

2.4.1.3 Allocate T&E Resources

Allocation of resources (funding) is not feasible solely according to mission accomplishment. Other criteria generally restrict the allocation of resources. There are seven criteria (not listed in order of importance) used for determining resource allocation priorities:

(1) Contribution to mission accomplishment (i.e. ranking from the previous example);
(2) Contribution to training readiness within a Capability Set;
(3) Contribution to T&E objectives as defined in the MCMP;
(4) Contribution to T&E goals as defined in the SEMP;
(5) External factors (i.e. mandated by public law, DoD directed, CMC directed);

(6) Program risk (i.e. program definition, scope, implementation); and,

(7) Program cost.

Funding rankings and methods for allocating resources are detailed in paragraph 3.2.3.

The MCTRSS will simplify and standardize the resource allocation and budgeting process by:

- Lessening the amount of time that is currently spent making tough funding prioritization and budget allocation decisions;
- Establishing, tracking and validating objective decisions based on established criteria;
- Performing "what-if" analysis with the available resources to determine the best possible budget allocation scheme;
- Providing a system able to handle up-to-date funding changes; and,
- Standardizing components of the budgeting process from year-to-year.

2.4.2 SUMMARY OF IMPACTS

Organizational impact on T&E Division, MCCDC, or the MEFs will be minimal. Each operating site will require a system administrator as a collateral duty with normal AIS system administrator authority and responsibilities. No other organizational impact is envisioned.

Operational impact is dependent upon the final fielding plan. Section 4 describes a likely MCTRSS system framework. Operating centers will have their own assessment capability with interfacing commands having access to output data for review, comment, or action as appropriate. A significant capability afforded to the Marine Corps by the MCTRSS is standardization of and wide-spread real-time access to training readiness assessment data. MCTRSS provides the capability to evaluate a wide range of training readiness indicators simultaneously to obtain a better picture than relying on one readiness reporting system (i.e SORTS, MCCRES).

Recurring cost will include update to the data base during each two year POM cycle and changes to the assessment hierarchy as they occur. This can be accomplished by the operators.

2.5 ASSUMPTIONS AND CONSTRAINTS

Some of the CDP functions and processes that impact MCTRSS will change.

The CDP will continue as the methodology for putting combat-ready MAGTFs in the field.

Applicable DoD, DoN and the CMC directed requirements for standardization, integration or interface with other AISs will be applied to solution development.

Requirements for AIS security, sensitive information security, privacy, and information reporting need to be identified.

Interfaces with existing AISs will be necessary. The specific AISs will be determined after the key-based data model is completed. Interfaces will be built based on standards.

The mission need should be satisfied by mid-1996.

Continuity of Operations of Marine Corps Information (COOP-MC INFO) will follow local ISMO recovery procedures.

SECTION 3
DETAILED FUNCTIONAL REQUIREMENTS

This Section contains the detailed functional requirements which must be present in the MCTRSS environment. The MCTRSS functional requirements will form the basis for mutual understanding between the developer and the user communities. It contains the definition of the operational capability which will be the MCTRSS. The objectives of the detailed functional requirements are to:

- Provide the functional baseline requirements information needed by users, managers, technical staffs, maintenance personnel, and systems engineers;
- Present this information in a manner that will facilitate reference and provide a basis for configuration Management; and,
- Ensure economy and efficiency in satisfying implementation requirements.

The functional requirements are a tool for use by both the functional and systems analyst during the systems design phase of the life cycle management process.

3.1 SPECIFIC PERFORMANCE MEASURES

The MCTRSS will meet public law, Department of Defense policy, and Marine Corps policy for readiness assessment and resource allocation. In order to assess Marine Corps training readiness and allocate T&E resources according to value added to mission accomplishment, the MCTRSS will support the primary functions of individuals who evaluate and resource training and education.

- Documentation and validation. The MCTRSS will be able to document T&E deficiencies and provide the validation audit trail from national level taskings to T&E programs. The MCTRSS will provide the capability to aggregate key source T&E readiness data and make raw and processed data available for additional analyses, reports and queries.

- Evaluation. The mere existence of a "valid" deficiency is insufficient justification for expending resources to alleviate the deficiency. The impact of deficiencies on operational capability objectives must be succinctly articulated and presented to the decision-maker in such a manner as to leave no doubt as to a course of action - either to view the deficiency as an acceptable risk or to commit resources to alleviate the deficiency.

- Prioritization. Fiscal reality is one of the four major challenges that needs to be addressed when determining how the Marine Corps can best fulfill its roles and functions. T&E programs and funding requirements need to be prioritized within the overall operational framework. Resources to alleviate a deficiency impacting a critical capability and mission performance objective will in all likelihood come from current programs supporting less critical capability and mission performance objectives.

- Resource allocation. In addition to operational capability and mission performance objectives, T&E resource managers and high level decision-makers are presented with higher level guidance and constraints that govern the expenditure of resources. These often conflict with operational objectives but must be addressed in the POM and budget process. MCTRSS will provide the user with the capability to consider these external influences and controls.

- Reports Generation. MCTRSS will provide the user with the capability to produce standard and ad-hoc reports.

3.1.1 ACCURACY AND VALIDITY

Detailed assessment roll-up and prioritization algorithms are presented in Appendix D and E. The accuracy of the mathematical calculations must be 100%.

The assessment process is complicated by the fact that requirements for T&E programs tend to be imprecisely stated and raw readiness and capability deficiency data tend to be manipulated in the reporting process.

Accuracy requirements for MCTRSS will be to the same standard as current/projected AISs with or within which MCTRSS will interface or operate. The accuracy of the MCTRSS output is contingent upon the validity and timeliness of the data provided as input. Data as received must be stored with 100% accuracy.

All input data must be edited prior to transmission into MCTRSS to assure that data are valid and current. The consistency of input data must be monitored for completeness and reasonableness.

3.1.2 TIMING

The following timing performance requirements shall apply to MCTRSS:

- Response time from receipt of input data to availability of an assessment or resource allocation depends upon the amount of data to be entered, the form of the data (electronic, paper), the type of assessment, and the user level (MEF, MCCDC). After data entry, a MEF level assessment will be completed within 30 minutes. A MCCDC (global) assessment can be completed within two hours. After completion of an assessment roll-up, a resource allocation scheme can be completed within 30 minutes.

- Response time to operator queries depends upon the complexity of the query. The system operating speed is 33 mhz. Response time to remote users is dependent on the network capacity and loading.

- Assessments are first rolled-up to the lowest level and then to increasingly higher levels until the level specified by the user is reached. (See Appendix D). The assessment roll-up must be completed before the mission ranking can be completed. Mission ranking must be completed before the resource allocation can be completed (See Appendix E).

- Priorities on data input or modes of operation are determined by the user and do not significantly impact system response times.

- The MCTRSS will be used daily but most heavily during the three to four months preceding publication of the Marine Corps Master Plan, Supporting Establishment Master Plan and Marine Corps POM guidance and during POM development and budget reviews. Peak load times may generate the requirement for larger amounts of input data to update the database. Response times for input data are dependent on operator experience.

- MCTRSS will provide a baseline for updating Mission Area Analyses. The updated Mission Area Analysis will serve as a calibration point (validation) of the data within the MCTRSS Assessment database. Each Mission Area is to be analyzed once every two years. Since there are currently 12 Mission Areas, a MCTRSS input is required six times per year.

- MCTRSS databases may also be used during performance standards development.

- MCTRSS work is performed on PCs however, the supporting network must be capable of responding to user demands within the normal standards developed for Banyan.

3.1.3 CAPACITY LIMITS

MCTRSS is initially provided to the MEFs and MARRESFOR on two 124 megabyte hard drives and to MCCDC on a 340 megebyte and a 124 megabyte hard drive. Larger storage capacity can be provided if required.

3.2 FUNCTIONAL REQUIREMENTS

This Section will provide a detailed description of the MCTRSS functional requirements specified in paragraph 2.4. The MCTRSS functional requirements have been developed to support the framework of the three major processing functions of the CDP: the Concept Based Requirements System (CBRS), the Solution Development

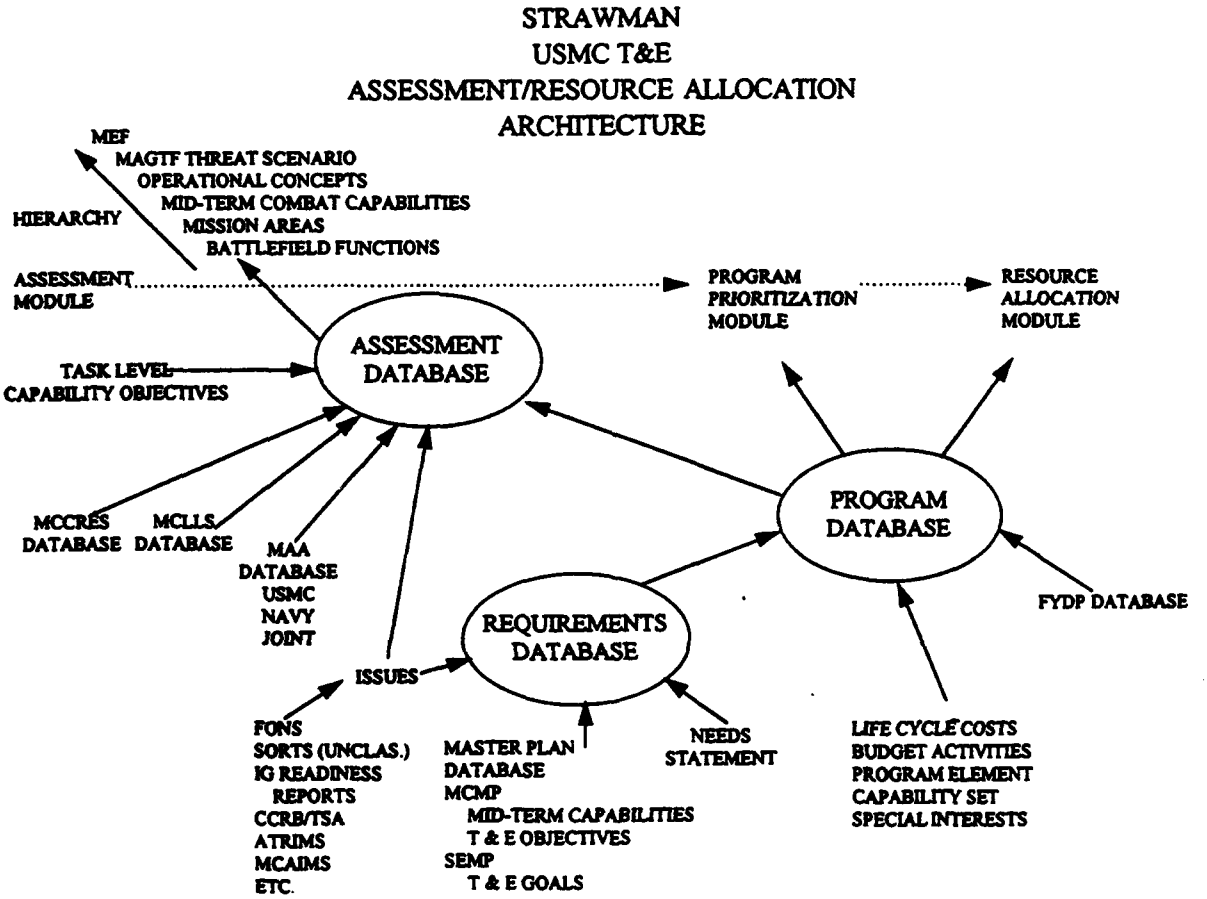


Figure 3-1: MCTRSS ASSESSMENT/RESOURCE ALLOCATION ARCHITECTURE

System (SDS), and the Capability Support System. Each of the following sections identifies the functional requirements as primarily related to either an assessment, program ranking, or resource allocation context. These requirements have been developed from analyses of data models depicting data entities and attributes of the T&E process within the CDP. The relationship of data entities and their associated attributes remain stable over time and establish the baseline for implementing MCTRSS regardless of process changes within the CDP or AIS selected to support the CDP. The functional requirements will be described in enough detail to enable the systems analyst to understand the functional analyst's desired outcome from the functional requirement. The assessment, prioritization, and resource allocation flow/interfaces framework is shown in Figure 3-1.

3.2.1 PERFORM T&E ASSESSMENT GENERAL REQUIREMENTS

Under MCTRSS, the "Perform T&E Assessment" function will allow a user to:

- Assign hierarchy dependence values to each element in the assessment hierarchy;
- Specify current programs and assign current assessment values to Task Level Capability Objectives;
- Document current deficiencies (through Mission Area Analysis, review of current readiness reporting data such as MCLLS, SORTS, MCCRES, FONS, etc.) and specify mid-term improvement programs that will resolve current deficiencies for a Task Level Capability Objective;
- Assign midterm assessment values to Task Level Capability Objectives;
- Document residual deficiencies (i.e. deficiencies left after applying midterm improvement programs to current deficiencies), and specify future improvement programs (or requirements) that will resolve the residual deficiencies; and,
- Run an assessment rollup algorithm to determine how well Task Level Capability Objectives are being achieved at each level in the assessment hierarchy. (See paragraph 2.4.1.1.)

Assessment algorithms are discussed in Appendix D.

3.2.2 RANK T&E PROGRAMS GENERAL REQUIREMENTS

MCTRSS will provide the option to rank order T&E programs in accordance with three optional criteria:

- Rank T&E Programs By Seriousness of Mission Degradation.
  MCTRSS will provide the option to rank T&E programs based on the seriousness of the associated deficiency weighted by the dependency chain of the selected hierarchy, either in Service mode or Joint mode. Deficiencies will have a one-to-one relationship with a Task Level Capability Objective. T&E program solutions may or may not have a one-to-one relationship, because a single T&E program may be used as a solution for various deficiencies.

- Rank T&E Programs by Optimum Gain in Training Readiness.
  MCTRSS will provide the option to rank the contribution that T&E programs will make toward improving MAGTF capabilities. Final T&E program prioritization will be based upon weighted (dependency) assessment improvement made or expected between the current and mid-term time frames.

- Rank T&E Programs by Seriousness of Associated Deficiencies and Contribution to Improving MAGTF Capabilities.
  MCTRSS will provide the option to rank T&E programs based on a combination of scores from the two previous options.

Program ranking algorithms are discussed in Appendix E.

3.2.2.1 Program Value Structure

T&E program solutions are to be valued based on their relation to T&E deficiencies. T&E deficiencies are stated in the form of capability shortfalls, and T&E program data is entered in a manner that directly ties a programmed solution to the deficiency. MCTRSS design will require the T&E planner to specify (estimate) the degree to which a program resolves a deficiency by entering this information during MCTRSS Assessment Data Entry.

The MCTRSS program data base will contain T&E program resource and attribute information. MCTRSS will have the option of initiating a relational search of linking attributes to define multiple program solution sets that would resolve deficiencies with common T&E root causes. Database queries should be able to

identify all T&E programs that would potentially resolve a shortfall, without having to rely on the T&E planner to identify specific T&E program solutions for complicated, multi-attribute problems.

3.2.2.2 MCTRSS Enhanced Mode

MCTRSS will have the capability to operate in the Enhanced Mode if there is uncertainty about the current or mid-term assessment or about the probability/possibility that the capability will be required. If there is uncertainty about the dependency of a function on a particular capability, the estimated probability of dependency can be indicated for each dependency level, i.e. the probability that the function would be required at the Essential, Highly Dependent, Moderately Dependent, or merely Contributing level can be identified. The Enhanced Mode will not change the value weightings, but will calculate assessment values based on combinations over the full range of capability and dependency inputs.

3.2.3 ALLOCATE T&E RESOURCES GENERAL REQUIREMENTS

T&E resources shall be allocated based on certain aspects of a program (i.e. criteria values) and weights assigned to these criteria.

CRITERIA

The following criteria will be considered in the allocation of T&E resources:

- Contribution to mission accomplishment;
- Contribution to capability within a Capability Set;
- Contribution to T&E objectives as defined in the MCMP;
- Contribution to T&E goals as defined in the SEMP;
- External factors (i.e. mandated by public law, DoD directed, CMC directed);
- Program risk (i.e. program definition, scope, implementation); and,
- Program cost.

WEIGHT CRITERIA

This function will allow the user to directly choose the relevant criteria weight, use a pairwise comparison weighting technique, or indicate whether each criteria is to be maximized or minimized.

Direct Weight. For the direct entry of weights, the user may enter a value for each of the criteria. These weights are automatically normalized by the program so that the weights of the criteria sum to one. For example, if four criteria are weighted as (2, 3, 1, and 4) the resulting weights are (0.2, 0.3,

0.1, and 0.4). After entering all the attribute weights directly, the user may elect to re-weight the criteria.

Pairwise Comparison The eigenvector pairwise comparison method gives the user the ability to determine the criteria weights based on a subjective comparison of one criteria to another. This method is helpful when the user is uncertain of the assignment of the weights of each criteria. The following scale describes the different weighting values between criteria.

THE SCALE AND ITS DESCRIPTION

1 . . Equal Importance
2
3 . . More Importance
4
5 . . Essential Importance
6
7 . . Demonstrated Importance
8
9 . . Absolute Importance

The user selects the most important criteria and its weight. Each pair of criteria is compared with each other. If weights have been calculated using the pairwise comparison method, these weights are used until the operator either re-enters the most important choice and degree of importance or enters weights directly.

Max/Min. In this option, the user determines whether a criteria is to be minimized or maximized. If criteria are maximized, this means that a bigger value is a better score. Conversely, if criteria are minimized, a smaller value is a better score.

CRITERIA VALUES

These values are assigned by the user based on current POM/Budget guidance, with the exception of the Mission Benefit which is an output of the Training Readiness Assessment.

Mission Benefit - Numerical ranking 1 $\rightarrow$n. 1 = High mission benefit; n = lower mission benefit. Assigned from the Assessment Module.

MCMP T&E Mid-Term Objective - Numerical value 1 →n. 1 = High priority; n = lower priority.

SEMP T&E Mid-Term Objective - Numerical value 1 →n. 1 = High priority; n = lower priority.

External Factors - Numerical value 1 →n. 1 = Fenced; 2 = Public Law; 3 = DoD Directed; 4 = CMC Directed. 1 = Higher priority; 4 = lower priority.

Contribution to Capability within T&E Capability Set - Numerical value 1 →n. A ranking of T&E Programs within Capability Sets based on Optimum Gain. (See Appendix C for detailed ranking algorithms).

Program Cost - High, Medium, Low .

Program Risk - High, Medium, Low.

FUNDING RANKING

This function ranks each program on the basis of the score obtained through the algorithmic ranking process based on the previous criteria. This score is the closeness of that criteria to the best possible solution and is an indisputable preference order of items. This score is determined from the values entered for each of the criteria and the weighting scheme determined from the Weight Criteria. The score resulting from the ranking process is used to generate the funding rank of each of the programs. The user can do what-if analysis for the prioritization of programs by running the ranking algorithm with different sets of weights for the criteria or by changing the values within a specific criteria. This allows the user the ability to determine the best possible prioritization based on the goals and objectives of the organization.

MCTRSS T&E ALLOCATION

In this function, the system calculates a criteria based prioritization funding scheme for the programs in each capability set. This allocation scheme is based on the score resulting from the MCTRSS funding prioritization. This score is used to determine a dollar value associated with each capability set. This dollar value is compared to the Minimum and Total Requirements of the program to allocate value-based funds to the capability set. Fenced resources will always be allocated first, then Minimum Requirements up to any funding limitations imposed by training category, budget activity, or type of funding.

After the allocation is completed, the total budget amount for each Budget Activity is presented for each program.

SLICE OF MINIMUM REQUIREMENTS

This function will be used to adjust all of the Minimum Requirements for each program. This percentage allows the user to take a slice off of the Minimum Requirements (i.e. non-specific cut in T&E resources) and see the resulting budgeting scheme.

The system allocates funds for the fenced resources of a program first.
The system then allocates funds for the minimum resources of a program.

After the allocation is completed, the total budget amount available for each Budget Activity and the minimum funding level, allocated funds, and unallocated funds are presented for each program.

INDIVIDUAL FUNDING LEVELS OPTION

This function will allow the user to enter a Funding Amount for each Budget Activity individually. MCTRSS will allocate the available resources to individual programs within the Budget Activity according to Funding Priority within Budget Activity.

3.2.4 VIEW/ENTER/MODIFY DATA GENERAL REQUIREMENTS

MCTRSS shall provide the capability for a MCTRSS user to view T&E requirements. A T&E requirement may be stated in a Mission Need Statement (MNS) or a Fleet Operational Needs Statement (FONS). T&E requirements are assessed and met as part of the solution development phase of the CDP and are keyed in MCTRSS to the deficiencies that they eliminate or resolve. T&E requirements are listed in the Requirements Catalogue. T&E requirements are cross-referenced to MNS, FONS, and/or Requirements Catalogue in the T&E Requirements Database.

MCTRSS shall provide the capability for a MCTRSS user to view MCLLS data. The MCLLS database will be loaded from an external source. Oracle's SQL*LOADER utility will be used to load this data. It is assumed that the MCLLS data will be in a format that SQL*LOADER can process. MCLLS will be used to retrieve lessons learned from military exercises and operations. This information is useful in the assessment of units to perform mission objectives.

MCTRSS will provide the user with budget information for each Training Category in the input database. This information consists of the T&E Program, Minimum and Total Budget Requirements, whether the program was funded and if it had fenced money allocated to it.

MCTRSS shall provide summary and detail views of MCTRSS data. A summary view will contain a list of selected records, one per line. Data elements displayed will be a subset of data elements. The detail view will show all data elements for one record on one or more screens.

3.2.5 VIEW/PRINT REPORTS GENERAL REQUIREMENTS

The Query/Reporting Subsystem provides a focal point for querying the MCTRSS database and generating standard reports. Currently, three main function are included in the subsystem: view MCTRSS data, view/print standard reports, and perform text search. Text search is a special type of query that allows a user to find data areas of interest. The Text Search function is also directly available via the TEXT SEARCH function key. It is included here since it is a special type of query. The user is provided two options for preformatted reports. Reports can be sent to the printer for paper outputs or to files for electronic transmission to other offices, record purposes, or other uses.

3.2.6 PERFORM SYSTEM UTILITIES GENERAL REQUIREMENTS

The "MCTRSS System Administration Utilities" subsystem includes functions for maintaining standardized lists, maintaining user profiles, exporting and importing data, and setting MCTRSS configuration parameters. This function includes all the automated processes for adding and modifying various standardized lists.

MCTRSS shall provide the capability for a MCCDC system administrator to add, modify, and delete definition of terms. The glossary will provide MCTRSS users a set of definitions to help them in understanding MCTRSS.

MCTRSS shall provide the capability for a MCCDC system administrator to add, modify, and delete bibliography entries. The bibliography will provide a MCTRSS user an on-line reference of material that can be used in preparing the T&E Program Assessment.

MCTRSS shall provide the capability for a MCCDC system administrator to maintain a list of acronyms. Maintaining this list on-line will provide the MCTRSS user with a quick reference to the meaning of acronyms that may appear in the MCTRSS database.

MCTRSS shall provide the capability for a MCCDC system administrator to maintain a list of budget requests (or Program Operation Memorandums) for funding programs.

MCTRSS shall provide the capability for a MCCDC system administrator to modify hierarchy dependence types and their associated numeric values. The number of dependence types will be set to a fixed number. The MCCDC system administrator will be able to modify the dependence codes, descriptions, and values, but will not be able to increase or decrease the number of dependence types. Dependencies will be used in the assessment roll-up algorithm.

MCTRSS will include a function that includes automated functions for adding, modifying, and deleting MCTRSS users. A user profile includes the user name, user password, user type, and user-function assignment.

MCTRSS shall provide the capability for a MCTRSS system administrator to add new MCTRSS users. The MCTRSS system administrator will add user name, user password, and user type. A default assignment of MCTRSS functions will be made based on user type.

MCTRSS will maintain a baseline MCTRSS database. The MCCDC baseline database will contain a default assessment framework, a standardized list of reports, and a help database. The baseline MCCDC database will be available to the MEF/MARRESFOR as a starting point for building a customized MEF/MARRESFOR database.

MCCDC will periodically receive MEF/MARRESFOR specific data from all the MEF/MARRESFOR and integrate this data into the MCCDC database, creating a global (although not current) repository of MCTRSS data.

Periodically, MCCDC will ship out updates to MCTRSS (includes software and database updates). Database updates may include changes in the default command framework, standardized lists, and the help database. MCCDC may also provide a MEF/MARRESFOR with another MEF/MARRESFOR data to be used as a reference.

MCTRSS shall provide the capability for the MCCDC system administrator to export the MCTRSS baseline database.

Note that changes in the default command structure or standardized lists may impact a MEF/MARRESFOR's existing database, compromising database integrity. As part of this requirement a procedure needs to be developed to deal with this problem.

MCTRSS shall provide the capability for the MEF/MARRESFOR system administrator to export MEF/MARRESFOR specific data, which includes all data not part of the MCCDC baseline database.

MCTRSS shall provide the capability for a MEF/MARRESFOR system administrator to import MCCDC data. Since new changes to the MCCDC data may impact existing MEF/MARRESFOR data, the import utility must be intelligent enough to prevent changes that will compromise database integrity.

MCTRSS shall provide the capability for the MCCDC system administrator to import MEF/MARRESFOR specific data and integrate this data with MCCDC data and other MEF/MARRESFOR's data. The identity of the data must be maintained. In other words, it must be possible to distinguish between MCCDC data and each of the MEF/MARRESFOR specific data.

DATA TRANSFER

This function will allow the user the option to use files to either upload data, download data, or erase the current data. On screen prompts will guide the user through each operation. Checks on proper file naming procedures will be included in the program as much as possible.

UPLOAD DATA

This function allows the user to append data to the current database or erase the current data from the database and then append new data.

APPEND TO CURRENT DATA FILE

This function allows the user to append a text or .DBF file to the existing data. A path, filename, and filename extension must be entered. Delimiter information must also be provided if the file is a text file.

ERASE CURRENT DATA FILE AND APPEND NEW DATA

This function allows data from the current data file to be erased prior to appending new data. A backup file will be generated prior to the erasing of the data. Path, filename, and file extension must be entered.

DOWNLOAD DATA

The download function provides two alternatives:

- Download data ir dBase III format.
- Download data in text format.

Dbase III files can be translated into Lotus format using the Lotus Translate Utility.

ERASE CURRENT DATA

The erase function erases the existing data from the file. A backup file will be generated prior to erasing the file.

3.2.7 HELP GENERAL REQUIREMENTS

The MCTRSS Help system is designed to be an interactive help in that the MCTRSS System Administrator (MSA) can enter, modify, or delete information in the help database. There are three levels of help information:

The first level is the **field level help**. This is information related to a specific data field on a screen.

The second level is the **screen level help**. This is information related to the entire screen being displayed or the process to which the screen is related.

The third level **help** is for the display of the Function Key assignment or other common information which might be desired.

SECTION 4
DESIGN CONSIDERATIONS

This Section briefly describes how MCTRSS will satisfy the requirements delineated in Sections 2 and 3.

A MCTRSS Software Unit Specification will specify how the design considerations are to be implemented in sufficient detail to begin programming

4.1 SYSTEM DESCRIPTION

The detailed MCTRSS system requirements are influenced by the data availability and information requirements of the Combat Development Process, as highlighted in Section 2.3.1. MCTRSS will support training and education assessment and resource allocation processes within the CDP. MCTRSS is resident on a standard 486/33 mhz stand alone PC, networked with the Banyan wide area network. A removable unix operating system hard drive is provided to preclude the requirement for access to a separate unix based PC. The Standards Branch, T&E Division MCCDC, will be the MCTRSS system administrator and manage the master database. Other branches within T&E Division and other divisions within MCCDC will have access to MCTRSS through the network. Selected offices within Headquarters Marine Corps will also have access to MCTRSS through the network. MEFs and MARRESFOR will have their own MCTRSS system, with the capability for data exchange with the MCCDC system via network and floppy disk.

Figure 4-1 shows the relationship of user organizations to the MCTRSS:

4.2 SYSTEM FUNCTIONS

The major functions of MCTRSS are summarized below:

Define Assessment **Frameworks**. Allows MCCDC to define a set of standard warfighting environments, mission areas, mission elements, and task level capability objectives. MEF/MARRESFOR can add mission elements and task level capability objectives to this standard set, and then, using this set of definitions, build their mission structure.

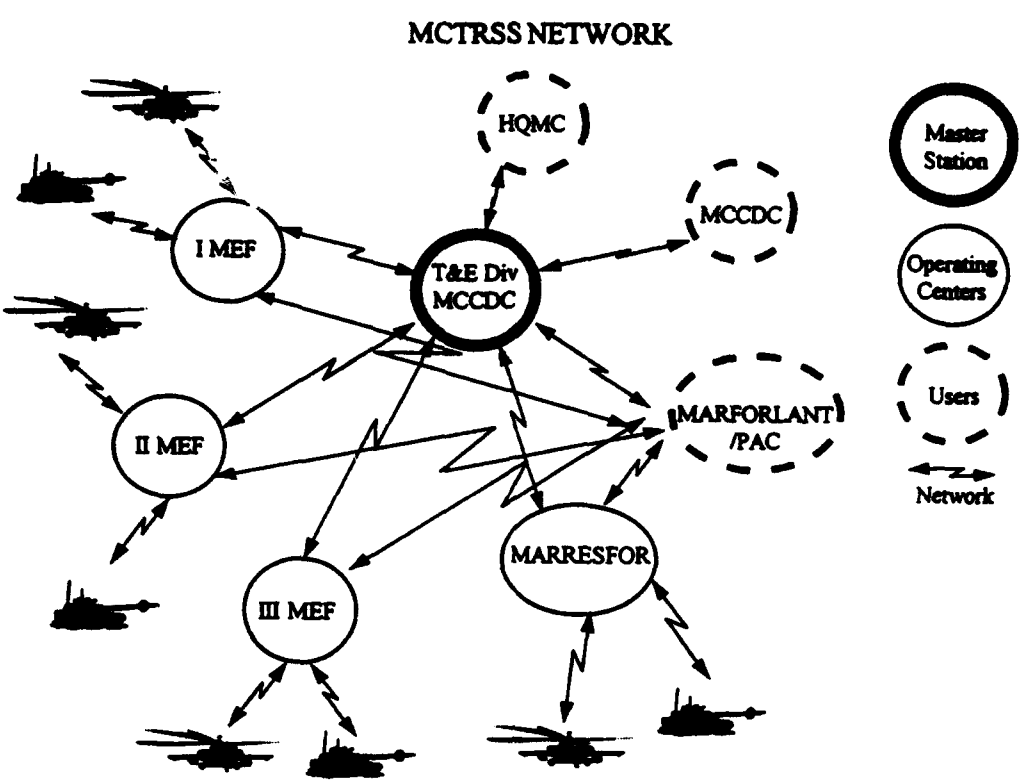


Figure 4-1 MCTRSS NETWORK

Manage Programs. Allows MCCDC and MEF/MARRESFOR to maintain program data (including funding information) and rank programs. Ranking of programs includes assigning weights to decision criteria.

Perform Assessment. Allows MCCDC and MEF/MARRESFOR to maintain assessment data, assign hierarchical dependencies to each node in the assessment hierarchy and assessments values to each capability objective, and to perform an assessment rollup.

Perform Resource Allocation. Allows MCCDC to allocate T&E resources according to seven criteria. Criteria can be changed based on DoD, DoN, or USMC fiscal guidance.

View MCTRSS Reference Data. Allows MCCDC and MEF/MARRESFOR to view information that can be used when preparing T&E assessment reports. Reference data includes: MCLLS, MCCRES, MAA, IG RAP, MNS, FONS.

Query MCTRSS Data / Generate Standard Reports. This subsystem implements the query and reporting functions of MCTRSS. It allows viewing of MCTRSS data, viewing/printing of standard reports, and searching of text fields for specific strings of characters.

Execute System Utilities. These are System Administration functions, accessible only by the system administrator. Functions include: maintaining standardized lists, maintaining user profiles, exporting, importing, and archiving data, and interfacing with the Banyan network.

The following is a list of required MCTRSS user-machine interface capabilities:

I. Perform Assessment
- Define Assessment Framework
  - Modify MAGTF Threat Scenarios
  - Modify Operational Concepts
  - Modify Midterm Combat Development Capabilities
  - Modify Warfighting Environments
  - Modify Mission Areas
  - Modify Battlefield Functions
  - Modify Task Level Capability Objectives
  - Modify Mission/Dependency Structure
- Enter/Modify Assessment Data
- Select Alternative Algorithms
- Select Assessment Mode
- Initiate T&E Assessment
- View Assessment Results
- Analyze Assessment Results

II. Rank T&E Programs
- Rank T&E Programs
  - Select Ranking Criteria
  - Select Optional Criteria
  - Initiate Ranking
  - View Ranking
- Perform Sensitivity Analysis

III. Allocate T&E Resources
- Enter/Modify POM/Budget Data
- Optimize T&E Resources
  - Weight Criteria
  - Select Criteria Values
  - Select Allocation Options
  - Perform Funding Ranking
  - Initiate Resource Allocation
- View Resource Allocation
- Perform "What-If" Analysis

IV. View/Enter/Modify Data
- MCCRES Data
- MCLLS Data
- MAA Data
- T&ENS Data
- Issues/FONS Data
- IG Readiness Data
- SORTS Data
- Master Plan Data
- Update T&E Program Data

V. View/Print Reports
- Task Level Capability Objectives
- Mission Structure
- Capability Assessments/Deficiencies
- Assessment Reports
  - Training Readiness Assessment
  - MEF/Threat Scenario Assessment
  - CINC/WFE Assessment
  - Operational Concept Assessment
  - Midterm Combat Development Capability Assessment
  - Mission Area Assessment
  - Battlefield Functions Assessment
- Program Ranking Reports
  - All Programs
  - By MEF/Threat Scenario
  - By CINC/WFE
  - By Mission Area/Battlefield Functions
  - By Training Category
  - By FYDP Program Element
- Resource Allocation Reports
- Program Data Sheets
- Deficiencies/Requirements
  - By MEF/Threat Scenario
  - By CINC/WFE
  - By Operational Concept
  - By Mission Area/Battlefield Functions
  - By Training Category

VI. Perform System Utilities
- Export Data
- Import Data
- Modify Standard Lists
  - Glossary
  - Bibliography
  - Acronyms
  - POCs

VII. Help

4.3 FLEXIBILITY

MCTRSS provides the following features:

- Interactive data entry through user friendly data entry screen displays;
- Interactive data modification through data change screen displays;
- Prioritized list of T&E programs and systems;
- Summary of MEF/CINC's assessment by mission and warfighting environment; and,
- Interactive resource allocation capability and sensitivity analysis.

4.4 SYSTEM DATA

4.4.1 INPUT/OUTPUT DATA

The inputs to MCTRSS are shown in Figure 3-1 *MCTRSS Functional Architecture*. The outputs are T&E Readiness Assessment Reports, Program Prioritization, Resource Allocation Reports and supporting exhibits.

4.4.2 DATABASE

The database will consist of all the data elements required to support the assessment/resource allocation functions described in Section 3 logically arranged in tables. The tables, and logical relationships between them will be detailed in the Software Unit Specification. These tables support the Oracle RDBMS v.6.0.

SECTION 5
ENVIRONMENT

5.1 EQUIPMENT ENVIRONMENT

MCTRSS can be supported by PC computers, peripheral devices, and communications equipment organic to the Marine Corps and will not require systems acquisition. The minimum requirements for MCTRSS are:

a. Processors.
   486/33 based motherboard and CPU
   8 megabytes of RAM
   115/220 volt switchable power supply
b. Storage Media.
   1 1.2 megabyte, 5¼" floppy drive
   1 1.44 megabyte, 3½" floppy drive
   2 124 megabyte hard drives in removable docking bays
c. Input/Output Devices.
   1 I/O card with 1 parallel and 2 serial ports
   VGA monitor / 1 megabyte VGA video card
   1 101 key keyboard
   Access to a local laser printer.
d. Communications.
   The PCs must have access to Banyan.

5.2 SUPPORT SOFTWARE ENVIRONMENT

System Software. The operating system used for MCTRSS will be INTERACTIVE UNIX System V/386 Release 3.2 with the UNIX VP/IX DOS Emulator package. The database used for the maintenance of MCTRSS data will be ORACLE 6.0 for INTERACTIVE UNIX, a relational database system. MCTRSS programming routines will be written in ANSI Standard C using the INTERACTIVE UNIX C compiler and the ORACLE PRO*C precompiler. Oracle's application development tools (SQL*Forms, SQL*Report, and SQL*Menu) will not be used in developing MCTRSS.

Independent Screen Design Package. An independent screen package will be used to design the user interface for MCTRSS. An independent screen package will reduce total dependence on Oracle as the DBMS

for future enhancements. With an independent package, the DBMS can change without a major impact on the user interface. VERMONT VIEWS 3.0 for INTERACTIVE UNIX will be used as the screen interface designer.

Accessing Remote MCTRSS Databases. MCTRSS shall be designed with the capability to access remote MCTRSS databases in addition to accessing local databases.

Communication Interfaces. A requirement for MCTRSS is for it to run on a LAN. PROCOMM PLUS communications software is provided as part of the system software.

5.3 COMMUNICATIONS REQUIREMENTS

The Standards Branch, T&E Division MCCDC, will be the MCTRSS system administrator and manage the master system/database. Other branches within T&E Division and other divisions within MCCDC will have access to MCTRSS through the Banyan network. Selected offices within Headquarters Marine Corps and MARFORLANT/PAC will also have access to MCTRSS through the Banyan network. MEFs and MARRESFOR will have their own MCTRSS system/databases, with the capability for data exchange with the MCCDC system via existing network and/or floppy disk.

5.4 INTERFACES

The MCTRSS will interface with the MCLLS, Requirements Catalogue, and MCCRES databases. Currently T&E budget data, Mission Area Analyses data, IG readiness data, FONs data, and MNS data reside in PC word processing or spreadsheet format at various locations, all with access to Banyan. MCTRSS will have the capability to import this data into the master database electronically.

5.5 SUMMARY OF IMPACTS

5.5.1 ADP ORGANIZATIONAL IMPACTS

A MCTRSS master systems administrator needs to be designated within the Standards Branch, T&E Division, MCCDC. In addition, a MCTRSS local systems administrator needs to be designated at each of the four remote MCTRSS sites. No changes in authorized strength, location, or skill level are required.

5.5.2 ADP OPERATIONAL IMPACTS

There are no known impacts on USMC/MCCDC ADP operational procedures with MCTRSS implementation.

5.5.3 ADP DEVELOPMENT IMPACTS

ADP developmental impacts are minimized because MCTRSS is a modification to an existing, operational system. The greatest impact is on database development, including provision for electronic transfer of data, and providing network compatibility. Full database development is expected to require eight man-years (four individuals X 24 mos.) Software modification is estimated at four man-years. Nine months is planned for prototype development, three months for test and evaluation, and twelve months implementation and fielding.

5.6 FAILURE CONTINGENCIES

The following minimum failure contingencies must be addressed by the MCTRSS:

- Restart. A restart is initiated each time the system is brought back up after a normal shut-down or after a termination caused by a correctable software or hardware problem that does not necessitate a system initialization. A restart will store the current operational environment existing at the time of termination.

- Other:

  (1) Copies of all master files must be made daily when changes have been made. Copies of these files must be removed from the computer site at least monthly.

  (2) Finalized Continuity of Operations Plans (COOP) must allow for backup capability, in the event of a major problem. The COOP will have all contingencies listed, as to how the customer will operate and conduct business during major system problems. Each site will have its own COOP. MCTRSS sites must have the capability, so that if one site goes down, all input/output can be diverted to another site.

5.7 ASSUMPTIONS AND CONSTRAINTS

The following assumptions and constraints relate to development and operation of MCTRSS:

- Future MCTRSS sites have organic hardware capability to support MCTRSS. The only additional hardware requirement is for a removable hard drive that contains the MCTRSS software.
- Users remote to the five MCTRSS sites (T&E Division, I MEF, II MEF, III MEF, and MARRESFOR) will have read-only capability to the database. Comments and feedback to the primary sites will be via existing "E" mail capability.
- Funds will be available to support the required level of effort.

SECTION 6
SECURITY

6.1 BACKGROUND INFORMATION

MCTRSS will provide T&E assessment data that in itself is unclassified and nonsensitive but when combined with resource planning data it becomes sensitive in nature. As a result, normal system security considerations are discussed in the following sections.

6.2 USER ACCESS AND DATA SECURITY

- Access to the MCTRSS is controlled through the use of User IDs and Passwords. These IDs and Passwords are assigned by the individual assigned as the MCTRSS master system administrator (MSA). The MSA will be responsible for ensuring that only authorized personnel receive IDs and Passwords. Access to the Oracle Database system for inquiries beyond those provided by MCTRSS will be the responsibility of the MSA.

- Users are permitted access to portions of the MCTRSS program based on the type of user they are. The MSA enters this information into the MCTRSS when the User IDs and Passwords are assigned. Users must contact the MSA for access changes.

- Access to the MCTRSS for uses other than the running of the MCTRSS program is also controlled by the use of User IDs and Passwords.

6.3 CONTROL POINTS, VULNERABILITIES, AND SAFEGUARDS

This paragraph describes the input, processing and output control points, their vulnerabilities and safeguard requirements to reduce risk to an acceptable level.

6.3.1 CONTROL POINTS

The following control points have been identified as those that there is a known vulnerability which requires a specific safeguard.

- Input Control Points. Data are entered into the MCTRSS from personnel at a MCTRSS PC work-station located at one of five sites. The MCTRSS PC work-station is connected to the BANYAN through a communication link. A MCTRSS work-station can be located at any geographical point within a site that best supports their mission.

- Process Control Points.
  Process control points are the same as Input Control Points.

- Output Control Points.
  Production. Output devices are video display units, system printers, and online transactions.
  Distribution. Output is routed to a device that is identified by the system administrator. These output devices may be remote to the site and connected to a MCTRSS site by LAN or by disc.

6.3.2 VULNERABILITIES

- Input/Output Control Points.
  Persons causing physical damage to the work-station devices.
  Equipment downtime.
  Communication link downtime.

- Input Control Points.
  Unauthorized input of data.

- Output Control Points.
  Output lost after delivered by the system.
  Output stolen.
  Output mis-routed.

- Processing Control Points.
  Application software failure

Hardware failure.

Facilities utilities failure.

Natural disaster.

Sabotage.

Human error.

6.3.3 SAFEGUARDS

Security for the processing site is the responsibility of that site.

- Administrative Services. Assign a MCTRSS local system administrator (LSA) for each organization where MCTRSS resides. Identify personnel requiring access and assign a user identification code and associated password. Provide training for use of the input/output work-stations to include output distribution and recovery.

- Physical Safeguards. Physical security for the processing site is the responsibility of that site.

- Technical Safeguards.
  (1) Assign each user a user identification and an associated machine generated random password every year.
  (2) Disconnect the user from the system and notify the systems administrator if there is any incident where someone attempts to access the system three times with the wrong password.

6.4 SYSTEM MONITORING AND AUDITING

This Section shall describe MCTRSS user requirements for the production of an audit trail necessary to conduct MCTRSS causative research. The following are considered general level requirements:

6.4.1 JOURNALIZING

MCTRSS provides the capability for a user to record notes during the assessment/resource allocation process. There are two distinct functions within "NOTES": one of the functions is to assign or view a note on an individual screen; the other is to view all notes in the MCTRSS.

6.4.2 AUDIT TRAIL

The MCTRSS audit trail will be automated allowing the user to track the T&E program, funding priority, and mission importance to required capability, requirements, and guidance.

Appendix A

Definitions & Acronyms

APPENDIX A
DEFINITIONS

Alternative Implementation Set

The set of possible solutions that can fill a need. The solution set considers all feasible combinations of Doctrine, Organization, Training, Equipment, and Support (DOTES).

Battlefield Function

A Battlefield Function is one of seven tactical processes or functions (Command, Control and Support; Intelligence; Maneuver; Fires; Air Defense; Mobility/Countermobility/Survivability; and Combat Service Support) that occur over time with out implying how they will be accomplished or what instruments or methods will be used to perform them. The functions provide an operational framework of the battlefield and a standard reference from which collective analysis of mission areas can be conducted during Mission Area Analysis. The functions are adapted from the Army's Battlefield Functions that are explained in detail in TRADOC PAMPHLET 11-9, BLUEPRINT OF THE BATTLEFIELD and are referred to as the BLUEPRINT FOR THE TACTICAL LEVEL OF WAR. Battlefield Functions will be explained in an upcoming revision to FMFM 2, "*Marine Air-Ground Task Force: A Global Capability*".

Budget

The plan for the allocation of resources that are available for, required for, or assigned to a particular purpose.

Budget Activity

A major functional classification of appropriation type within a budget.

Budget Line Item

The lowest level of appropriation visibility within a budget.

Capability

An ability to achieve an objective, action or task that results from analyzing a concept. Marine Corps capabilities are categorized as operational and functional.

An OPERATIONAL CAPABILITY is the ability to achieve the National Security Strategy responsibilities of the Marine Corps. The Marine Corps has identified the following 8 operational capabilities:

- Command, Control and Surveillance
- Battlespace Dominance
- Power Projection
- Force Sustainment
- Forward Deployment
- Crisis Response
- Strategic Deterrence
- Sealift

A FUNCTIONAL CAPABILITY is the ability to achieve the Marine Corps Strategy set forth in the operational capabilities. Functional capabilities are prioritized in the Marine Corps Master Plan.

A SUPPORTING CAPABILITY is the ability of the Supporting Establishment to support the total force.

Capability Set

A group of related implementing actions from the various requirements categories (doctrine, organization, training and education, equipment, facilities and support) necessary to achieve solutions to deficiencies or to take advantage of opportunities.

Class

One iteration of a course, usually designated numerically.

Collective Standard

Measures of mission performance used to determine whether units can or cannot perform an assigned task. (e.g. collective training standards equate to Mission Performance Standards (MPS) contained in the MCCRES.)

Collective Task

A unit of work or action requiring interaction between two or more individuals for its accomplishment.

Concept

A notion or statement of an idea, expressing how something might be done or accomplished. A concept is broad in scope and pertains to the operational warfighting or major functional areas such as aviation, intelligence and combat service support. These concepts are analyzed to determine those capabilities that will be required to implement the concept. Concepts are characterized as operational or functional.

> An OPERATIONAL CONCEPT is a broad statement of an idea in sufficient detail to provide the basis for determining new or revised doctrine, organization, training and education, equipment, or facilities and support. The three current major operational concepts are "Operational Maneuver from the Sea", Sustained Operations Ashore" and "Other Expeditionary Operations."
>
> A FUNCTIONAL CONCEPT is a statement of how the elements of the MAGTF (command, air combat, ground combat, combat service support) operate or will operate in support of each major operational concept.
>
> A SUPPORTING CONCEPT is a broad statement that describes the way in which the Supporting Establishment supports the total force.

Condition

A restricting or modifying factor.

Course

An ordered arrangement of subject matter designed to instruct personnel.

Curriculum

The planned content for a course of instruction.

Deficiency

A shortcoming in some aspect of a required capability, as specified in the Marine Corps Master Plan, identified through analysis, assessment or the formal studies program.

Delivery System

The instructional method and media used to present the instruction.

Doctrinal Program

Packaged Marine Corps requirements and the means to achieve them that are established to implement a fundamental principle which guides the Corps actions in support of national objectives.

Doctrinal Requirement

An established need based on a validated deficiency in the ability of the Marine Corps to carry out a fundamental principle which guides the Corps actions in support of national objectives.

Drill

A battle/tactical exercise designed to prepare a unit or team to perform a tactical technique or procedure through progressive repetition. It is used, principally, to train small units to perform tasks requiring a high degree of teamwork, such as fire and maneuver actions in danger areas, and counter-ambush techniques.

Equipment Program

Packaged Marine Corps requirements and the means to achieve them established to provide non-expendable items needed to outfit/equip an individual or organization in order to meet missions.

Equipment Requirement

An established need based on a validated deficiency in the ability of the Marine Corps to provide non-expendable items needed to outfit/equip an individual or organization.

Exercise

Training events conducted under simulated combat conditions in which troops and armament of one side are actually present. Forces or equipment of the opposition may be either imagined or partially or fully present.

Functional Capability

Functional Concept

See CONCEPT.

Individual Task

A composite of related activities performed for an immediate purpose by an individual.

Individual Job Task

A specific combination of an INDIVIDUAL TASK that makes up a JOB. A JOB must be associated with at least one and possibly many INDIVIDUAL TASKs.

Individual Standard

Level of proficiency to which a Marine must perform a task.

Instructional Setting

The environment in which instruction or learning will occur.

Integrated Program

Packaged Marine Corps requirements to meet missions linked to the means (e.g. materiel, human resources) to achieve them.

Integrated Requirement

A capability that satisfies a doctrinal, organizational, training and education, equipment or/and facilities and support need that has been identified as a deficiency or opportunity. The INTEGRATED REQUIREMENT is the optimal combination of DOTES elements that has been selected.

Intervention Alternative

A potential "solution" or plan to correct a "real" need. It may consist of the purchase of new equipment, of providing additional training, of altering the present methods of training or any other viable means of correcting the deficiency.

Job

The combination of all human performance required for one personnel position in a system. (e.g., driver).

Job Aid

A checklist, procedural guide, decision table, worksheet, algorithm, or other tool used by job incumbents to aid in task performance.

Knowledge

Information required to perform an activity for the effective accomplishment of a task.

Learning Objective

A statement of the behavior or performance expected as a result of a learning experience.

Location

A region of the world for which plans are developed.

Military Manpower Training Report (MMTR) Training Category

One of five classifications of individual training (Recruit, Officer Acquisition, Specialized Skill, Flight, and Professional Development Education) used by OSD and Congress for planning, programming and budgeting purposes.

Mission

A task, together with a purpose, which clearly indicates the action which is to be taken and the reason therefor.

Mission Area

A grouping of related functions which together support the accomplishment of a mission. There are currently 12 Mission Areas.

Mission Capability

A required ability to accomplish a mission supporting a concept of operations.

Need

Lack of something required or desirable.

Occupational Field

A range of related Military Occupational Specialties (MOSs).

Operational Capability

See CAPABILITY.

Operational Concept

See CONCEPT.

Opportunity

The recognition of a current or conceptual capability that if expanded upon would enhance battlefield success.

Organization

An administrative structure with a mission.

Organizational Program

A packaged Marine Corps requirement linked to the means to achieve an improvement in an administrative structure that has a mission.

Organizational Requirement

An established need based on a valid deficiency in an administrative structure with a mission.

Person

A human being.

Plan

A detailed scheme or method for the accomplishment of an objective.

Program Element

A major classification of appropriations within the DoD Program Objectives Memorandum (POM) and Future Years Defense Plan (FYDP).

Resource

An asset required or made available to an organization to accomplish a purpose.

Skill

The ability to perform an action.

Standard

An exact value, a physical entity, or an abstract concept, established and defined by authority, custom, or common consent to serve as a reference, model, or rule in measuring quantities or qualities, establishing practices or procedures, or evaluating results. A fixed quantity or quality.

Support Program

Packaged Marine Corps support requirements linked to the means to achieve them.

Support Requirement

An established support need based on a validated deficiency justifying the timely allocation of resources to achieve a capability to accomplish approved military objectives, missions, or tasks.

Supporting Capability

See CAPABILITY.

Supporting Concept

See CONCEPT.

T&E Capability Set

One of the eight classifications of individual training (Recruit, Officer Acquisition, Specialized Skill, Mission-oriented, Flight, Professional Military Education, Marine Battle Skills and Related) used internally in the Training and Education Division for planning, programming and budgeting purposes.

T&E Intervention Action

An action taken to correct a T&E deficiency or to take advantage of a T&E opportunity.

T&E Program

Packaged Marine Corps training and education requirements linked to the means to achieve them that are needed to meet a mission.

T&E Requirement

Any identified training and education need based on a validated deficiency justifying the allocation of resources to achieve a capability to accomplish approved military objectives, missions or tasks.

Task

A composite of related activities performed for an immediate purpose. (Activities are perceptions, decisions, and responses in a single unit of work and are written in operator/maintainer language, e.g. "change a tire.")

Test

Any device or technique used to measure performance.

Test Item

A performance measure.

Training Event

An occurrence such as a wargame, exercise or drill which supports training.

Training Facility

A permanent or semi-permanent government, military, or contractor real property used for the purpose of supporting or conducting training.

Training Material

Weapons, equipment, tools, supplies and systems used for training and education purposes.

Training Objective

A goal of a training event.

Training Plan

A document that outlines the general plan for the conduct of individual and collective training in an organization.

Training Task

A task or job-task identified to be trained.

Unit

Any military element whose structure is prescribed by competent authority, such as a table of organization and equipment: specifically, part of an organization.

Unit Mission

A specific combination of one UNIT with one MISSION. A UNIT must be associated with at least one and possibly many MISSIONs.

Unit Mission Task

A unique identification of one TASK to be performed by a UNIT in the conduct of a specific MISSION. A UNIT with a specific MISSION must be associated with at least one and possibly many TASKs.

Wargame

Battle simulations, both manual and computer-assisted.

Warfighting Environment

The anticipated conflict environment that covers the spectrum of conflict as defined in CJCS MOP 50. The current environments are; Peace Through Confrontation (PTC), Lesser Regional Conflict (LRC), Major Regional Conflict (MRC), Theater Nuclear War (TNW) and General Nuclear War (GNW).

ACRONYMS

AAR	After Action Report
ACE	Air Combat Element
ACMC	Assistant Commandant of the Marine Corps
AIS	Automated Information System
ATIMP	Army Training Information Management Program
ATSDMS	Automated Training Standards Development and Maintenance System
BA	Budget Activity
BF	Battlefield Function
BFTD	Battlefield Training Days
BOBCAT	Blueprint of the Battlefield Computerized Assessment Tool
C2	Command & Control
C4	Command, Control, Communications, Computers
C4I2	Command, Control, Communications, Computers, Information & Intelligence
CALL	Center for Army Lessons Learned
CBRS	Concept Based Requirements System
CDP	Combat Development Process
CE	Command Element
CG	Commanding General
CINC	Commander-In-Chief
CJCS	Chairman, Joint Chiefs of Staff
CMC	Commandant of the Marine Corps
CNA	Center for Naval Analysis
CODAP	Comprehensive Occupational Data Analysis Program
COMMARFORLANT	Commander Marine Forces Atlantic
COMMARFORPAC	Commander Marine Forces Pacific
COMMARRESFOR	Commander Marine Reserve Forces
COOP	Continuity of Operations
CPU	Central Processing Unit
CRS	Capability Review System
CSS	Capability Support System
CSSE	Combat Service Support Element

DoD	Department of Defense
DON	Department of the Navy
DPG	Defense Planning Guidance
FMF	Flat Marine Force
FONS	Fleet Operational Needs Statement
FSPG	Force Structure Planning Group
FYDP	Future Years Defense Plan
GAO	Government Accounting Office
GCE	Ground Combat Element
GNW	General Nuclear War
HQMC	Headquarters Marine Corps
I&L	Installations & Logistics
IG	Inspector General
IPL	Integrated Priority List
ISMO	Information Systems Management Office
ITS	Individual Training Standard
ITSS	Individual Training Standard System
JCLL	Joint Center for Lessons Learned
JDSS	Joint Decision Support System
JTF	Joint Task Force
LAN	Local Area Network
LCM	Life Cycle Management
LRC	Lesser Regional Conflict
MA	Mission Area
MAA	Mission Area Analysis
MAGTF	Marine Air-Ground Task Force
MARSCHOOL	Marine School
MATMEP	Maintenance Training Management and Evaluation Program
MATS	Miles Automated Tracking System
MCAIMS	Marine Corps Automated Information Management System
MCCDC	Marine Corps Combat Development Command
MCCRES	Marine Corps Combat Readiness Evaluation System
MCDC	Mid-Term Combat Development Capabilities

MCI	Marine Corps Institute
MCLLS	Marine Corps Lessons Learned System
MCMP	Marine Corps Master Plan
MCSAM	Marine Corps Sorts Assessment Module
MCTRSS	Marine Corps Training Readiness Support System
MEB	Marine Expeditionary Brigade
MEF	Marine Expeditionary Force
METL	Mission Essential Task List
MEU	Marine Expeditionary Unit
MILCON	Military Construction
MIDAS	MCCDC Integrated Data Automation System
MNS	Mission Need Statement
MOS	Military Occupational Specialty
MOSMAN	Military Occupational Specialties Manual
MP	Military Manpower
MPS	Mission Performance Standard
MRC	Major Regional Conflict
MSA	MCTRSS System Administrator
MSC	Major Subordinate Command
MSTP	MAGTF Staff Training Program
NEO	Noncombatant Evacuation Operation
O&M, MC	Operation & Maintenance, Marine Corps
OPR	Office with Primary Responsibility
P&R	Plans & Requirements
PC	Personal Computer
PE	Program Element
PEG	Program Evaluation Group
PMC	Procurement, Marine Corps
POM	Program objectives Memorandum
PP&O	Plans, Policies & Operations
PPBS	Planning, Programming and Budgeting system
PRG	Program Review Group
PTC	Peace Through Confrontation

PWG	POM Working Group
R&D	Research & Development
RA	Remedial Action
RAM	Random Access Memory
RAP	Remedial Action Program
RAT	Readiness Assistance Team
RDBMS	Relational Database Management System
RFMSS	Range Facility Management Support System
SAT	System Approach to Training
SATS	Standard Army Training System
SDS	Solution Development System
SEMP	Supporting Establishment Master Plan
SOC	Special Operations Capable
SORTS	Status of Resources and Training System
SQL	Structured Query Language
T&E	Training and Education
T&R	Training and Readiness
TDP	Training Development Process
TLCO	Task Level Capability Objective
TNW	Theater Nuclear War
TRADOC	Training & Doctrine Command (U.S. Army)
TRRMS	Training Resource Requirements Management System
UJTL	Universal Joint Task List
USMC	United States Marine Corps
WFE	Warfighting Environment

Appendix B

Key Based Data Model

APPENDIX B

KEY-BASED DATA MODEL

This Appendix presents the Overview Data Model and four "views" to help understand the relationship between data entities and attributes. The data model identifies data requirements and relationships needed to establish a decision support data base.

The purpose of the Key-based Data Model is to define the current ("AS-IS") data used by the Marine Corps in the Combat Development Process (CDP) as it pertains to Training and Education processes. Emphasis is placed on that data that impacts training program assessment, resource allocation and readiness. The model will provide:

- A basis on which to build a training readiness assessment and resource allocation framework;
- A reference for database design; and
- A definition of T&E entity relationships within the Combat Development Process.

The model was developed within the context of data standardization procedures outlined in various DoD directives[1]. IDEF1X[2] methodology was used to develop the data model.

The Overview Data Model, View 1, emphasizes data that impact training program assessment, resource allocation, and readiness within the Combat Development Process. Views 2 through 5 depict the data relationships centered around CDP/Mission, Concept, Program and Task respectively.

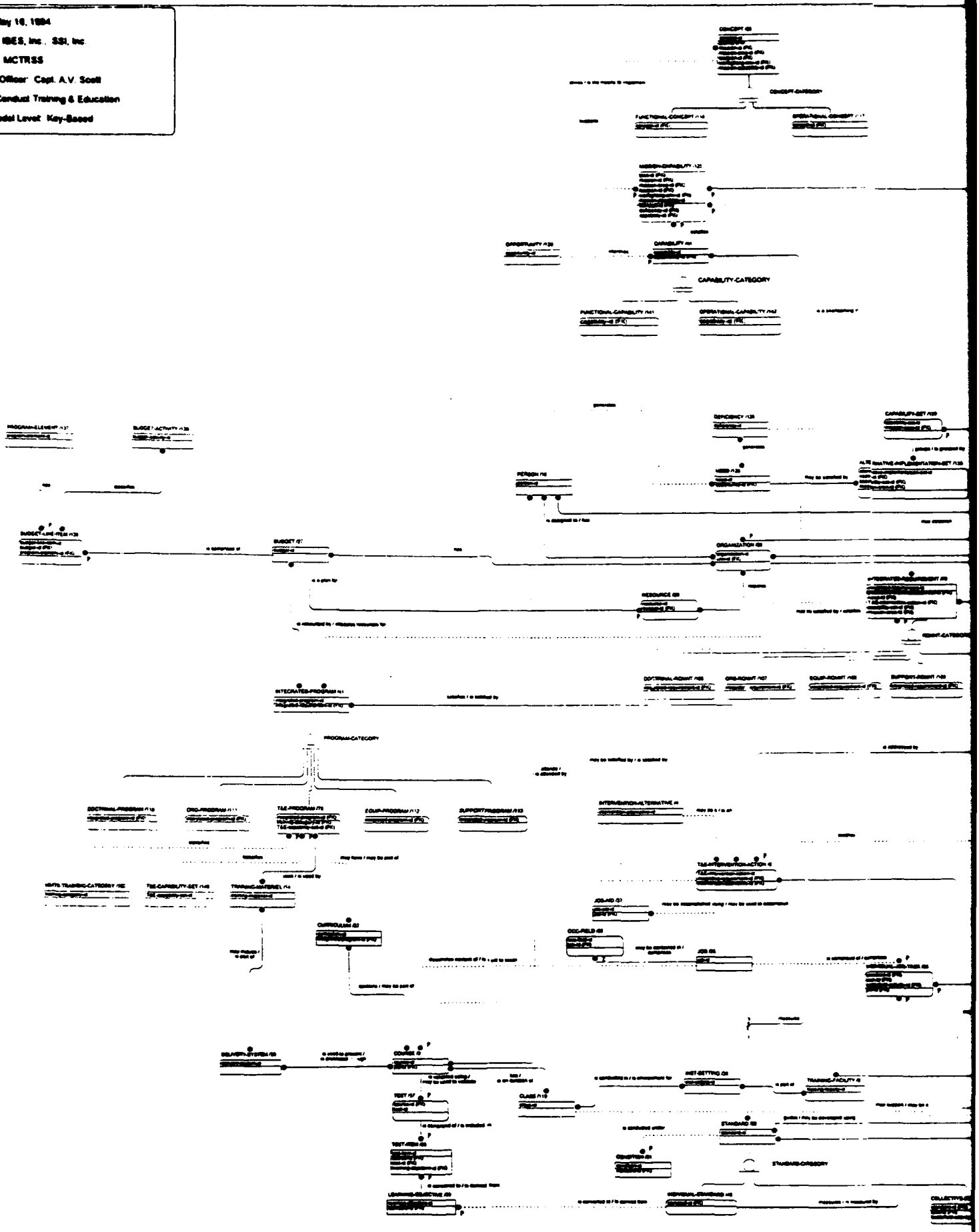
In order to show the relationship of data entities supporting training readiness assessment and resource allocation, it was necessary to expand the view of the model outside of the "traditional" boundaries of Training and Education to include the CDP. The Training and Education *"Key-based Data Model"* report dated 16 May, 1994 describes how the model was constructed.

---

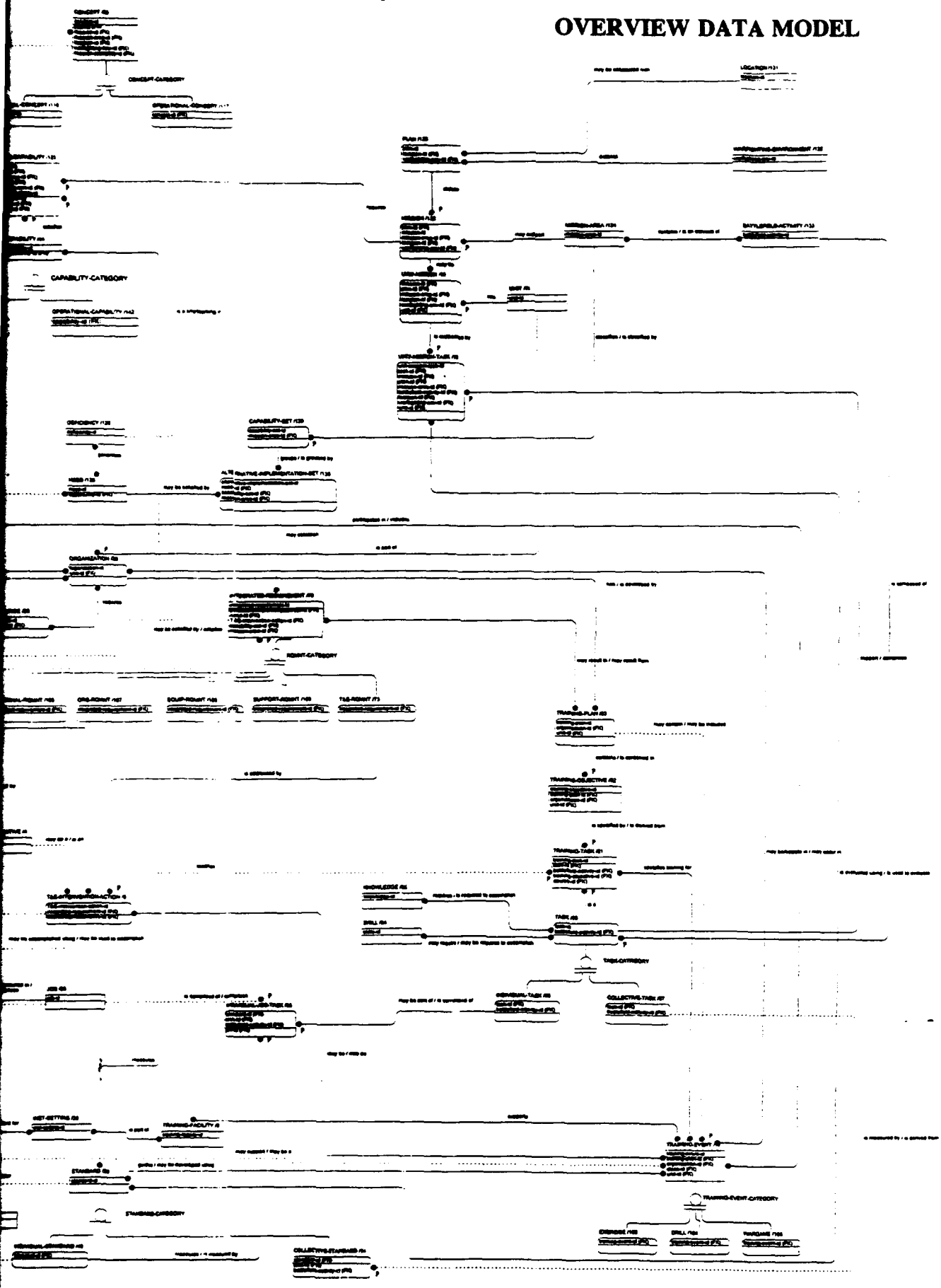
[1] See DoD directives 8320.1-M, 8320.1-M-1, 8320-M-x, and FIPS PUB 184.

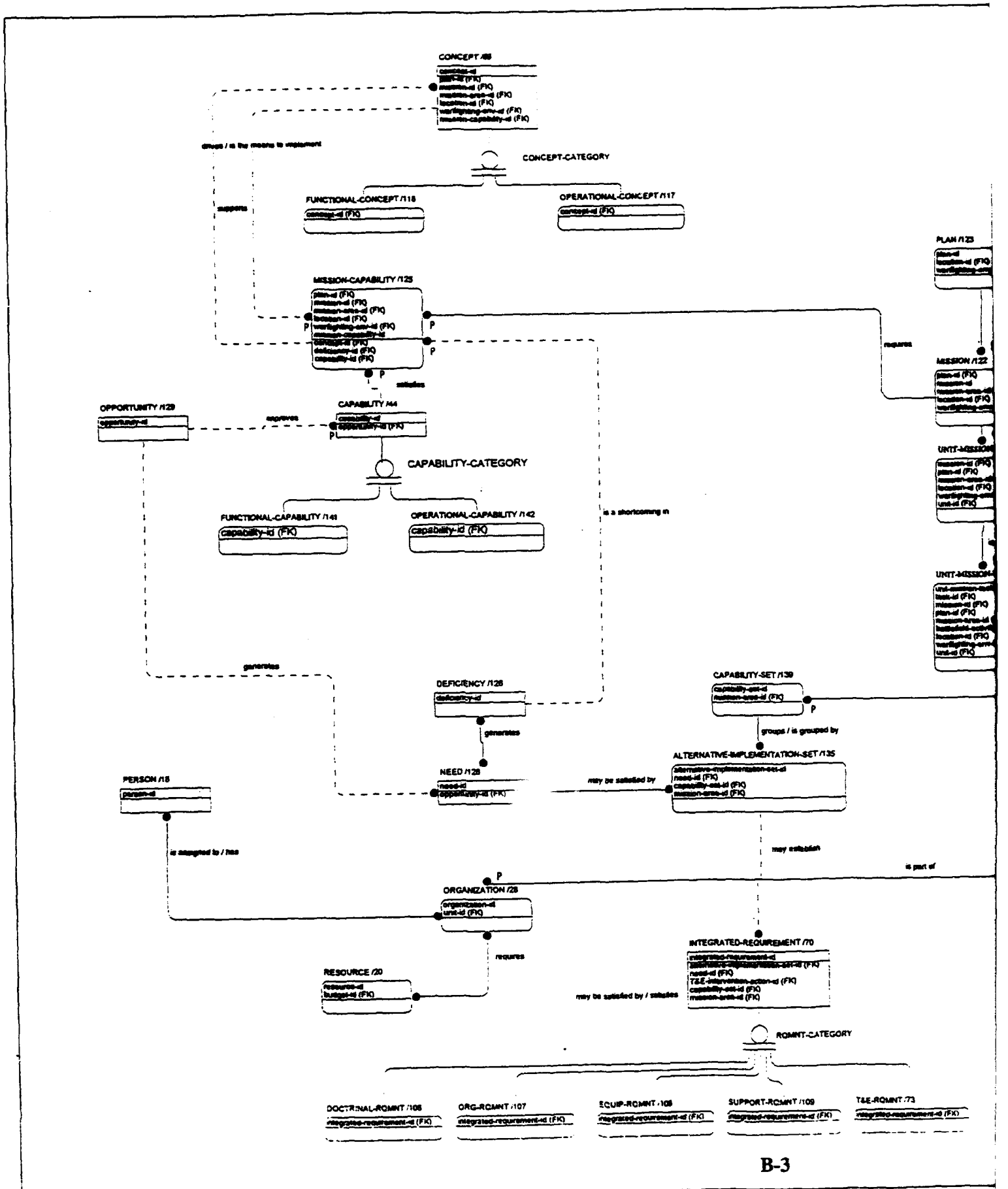
[2] IDEF1X. IDEF is an acronym for ICAM DEFinition, where ICAM stands for Integrated Computer Manufacturing. The '1' indicates an IDEF data model as opposed to '0' which indicates an activity mode. [IDEF0 is the methodology for developing activity models.] 'X' in IDEF1X stands for eXtended.

Date: May 16, 1994
Author: IDES, Inc., SSI, Inc.
Project: MCTRSS
Project Officer: Capt. A.V. Scott
View: Conduct Training & Education
Data Model Level: Key-Based

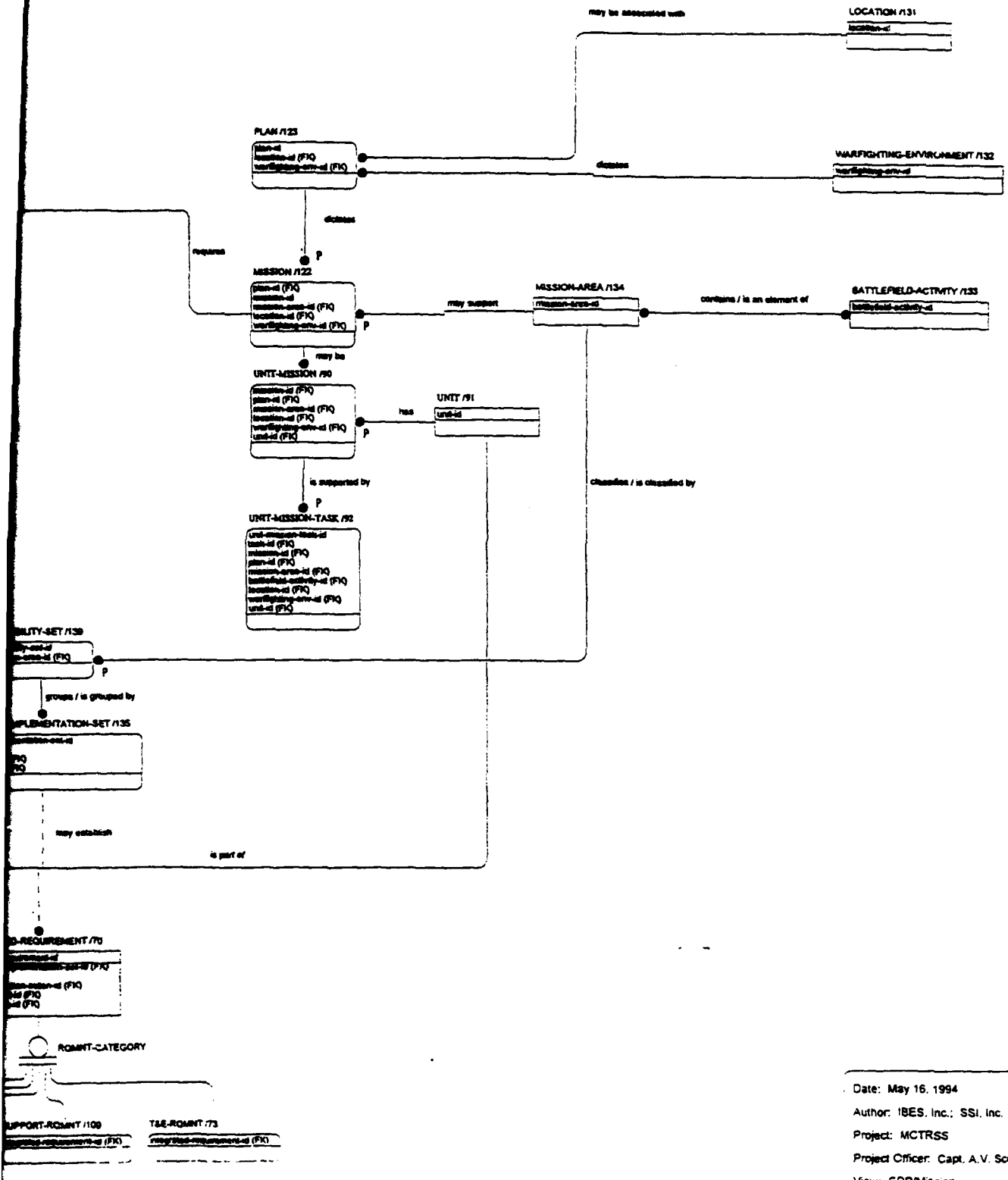


OVERVIEW DATA MODEL




CONCEPT /88
CONCEPT-CATEGORY
FUNCTIONAL-CONCEPT /118
OPERATIONAL-CONCEPT /117
MISSION-CAPABILITY /125
PLAN /123
MISSION /122
OPPORTUNITY /129
CAPABILITY /44
CAPABILITY-CATEGORY
FUNCTIONAL-CAPABILITY /141
OPERATIONAL-CAPABILITY /142
DEFICIENCY /126
CAPABILITY-SET /139
ALTERNATIVE-IMPLEMENTATION-SET /135
NEED /128
PERSON /18
ORGANIZATION /28
RESOURCE /20
INTEGRATED-REQUIREMENT /70
ROMNT-CATEGORY
DOCTRINAL-ROMNT /106
ORG-ROMNT /107
EQUIP-ROMNT /108
SUPPORT-ROMNT /109
T&E-ROMNT /73
supports
requires
satisfies
is a shortcoming in
generates
groups / is grouped by
may be satisfied by
is assigned to / has
may satisfy/sh
is part of
may be satisfied by / satisfies

CDP/MISSION VIEW



Date: May 16, 1994

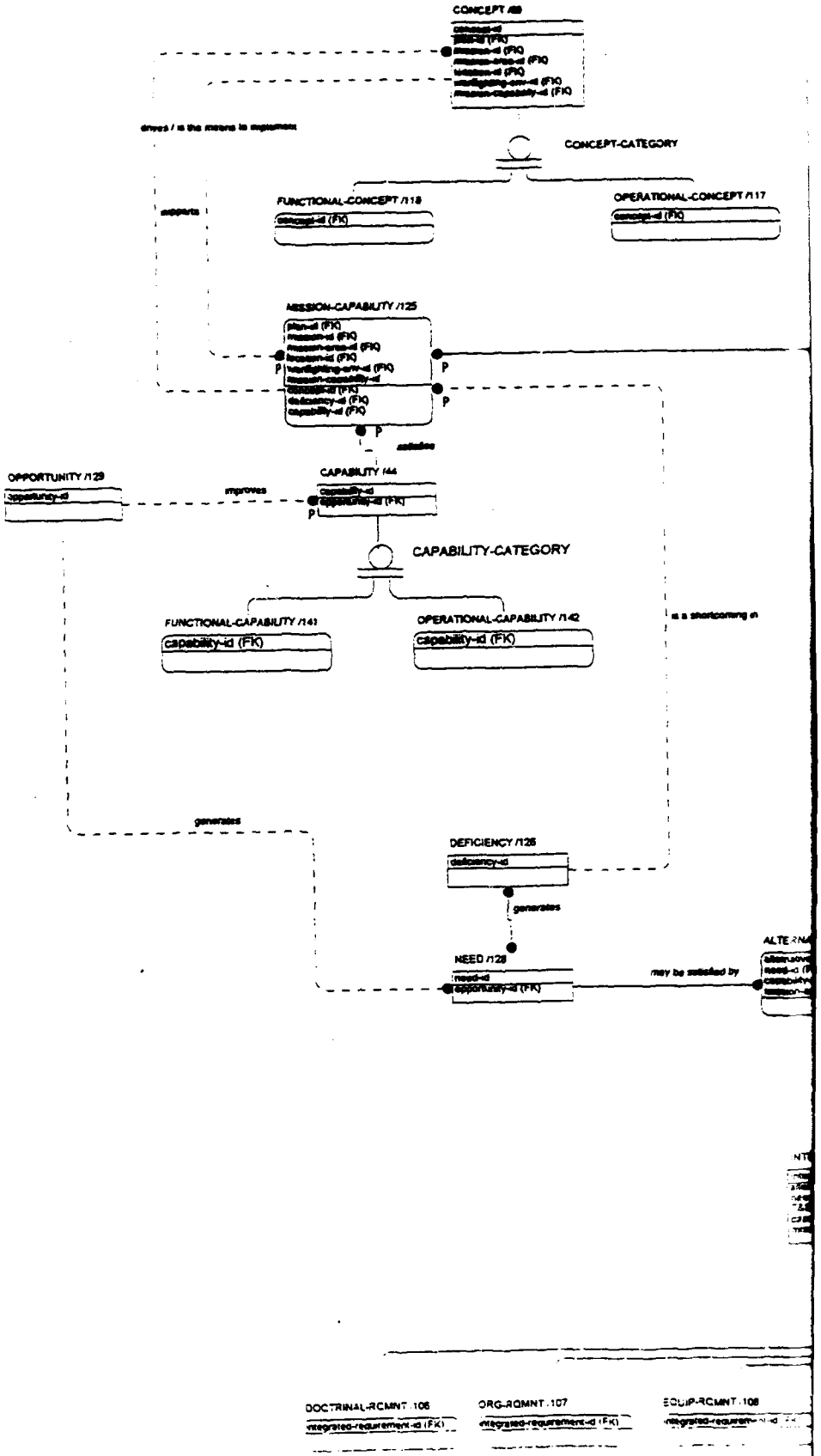
Author: IBES, Inc.; SSI, Inc.

Project: MCTRSS

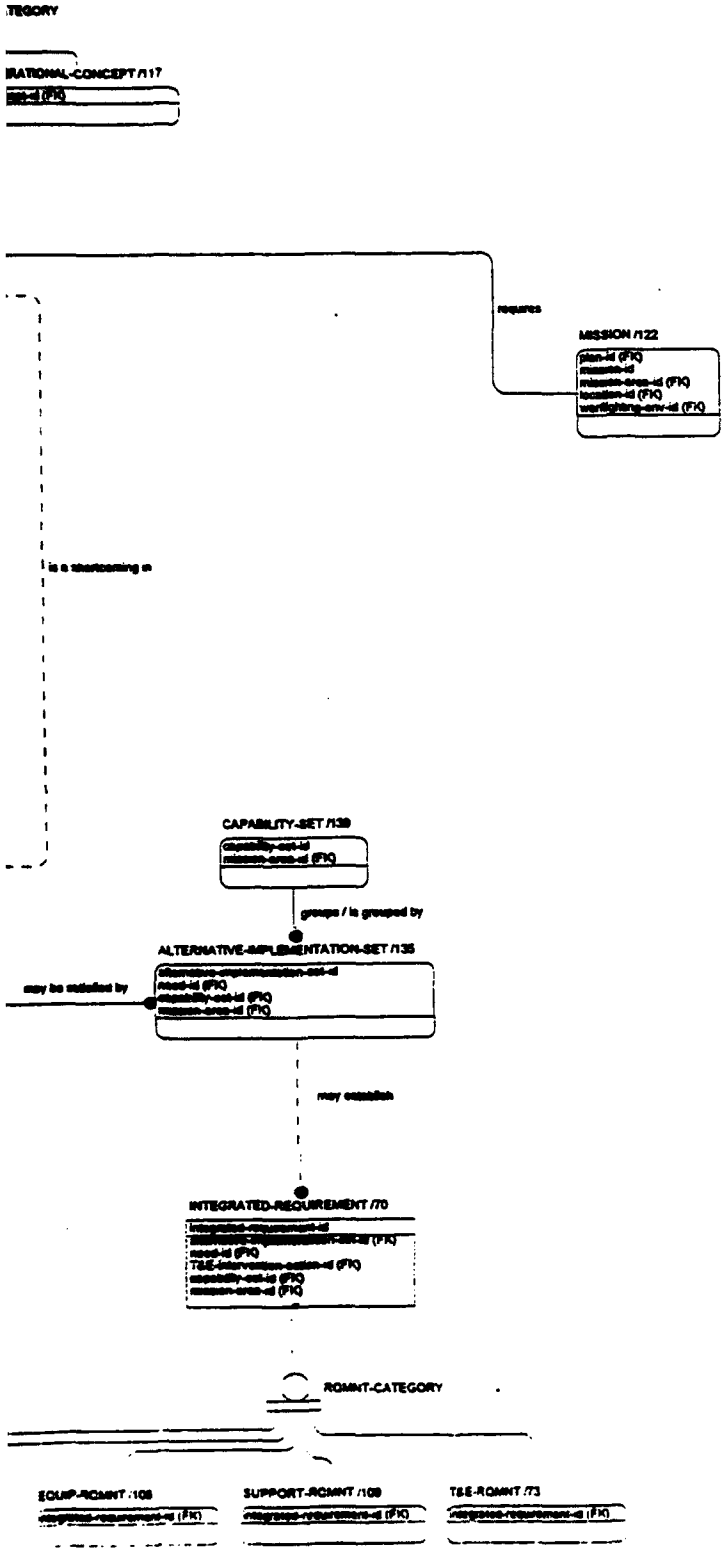
Project Officer: Capt. A.V. Scott

View: COP/Mission

Data Model Level: Key-Based


CONCEPT /88
drives / is the means to implement
CONCEPT-CATEGORY
FUNCTIONAL-CONCEPT /118
OPERATIONAL-CONCEPT /117
supports
MISSION-CAPABILITY /125
P
satisfies
OPPORTUNITY /129
improves
CAPABILITY /44
CAPABILITY-CATEGORY
FUNCTIONAL-CAPABILITY /141
capability-id (FK)
OPERATIONAL-CAPABILITY /142
capability-id (FK)
is a shortcoming in
generates
DEFICIENCY /126
deficiency-id
generates
NEED /128
need-id
opportunity-id (FK)
may be satisfied by
DOCTRINAL-RQMNT /106
integrated-requirement-id (FK)
ORG-RQMNT /107
integrated-requirement-id (FK)
EQUIP-RQMNT /108

CONCEPT VIEW



Date: May 16, 1994

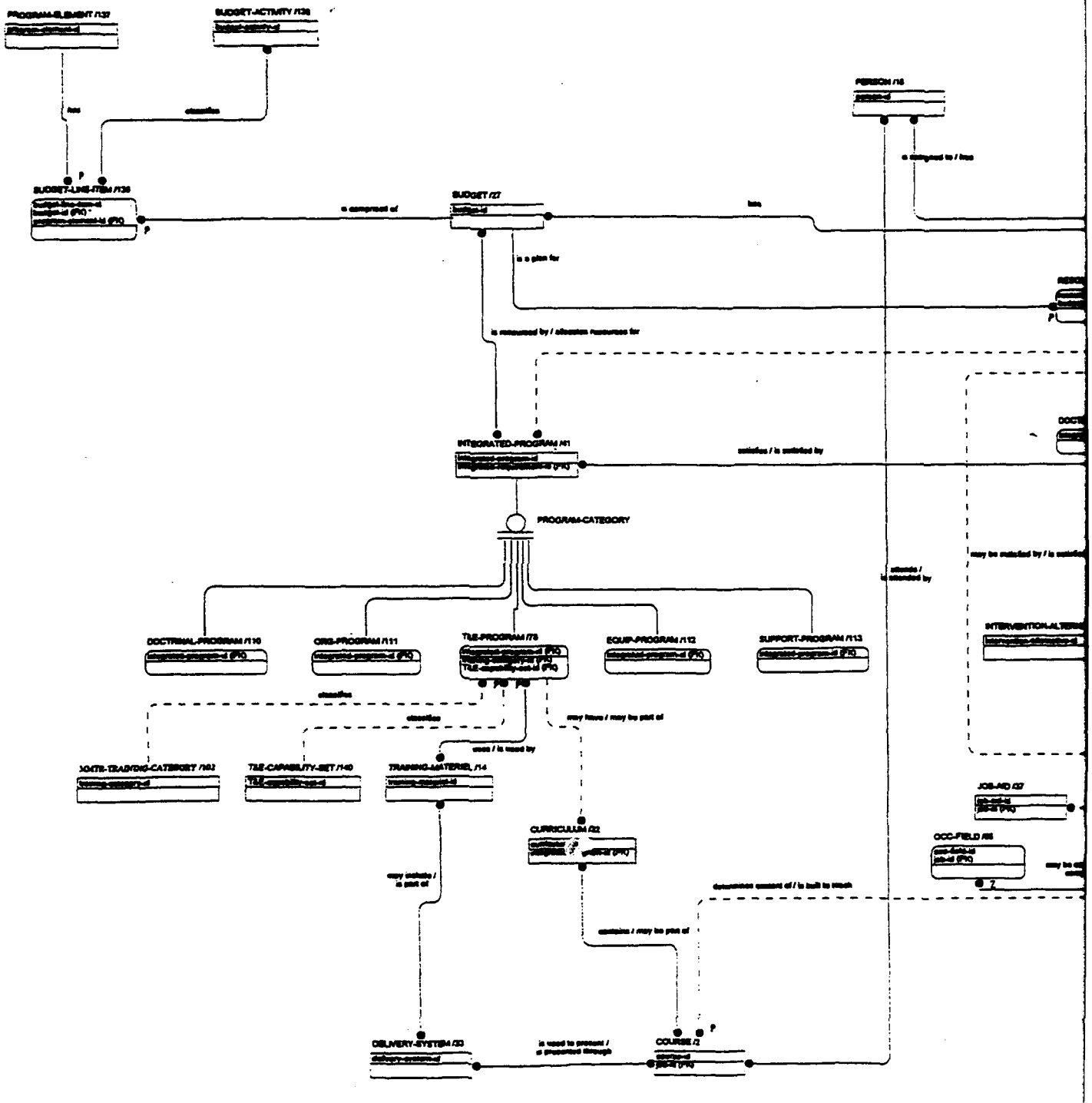
Author: IBES, Inc.; SSI, Inc.

Project: MCTRSS

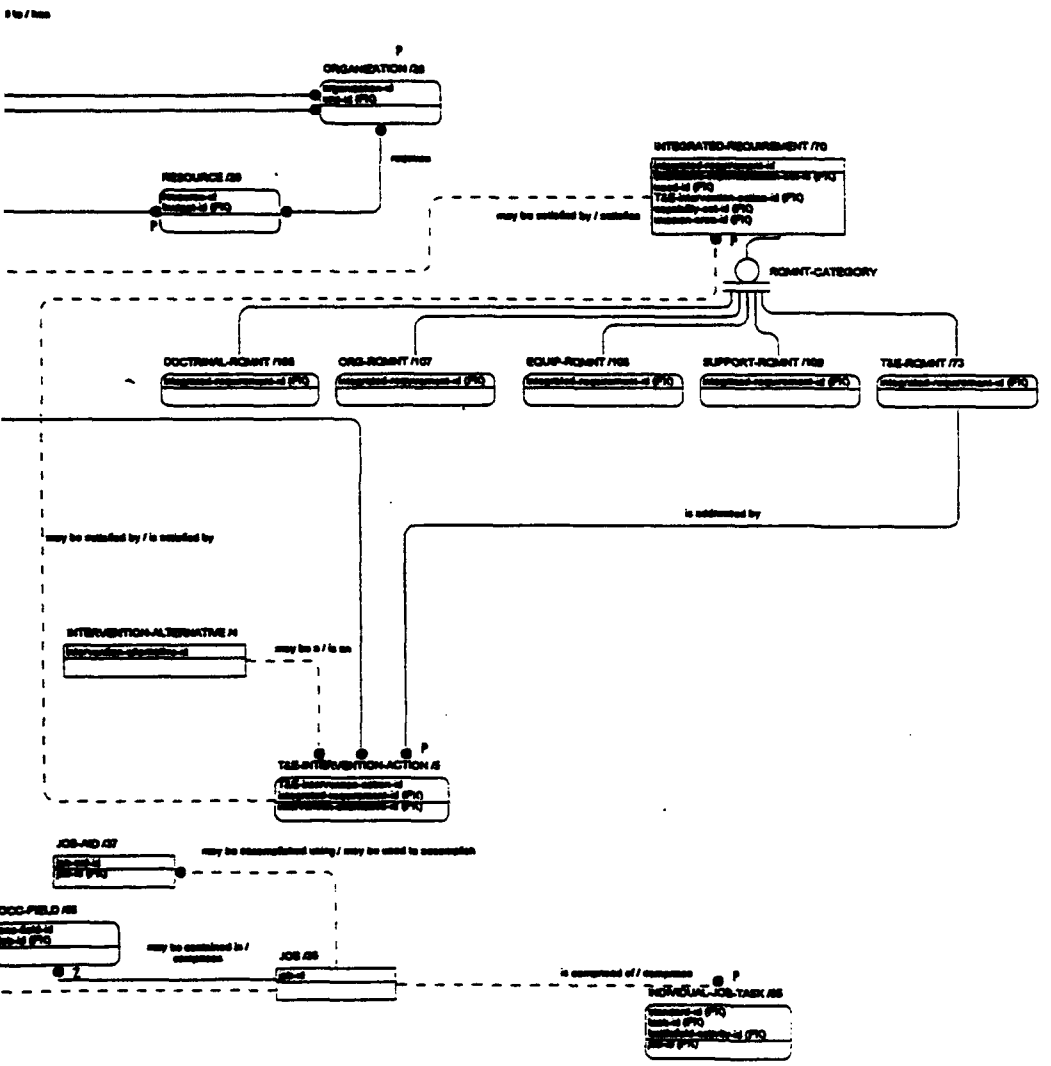
Project Officer: Capt. A.V. Scott

View: Concept

Data Model Level: Key-Based


PROGRAM-ELEMENT /137
BUDGET-ACTIVITY /136
has
classifies
PERSON /16
is assigned to / has
SUBSET-LINE-ITEM /139
is composed of
BUDGET /27
has
is a plan for
is measured by / allocates resources for
INTEGRATED-PROGRAM /41
satisfies / is satisfied by
PROGRAM-CATEGORY
DOCTRINAL-PROGRAM /110
ORG-PROGRAM /111
TILE-PROGRAM /75
EQUIP-PROGRAM /112
SUPPORT-PROGRAM /113
classifies
may have / may be part of
uses / is used by
JOINT-TRAINING-CATEGORY /162
TILE-CAPABILITY-SET /140
TRAINING-MATERIEL /14
CURRICULUM /22
JOB-AID /37
OCC-FIELD /85
may include / is part of
contains / may be part of
DELIVERY-SYSTEM /33
is used to present / is presented through
COURSE /2

PROGRAM VIEW



Date: May 16, 1994

Author: IBES, Inc.; SSI, Inc.

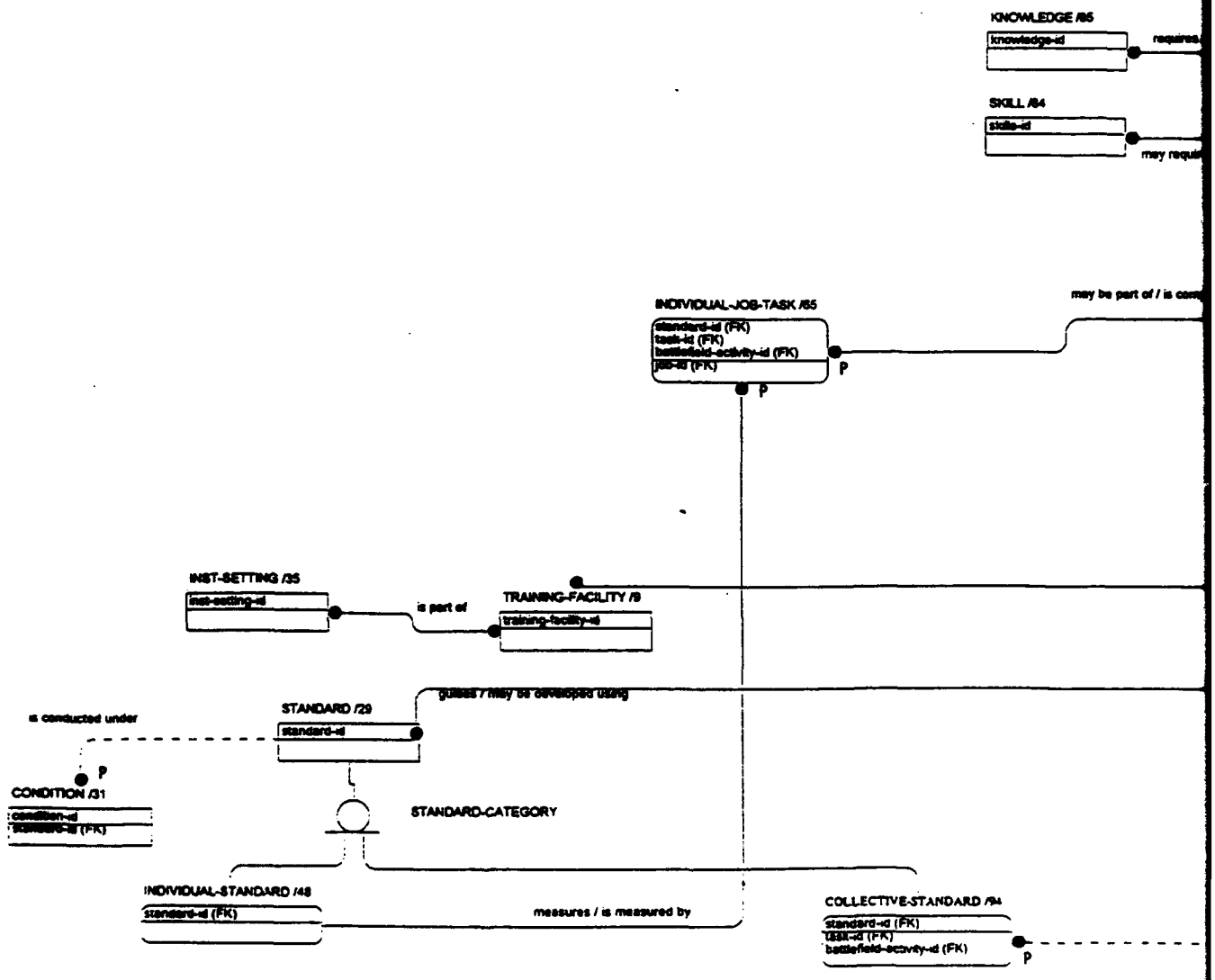
Project: MCTRSS

Project Officer: Capt. A.V. Scott

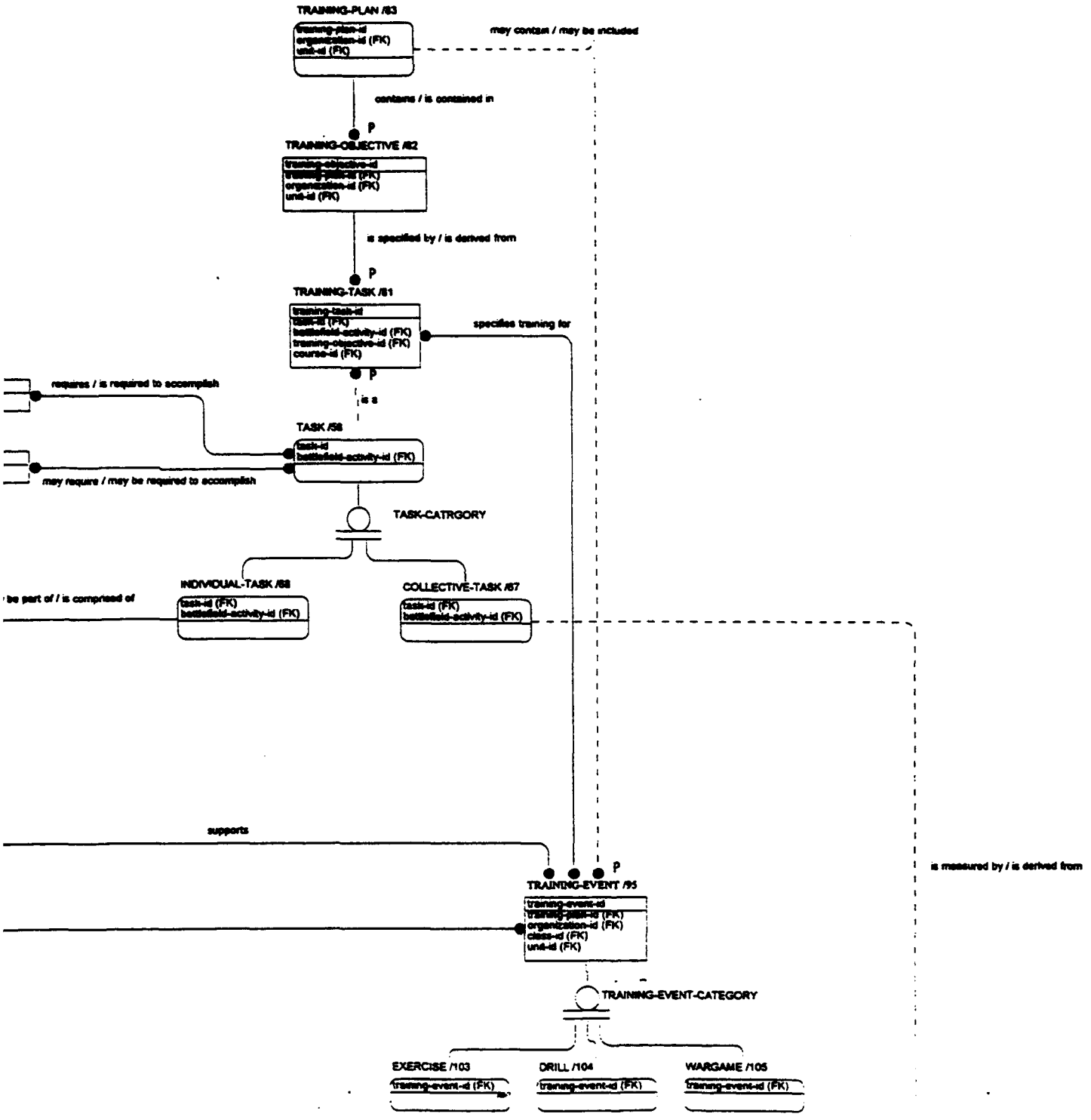
View: Program

Data Model Level: Key-Based

Date: May 16, 1994
Author: IBES, Inc.; SSI, Inc.
Project: MCTRSS
Project Officer: Capt. A.V. Scott
View: Task
Data Model Level: Key-Based



TASK VIEW


TRAINING-PLAN /83
training-plan-id
organization-id (FK)
unit-id (FK)
may contain / may be included
contains / is contained in
P
TRAINING-OBJECTIVE /82
training-objective-id
training-plan-id (FK)
organization-id (FK)
unit-id (FK)
is specified by / is derived from
P
TRAINING-TASK /81
training-task-id
task-id (FK)
battlefield-activity-id (FK)
training-objective-id (FK)
course-id (FK)
specifies training for
P
is a
requires / is required to accomplish
TASK /58
task-id
battlefield-activity-id (FK)
may require / may be required to accomplish
TASK-CATRGORY
INDIVIDUAL-TASK /68
task-id (FK)
battlefield-activity-id (FK)
be part of / is comprised of
COLLECTIVE-TASK /67
task-id (FK)
battlefield-activity-id (FK)
supports
P
TRAINING-EVENT /95
training-event-id
training-task-id (FK)
organization-id (FK)
class-id (FK)
unit-id (FK)
is measured by / is derived from
TRAINING-EVENT-CATEGORY
EXERCISE /103
training-event-id (FK)
DRILL /104
training-event-id (FK)
WARGAME /105
training-event-id (FK)

Appendix C

Activity Model

APPENDIX C
TRAINING AND EDUCATION
"AS-IS" ACTIVITY MODELS

INTRODUCTION

The "AS-IS" activity models represent current business processes associated with the Marine Corps activity *Develop/Modify/Conduct Training & Education*. The viewpoint used to develop these models is that of the Training and Education Program Manager. T&E Program Managers include personnel responsible for training in the Supporting Establishment and the Fleet Marine Force. Although training managers operate within different kinds of units and organizations and sometimes use separate automated information systems, they all perform similar activities.

The models have been developed from a "total force" aspect in that Reserve component activities are integrated within the model. This is consistent with current practice. Training and education activities for the Reserve component are basically the same as for the Active Duty component.

RELATIONSHIP TO THE COMBAT DEVELOPMENT PROCESS (CDP)

The Combat Development Process is evolving. It is a process which formulates battlefield requirements and produces combat ready MAGTF's based on fundamental concepts supported by interdependent systems for development of doctrine, training/education, organization, equipment and facilities/support. The process is employed by the Marine Corps to identify, obtain and support necessary combat capabilities. Moving from the abstract to the concrete, the CDP transforms ideas into programs. Combat development integrates planning, programming, budgeting, execution, and life cycle management. The CDP is composed of three functional, interdependent systems. The Concept Based Requirements System (CBRS) begins with the development of operational, functional and tactical concepts and leads to the identification of required combat capabilities. The Solution Development System (SDS) assesses and meets the requirements. The Capability Support System (CSS) reviews, maintains, and updates the capability throughout its life cycle. A fourth system, the Capability Review System (CRS), is a proposed automated data system that is intended to automate the Combat Development Process. The Requirements Catalog will be contained within the CRS and will track programs approved for development. When fielded, it will provide continuous feedback and interaction between developers of new systems, doctrine and training, and operators in the field.

The Combat Development Process is described in Figure C-1.

COMBAT DEVELOPMENT PROCESS	
• CMC PLANNING GUIDANCE • DEVELOP THE CONCEPT • ESTABLISH/ASSESS CAPABILITIES • DETERMINE THE REQUIREMENT	CONCEPT BASED REQUIREMENTS SYSTEM (CBRS)
• MEET THE REQUIREMENT • Doctrine • Equipment • Training & Education • Organization • Facilities/Support	SOLUTION DEVELOPMENT SYSTEM (SDS)
• SUPPORT THE CAPABILITY • Update • Review • Maintain	CAPABILITY SUPPORT SYSTEM

Figure C-1: THE COMBAT DEVELOPMENT PROCESS

Figure C-2 is a notional, "For Exposition Only" (FEO), diagram of the three major components of the Combat Development Process.

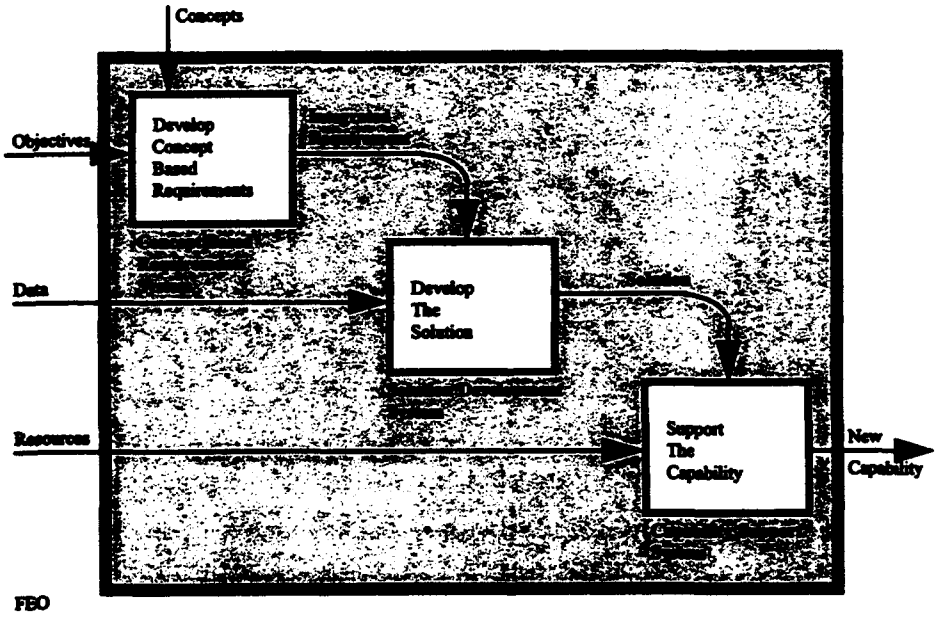


Figure C-2: THE COMBAT DEVELOPMENT PROCESS (Notional)

The major functions of the *Develop/Modify/Conduct Training and Education* activity model are shown in Figure C-3. *Develop/Modify/Conduct Training and Education* activities are controlled by requirements that are outputs (products) of the set of CDP activities that comprise the *Develop Concept Based Requirements* function.

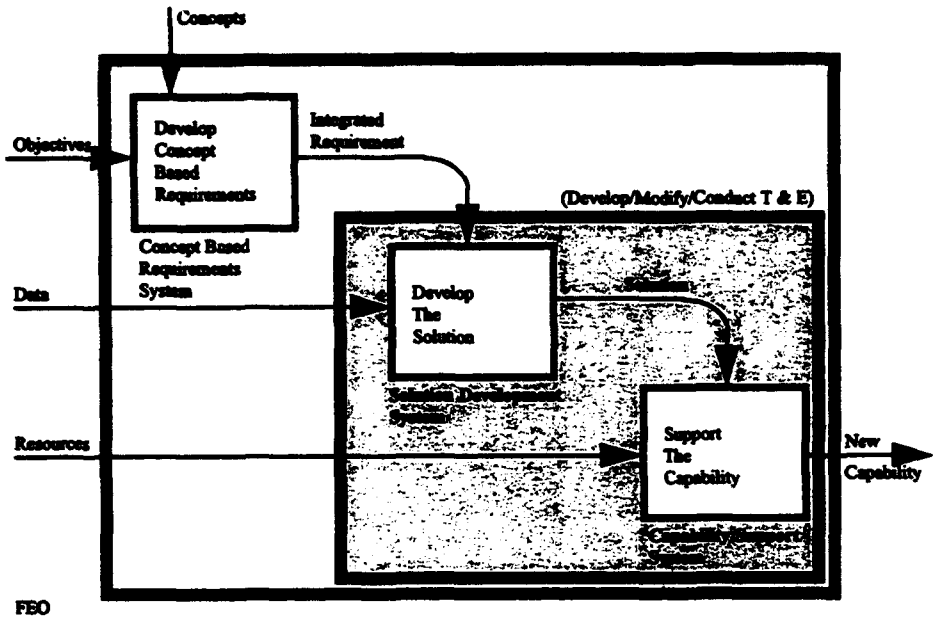


Figure C-3: DEVELOP/MODIFY/CONDUCT T&E

During the *Solution Development* stage of the CDP, concepts and requirements are turned into tangible warfighting capabilities. Each deficiency noted through mission area analysis, FMF input and other means is assessed from the perspective of doctrine, organization, training and education, equipment, and support and facilities. In each case, a needs statement will be developed and a recommended solution resulting from studies or analysis and a requirements document will be devised.

USMC Training and Education process is guided by the Systems Approach to Training (SAT). SAT principles are published in MCO 1553.1, "*The Systems Approach to Training*". SAT is a generic term that encompasses the entire range of activities of analyses, design, development, implementation, and evaluation of training and education programs across the spectrum of training categories. The SAT activities of *Analyze, Design, and Develop* are Training and Education solution development activities within the CDP *Solution Development* process.

Figure C-4 shows the major components of the activities that comprise the *Solution Development* process.

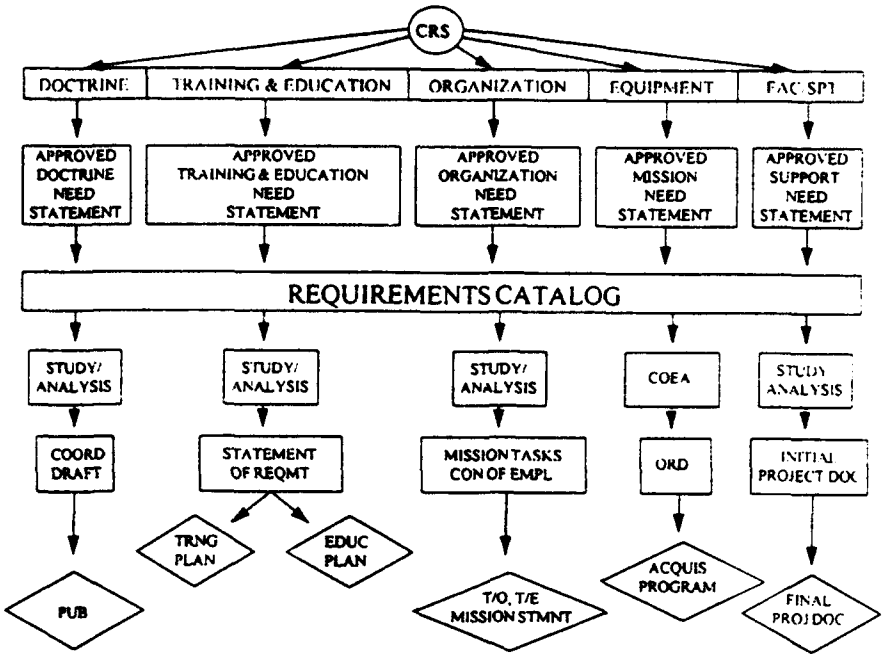


Figure C-4: SOLUTION DEVELOPMENT

Figure C-5 shows the correlation of the components of the CDP *Solution Development* process to the SAT activities of *Analyze/Design/Develop T&E*. The *Analyze/Design/Develop T&E* "node" of the T&E Activity Model (A2 shown on page C-17) is decomposed into activities that support needs approval, analysis and training plan development.

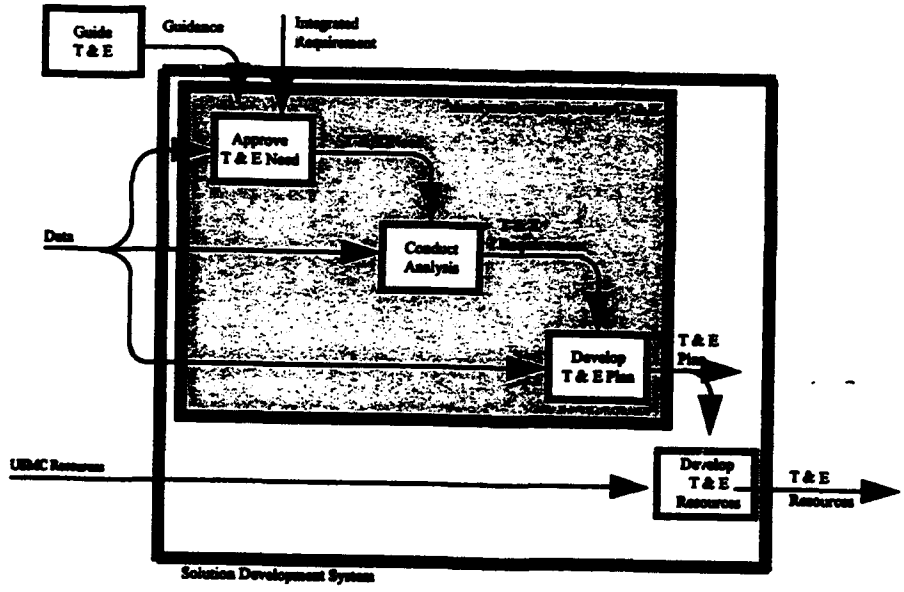


Figure C-5: DEVELOP/MODIFY T&E

The *Capability Support* function provides and maintains the resources needed for FMF and Supporting Establishment operations. It includes the Life Cycle Management Process, and the evolving Training and Education Assessment Process. During this step in the CDP, systems are monitored to ensure that they remain relevant and that combat capabilities remain fully integrated. At a minimum, all requirements will be assessed every 2 years through either mission area analysis or the Marine Corps Master Plan.

Figure C-6 shows the correlation of the CDP function *Capability Support* to the T&E processes of *Implement and Evaluate T&E.*

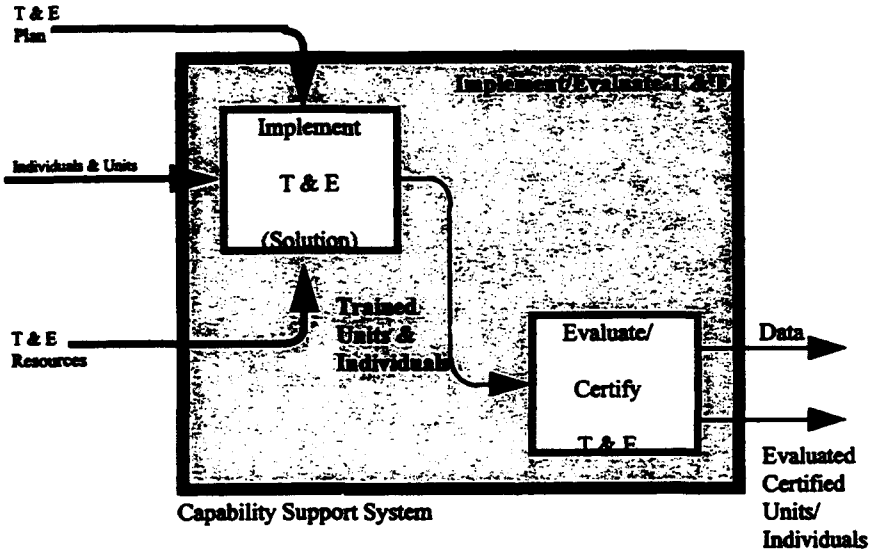


Figure C-6: CONDUCT T&E

The USMC Corporate Information Management (CIM) Functional Process Improvement (FPI) program has developed an activity model of the CDP from the viewpoint of the overall CDP Coordinator. The model includes all activities required to produce combat ready MAGTFs. Figure C-7 is node A22 "*Develop/Modify Resources*" from the USMC CDP Activity Model version 1.1 dated 10 March 1994.

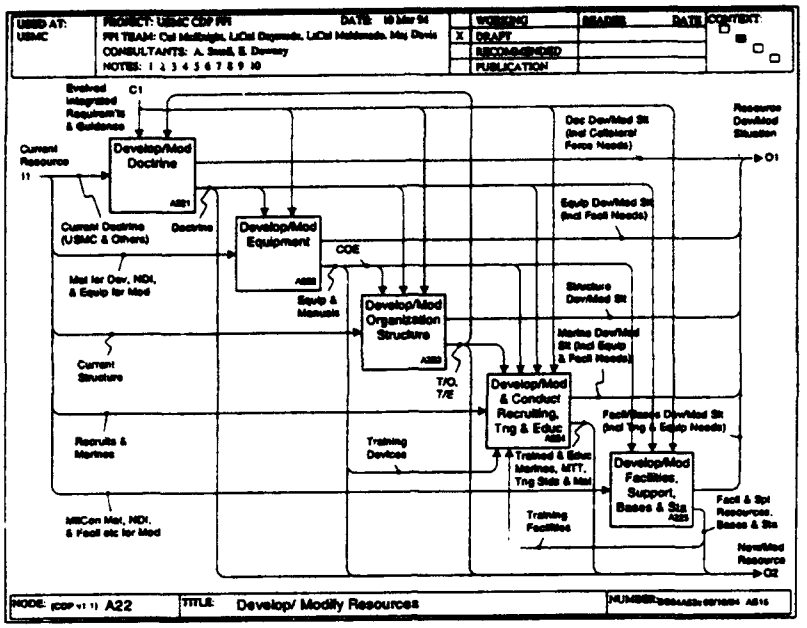


Figure C-7: USMC CDP MODEL NODE A22

The T&E model is adapted from node A224 "*Develop/Modify & Conduct Recruiting, Training & Education*" in the CDP model. Node A224 includes those activities associated with bringing in new Recruits as well as training and educating all Marines. The T&E model does not include those activities associated with Recruiting. The T&E model incorporates all Inputs, Controls, Outputs, and Mechanisms (ICOMs) from the CDP model with one addition; T&E Data as an input. T&E Data is technical information or any other information with education and training application. State of the art techniques reflecting new technologies and developed by civilian and/or other Service training and education institutions are examples of T&E Data developed outside Marine Corps training and education processes.

"AS-IS" ACTIVITY MODELS

Figures C-8 through C-13 show node trees for the activity *Develop/Modify/Conduct Training & Education.* IDEF 0 diagrams of the major nodes A-0, A0, A1, A2, A3, A4 and A5 are shown on pages C-14 through C-20. The "T&E" model was developed incorporating individual as well as unit training and considers training and education in the classroom and in the field. The structure of the model reflects the Marine Corps' *Systems Approach to Training* (SAT) as documented in the SAT Guide published 19 October 1993. The five major nodes are:

- **A1: Guide T&E** — processes which result in development of T&E policies/guidance/goals & objectives, issue approval and publication of directives, manuals, educational materials, and other documents;

- **A2: Analyze, Design, Develop T&E** — processes involved with analyzing needs, developing task requirements and standards, designing instruction, and developing instructional material and plans;

- **A3: Develop T&E Resources** — processes associated with planning, programming, and budgeting training and education resources;

- **A4: Implement T&E** — processes which include direct administrative support, the conduct of institutional training and education, and conduct of training in units;

- **A5: Evaluate/Certify T&E** — processes which involve the validation of the SAT, evaluation of T&E management, evaluation of the conduct of training, evaluation and certification of individuals and units, and the analysis and interpretation of evaluation results for feedback to modify training and education.

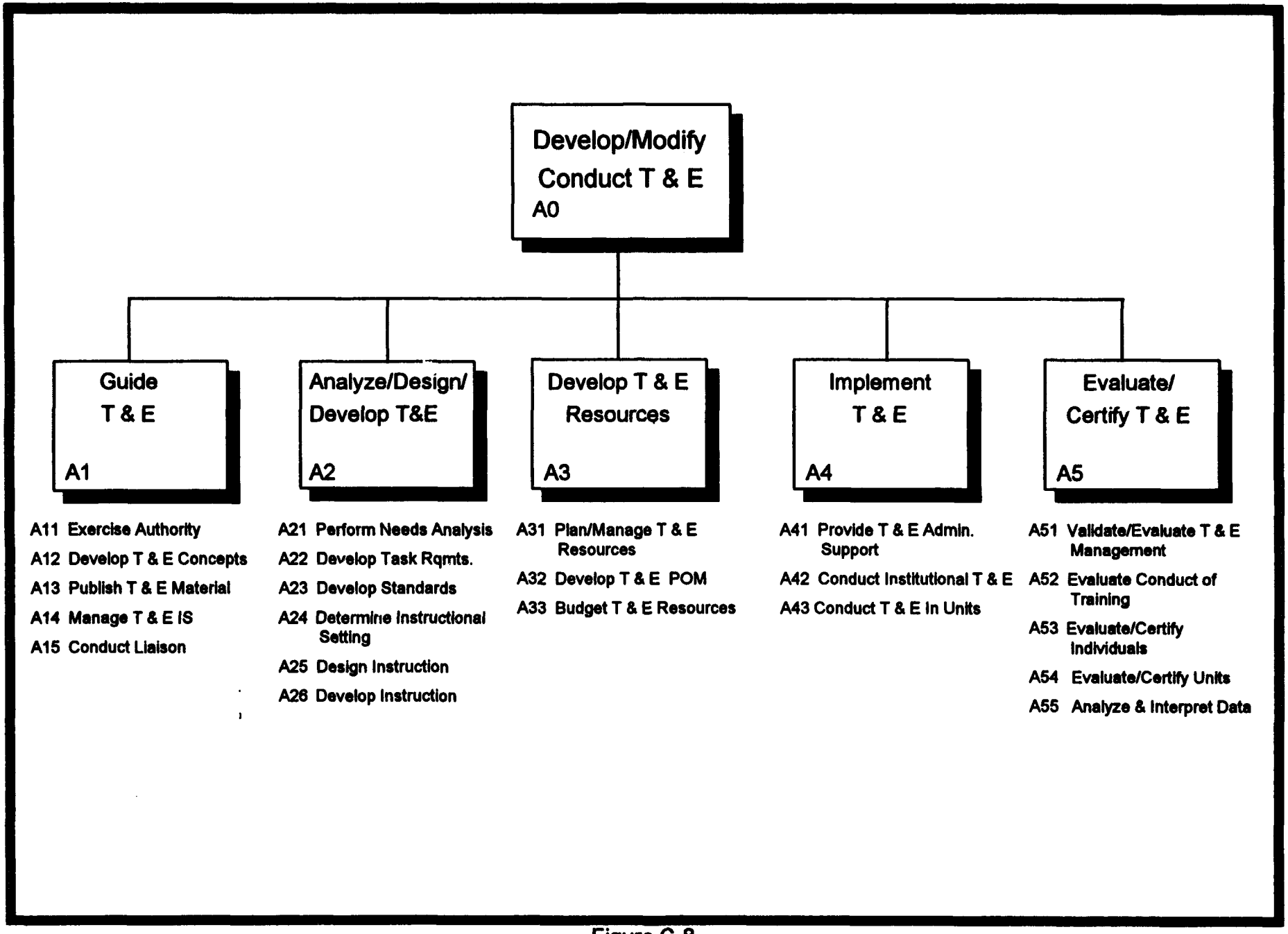

Develop/Modify
Conduct T & E
A0
Guide
T & E
A1
Analyze/Design/
Develop T&E
A2
Develop T & E
Resources
A3
Implement
T & E
A4
Evaluate/
Certify T & E
A5
A11 Exercise Authority
A12 Develop T & E Concepts
A13 Publish T & E Material
A14 Manage T & E IS
A15 Conduct Liaison
A21 Perform Needs Analysis
A22 Develop Task Rqmts.
A23 Develop Standards
A24 Determine Instructional Setting
A25 Design Instruction
A26 Develop Instruction
A31 Plan/Manage T & E Resources
A32 Develop T & E POM
A33 Budget T & E Resources
A41 Provide T & E Admin. Support
A42 Conduct Institutional T & E
A43 Conduct T & E In Units
A51 Validate/Evaluate T & E Management
A52 Evaluate Conduct of Training
A53 Evaluate/Certify Individuals
A54 Evaluate/Certify Units
A55 Analyze & Interpret Data

Figure C-8

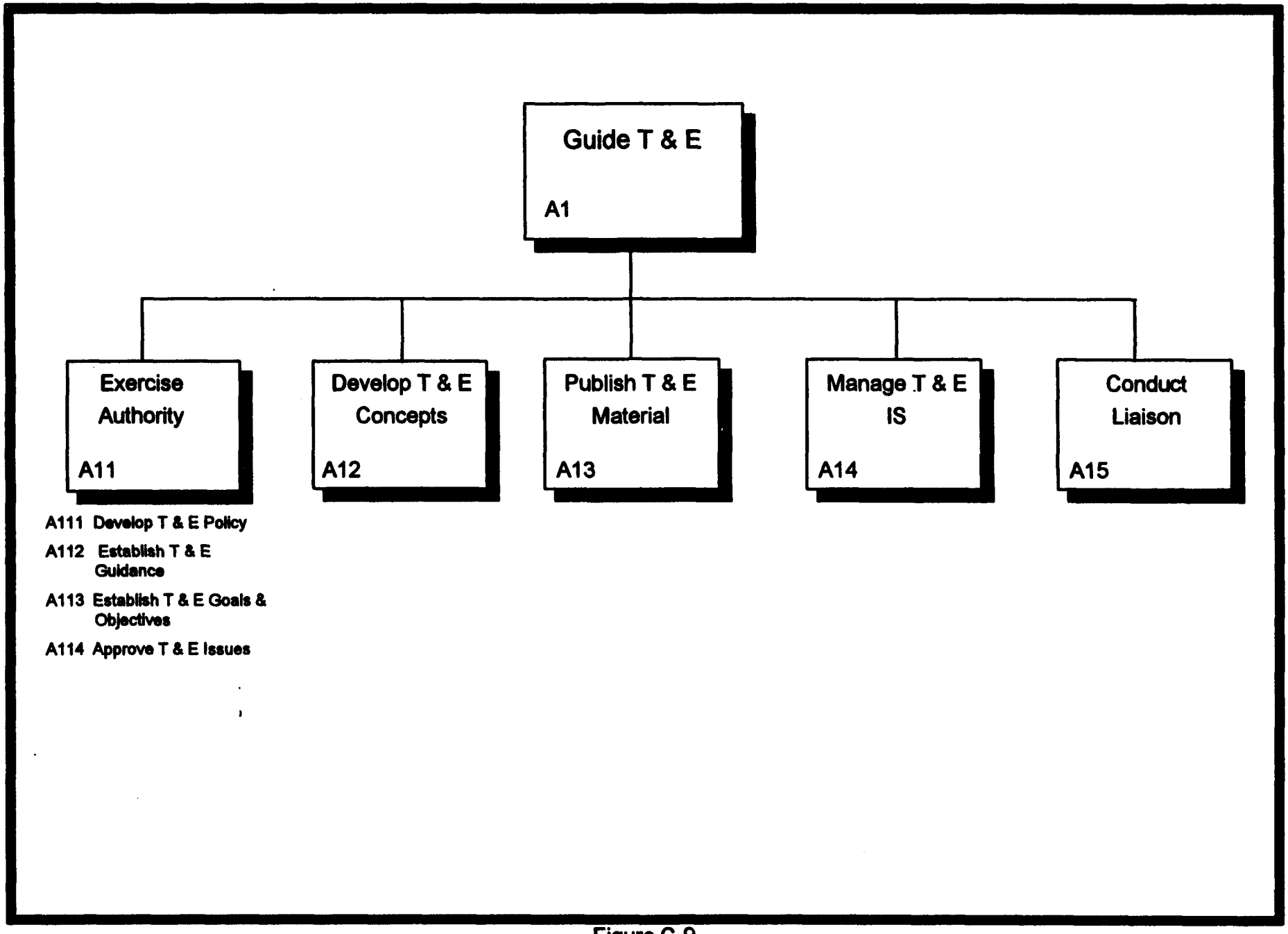

Guide T & E
A1
Exercise Authority
A11
Develop T & E Concepts
A12
Publish T & E Material
A13
Manage T & E IS
A14
Conduct Liaison
A15
A111 Develop T & E Policy
A112 Establish T & E Guidance
A113 Establish T & E Goals & Objectives
A114 Approve T & E Issues

Figure C-9

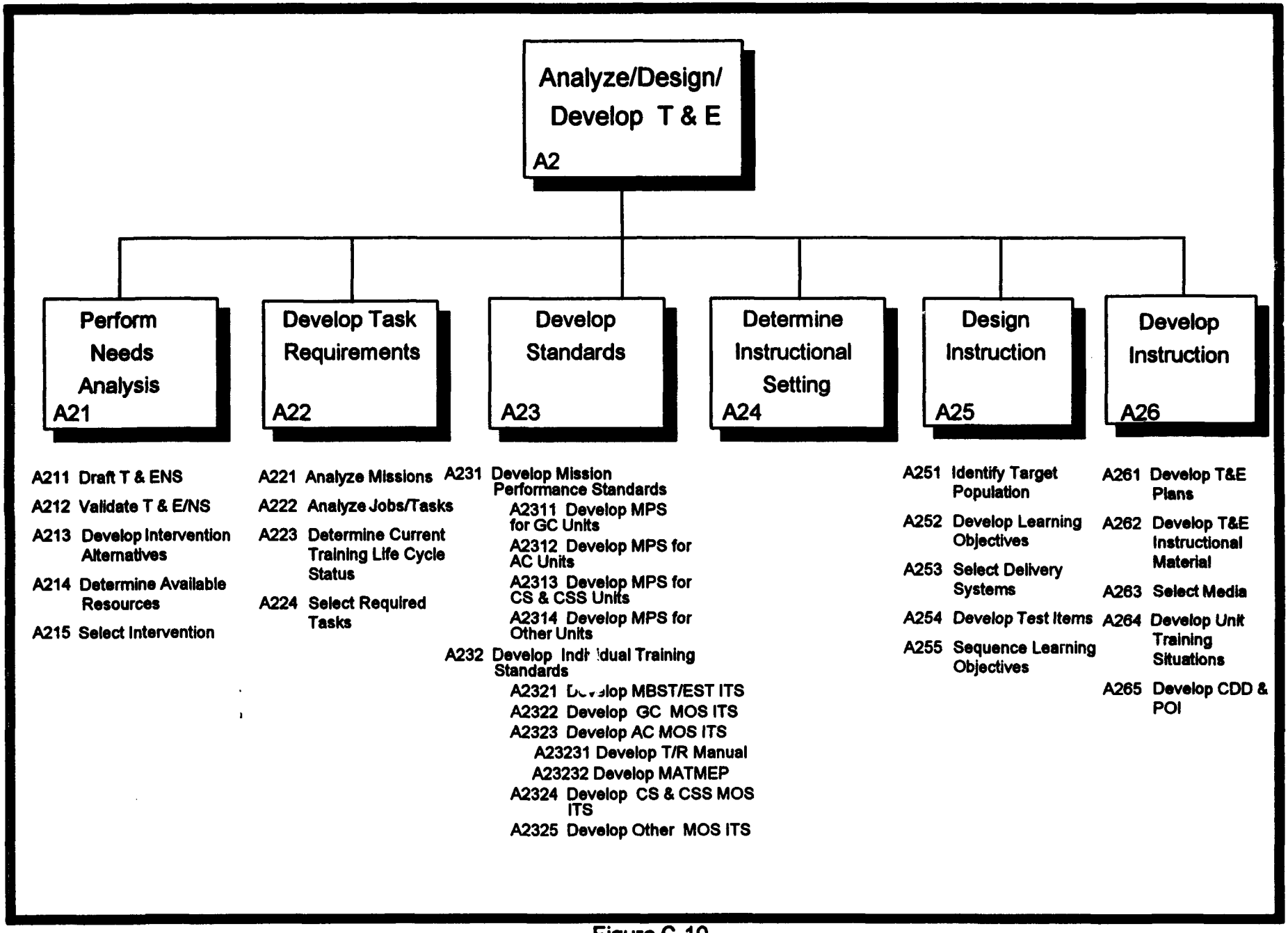

Analyze/Design/ Develop T & E
A2
Perform Needs Analysis
A21
Develop Task Requirements
A22
Develop Standards
A23
Determine Instructional Setting
A24
Design Instruction
A25
Develop Instruction
A26
A211 Draft T & ENS
A212 Validate T & E/NS
A213 Develop Intervention Alternatives
A214 Determine Available Resources
A215 Select Intervention
A221 Analyze Missions
A222 Analyze Jobs/Tasks
A223 Determine Current Training Life Cycle Status
A224 Select Required Tasks
A231 Develop Mission Performance Standards
A2311 Develop MPS for GC Units
A2312 Develop MPS for AC Units
A2313 Develop MPS for CS & CSS Units
A2314 Develop MPS for Other Units
A232 Develop Individual Training Standards
A2321 Develop MBST/EST ITS
A2322 Develop GC MOS ITS
A2323 Develop AC MOS ITS
A23231 Develop T/R Manual
A23232 Develop MATMEP
A2324 Develop CS & CSS MOS ITS
A2325 Develop Other MOS ITS
A251 Identify Target Population
A252 Develop Learning Objectives
A253 Select Delivery Systems
A254 Develop Test Items
A255 Sequence Learning Objectives
A261 Develop T&E Plans
A262 Develop T&E Instructional Material
A263 Select Media
A264 Develop Unit Training Situations
A265 Develop CDD & POI

Figure C-10

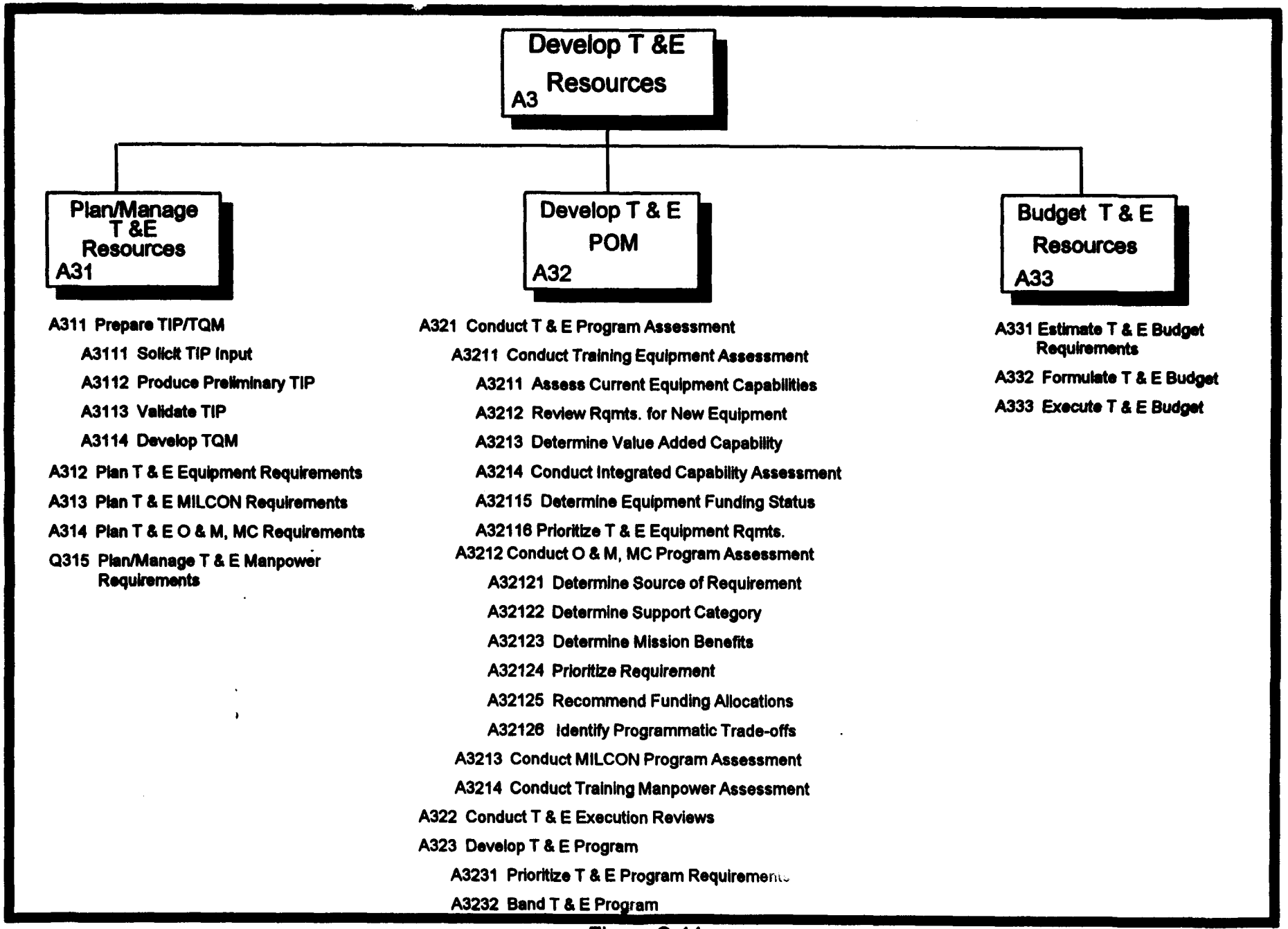

Develop T &E Resources
A3
Plan/Manage T &E Resources
A31
Develop T & E POM
A32
Budget T & E Resources
A33
A311 Prepare TIP/TQM
A3111 Solicit TIP Input
A3112 Produce Preliminary TIP
A3113 Validate TIP
A3114 Develop TQM
A312 Plan T & E Equipment Requirements
A313 Plan T & E MILCON Requirements
A314 Plan T & E O & M, MC Requirements
Q315 Plan/Manage T & E Manpower Requirements
A321 Conduct T & E Program Assessment
A3211 Conduct Training Equipment Assessment
A3211 Assess Current Equipment Capabilities
A3212 Review Rqmts. for New Equipment
A3213 Determine Value Added Capability
A3214 Conduct Integrated Capability Assessment
A32115 Determine Equipment Funding Status
A32116 Prioritize T & E Equipment Rqmts.
A3212 Conduct O & M, MC Program Assessment
A32121 Determine Source of Requirement
A32122 Determine Support Category
A32123 Determine Mission Benefits
A32124 Prioritize Requirement
A32125 Recommend Funding Allocations
A32126 Identify Programmatic Trade-offs
A3213 Conduct MILCON Program Assessment
A3214 Conduct Training Manpower Assessment
A322 Conduct T & E Execution Reviews
A323 Develop T & E Program
A3231 Prioritize T & E Program Requirements
A3232 Band T & E Program
A331 Estimate T & E Budget Requirements
A332 Formulate T & E Budget
A333 Execute T & E Budget

Figure C-11

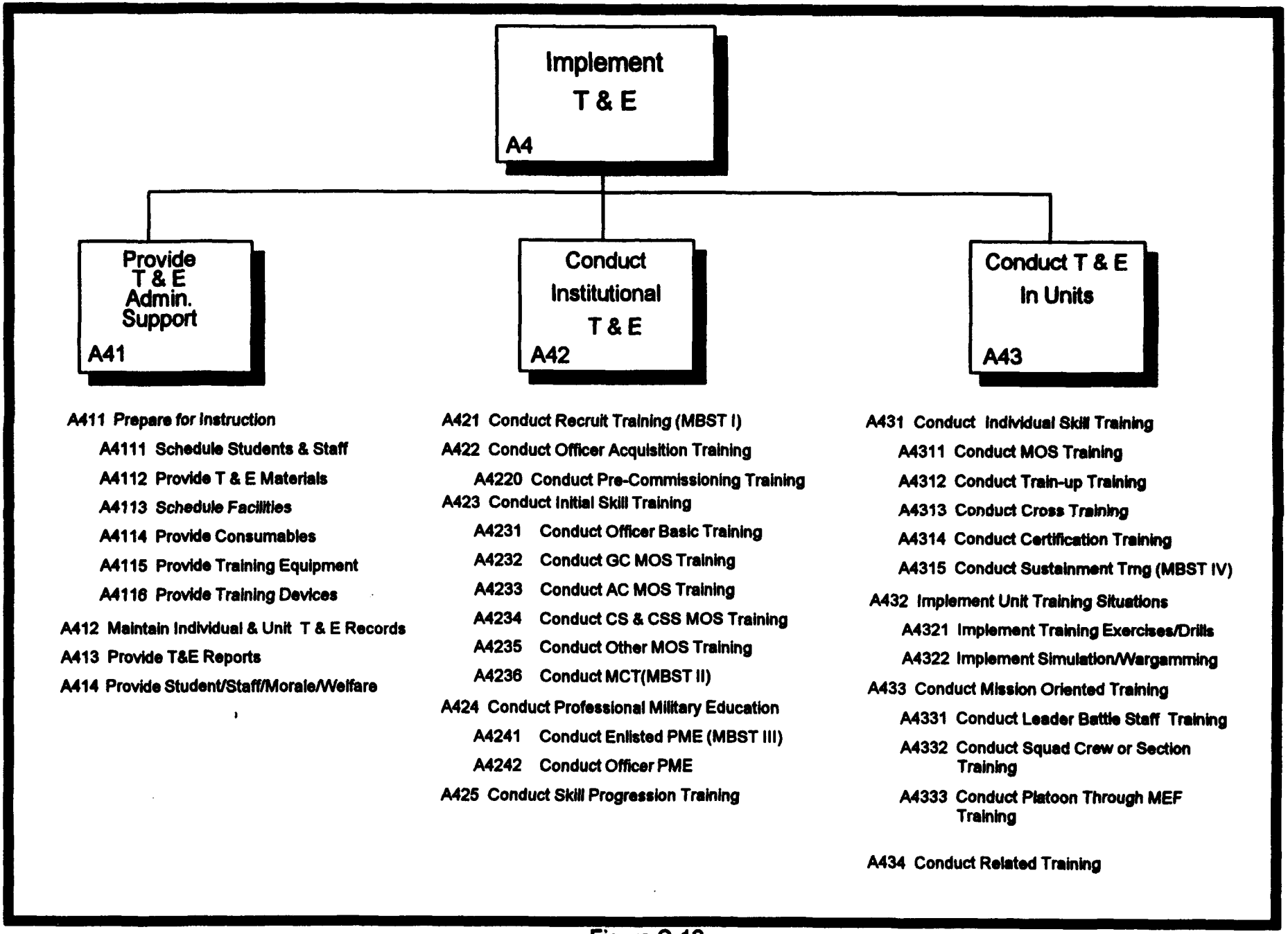

Implement T & E
A4
Provide T & E Admin. Support
A41
Conduct Institutional T & E
A42
Conduct T & E In Units
A43
A411 Prepare for Instruction
A4111 Schedule Students & Staff
A4112 Provide T & E Materials
A4113 Schedule Facilities
A4114 Provide Consumables
A4115 Provide Training Equipment
A4116 Provide Training Devices
A412 Maintain Individual & Unit T & E Records
A413 Provide T&E Reports
A414 Provide Student/Staff/Morale/Welfare
A421 Conduct Recruit Training (MBST I)
A422 Conduct Officer Acquisition Training
A4220 Conduct Pre-Commissioning Training
A423 Conduct Initial Skill Training
A4231 Conduct Officer Basic Training
A4232 Conduct GC MOS Training
A4233 Conduct AC MOS Training
A4234 Conduct CS & CSS MOS Training
A4235 Conduct Other MOS Training
A4236 Conduct MCT(MBST II)
A424 Conduct Professional Military Education
A4241 Conduct Enlisted PME (MBST III)
A4242 Conduct Officer PME
A425 Conduct Skill Progression Training
A431 Conduct Individual Skill Training
A4311 Conduct MOS Training
A4312 Conduct Train-up Training
A4313 Conduct Cross Training
A4314 Conduct Certification Training
A4315 Conduct Sustainment Trng (MBST IV)
A432 Implement Unit Training Situations
A4321 Implement Training Exercises/Drills
A4322 Implement Simulation/Wargamming
A433 Conduct Mission Oriented Training
A4331 Conduct Leader Battle Staff Training
A4332 Conduct Squad Crew or Section Training
A4333 Conduct Platoon Through MEF Training
A434 Conduct Related Training

Figure C-12

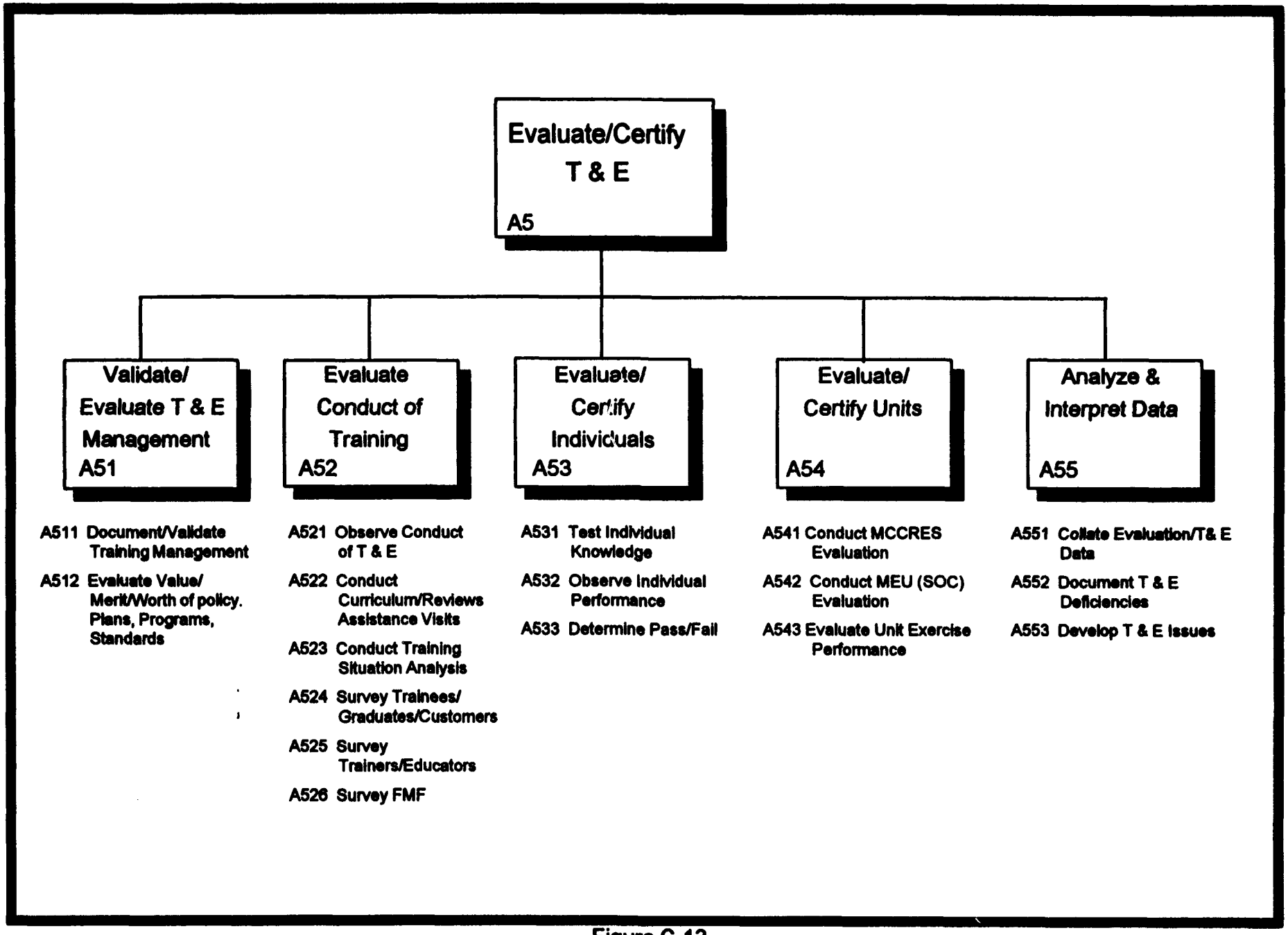

Evaluate/Certify T & E
A5
Validate/ Evaluate T & E Management
A51
Evaluate Conduct of Training
A52
Evaluate/ Certify Individuals
A53
Evaluate/ Certify Units
A54
Analyze & Interpret Data
A55
A511 Document/Validate Training Management
A512 Evaluate Value/ Merit/Worth of policy. Plans, Programs, Standards
A521 Observe Conduct of T & E
A522 Conduct Curriculum/Reviews Assistance Visits
A523 Conduct Training Situation Analysis
A524 Survey Trainees/ Graduates/Customers
A525 Survey Trainers/Educators
A526 Survey FMF
A531 Test Individual Knowledge
A532 Observe Individual Performance
A533 Determine Pass/Fail
A541 Conduct MCCRES Evaluation
A542 Conduct MEU (SOC) Evaluation
A543 Evaluate Unit Exercise Performance
A551 Collate Evaluation/T& E Data
A552 Document T & E Deficiencies
A553 Develop T & E Issues

Figure C-13

ELECTRONIC FILE NAME: G1 .IDD	AUTHOR: IBES, Inc.; SSI, Inc.	DATE: 10/8/93		WORKING	READER DATE	CONTEXT:
	PROJECT: MCTRSS	REV DATE: 05/05/94		DRAFT		Top
	PROJECT OFFICER: Capt. A.V. Scott, USMC	REV NO:		RECOMMENDED		
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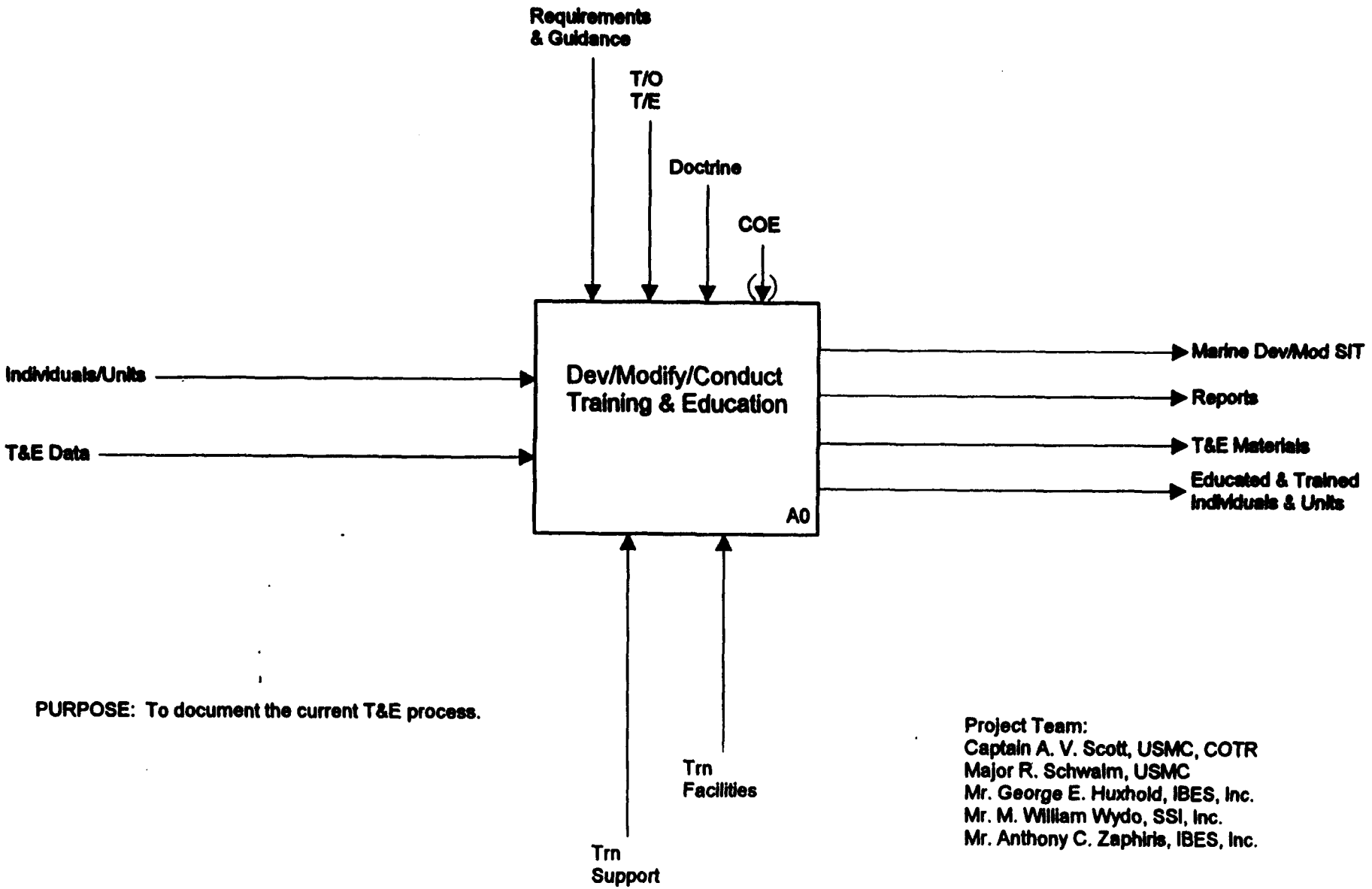

PURPOSE: To document the current T&E process.

Project Team:
Captain A. V. Scott, USMC, COTR
Major R. Schwalm, USMC
Mr. George E. Huxhold, IBES, Inc.
Mr. M. William Wydo, SSI, Inc.
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NODE: A-0	TITLE: Dev/Modify/Conduct Training & Education	VIEWPOINT: T&E Program Manager

ELECTRONIC FILE NAME: G1 .IDD	AUTHOR: IBES, Inc.; SSI, Inc.	DATE: 10/8/93		WORKING	READER	DATE	CONTEXT:
	PROJECT: MCTRSS	REV DATE: 05/05/94		DRAFT			
	PROJECT OFFICER: Capt. A.V. Scott, USMC	REV NO:		RECOMMENDED			
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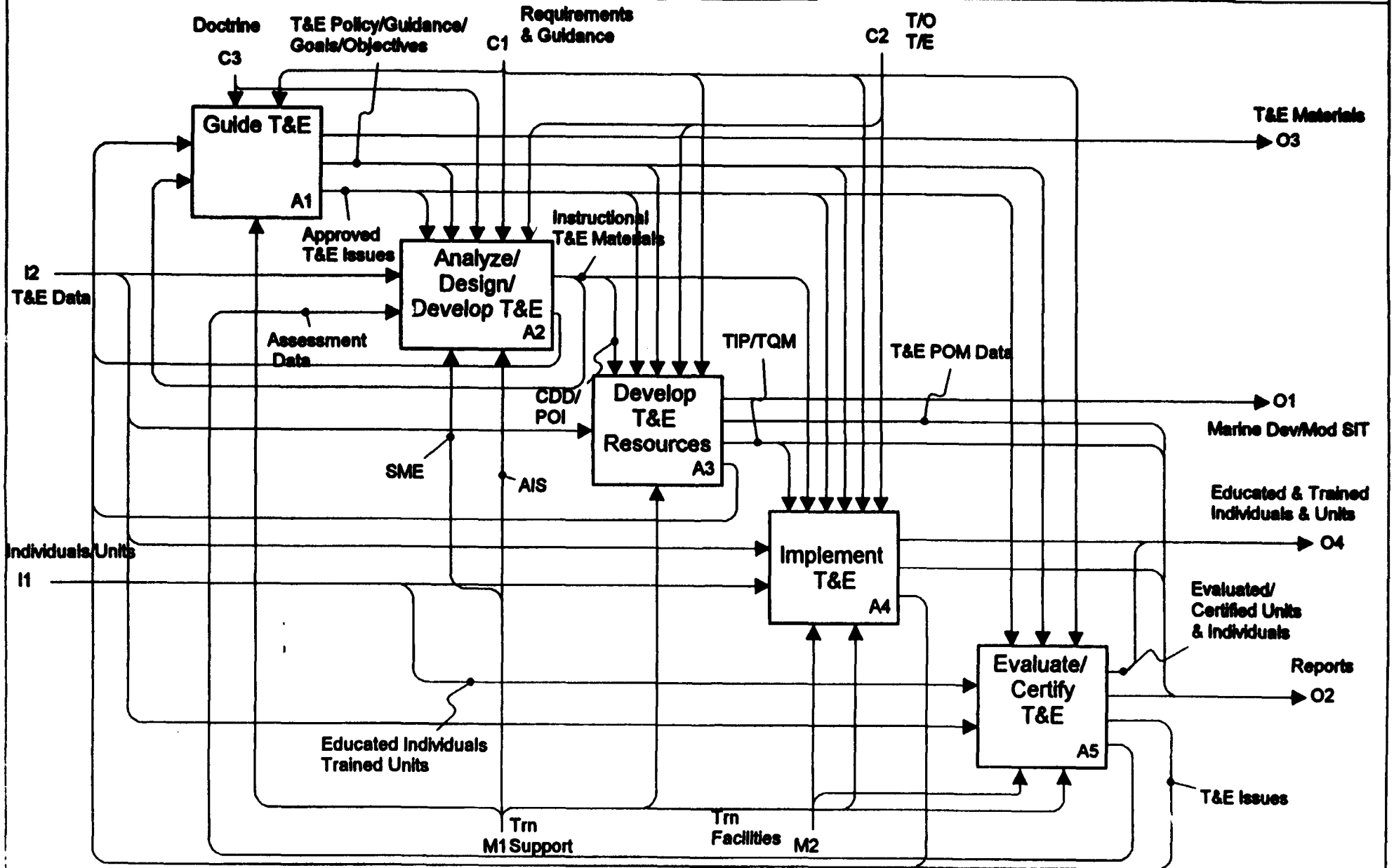
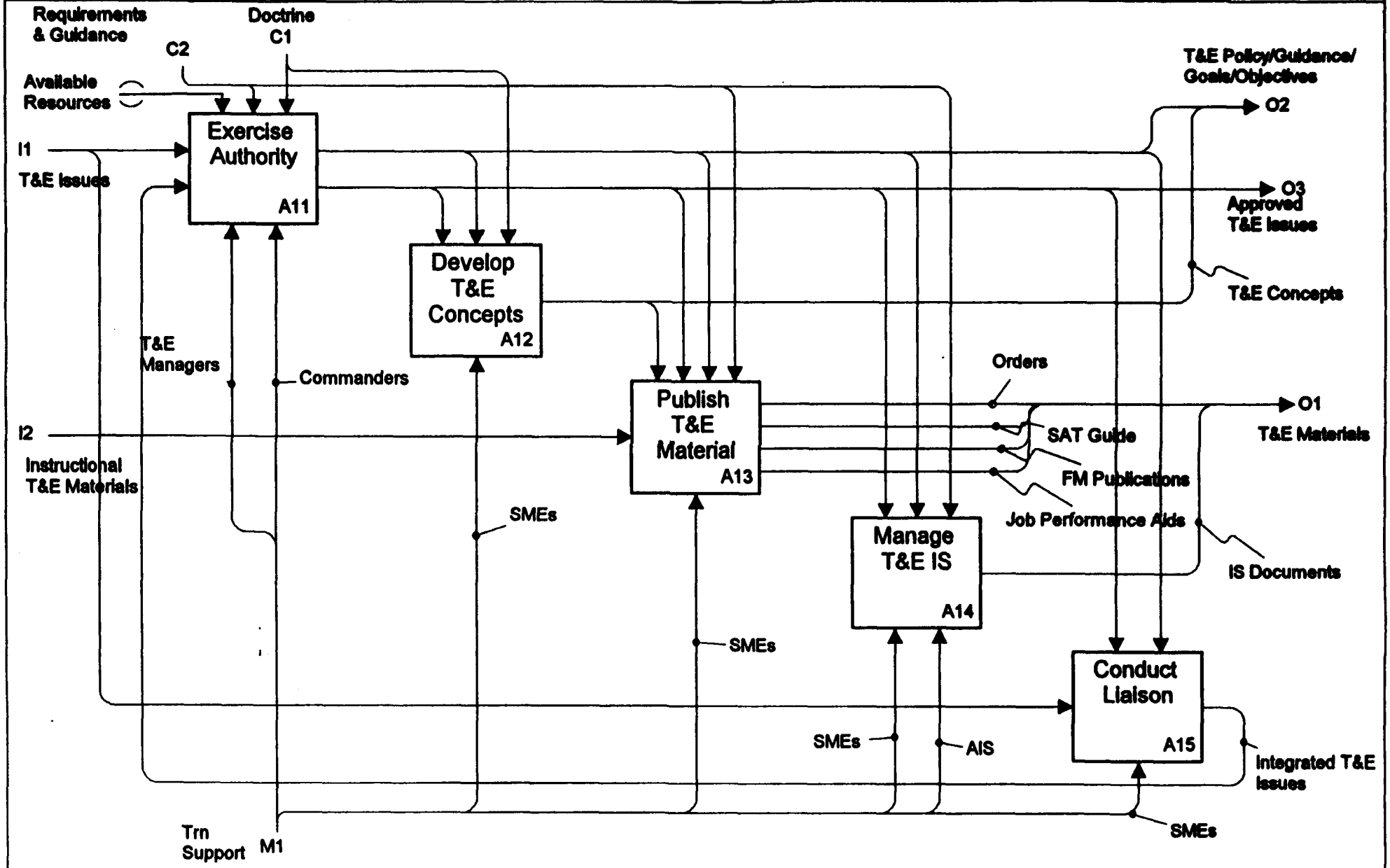


NODE: A0	TITLE: Dev/Modify/Conduct Training & Education	VIEWPOINT: T&E Program Manager

ELECTRONIC FILE NAME: G1 .IDD	AUTHOR: IBES, Inc.; SSI, Inc. PROJECT: MCTRSS PROJECT OFFICER: Capt. A.V. Scott, USMC NOTES: 1 2 3 4 5 6 7 8 9 10	DATE: 10/8/93 REV DATE: 05/05/94 REV NO:

	WORKING	READER	DATE
	DRAFT		
	RECOMMENDED		
X	PUBLICATION		

CONTEXT:



NODE: A1	TITLE: Guide T&E	VIEWPOINT: T&E Program Manager

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	PROJECT: MCTRSS	REV DATE: 05/11/94		DRAFT			
	PROJECT OFFICER: Capt. A.V. Scott, USMC	REV NO:		RECOMMENDED			
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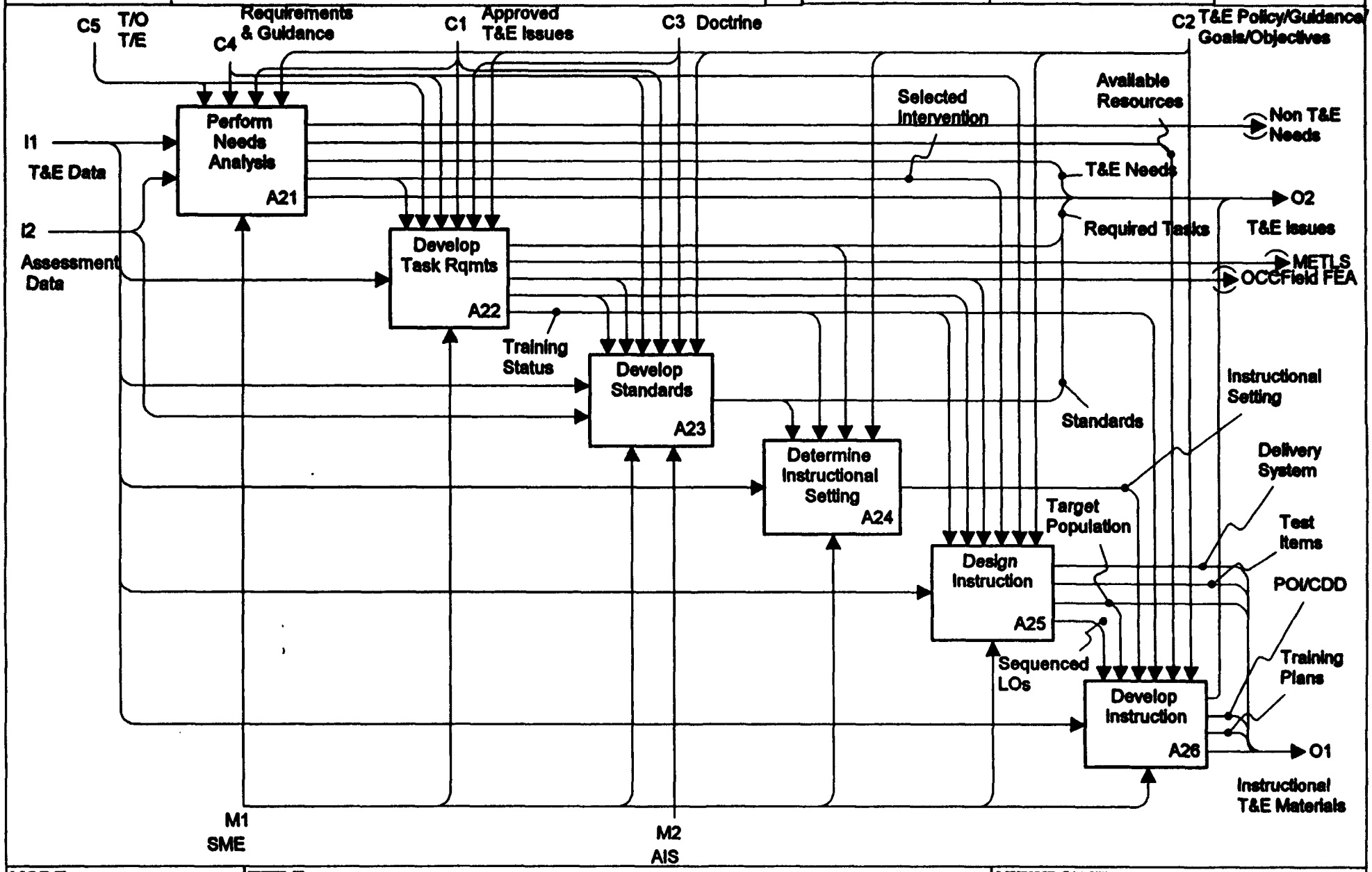

NODE:	TITLE:	VIEWPOINT:
A2	Analyze/ Design/ Develop T&E	T&E Program Manager

ELECTRONIC FILE NAME: G1 .IDD	AUTHOR: IBES, Inc.; SSI, Inc.	DATE: 10/8/93		WORKING	READER	DATE	CONTEXT:
	PROJECT: MCTRSS	REV DATE: 04/25/94		DRAFT			
	PROJECT OFFICER: Capt. A.V. Scott, USMC	REV NO:		RECOMMENDED			
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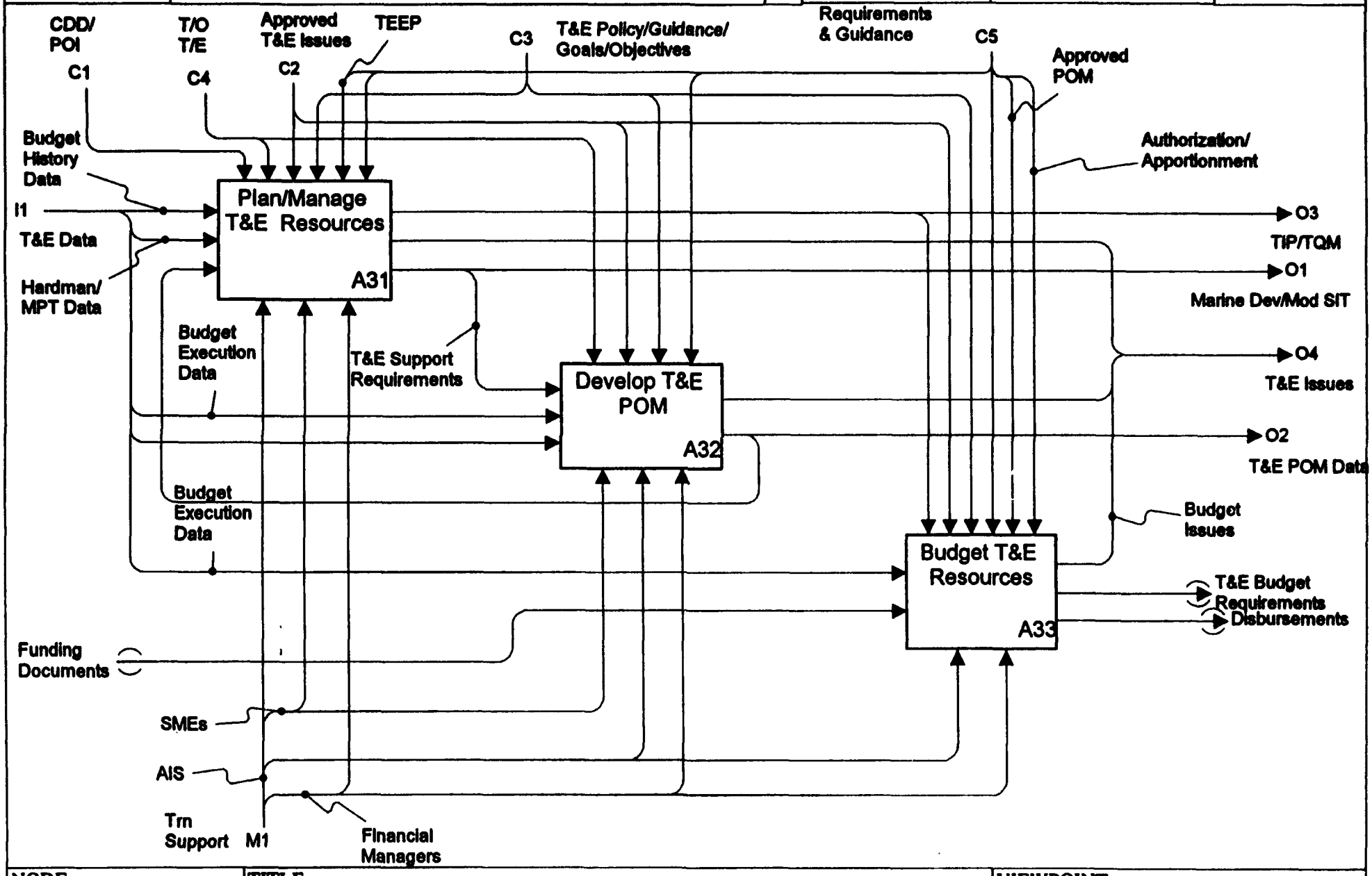
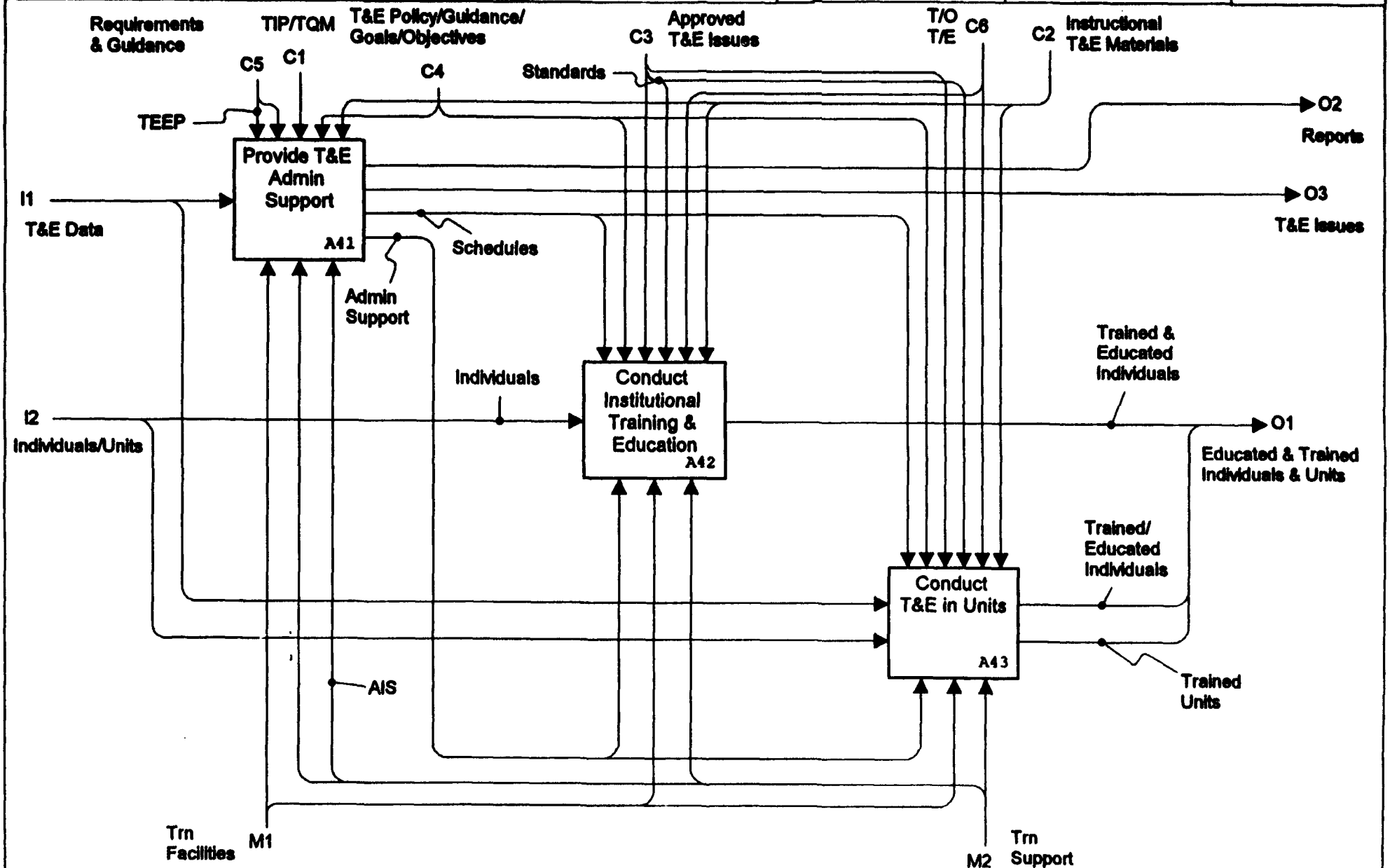


NODE: A3	TITLE: Develop T&E Resources	VIEWPOINT: T&E Program Manager

FILE NAME:	PROJECT: MCTRSS	REV DATE: 04/25/94		
G1 .IDD	PROJECT OFFICER: Capt. A.V. Scott, USMC	REV NO:		DRAFT
	NOTES: 1 2 3 4 5 6 7 8 9 10			RECOMMENDED
			X	PUBLICATION



NODE:	TITLE:	VIEWPOINT:
A4	Implement T&E	T&E Program Manager

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	PROJECT: MCTRSS	REV DATE: 04/25/94		DRAFT	
	PROJECT OFFICER: Capt. A.V. Scott, USMC	REV NO:		RECOMMENDED	
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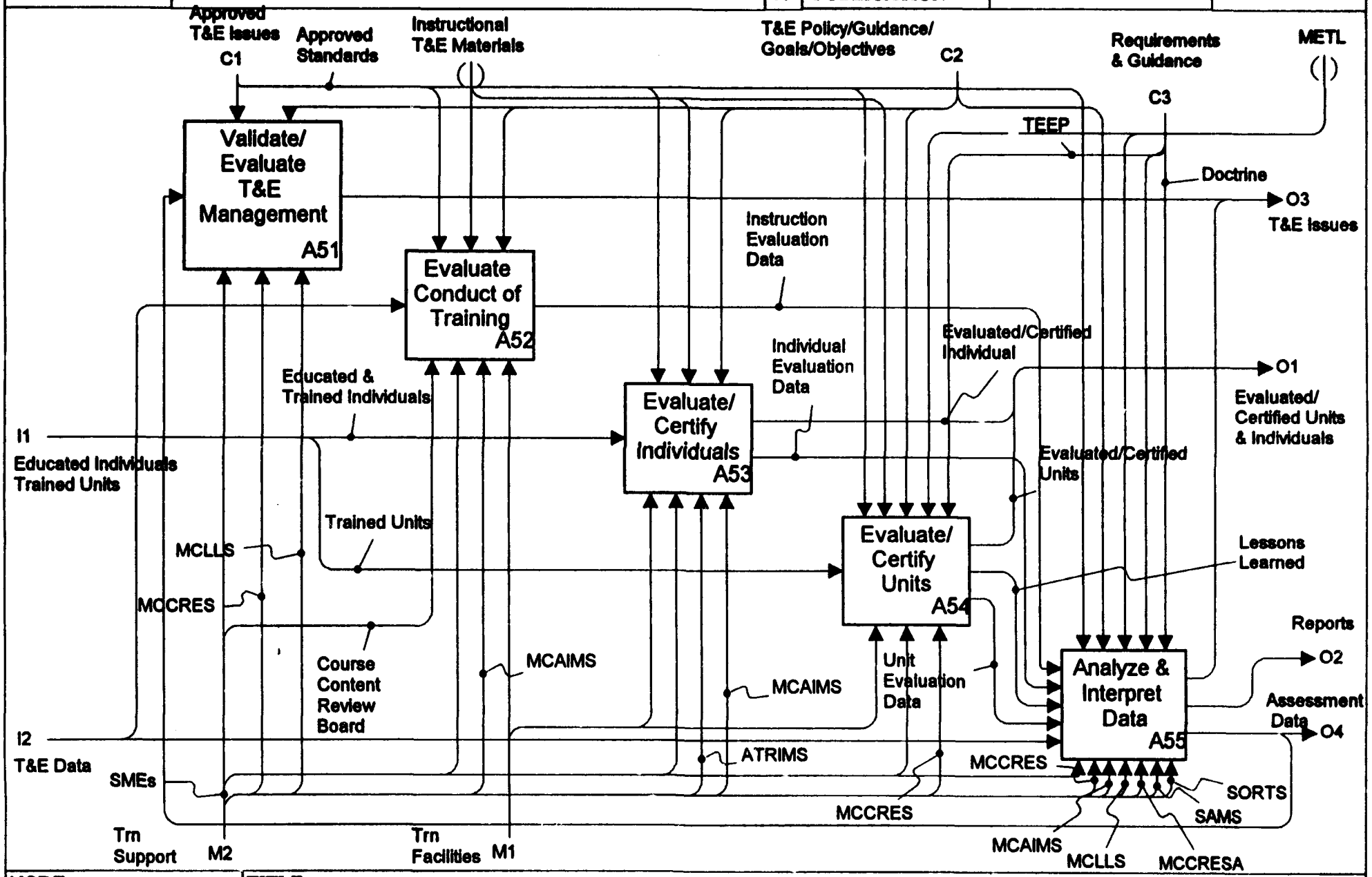
CONTEXT:



NODE:	TITLE:	VIEWPOINT:
A5	Evaluate/ Certify T&E	T&E Program Manager

Appendix D

Assessment Rollup Algorithms

APPENDIX D

ASSESSMENT ROLL-UP ALGORITHMS

Introduction

This appendix describes the algorithms for carrying out the rollup of task level capability assessments into a Marine Corps training readiness assessment. Five models of the analysis are presented: nominal optimist, nominal pessimist, weighted average, bias toward red, and bias toward green. The names describe the type of rollup produced by each of the models.

A diagram of the relationships among the rollup algorithms is shown in Figure 1.1 below. It shows that there is a relationship among four of the models because the four basically have the same algorithm with only a modification in the mathematical operator used in them. The weighted average, though, is shown along a different branch since it is based on a different algorithm.

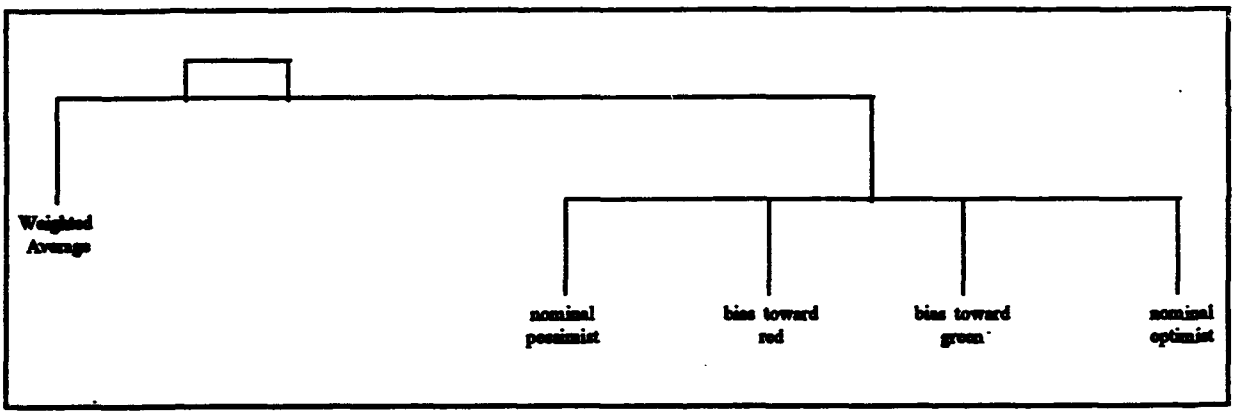


Figure 1.1. *RELATIONSHIPS AMONG THE ROLLUP MODELS.*

Section 1 describes the nominal model which has two different results when ties occur. The nominal optimist result produces rollups that strongly tend toward green. The nominal pessimist model produces rollups that strongly tend toward red.

Section 2 describes the weighted average which produces a rollup that is an average of the individual elements.

Section 3 defines the bias toward red model which produces rollups with a slight tendency toward red.

Section 4 defines the bias toward green model which produces rollups with a slight tendency toward green.

Section 5 gives a summary of the rollup results for the five models.

The MCTRSS is to be set up with two assessment modes: a standard mode and an enhanced mode. In standard mode, the input will be the assignment of a single hierarchical dependence and a single color assessment for each Task Level Capability Objective. The enhanced mode will allow an assessment matrix to be created for each Task Level Capability Objective. This allows multiple hierarchical dependences and multiple color assessments with associated confidence levels to be assigned to each objective. Although all examples in this document have multiple color assessments and confidence levels assigned to objectives, algorithms presented for each model will also work when only a single color assessment and dependence are assigned.

The Rollup (Aggregation) of Capability Assessments

The rollup of capability assessments is a procedure which aggregates the assessments of Task Level Capability Objectives into Battlefield Functions, Mission Areas, Mid-Term Combat Development Capabilities, Operational Concepts, MAGTF Threat Scenarios, MEFs, Warfighting Environments, CINCs, and the global state of Marine Corps T&E readiness (see Figure 1.2). The result of the rollup assessment is an indication of the state of Marine Corps training readiness. The rollup assessment is carried out starting from assessments of individual Task Level Capability Objectives. These capability assessments are rolled up or aggregated into the individual Battlefield Functions and Mission Areas. The Missions Areas are then rolled up into Mid-Term Combat Development Capabilities and Operational Concepts. In the Service assessment, the rollup continues to the MAGTF Threat Scenarios, the MEFs and finally the global state of Marine Corps training readiness. In the Joint assessment, the MCTRSS takes a different approach and rolls up to Warfighting Environments and CINCs.

Assessment Hierarchy

The assessment hierarchy is the structure that has been imposed on the assessment process to combine the Task Level Capability Objectives into the missions and environments in which the Marine Corps operates. The levels in the assessment hierarchy are:

Level	Abbrev	Assessment Level
0	GLOBAL	GLOBAL
1	MEF	MARINE EXPEDITIONARY FORCE
2	MTS	MAGTF THREAT SCENARIOS
1a	CINC	CINC
2a	WFE	WARFIGHTING ENVIRONMENTS (GNW, TNW, MRC, LRC, PTC)
3	OPCON	OPERATIONAL CONCEPTS (OMFTS, SOA, OEO)
4	MCDC	MID-TERM COMBAT DEVELOPMENT CAPABILITIES
5	MA	MISSION AREAS
6	BF	BATTLEFIELD FUNCTIONS
5	OBJ	TASK LEVEL CAPABILITY OBJECTIVES

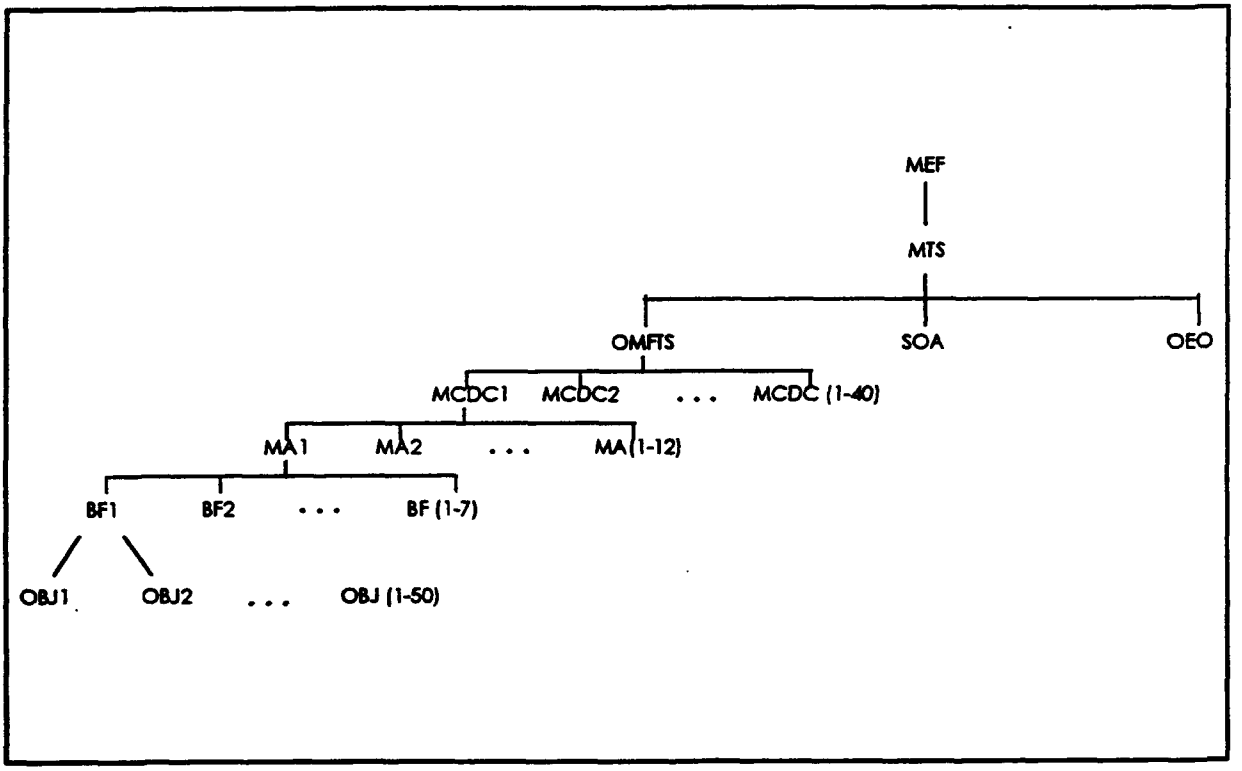


Figure 1.2 *SERVICE ASSESSMENT HIERARCHY*

Hierarchical Dependences

Each objective is assigned a hierarchical dependence type which represents the relative importance or weight of the objective to the mission. The hierarchical dependence types are:

Code	Dependence
ES	Essential
HD	Highly Dependent
MD	Moderately Dependent
CO	Contributing

To illustrate, an objective under a particular MEF Assessment is shown below:

MEF:	III MEF
MTS:	Conventional Combat - N. Korea
OPCON:	Sustained Operations Ashore
MCDC:	Capability to identify, designate, and engage targets.
MA:	Anti-Air Warfare
BF:	Maneuver

Task Level Capability Objective 1: Gain and maintain air superiority.

The hierarchy dependence value represents how dependent (important, critical) for the Maneuver function within the Mission Area of Anti-Air Warfare is the capability to gain and maintain air superiority. Is the mission Essentially dependent on the capability or is the mission only Highly Dependent, Moderately Dependent or not very (Contributing) dependent on the capability?

Task Level Capability Objective Assessments

Task Level Capability Objective assessments are assessments of how well a MEF or MAGTF unit performs a particular Task Level Capability Objective and are expressed in terms of a color. Assessments are expressed in terms of three major classifications (red, yellow, and green) and two intermediate classifications (red/yellow and yellow/green). These are defined as:

Red - The assessment concludes that T&E capabilities are inadequate to support tasks with acceptable risk. (Not Capable)

Yellow - The assessment concludes that T&E capabilities are marginal to support tasks with acceptable risk (Capable - Not to standard).

Green - The assessment concludes that T&E capabilities are adequate to support tasks with acceptable risk (Capable).

Red/Yellow and Yellow/Green - Represent intermediate capabilities.

A summary of the capability assessment colors, codes, and meaning of the colors are:

Code	Color	Meaning
R	Red	Not Capable (T&E programs are inadequate)
R/Y	Red/Yellow	
Y	Yellow	Capable - Not to Standard (T&E programs are marginal)
Y/G	Yellow/Green	
G	Green	Capable (T&E programs are adequate)

Red/yellow and yellow/green are intermediate levels of capability.

Rollup - Nominal Optimist and Pessimist Models

This section describes the calculations of the rollups for the nominal optimist and pessimist models. The nominal pessimist model gives rollups which strongly tend toward red and the nominal optimist model gives rollups which strongly tend toward green. The calculation of both models are the same. The difference in the two models occur when there are ties in choosing the rollup color. The tied color closest to green is chosen for the nominal optimist model and the color closest to red is chosen for the nominal pessimist model.

Step 0 - Assign values to each hierarchical dependence type. Each objective is assigned a hierarchical dependence type which represents the relative importance of the objective to the mission. The possible hierarchical dependence types that can be assigned are Essential (ES), Highly Dependent (HD), Moderately Dependent (MD), or Contributing (CO).

A numeric value between zero and one is assigned to each of the hierarchical dependence types representing the relative importance of the dependence. The more important dependences are assigned larger values. A possible assignment is shown in Table 1.0.

Table 1.0 Values of Hierarchical Dependences

Hierarchical Dependence	ES	HD	MD	CO
Value	.85	.7	.4	.25

1.1.1 Rollup to Battlefield Function BF-1 (i.e. Maneuver)

The following is the procedure for computing the rollup to the Battlefield Function level from the Task Level Capability Objective assessments using the nominal pessimist model.

Step 1- Assess each objective. Each objective is assessed by assigning a hierarchical dependence, and a set of colors and confidence levels to it. The confidence level indicates how confident the analyst is in the assessment. For example, the analyst may be 75% confident that objective X1 is yellow with an Essential dependence (see Table 1.1).

More than one color and associated confidence level may be assigned to each objective. Thus, the analyst may feel that objective X1 could also be red/yellow or yellow/green but at only 25% and 40% confidence level respectively.

Also more than one hierarchical dependence may be assigned to the objective.
Table 1.1 shows an example where the objective is also assigned highly dependent with the confidence levels of 30% for red, 70% for red/yellow, and 45% for yellow.

Table 1.1 Assessments for objective X1

	R	R/Y	Y	Y/G	G
ES		.25	.75	.40	
HD	.30	.70	.45		
MD					
CO					

Shown in Table 1.2 below are the assessments of all the objectives for the Battlefield Function BF-1. The numbers represent the confidence level for the assessment of the objective at the color and dependence.

Table 1.2 Assessments of Objectives by color and Confidence Level for BF-1

	Objective	R	R/Y	Y	Y/G	G
ES	X1:			.25	.75	.40
ES	X2:					.85
ES	X3:				.60	.90
HD	X1:	.30	.70	.45		
HD	X4:		.30	.85	.40	
MD	X5:			.40	.90	.30
MD	X6:		.20	.70	.35	

Step 2 -Aggregate confidence levels by hierarchical dependence type. The confidence levels for the objective assessments are aggregated by each hierarchical dependence type. All the objectives with Essential dependence are aggregated into one set of confidence levels (see Table 1.3). Likewise, all Highly Dependent objectives (Table 1.4), all Moderately Dependent objectives (Table 1.5), and all Contributing objectives are combined into a set of confidence levels.

The objective assessments are aggregated using the Union operator (MAX operator), U. That is, the maximum confidence level value under each color is picked as the aggregated value. For example, objectives with Essential dependence (see Table 1.3) are aggregated for color yellow/green, by selecting the maximum value of (.40, .85, .60), which is .85.

Table 1.3 Aggregated Confidence Levels of Essential (ES) Objectives

		R	R/Y	Y	Y/G	G	
ES	X1	.25	.75	.40			
ES	X2			.85			
ES	X3			.60	.90		
ES	X1 U X2 U X3	.25	.75	.85	.90	0	(aggregated confidence levels - max value over all objectives at each color)

U is the Union operator (MAX operator) over all objectives

Table 1.4 Aggregated Confidence Levels of Highly Dependent (HD) Objectives

		R	R/Y	Y	Y/G	G	
HD	X1	.30	.70	.45			
HD	X4		.30	.85	.40		
HD	X1 U X4	.30	.70	.85	.40	0	(aggregated confidence levels)

Table 1.5 Aggregated Confidence Levels of Moderately Dependent (MD) objectives

		R	R/Y	Y	Y/G	G	
MD	X5			.40	.90	.30	
MD	X6		.20	.70	.35		
MD	X5 U X6	0	.20	.70	.90	.30	(aggregated confidence levels)

The aggregated confidence levels for each hierarchical dependence type from the bottom line of Tables 1.3, 1.4, and 1.5 are combined into matrix N of Table 1.6.

Table 1.6 Aggregated Confidence Levels by Hierarchical Dependence Types

Matrix N

	R	R/Y	Y	Y/G	G
ES	0	.25	.75	.85	.90
HD	.30	.70	.85	.40	0
MD	0	.20	.70	.90	.30
CO	0	0	0	0	0

Step 3 - Factor the hierarchical dependence value into the aggregated confidence levels matrix. The hierarchical dependence values, di, are factored into the confidence levels matrix using the MIN operator. That is, the confidence levels, nij from Table 1.6, can be no greater than the dependence value, di. For example, for dependence ES, the confidence values can be no greater than .85, the dependence value for ES. Thus, the .90 confidence level for color green is reduced to .85. Table 1.6 is shown below with the dependence values, di, along the side. The aggregated confidence level matrix factored by the dependence values is shown in Table 1.7.

Table 1.6a Aggregated Confidence Levels by Hierarchical Dependence Types

Matrix N

di		R	R/Y	Y	Y/G	G
.85	ES	0	.25	.75	.85	.90
.70	HD	.30	.70	.85	.40	0
.40	MD	0	.20	.70	.90	.30
.25	CO	0	0	0	0	0

Table 1.7 Aggregated Confidence Level Matrix Factored by the Dependence Value

$$N' = \text{Min}\,[di, nij], \text{ for all } i, j$$

	R	R/Y	Y	Y/G	G
ES	0	.25	.75	.85	.85
HD	.30	.70	.70	.40	0
MD	0	.20	.40	.40	.30
CO	0	0	0	0	0

Step 4 - Aggregate confidence levels over all dependences. The confidence levels are then aggregated over all hierarchical dependences using the MAX operator by picking the maximum confidence level under each color from Table 1.7. The results in Table 1.8 represent the final aggregated confidence level for each color.

Table 1.8 Final Aggregated Confidence Levels for each color

$$M = \text{Max } n'ij, \text{ for all } i, ji$$

R	R/Y	Y	Y/G	G
.30	.70	.75	.85	.85

Step 5 - Determine the rollup color. The rollup color is the color with the maximum aggregated confidence level. In case of ties, as in Table 1.8, the color closest to Red (Yellow/Green in this case) is chosen as the nominal pessimist rollup color. The color closest to Green (Green in this case) is chosen for the nominal optimist model. The final rollup results are shown below for the rollup to Battlefield Activity BA-1.

Rollup colors: Nominal pessimist Model: (Y/G .85)
Nominal optimist Model: (G .85)

Step 6 - Determine the drivers of the rollup color.

Driver of nominal pessimist rollup color: The driver of the nominal pessimist rollup color is the objective assessment which caused the nominal pessimist rollup color to be yellow/green at a .85 confidence level. The driver is determined by scanning all objectives with a dependence value greater than or equal to .85 (i.e. all essential dependence objectives) and with a confidence level for yellow/green of .85 or higher. Objective X2 is the only objective that satisfies these conditions with an essential dependence and a confidence level for yellow/green of .85. Therefore objective X2 is the driver.

Driver of nominal pessimist rollup color: X2: (ES) (Y/G .85)

Driver of the nominal optimist rollup color: The driver of the nominal optimist rollup color is the objective assessment which caused the nominal optimist rollup color to be green at a .85 confidence level. The driver is determined in the same way as for the nominal pessimist rollup color by scanning all objectives with a dependence value greater than or equal to .85 (i.e. all essential dependence objectives) and with a confidence level for green of .85 or higher. Objective X3 is the only objective that satisfies these conditions with an essential dependence and a confidence level for green of .90. Therefore objective X3 is the driver. It is possible that more than one objective may satisfy the conditions for the driver. If so, all the objectives that are drivers are stored and displayed.

Driver of nominal optimist rollup color: X3: (ES) (G .90)

Summary of rollup results to Battlefield Function BF-1:

Rollup colors: Nominal pessimist Model: (Y/G .85) Driver: X2: (ES) (Y/G .85)
Nominal optimist Model: (G .85) Driver: X3: (ES) (G .90)

1.1.2 Rollup to Battlefield Function BF-2 (i.e. Fire Support)

Rollup to other Battlefield Functions (BF-2 thru BF-7) is similar to the rollup for Battlefield Function 1.

1.2.1 Rollup to Mission Area MA-1 (i.e. AAW)

The rollup to the Mission Area Level uses the rollup color and confidence level from the Battlefield Function level. The nominal pessimist model uses the nominal pessimist rollup result and the nominal optimist model uses the nominal optimist rollup result. Since the computation of the rollup is identical for both the nominal pessimist and nominal optimist models except in the last step, only the nominal pessimist model will be illustrated here.

Table 1.17 Rollup Results from Battlefield Function Level (Nominal Pessimist Model)

	R	R/Y	Y	Y/G	G
ES BF-1:		.85			
HD BF-2:	.85				
HD BF-3:	.70				

Step 2 - Aggregate confidence levels by hierarchical dependence type.

Table 1.18 Aggregated Confidence Levels by Hierarchical Dependence Type

Matrix N

	R	R/Y	Y	Y/G	G
ES				.85	
HD	.85	.70			

Step 3 - Factor the hierarchical dependence value into the aggregated confidence levels matrix.

Table 1.19 Aggregated Confidence Level Matrix Factored by the Dependence Value

$N' = \text{Min}[di, nij]$, for all i, j

di		R	R/Y	Y	Y/G	G
.85	ES	0	0	0	.85	0
.7	HD	.70	.70	0	0	0

Step 4 - Aggregate confidence levels over all dependences.

Table 1.20 Final Aggregated Confidence Levels for each color

R	R/Y	Y	Y/G	G
.70	.70	0	.85	0

Steps 5, 6 - Determine the rollup color and driver for MA-1.

Summary of rollup results to Mission Area MA-1:

Rollup color: Nominal pessimist: (Y/G .85) Driver: BA-1: (ES) (Y/G .85)

1.3.1 Rollup to Mid-Term Combat Development Capabilities MCDC-1

The rollup to the Mid-Term Combat Development Capability level uses the rollup color and confidence level from the Mission Area Level.

1.4.1 Rollup to Operational Concept OPCON-1

The rollup to the Operational Concept uses the rollup color and confidence level from the Mid-Term Combat Development Capability level.

II. Rollup -Weighted Average Model

This model of the rollup produces a result which represents an average of all the individual assessments. Steps 0 through 2 are the same as in the pessimist model. Beginning from Step 3 is where the algorithm differs from the pessimist model.

Step 0 - Assign values to each hierarchical dependence type.

Each objective is assigned a hierarchical dependence type which represents the relative importance of the objective to the mission. The possible hierarchical dependence types that can be assigned are Essential (ES), Highly Dependent (HD), Moderately Dependent (MD), or Contributing (CO).
A numeric value between zero and one is assigned to each of the hierarchical dependence types representing the relative importance of the dependence. The more important dependences are assigned larger values. A possible assignment is shown in Table 2.0.

Table 2.0 Values of Hierarchical Dependences

Hierarchical Dependence	ES	HD	MD	CO
Value	.85	.7	.4	.25

2.1.1 Rollup to Battlefield Funciton BF-1.

The following is the procedure for computing the rollup to the Battlefield Function level from the Task Level Capability Objective assessments using the weighted average model.

Step 1 - Assess each objective.

Shown in Table 2.1 below are the assessments of all task level objectives for the Battlefield Function BF-1. The numbers represent the confidence level for the assessment of the objective at the color and dependence.

Table 2.1 Assessments of Objectives by color and Confidence Level

	Objective	R	R/Y	Y	Y/G	G
ES	X1:			.25	.75	.40
ES	X2:					.85
ES	X3:			.60	.90	
HD	X1:		.30	.70	.45	
HD	X4:			.30	.85	.40
MD	X5:		.40	.90	.30	
MD	X6:			.20	.70	.35

Step 2 - Aggregate confidence levels by hierarchical dependence type.

The confidence levels for the objective assessments are aggregated by each hierarchical dependence type using the Union operator (MAX operator), U. The aggregation for the Essential, Highly Dependent, and Moderately Dependent objectives are shown in Tables 2.2, 2.3, and 2.4 respectively.

Table 2.2 Aggregated Confidence Levels of Essential (ES) Objectives

		R	R/Y	Y	Y/G	G	
ES	X1:	.25	.75	.40			
ES	X2:			.85			
ES	X3:			.60	.90		
ES	X1 U X2 U X3	0	.25	.75	.85	.90	(Aggregated confidence levels - max value over all objectives at each color)

U is the Union operator (MAX operator)

Table 2.3 Aggregated Confidence Levels of Highly Dependent (HD) Objectives

		R	R/Y	Y	Y/G	G	
HD	X1:	.30	.70	.45			
HD	X4:		.30	.85	.40		
HD	X1 U X4:	.30	.70	.85	.40	.0	(aggregated confidence levels)

Table 2.4 Aggregated Confidence Levels of Moderately Dependent (MD) Objectives

	R	R/Y	Y	Y/G	G	
MD X5:			40	.90	.30	
MD X6:		.20	.70	.35		
MD X5 U X6	0	.20	.70	.90	.30	(aggregated confidence levels)

The aggregated confidence levels for each hierarchical dependence type from the bottom line of Tables 2.2, 2.3, and 2.4 are combined into matrix N of Table 2.5.

Table 2.5 Aggregated Confidence Levels by Hierarchical Dependence Types

Matrix N

	R	R/Y	Y	Y/G	G
ES	0	.25	.75	.85	.90
HD	0	.30	.70	.85	.40
MD	0	.20	.70	.90	.30
CO	0	0	0	0	0

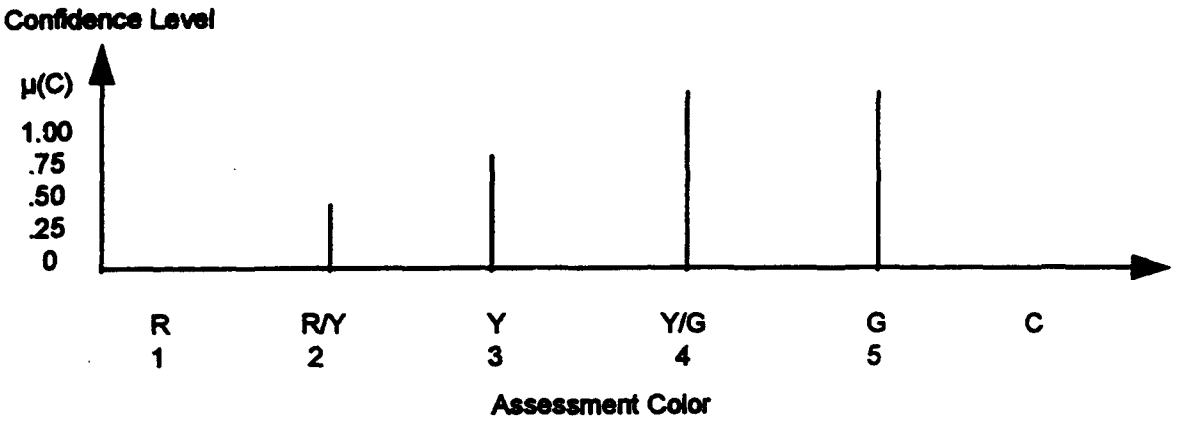
Step 3 - Convert the aggregated confidence levels into numeric color scores.

After the confidence levels have been aggregated by dependence type, the next step is to convert these values into a single numeric score for each dependence. This conversion can be done using a weighted average method. The confidence levels, which represent weights on the color values, are normalized to sum to one. These normalized confidence levels are then multiplied by the color values and summed over all colors to get the numeric score, which represents a partial rollup score for each dependence type.

Conversion of aggregated confidence levels for Essential Dependent objectives into a numeric score

To help visualize the results of the previous step and the current step, a plot is made of the aggregated assessments for each dependence type. The x- axis is the color values, C, and the y-axis is the confidence levels, $\mu(C)$. Shown first is the results for objectives with Essential dependence.

Aggregated assessments for Essential dependent objectives



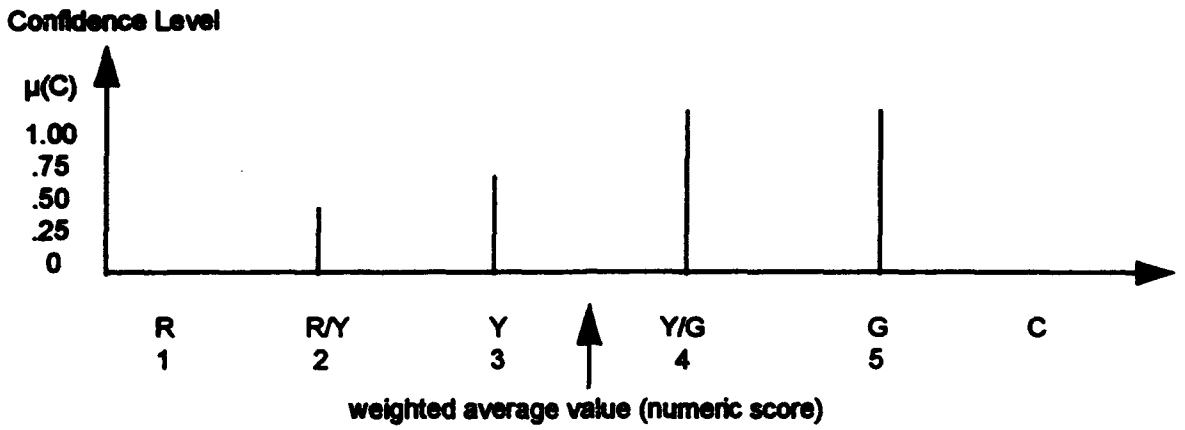
The computations for converting the aggregated confidence levels for objectives with Essential dependence are shown below. The confidence levels are first normalized by dividing by the sum, 2.75. The normalized confidence levels or weight, Di, are then multiplied by the color value, Ci, and summed over all color.

						Sum
Confidence Level, μ(C)	0	.25	.75	.85	.90	2.75
(Weight on color)						
Normalized Weight, Di	0	.0909	.273	.309	.327	
	R	R/Y	Y	Y/G	G	
color Values, Ci	1	2	3	4	5	

Di * Ci (0 * 1) (.0909 * 2) (.273 * 3) (.309 * 4) (.327 * 5)
Σ (Di * Ci) = 0 + .182 + .819 + 1.236 + 1.636 = 3.87
Partial Rollup color = Y/G

The numeric score for the aggregated confidence levels for objectives with Essential dependence is 3.87. This value is shown on the next page in the plot of the aggregated assessments.

Aggregated assessments for Essential dependence objectives

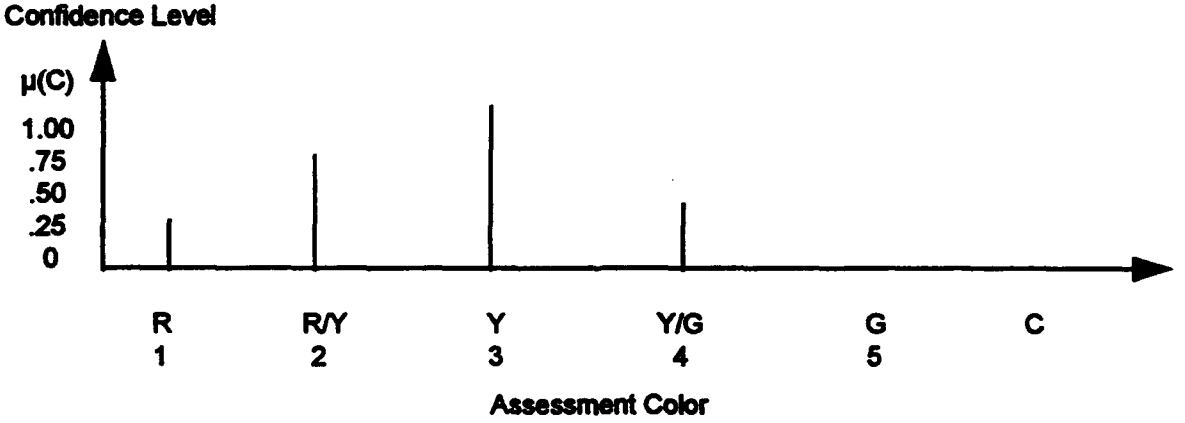


The numeric score of 3.87, if converted to a color, would be rounded to 4, which is the color yellow/green. This score, however, is only a partial rollup score as it represents only Essential dependent objectives.

Conversion of aggregated confidence levels for Highly Dependent objectives into a numeric score

A plot of the aggregated confidence levels for Highly Dependent objectives is shown below.

Aggregated assessments for Highly Dependent objectives



The weighted average computations for converting the aggregated confidence levels for the Highly Dependent objectives into a numeric score follows.

						Sum
Confidence Level, μ(C) (Weight on color)	.30	.70	.85	.40	0	2.25
Normalized Weight, Di	.133	.311	.378	.178	0	

	R	R/Y	Y	Y/G	G
color Values, Ci	1	2	3	4	5

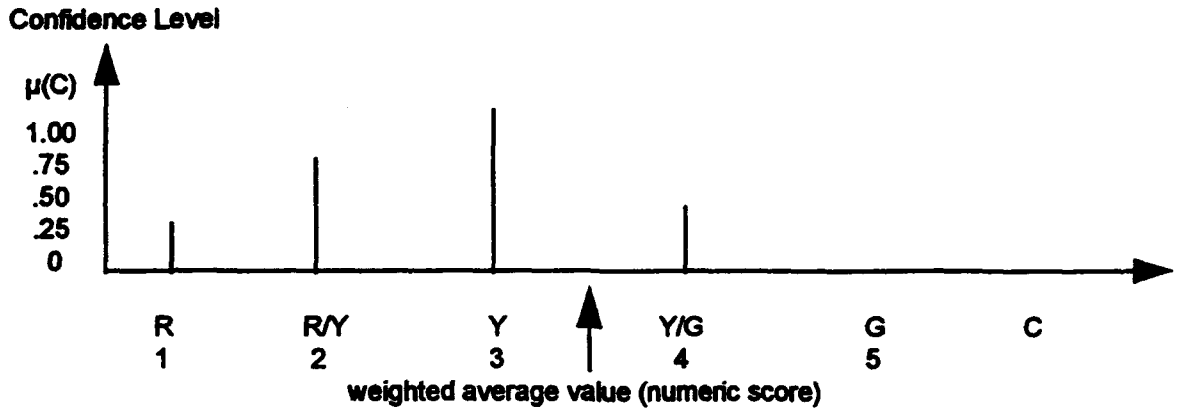
Di * Ci (.133 * 1) (.311 * 2) (.378 * 3) (.178 * 4) (0 * 5)

Σ (Di * Ci) = .133 + .622 + 1.133 + .711 + 0 = 2.60

Partial Rollup color = Y

The numeric score for the aggregated confidence levels for objectives which are Highly Dependent is 2.60. This value is shown below in the plot of the aggregated assessments.

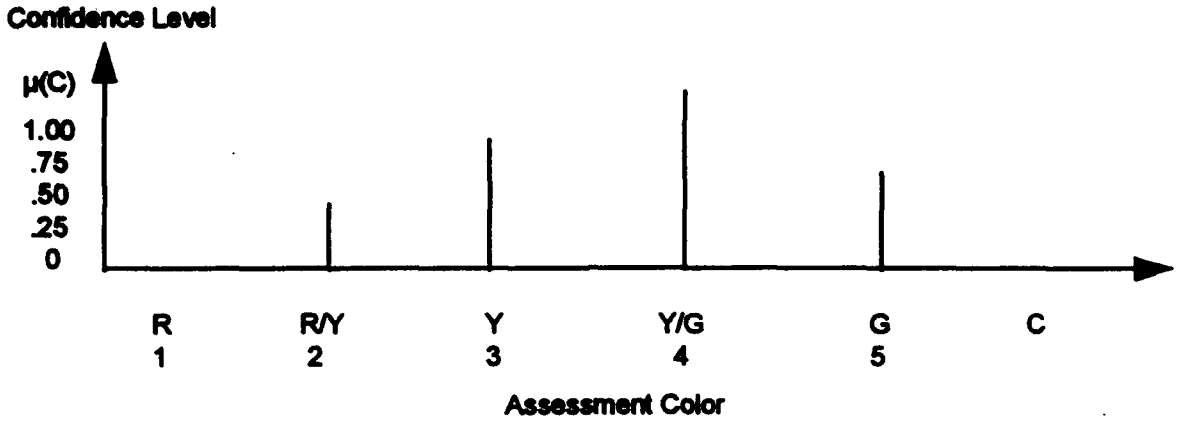
Aggregated assessments for Highly Dependent objectives



Conversion of aggregated confidence levels for Moderately Dependent objectives into a numeric score

A plot of the aggregated confidence levels forModerately Dependent objectives is shown below.

Aggregated assessments for Moderately Dependent objectives



The weighted average computations for converting the aggregated confidence levels for the Moderately Dependent objectives into a numeric score is shown below.

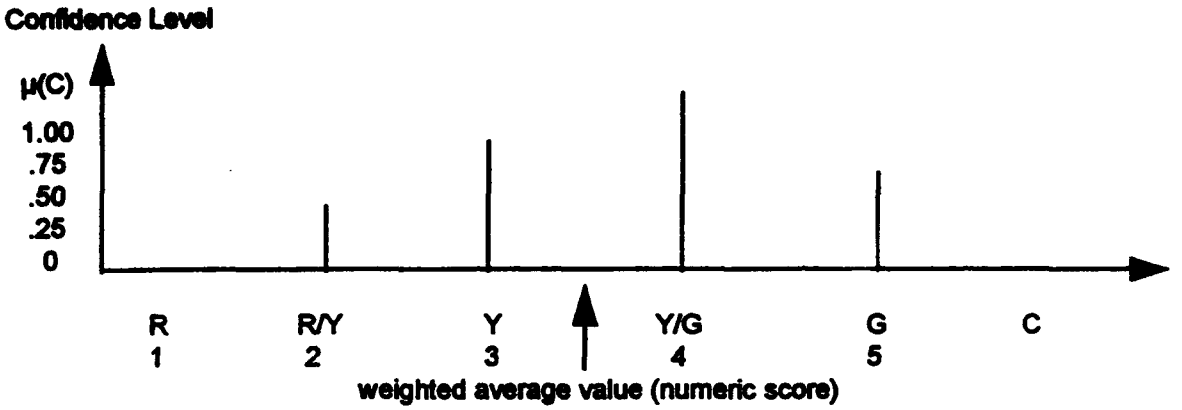
						Sum
Confidence Level, μ(C)	0	.20	.70	.90	.30	2.10
(Weight on color)						
Normalized Weight, Di	0	.0952	.333	.429	.143	

	R	R/Y	Y	Y/G	G
color Values, Ci	1	2	3	4	5

Di * Ci (0 * 1) (.0952 * 2) (.333 * 3) (.429 * 4) (.143 * 5)
Σ (Di * Ci) = 0 + .190 + 1.00 + 1.714 + .714 = 3.62
Partial Rollup color = Y/G

The numeric score for the aggregated confidence levels for objectives which are Moderately Dependent is 3.62. This value is shown below in the plot of the aggregated assessments.

Aggregated assessments for Moderately Dependent objectives



Step 4 - Compute a weighted average rollup assessment.

The weighted average rollup color is computed as a product of the normalized hierarchical dependence (weight) values, Wi, multiplied by the numeric color values, Ci, summed over all dependencies. The computations are shown below.

The hierarchical dependence (weight) values are the ones assigned in Step 0. The normalized weight values, Wi, are computed by dividing each hierarchical dependence value by the sum of the three dependences, 1.95. The numeric color values, Ci, are taken from the results of the previous section.

				Sum
Hierarachical Dependence (Weight)	ES (.85)	HD (.7)	MD (.4)	1.95
Normalized Weight, Wi	.436	.359	.205	
Numeric Color Values, Ci	Y/G 3.87	Y 2.6	Y/G 3.62	

Wi * Ci (.436 * 3.87) (.359 * 2.6) (.205 * 3.62)
Σ (Wi * Ci) = 1.69 + 0.933 + 0.742 = 3.36
Rollup color = Y

The weighted average value is 3.36 which when converted back into a color is rounded to the nearest integer 3, which is yellow. Thus, the weighted average rollup color is yellow.

Rollup to Battlefield Function BF-1

Weighted Average: Y (3.36)

Note on drivers of the weighted average model

Since the weighted average model is computed based on all the objective assessments, there is no single objective which drives the rollup. Therefore the weighted average model has no drivers.

2.2.1 Rollup to Mission Area MA-1

The rollup results for the Battlefield Functions are used in the calculation of the rollup to the Mission Area Level.

2.3.1 Rollup to Mid-Term Combat Development Capability MCDC-1

The weighted average rollup results for the Mission Areas are used in the calculation of the rollup to the MCDC level.

2.4.1 Rollup to Operational Concept OPCON-1

The weighted average rollup results for Mid-Term Combat Development Capabilities are used in the calculation of the rollup to the Operational Concept.

III. Rollup - Bias Toward Red Model

This section describes the calculation of the rollup for the bias toward red model. This model gives rollups which tend towards red when compared to the rollups for the nominal optimist or bias toward green models but usually not as red as the nominal pessimist model.

The steps for calculating this rollup are identical to that for the nominal optimist and pessimist models with the exception of the mathematical operators used. In steps 2 and 4, the union operator used to aggregate the confidence levels is the algebraic sum (x + y - xy) operator instead of the MAX (max (x,y)) operator used in the nominal optimist and pessimist models. The MAX operator used in the nominal optimist model simply picks the maximum value among all confidence levels as the aggregated value. It is a no compensation operator in that only

one confidence level (the maximum one) is used in arriving at the aggregated value. The algebraic sum operator, on the other hand, is a compensation type operator in that it combines the values of all confidence levels in arriving at the aggregated value.

Another difference is the intersection operator used in step 3 to factor the hierarchical dependence value into the aggregated confidence levels matrix. The bounded product ($x \cdot y$) operator is used instead of the MIN (min (x,y)) operator used in the nominal pessimist model. The bounded product operator is a compensation operator like the algebraic sum, whereas the MIN operator is a no compensation operator.

In case of ties in the final step of the rollup calculations, the color closest to red is chosen as the rollup color.

Step 0 Assign values to each hierarchical dependence type

The values assigned to the hierarchical dependences are shown in Table 3.0.

Table 3.0 Values of Hierarchical Dependences

Hierarchical Dependence	ES	HD	MD	CO
Value	.85	.7	.4	.25

3.1.1 Rollup to Battlefield Function BF-1

The following is the procedure for computing the rollup to the Battlefield Function Level from the Task level Capability Objective assessments using the bias toward red model.

Step 1 Assess each objective

Shown in Table 3.2 below are the assessments of all the objectives for the Battlefield Function BF-1. The numbers represent the confidence level for the assessment of the objective at the color and dependence.

Table 3.2 Assessments of Objectives by color and Confidence Level

Objective		R	R/Y	Y	Y/G	G
ES	X1:		.25	.75	.40	
ES	X2:				.85	
ES	X3:				.60	.90

HD	X1:	.30	.70	.45		
HD	X4:		.30	.85	.40	
MD	X5:			.40	.90	.30
MD	X6:		.20	.70	.35	

Step 2 Aggregate confidence levels by hierarchical dependence type

The confidence levels for the objective assessments are aggregated by each hierarchical dependence type. The objective assessments are aggregated using the algebraic sum operator (x + y - xy). The calculation is done on two values at a time, with the result used in combining the third value and so on.

For example, to aggregate the confidence levels for the color Y/G, the .40 and .85 values are first combined as shown below.

$$x + y - xy = .40 + .85 - (.40)(.85) = .91$$

The .91 resultant value is then combined with the value .60 using the same calculation as follow.

$$x + y - xy = .91 + .60 - (.91)(.60) = .96$$

The aggregated value is thus .96 for color Y/G.

Table 3.3 Aggregated Confidence Levels of Essential (ES) Objectives

		R	R/Y	Y	Y/G	G	
ES	X1:		.25	.70	.45		
ES	X2:				.85		
ES	X3:				.60	.90	
ESX1 U X2 U X3		0	.25	.75	.96	.90	(aggregated confidence levels - using the algebraic sum operator)

U is the Union operator (using the algebraic sum (x + y - xy) operator)

Table 3.4 Aggregated Confidence Levels of Highly Dependent (HD) Objectives

		R	R/Y	Y	Y/G	G	
HD	X1:	.30	.70	.45			
HD	X4:		.30	.85	.40		
HD	X1 U X4	.30	.79	.92	.40	0	(aggregated confidence levels)

Table 3.5 Aggregated Confidence Levels of Moderately Dependent (MD) Objectives

		R	R/Y	Y	Y/G	G	
MD	X5:			.40	.90	.30	
MD	X6:		.20	.70	.35		
MD	X5 U X6	0	.20	.82	.94	.30	(aggregated confidence levels)

The aggregated confidence levels for each hierarchical dependence type from the bottom line of Tables 3.3, 3.4, and 3.5 are combined into matrix N of Table 3.6.

Table 3.6 Aggregated Confidence Levels by Hierarchical Dependence Types

Matrix N

	R	R/Y	Y	Y/G	G
ES	0	.25	.75	.96	.90
HD	.30	.79	.92	.40	0
MD	0	.20	.82	.94	.30
CO	0	0	0	0	0

Step 3 Factor the hierarchical dependence value into the aggregated confidence levels matrix

The hierarchical dependence values, di, are factored into the confidence levels matrix using the bounded product operator, a compensation-min operator. This calculation reduces the confidence levels by a factor of the dependence value. For example, the confidence level for color R/Y at Essential dependence in Table 3.6a is factored by the dependence value of .85 as shown below.

$$x \cdot y = .85 \cdot .25 = .21$$

The value .21 is the factored confidence level value as shown in Table 3.7.

Table 3.6a Aggregated Confidence Levels by Hierarchical Dependence Types

Matrix N

di		R	R/Y	Y	Y/G	G
.85	ES	0	.25	.75	.96	.90
.70	HD	.30	.79	.92	.40	0
.40	MD	0	.20	.82	.94	.30
.25	CO	0	0	0	0	0

Table 3.7 Aggregated Confidence Level Matrix Factored by the Dependence Value

$N' = di \cdot nij$, for all i, j

	R	R/Y	Y	Y/G	G
ES	0	.21	.64	.82	.77
HD	.21	.55	.64	.28	0
MD	0	.08	.33	.38	.12
CO	0	0	0	0	0

Step 4 Aggregate confidence levels over all dependences

The confidence levels are then aggregated over all hierarchical dependences using the algebraic sum operator in the same manner as it was used in step 2.

For example, to aggregate the confidence levels for the color R/Y, the .21 and .55 values are first combined as shown below.

$$x + y - xy = .21 + .55 - (.21)(.55) = .64$$

The .64 resultant value is then combined with the value .08 as follows.

$$x + y - xy = .64 + .08 - (.64)(.08) = .67$$

The aggregated value is thus .67 for color R/Y.

The results in Table 3.8 represent the final aggregated confidence level for each color.

Table 3.8 Final Aggregated Confidence Levels for each color

$$M = x + y - xy$$

R	R/Y	Y	Y/G	G
.21	.67	.91	.92	.80

Step 5 Determine the rollup color

The rollup color is the color with the maximum aggregated confidence level. In case of ties, the color closest to red is chosen as the rollup color.

Rollup to Battlefield Funciton BF-1:

Rollup color: (Y/G .92)

Step 6 Determine the driver of the rollup color:

The driver of the rollup color is the objective assessment which was most influential in causing the rollup color to be yellow/green at a .92 confidence level. The driver is determined by first finding the maximum value under color yellow/green in Table 3.7. The maximum value .82 is from Essential dependence objectives. Thus, all Essential dependent objectives are searched to find the maximum confidence level under color yellow/green. The maximum value is .85 for objective X2 from Table 3.3. Thus the driver of the rollup color is objective X2 as shown below.

Summary of rollup results to Battlefield Function BF -1:

Rollup color: (Y/G .92) Driver: X2: (ES) (Y/G .85)

IV. Rollup - Bias Toward Green Model

This section describes the calculation of the rollup for the bias toward green decision making model. This model gives rollups which tend towards green when compared to the rollups for the nominal pessimist or bias toward red models but usually not as green as the nominal optimist model.

The steps for calculating this rollup are identical to that for the nominal optimist and pessimist and bias toward red models with the exception of the mathematical operators used. In steps 2 and 4, the union operator used to aggregate the confidence levels is the min(1,x+y) operator instead of the MAX operator or algebraic sum operator. The min(1,x+y) operator like the algebraic sum operator is a compensation type operator in that it uses the values of all confidence levels in arriving at the aggregated value.

The other difference in this model is the intersection operator used in step 3 to factor the hierarchical dependence value into the aggregated confidence levels matrix. The max(0,x+y-1) operator is used instead of the MIN (min(x,y) or the bounded product (x · y) operator. The max(0,x+y-1) operator is also a compensation operator.

In case of ties in the final step of the rollup calculations, the color closest to green is chosen as the rollup color.

Step 0 Assign values to each hierarchical dependence type

The values assigned to the hierarchical dependences are shown in Table 4.0.

Table 4.0 Values of Hierarchical Dependences

Hierarchical Dependence	ES	HD	MD	CO
Value	.85	.7	.4	.25

4.1.1 Rollup to Battlefield Function BF-1

The following is the procedure for computing the rollup to the Battlefield Function level from the Task Level Capability Objective assessments using the bias toward green model.

Step 1 Assess each objective

Shown in Table 4.2 below are the assessments of all the objectives for the Battlefield Function BF-1. The numbers represent the confidence level for the assessment of the objective at the color and dependence.

Table 4.2 Assessments of Objectives by color and Confidence Level

Objective	R	R/Y	Y	Y/G	G
ES X1:		.25	.75	.40	
ES X2:				.85	
ES X3:				.60	.90
HD X1:		.30	.70	.45	
HD X4:			.30	.85	.40
MD X5:			.40	.90	.30
MD X6:		.20	.70	.35	

Step 2 Aggregate confidence levels by hierarchical dependence type

The confidence levels for the objective assessments are aggregated by each hierarchical dependence type. The objective assessments are aggregated using the min(1,x+y) operator. The calculation is done on two values at a time, with the result used in combining the third value and so on.

For example, to aggregate the confidence levels for the color Y/G, the .40 and .85 values are first combined as shown below.

$$\min(1,x+y) = \min(1, .40+.85) = \min(1, 1.25) = 1.0$$

The 1.0 resultant value is then combined with the value .60 using the same calculation as follow.

$$\min(1,x+y) = \min(1, 1.0+.60) = \min(1, 1.60) = 1.0$$

The aggregated value is thus 1.0 for color Y/G.

Table 4.3 Aggregated Confidence Levels of Essential (ES) Objectives

	R	R/Y	Y	Y/G	G	
ES X1:		.25	.75	.40		
ES X2:				.85		
ES X3:				.60	.90	
ES X1 U X2 U X3	0	.25	.75	1.0	.90	(aggregated confidence levels - using the min (1,x+y) operator)

U is the Union operator (using the min (1,x+y) operator)

Table 4.4 Aggregated Confidence Levels of Highly Dependent (HD) Objectives

		R	R/Y	Y	Y/G	G	
HD	X1:	.30	.70	.45			
HD	X4		.30	.85	.40		
HD	X1 U X4	.30	1.0	1.0	.40	0	(aggregated confidence levels)

Table 4.5 Aggregated Confidence Levels of Moderately Dependent (MD) Objectives

		R	R/Y	Y	Y/G	G	
MD	X5:			.40	.90	.30	
MD	X6:		.20	.70	.35		
MD	X5 U X6	0	.20	1.0	1.0	.30	(aggregated confidence levels)

The aggregated confidence levels for each hierarchical dependence type from the bottom line of Tables 4.3, 4.4, and 4.5 are combined into matrix N of Table 4.6.

Table 4.6 Aggregated Confidence Levels by Hierarchical Dependence Types

Matrix N

	R	R/Y	Y	Y/G	G
ES	0	.25	.75	1.0	.90
HD	.30	1.0	1.0	.40	0
MD	0	.20	1.0	1.0	.30
CO	0	0	0	0	0

Step 3 Factor the hierarchical dependence value into the aggregated confidence levels matrix

The hierarchical dependence values, di, are factored into the confidence levels matrix using the max(0,x+y-1) operator, a compensation-min operator. This calculation reduces the confidence levels by a factor of the dependence value. For example, the confidence level for color R/Y at Essential dependence in Table 4.6a is factored by the dependence value of .85 as shown below.

$$\max(0,x+y-1) = \max(0, .85+.25-1) = \max(0, .10) = .10$$

The value .10 is the factored confidence level value as shown in Table 4.7.

Table 4.6a Aggregated Confidence Levels by Hierarchical Dependence Types

Matrix N

di		R	R/Y	Y	Y/G	G
.85	ES	0	.25	.75	1.0	.90
.70	HD	.30	1.0	1.0	.40	0
.40	MD	0	.20	1.0	1.0	.30
.25	CO	0	0	0	0	0

Table 4.7 Aggregated Confidence Level Matrix Factored by the Dependence Value

$$N' = \max(0, di + nij - 1), \text{ for all } i, j$$

Step 4 Aggregate confidence levels over all dependences

The confidence levels are then aggregated over all hierarchical dependences using the min(1,x+y) operator in the same manner as it was used in step 2.

For example, to aggregate the confidence levels for the color R/Y, the .10 and .70 values are combined as shown below.

$$\min(1, x+y) = \min(1, .10+.70) = \min(1, .80) = .80$$

The aggregated value is thus .80 for color R/Y.

The results in Table 4.8 represent the final aggregated confidence level for each color.

Table 4.8 Final Aggregated Confidence Levels for each color

$$M = \min(1, x+y)$$

R	R/Y	Y	Y/G	G
0	.80	1.0	1.0	.75

Step 5 Determine the rollup color

The rollup color is the color with the maximum aggregated confidence level. In case of ties, the color closest to green is chosen as the rollup color since this model represents a bias toward green. Thus, the color yellow/green is chosen in this example.

Rollup to Battlefield Funciton BF-1:

Rollup color: (Y/G 1.0)

Step 6 Determine the driver of the rollup color:

The driver of the rollup color is the objective assessment which was most influential in causing the rollup color to be yellow/green at a 1.0 confidence level. The driver is determined by first finding the maximum value under color yellow/green in Table 4.7. The maximum value .85 is from Essential dependence objectives. Thus, all Essential dependent objectives are searched to find the maximum confidence level under color yellow/green. The maximum value is .85 for objective X2 from Table 4.3. Thus, the driver of the rollup color is objective X2 as shown below.

Summary of rollup results to Battlefield Funciton BF-1:

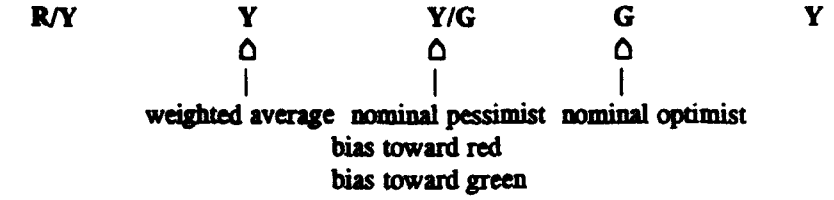
Rollup color: (Y/G 1.0) Driver: X2: (ES) (Y/G .85)

V. Summary of rollup results

Rollup to Battlefield Function BF-1

Assessments of Objectives by Color and Confidence Level

		R	R/Y	Y	Y/G	G
ES	X-1:		.25	.75	.40	
ES	X-2:				.85	
ES	X-3:				.60	.90
HD	X-1:	.30	.70	.45		
HD	X-1:		.30	.70	.35	
MD	X-5:			.40	.90	.30
MD	X-6:		.20	.70	.35	



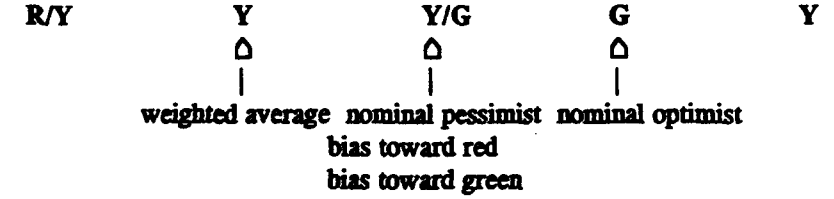
Rollup to Battlefield Funciton BF-2

Assessments for Battlefield Function BF-2

Rollup to Battlefield Function BF-3

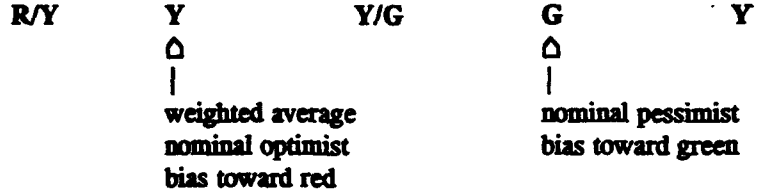
Assessments for Battlefield Function BF-3

		R	R/Y	Y	Y/G	G
ES	X8:	.85	.60	.20		
ES	X9:			.40	.90	.30
HD	X10:		.20	.95	.30	
MD	X11:	.30	.95	.20		
CO	X12:			.25	.90	

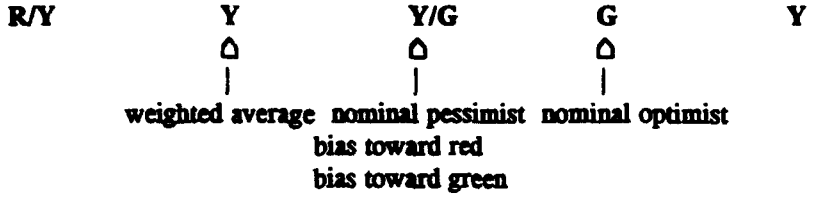


Rollup to Battlefield Function BF-2

Assessments for Battlefield Function BF-2



Rollup to Mission Area MA-1



Discussion of Models

It is the nature of the algorithms for the nominal optimist, nominal pessimist, and bias toward red, and bias toward green models that one objective will dominate or be most influential in the rollup. That objective is called the driver of the rollup. The weighted average model, on the other hand, does not allow any one objective to dominate the rollup. It computes a rollup based on all the individual assessments.

The rollup to Battlefield Function BF-2 is an example of the strong tendency toward red of the nominal pessimist model and the strong tendency toward green of the nominal optimist model. The rollup to BF-3 is an example of the slight tendency toward red of the bias toward red model and the slight tendency toward green of the bias toward green model. In the rollups to BF-1 and BF-2, where the assessments are evenly spread over both sides of yellow, the weighted average tends to yellow, the average in those two examples.

All the models except for the weighted average produce a rollup color where essential components heavily dominate the other dependence types. The weighted average model produces a rollup color which is computed based on all the individual assessment values. It weights the individual assessments by the hierarchical dependence assigned to it. It is not surprising to see the weighted average frequently produces rollups to yellow and may occasionally rollup to the left or right of all other models because of the way it aggregates the color and dependences.

Appendix E

Criteria for Prioritization of T&E Programs

APPENDIX E

CRITERIA FOR THE PRIORITIZATION OF T&E PROGRAMS

The rank ordering of T&E programs is accomplished using a Multiple Attribute Decision Making (MADM) method. A multiple attribute decision making problem can be represented in a decision matrix as shown below where the X_j's represent the attributes (criteria), the W_j's represent the weight on criterion X_j, and the Pi's represent the programs to be ranked. Each xij represents the value of criterion X_j for program Pi.

Decision Matrix for Prioritizing T&E Programs

	W_1	W_2	W_3	...	W_n
	X_1	X_2	X_3	...	X_n
P1	x11	x12	x13	...	x1n
P2	x21	x22	x23	...	x2n
P3	x31	x32	x33	...	x3n
.	.				.
.	.				.
.	.				.
Pm	xm1	xm2	xm3	...	xmn

Six criteria are used in the prioritization of T&E programs according to mission benefit.

X1. Criterion based on number of objectives a program contributes to;

X2. Relative importance of the Task Level Capability Objective;

X3. Seriousness of the current deficiency;

X4. Improvement in capability over the FYDP;

X5. Impact of program across Mid-Term Combat Development Capabilities (MCCDC user only);

X6. Impact of program across MEFs (MCCDC user only).

Criteria 1, 2, 3, 4, or 5 can be used in the prioritization by both the MCCDC and MEF user. Criteria 2, 3, and 4 are three different versions of a single criterion. It is intended that only one of the three criteria be assigned a nonzero weight at any given time by setting the weight for the other two criteria to zero. Criterion 5 and criterion

6 are applicable only for the MCCDC user.

Allocation of resources (funding) is not feasible solely according to mission accomplishment. Other criteria generally restrict the allocation of resources. There are seven criteria used for resource allocation (the above method applies but with the following different criteria):

Z1. Contribution to mission accomplishment (i.e. ranking from the previous example);
Z2. Contribution to T&E objectives as defined in the MCMP;
Z3. Contribution to T&E goals as defined in the SEMP;
Z4. External factors (i.e. mandated by public law, DoD directed, CMC directed);
Z5. Contribution to Training Readiness by Capability Set;
Z6. Program risk (i.e. program definition, scope, implementation)
Z7. Program cost.

The methods for determining mission accomplishment criteria values for each program is discussed on the following pages. Funding criteria values are not discussed herein, as they will be determined during prototype development.

PRIORITIZATION ACCORDING TO MISSION ACCOMPLISHMENT

1.1 Criterion 1: Based on the Number of Objectives

This criterion is a score value which is based on the number of objectives a program contributes to.

MEF User Prioritization

For the MEF user this criterion will be modeled using the logarithmic function (see Figure 1-1 and Table 1-1), a diminishing return function, where each additional objective increases the score but at a diminishing rate. A reason for using a diminishing return function is to prevent a MEF from adding a lot of additional objectives to force a particular program to be ranked high.

Criterion Score translated using a diminishing return function (logarithmic function)

The criterion score is computed based on the natural logarithm function for number of objectives up to 20 (see below). After 20 objectives, the score stays constant at 4.0. The number 20 after which the score does not increase can be changed to whatever value is more appropriate.

The criterion score is normalized by dividing the score for a single program by the sum of the scores for all programs. An example of the normalized criterion scores for five programs is shown in an example on the following page.

Figure 1-1 Diminishing return function for number of objectives a program contributes to:

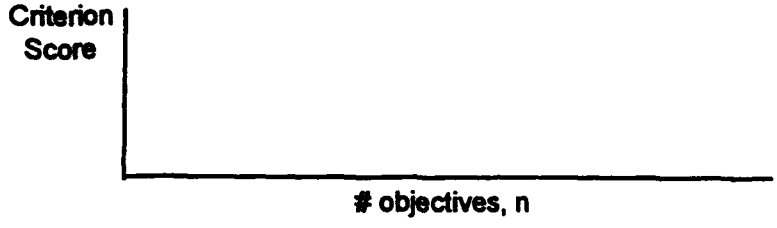


Table 1-1 Criterion Score for Number of Objectives a Program Contributes to:

n	Criterion Score = 1 + ln(n)	n	Criterion Score = 1 + ln(n)
1	1.000	11	3.398
2	1.693	12	3.485
3	2.099	13	3.565
4	2.386	14	3.639
5	2.609	15	3.708
6	2.792	16	3.772
7	2.946	17	3.833
8	3.079	18	3.890
9	3.197	19	3.944
10	3.303	20	3.996

Example: Criterion 1 for MCDC-1

Program	Unnormalized Criterion 1 Score: Number of Objectives	Normalized Criterion 1 Score: (1 + ln(n))/(1 + ln(n))	Sum
PGM1	3	2.099	0.2239
PGM2	4	2.386	0.2545
PGM3	0	0.000	0.0000
PGM4	6	2.792	0.2978
PGM5	3	2.099	0.2239
Sum		9.376	1.0000

MCCDC User Prioritization (Criterion 1: Based on the Number of Objectives)

For the MCCDC user this criterion will be calculated in the following way:

Criterion Score = total of unnormalized criterion score for each MEF using natural logarithm function

The criterion score will again be normalized by dividing the score for a single program by the sum of the scores for all programs.

An example is shown below for three programs. In Table 1-2 each entry under the MEF number represents the number of objectives a program contributes to. Table 1-3 is computed by applying the natural logarithm function to the values in Table 1-2 plus one where number of objectives ≤ 20. The total unnormalized criterion score for the MCCDC user is computed by adding up the values in Table 1-3 for all MEFs (shown on the next page). The criterion 1 score is then computed by dividing the totals for each program by the sum for all programs.

Example:

Table 1-2 Number of Objectives a Program Contributes to for each MEF

	MEF												
Program	1	2	3	4	5	6	7	8	9	10	11	12	13
PGM1	5	9	0	12	20	0	11	7	10	0	7	0	0
PGM2	0	50	0	0	0	0	0	0	0	0	0	0	0
PGM3	20	0	20	0	0	20	20	20	20	25	0	30	33

Table 1-3 Criterion Score using the Logarithm of # Objectives

$$\text{Value} = \begin{cases} 1 + \ln(n) & \text{for } n \leq 20 \\ 4.0 & \text{for } n > 20 \end{cases}$$

	MEF												
Program	1	2	3	4	5	6	7	8	9	10	11	12	13
PGM1	2.61	3.20	0	3.49	4.00	0	3.40	2.95	3.30	0	2.95	0	0
PGM2	0	4.00	0	0	0	0	0	0	0	0	0	0	0
PGM3	4.00	0	4.00	0	0	4.00	4.00	4.00	4.00	4.00	0	4.00	4.00

Table 1-3 Criterion Score using the Logarithm of # Objectives - continued

$$\text{Value} = \begin{cases} 1 + \ln(n) & \text{for } n \leq 20 \\ 4.0 & \text{for } n > 20 \end{cases}$$

	Criterion 1	
Program	**Σ unnormalized Criterion Score for each MEF**	**(MCCDC user)**
PGM1	28.29	0.4143

PGM	24.00	0.0586
PGM3	36.00	0.5272
Sum	68.29	1.0000

1.2 Criterion 2: Relative Importance of the Task Level Capability Objective

Criterion 2 is based on the relative importance of the Task Level Capability Objective which is computed using the hierarchical dependencies chained from the base level (level in assessment hierarchy chosen to do the ranking on) down to the Task Level Capability Objective level. The formula for computing this criterion shown below sums the normalized hierarchical dependencies, D_j, for all objectives a program contributes to.

$$\text{Criterion 2 Score} = \sum_{\text{all objs}} D_j$$

where D_j = Normalized Hierarchical Dependence (relative importance of objective) chained from the base level down to the objective level.

Table 1-4 shows the value assigned to each hierarchical dependence. Each successive term is shown as being twice as important as the next term. Thus, essential dependence is shown as twice the value of highly dependent which is twice the value of moderately dependent which is twice that of contributing. Different values can be assigned without affecting the steps in the algorithm.

Table 1-4 Hierarchical Dependence Values

Hierarchical Dependence	Value
ES	8
HD	4
MD	2
CO	1

1.2.1 Calculation of the Weight at the Task Level Capability Objective Level

The relative importance or weight of the Task Level Capability Objective is computed as a product of the normalized weight at each level in the Assessment Hierarchy. The normalized weight is computed by dividing the hierarchical dependence value by the total for all dependencies at each level.

In Example 1 shown below, the hierarchical dependence values for Mission Areas MA-1 and MA-2 are summed to get 12. Each hierarchical dependence value is then divided by the sum to get the normalized weights 0.667 and 0.333 for MA-1 and MA-2, respectively.

Example 1: Weights for the dependence between Mission Area and MCDC-1

MCDC-1:	Hier Dep	Hier Dep Value	Normalized Weight (Value/Sum)
MA-1:	ES	8	.667
MA-2:	HD	4	.333
	Sum	12	

Example 2 shows the calculations for computing the weights for the hierarchical dependence between the Battlefield Functions and Mission Area MA-1.

Example 2: Weights for the dependence between Battlefield Functions and MA-1

MA-1:	Hier Dep	Hier Dep Value	Normalized Weight (Value/Sum)
BF-1:	ES	8	.667
BF-2:	HD	4	.333
		Sum 12	

The same procedure is carried out for the Battlefield Functions under MA-2 and for each of the Task Level Capability Objectives.

Computation of total normalized weight for each Task Level Capability Objective

The total normalized weight for each Task Level Capability Objective is computed as the product of the normalized weight at each level in the assessment hierarchy.

Total normalized weight = MA wgt * BA wgt * OBJ wgt for Task Level Capability Objective j

Example: Total normalized weight for objective X1

Total normalized weight = MA-1 wgt * BF-1 wgt * OBJ-1 wgt
for OBJ-1 (X1) = .667 * .667 * .500
= .222

The values for the examples above are taken from Figure 1-2a on page 1-6. In the figure, to the left of each element (MCDC, MA, BA, or OBJ) is the hierarchical dependence (ES, HD, MD, CO) for that element relative to the element above it in the hierarchy. To its left is the value (8, 4, 2, 1) assigned to the hierarchical dependence and its normalized value (0 to 1.0). For the Task Level Capability Objectives, a third number (0 to 1.0 underlined) is shown which represents the total normalized weight of the Task Level Capability Objective. This value is the product of the normalized weight from the MCDC level down to the Task Level Capability Objective level shown in the computation above. Notice that the sum of the normalized weights at each level equals 1.0. The sum of the total normalized weights also equal 1.0.

1.2.2 Computation of Criterion 2 Score

The criterion score for a program is computed as the sum of the normalized hierarchical dependence values for each Task Level Capability Objective which a program affects.

$$\text{Criterion 2 Score} = \sum_{\text{all objs}} D_j$$

For the example shown below taken from Figure 1-2a, program PGM1 affects Task Level Capability Objectives X1 and X3. The criterion score is 0.222 + 0.222 = 0.444. The computations of the criterion score for the other programs are shown in the figure.

Example of criterion score computation

Program	Objective	Relative Importance Value
PGM1	X1	0.222
	X3	0.222
Criterion Score	=	0.444

Objectives affected by more than one program

If a task level capability objective is affected by more than one program, the total relative importance value will be assigned to each of the programs. The total value is assigned because it is not known how much each program actually contributes to the objective. Therefore the total score cannot be divided up into the proper proportion relative to its actual contribution to the objective.

Figure 1-2a Example Criterion 2 Calculations: ΣD_j

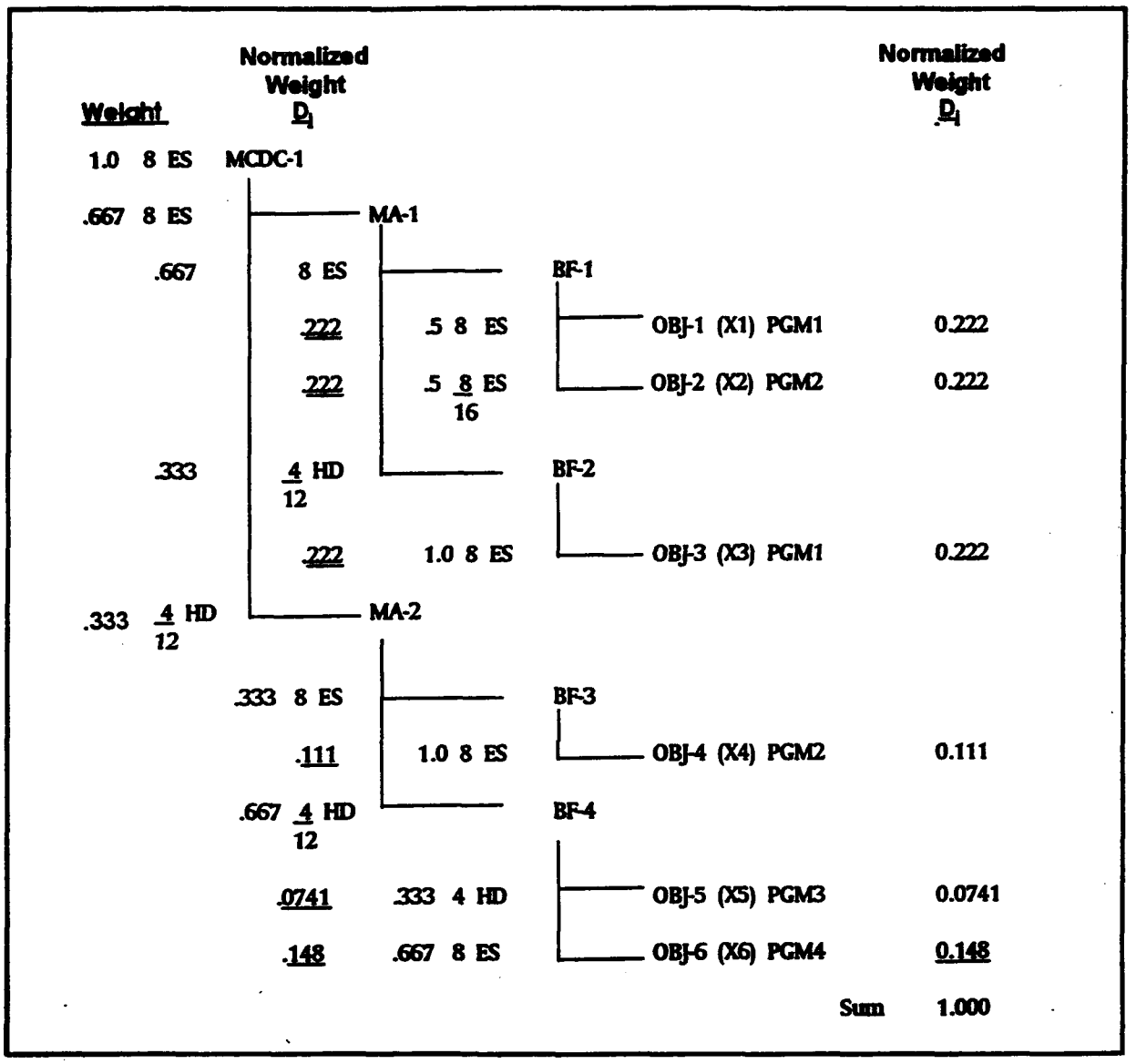


Figure 1-2a.

Calculation of Criterion 2 Score

PGM1: 0.222 + 0.222 = 0.444

PGM2: 0.222 + 0.111 = 0.333

PGM3: 0.0741 = 0.0741

PGM4: 0.148 = 0.148

1.3 Criterion 3: Seriousness of the Current Deficiency

Criterion 3 is based on the seriousness of the current deficiency which is the current color value of the objective. It also weights the objective by the relative importance factor which is the hierarchical dependencies. The formula for computing criterion 3 shown below sums the product of the normalized hierarchical dependencies, D_j, with the seriousness of the current deficiency, C_j, for the objectives contributed to by a program. The criterion score is then normalized by dividing by the sum for all objectives.

$$\text{Criterion 3 Score} = \underset{\text{for program i}}{\Sigma\,(D_j * C_j)} \Big/ \underset{\text{all objs}}{\Sigma\,(D_j * C_j)}$$

where D_j = Normalized Hierarchical Dependence (relative importance of objective) chained from the base level down to the objective level.

Cj = Seriousness of the current deficiency represented by the color value of the objective.

Table 1-5 shows the value assigned to each color (deficiency). A program which corrects a more serious deficiency (eg. Red assessment) is considered more important than one that corrects a less serious deficiency (eg. yellow). Thus, a red deficiency is shown with twice the value of a yellow which is twice that of green. As with the hierarchical dependence values, the color values can be changed without affecting the algorithm.

Table 1-5 Color Values Representing the Seriousness of the Current Deficiency

Color	Value
R	8
R/Y	5.75
Y	4
Y/G	2.75
G	2

Computation of Weighted Color Value

The weighted color value is computed as a product of the objective weight and the objective color value.

The formula for calculating the weighted color value is shown below.

Weighted Color Value = Dj * Cj

Examples of weighted color value computation (from Figure 1-2b)

Weighted Color Value
for X1 = 0.2222 * 8
= 1.778

Weighted Color Value
for X3 = 0.2222 * 4
= 0.888

Computation of Criterion 3 Score

The criterion 3 score for a program is computed as the weighted color scores summed for those task level capability objectives which a program affects and divided by the sum of the weighted color score for all objectives.

Criterion 3 Score = $\Sigma (D_j * C_j) / \Sigma (D_j * C_j)$
for program i pgm; i objs; all objs

Figure 1-2b Example Criterion 3 Calculations: $\Sigma (D_j * C_j)$

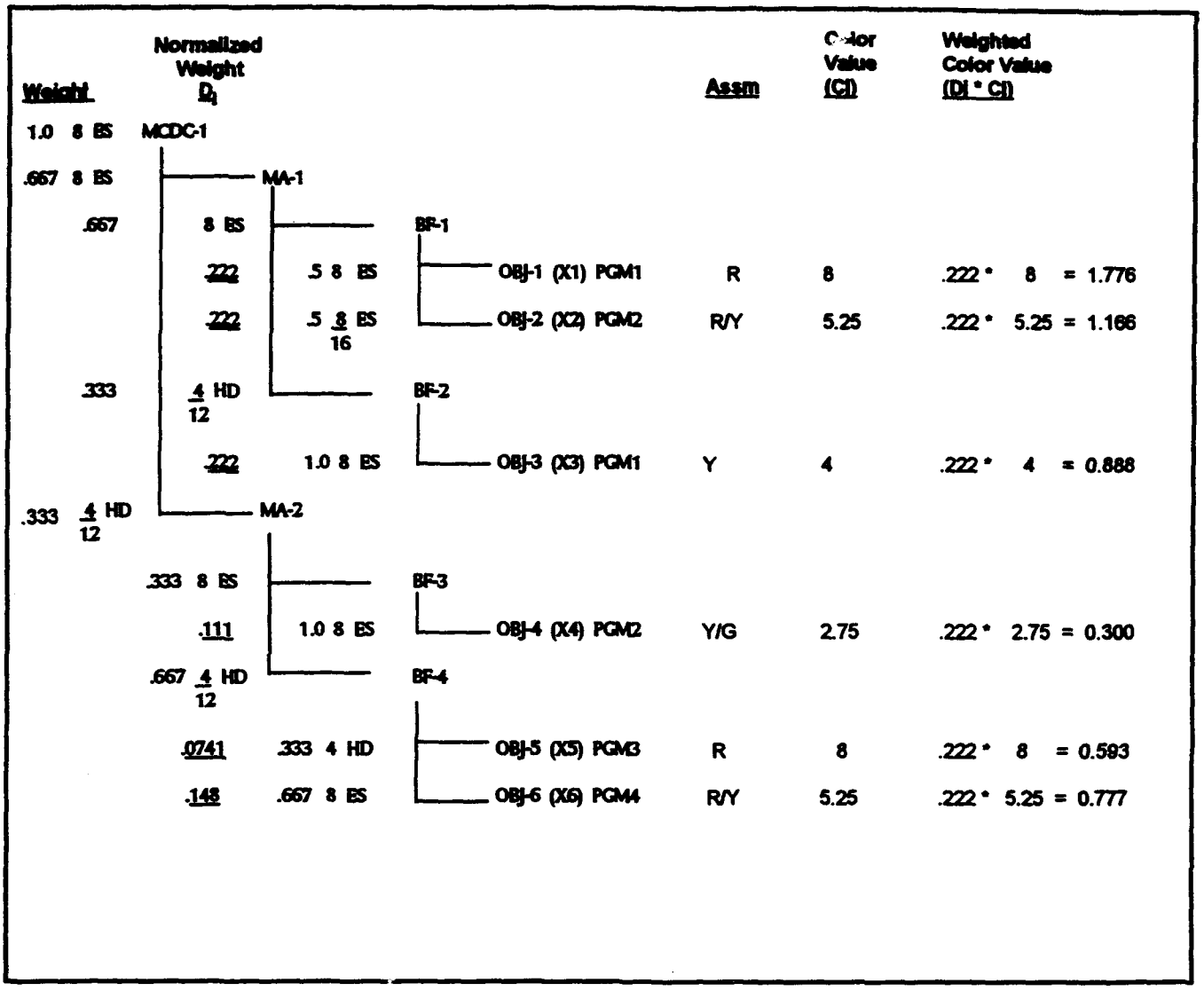


Figure 1-2b.

Calculation of Criterion 3 Score

PGM1: 1.778 + 0.888 = 2.666 / 5.695 = 0.468
PGM2: 1.278 + 0.306 = 1.584 / 5.695 = 0.278
PGM3: 0.593 = 0.593 / 5.695 = 0.104
PGM4: 0.852 = 0.852 / 5.695 = 0.150
5.695 1.000

For the example shown below taken from Figure 1-2b, program PGM1 affects task level capability objectives X1 and X3. The criterion score is the sum of the weighted color values for program PGM1 (1.778 + 0.888 = 2.666) divided by the sum of the weighted color values for all programs (2.666 / 5.695 = 0.468). The computations of the criterion score for the other programs are shown in Figure 1-2b.

Example of criterion score computation

Program	Objective	Weighted Color Value
PGM1	X1	1.778
	X3	0.888
		2.666
Criterion Score	=	2.666/5.695 = 0.468

Objectives affected by more than one program

If a Task Level Capability Objective is affected by more than one program, the total weighted color value will be assigned to each of the programs. Thus a program gets full credit for an objective even though its contribution may only be partial. This is done because it is not known how much contribution each program actually makes to the objective.

1.3 Criterion 4: Improvement in Capability Color over the FYDP

Criterion 4 uses the improvement in capability color over the FYDP weighted by the relative importance factor. The formula for criterion 4 shown below sums the product of the normalized hierarchical dependencies, D_j, with the improvement in capability color over the FYDP, ΔC_j, for the objectives contributed to by a program. The criterion score is then normalized by dividing by the sum for all objectives.

$$\text{Criterion 4 Score} = \Sigma (D_j * \Delta C_j) \; / \; \Sigma (D_j * \Delta C_j)$$

for program i; pgm i objs; all objs

where D_j = Normalized Hierarchical Dependence (relative importance of objective) chained from the base level down to the objective level.

ΔCj = Value representing the improvement in color over the FYDP and based on the seriousness of the current deficiency.

The seriousness of the current deficiency and the expected improvement in capability over the FYDP is represented by an objective improvement value shown below. This value is computed as the change in the color score from the current to the midterm assessment. The color scores were defined in Table 1-5 and are also shown above each color below.

As mentioned for criterion 3, a program which corrects a more serious deficiency (eg. red assessment) is considered more important than one that corrects a less serious deficiency (eg. yellow). Thus, a change in capability from red to yellow is shown as twice as valuable as a change from yellow to green.

Change in Assessment Color

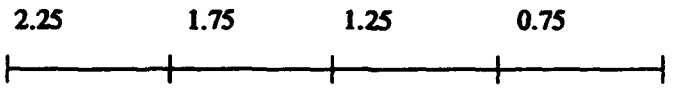
The objective improvement value is simply the difference in color value going from the current to the midterm assessment. For example, R to Y (8 - 4 = 4), R/Y to G (5.75 - 2 = 3.75).

No Change in Assessment Color

For objectives where the assessment color does not change, an objective improvement value of 0.5 is used. This allows a program to get some credit for its contribution to the objective in situations where the threat may be increasing and the program is needed just to maintain the current capability.

Objective Improvement Value for Change in Color from Current to Midterm Assessment

Color Value	8	5.75			2
	R	R/Y	Y	Y/G	G



For no change in color:

Objective Improvement Value = 0.5

Computation of Weighted Objective Improvement Value

The weighted objective improvement value is computed as a product of the objective weight and the objective improvement value as shown below.

Weighted Objective
Improvement Value = $Dj * \Delta Cj$

where Dj = objective weight (normalized hierarchical dependence)
ΔCj = objective improvement value

Examples of weighted objective improvement value computation (from Figure 1-2c)

Weighted Objective
Improvement Value
for X1 = 0.222 * 4
= 0.888

Weighted Objective
Improvement Value
for X3 = 0.222 * 0.5
= 0.111

Computation of Criterion 4 Score

To compute the criterion 4 score for a program, the weighted objective improvement scores are summed for all Task Level Capability bjectives which a program affects and divided by the sum of the weighted objective improvement score for all objectives.

Criterion 4 Score = $\Sigma (D_j * \Delta C_j) / \Sigma (D_j * \Delta C_j)$

for program i; pgm i objs; all objs

For the example shown below taken from Figure 1-2c, program PGM1 Affects Task Level Capability Objectives X1 and X3. The criterion score is the sum of the weighted color values for program PGM1 (0.888 + 0.111 = 0.999) divided by the sum of the weighted color values for all programs (0.999 / 2.472 = 0.404). The computations of the criterion score for the other programs are shown in Figure 1-2c.

Example of criterion score computation

Program	Objective	Weighted Objective Improvement Value
PGM1	X1	0.888
	X3	0.111
		0.999

Criterion Score = 0.999 / 2.472 = 0.404

Objectives affected by more than one program

If a Task Level Capability Objective is affected by more than one program, the total weighted objective improvement color value will be assigned to each of the programs. As explained for criteria 2 and 3, this is done because it is not known how much contribution each program actually makes to an objective.

Figure 1-2c Example Criterion 4 Calculations: $\Sigma (D_j * \Delta C_j)$

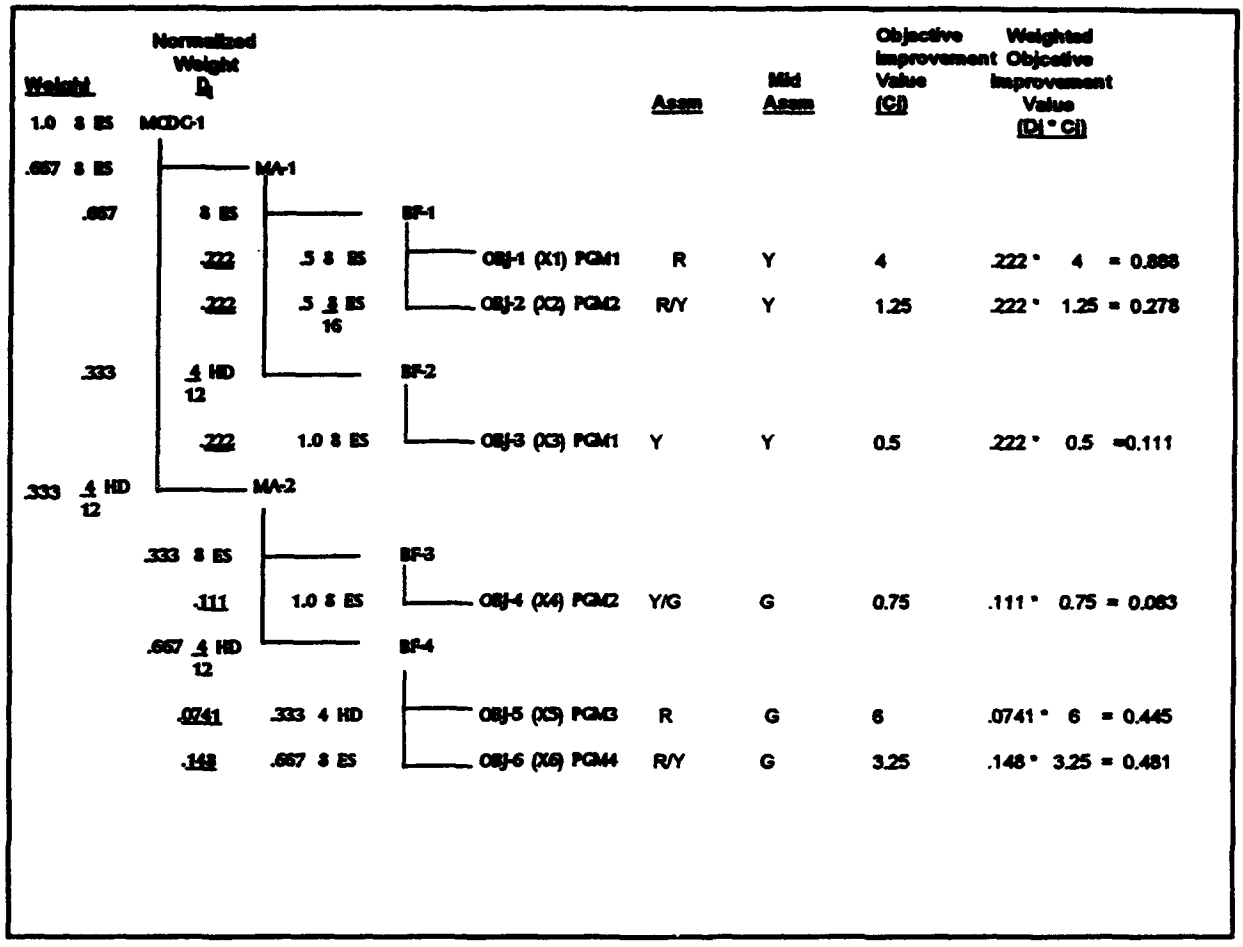


Figure 1-2c.

Calculation of Criterion 4 Score

PGM1:	0.888 + 0.111 = 0.999	/ 2.472 =	0.404
PGM2:	0.389 + 0.083 = 0.472	/ 2.472 =	0.191
PGM3:	0.445	= 0.445 / 2.472 =	0.180
PGM4:	0.556	= 0.556 / 2.472 =	0.225
		2.472	1.000

Criteria 2, 3, and 4

Computation of Criteria 2, 3, and 4 across MCDC

When the prioritization is to be done across all MCDCs, the computation of the score for criteria 2, 3, and 4 is the same as carried out for all levels up to the MCDC level.

MCCDC User Prioritization

The score for criteria 2, 3, and 4 for the MCCDC user prioritization will be the sum of the individual criterion score for each MEF. This represents the value for all objectives over all MEFs which a program affects.

1.4.1 A Second Example of Calculations of Criteria 2, 3, and 4

A second larger example of the calculations of criteria 2, 3, and 4 are shown on the following pages in Figures 1-3a, 1-3b, and 1-3c.

Figure 1-3a Example 2 Criterion 2 Calculations: ΣD_j

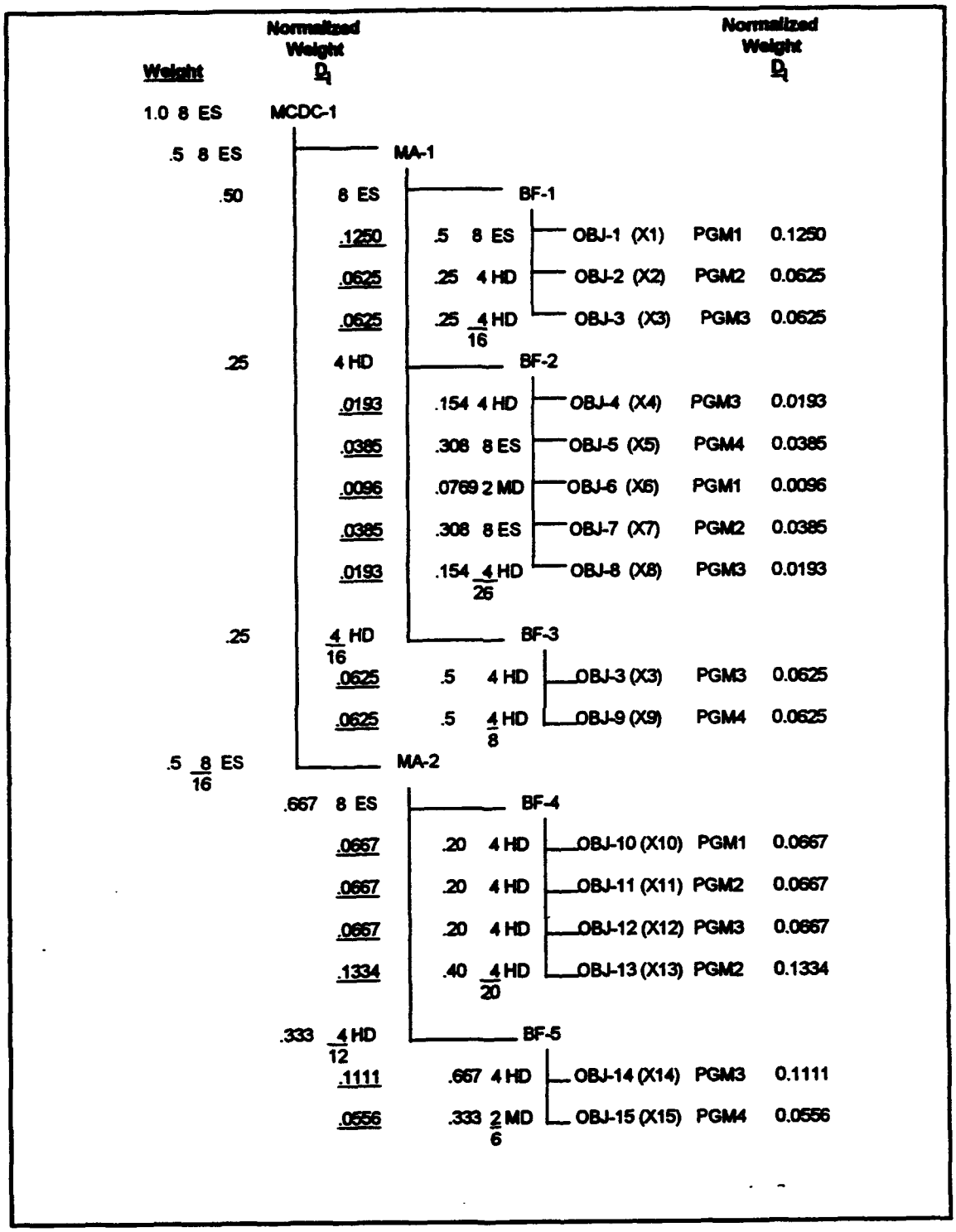

Weight
Normalized Weight D_i
Normalized Weight D_i
1.0 8 ES
MCDC-1
.5 8 ES
MA-1
.50
8 ES
BF-1
.1250
.5 8 ES
OBJ-1 (X1) PGM1 0.1250
.0625
.25 4 HD
OBJ-2 (X2) PGM2 0.0625
.0625
.25 4/16 HD
OBJ-3 (X3) PGM3 0.0625
.25
4 HD
BF-2
.0193
.154 4 HD
OBJ-4 (X4) PGM3 0.0193
.0385
.308 8 ES
OBJ-5 (X5) PGM4 0.0385
.0096
.0769 2 MD
OBJ-6 (X6) PGM1 0.0096
.0385
.308 8 ES
OBJ-7 (X7) PGM2 0.0385
.0193
.154 4/26 HD
OBJ-8 (X8) PGM3 0.0193
.25
4/16 HD
BF-3
.0625
.5 4 HD
OBJ-3 (X3) PGM3 0.0625
.0625
.5 4/8 HD
OBJ-9 (X9) PGM4 0.0625
.5 8/16 ES
MA-2
.667 8 ES
BF-4
.0667
.20 4 HD
OBJ-10 (X10) PGM1 0.0667
.0667
.20 4 HD
OBJ-11 (X11) PGM2 0.0667
.0667
.20 4 HD
OBJ-12 (X12) PGM3 0.0667
.1334
.40 4/20 HD
OBJ-13 (X13) PGM2 0.1334
.333 4/12 HD
BF-5
.1111
.667 4 HD
OBJ-14 (X14) PGM3 0.1111
.0556
.333 2/6 MD
OBJ-15 (X15) PGM4 0.0556

Figure 1-3a.

Calculation of Criterion 2 Score: ΣD_j

PGM1: 0.1250 + 0.0096 + 0.0667	= 0.2013
PGM2: 0.0625 + 0.0385 + 0.0667 + 0.1334	= 0.3011
PGM4: 0.0625 + 0.0193 + 0.0193 + 0.0625 + 0.0667 + 0.1111	= 0.3414
PGM5: 0.0193 + 0.0625 + 0.0556	= 0.1374

Figure 1-3b Example 2 Criterion 3 Calculations: $\Sigma (D_j * C_j)$

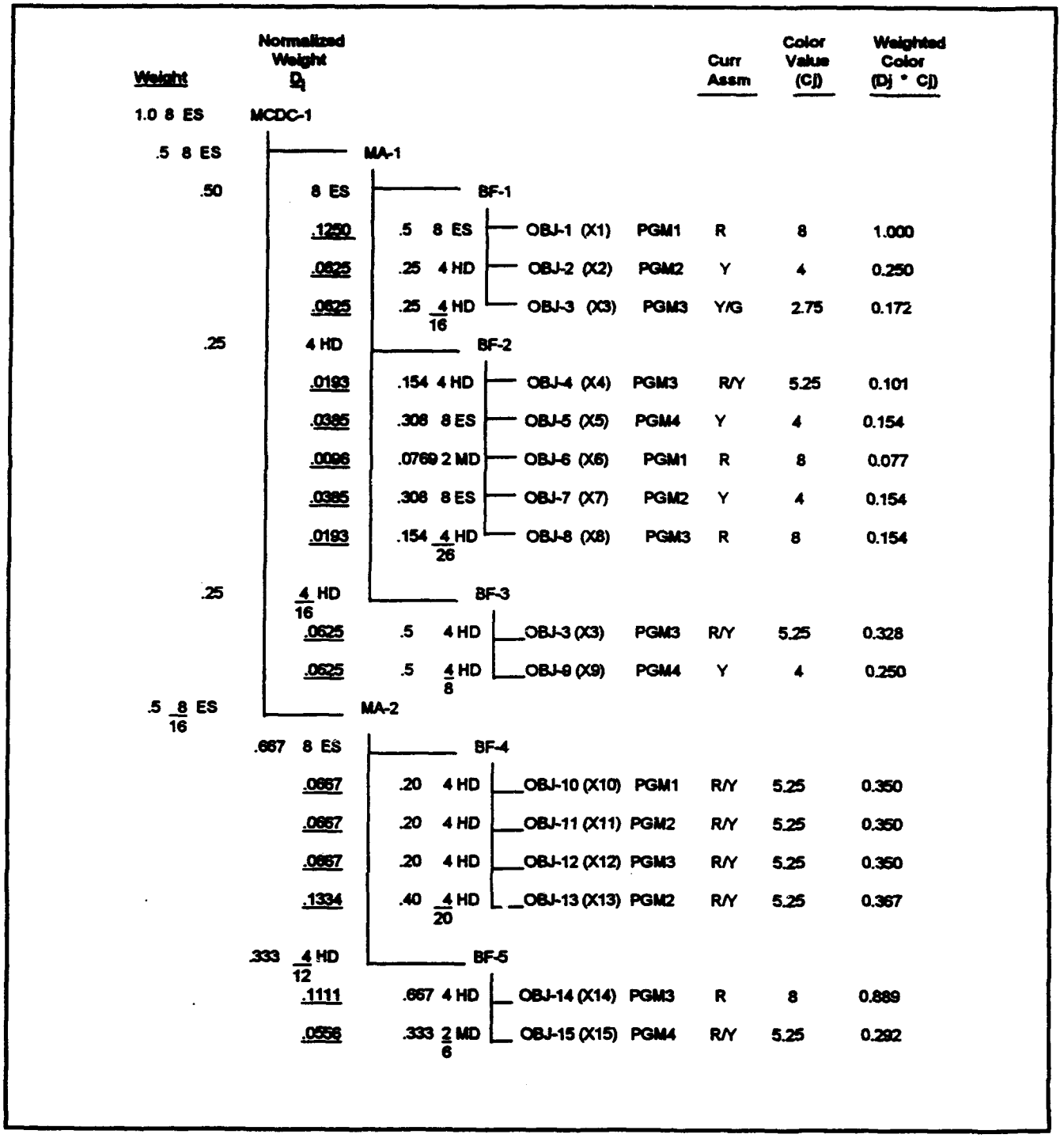

Weight
Normalized Weight D_i
Curr Assm
Color Value (Cj)
Weighted Color (Dj * Cj)
1.0 8 ES MCDC-1
.5 8 ES MA-1
.50 8 ES BF-1
.1250 .5 8 ES OBJ-1 (X1) PGM1 R 8 1.000
.0625 .25 4 HD OBJ-2 (X2) PGM2 Y 4 0.250
.0625 .25 4/16 HD OBJ-3 (X3) PGM3 Y/G 2.75 0.172
.25 4 HD BF-2
.0193 .154 4 HD OBJ-4 (X4) PGM3 R/Y 5.25 0.101
.0385 .308 8 ES OBJ-5 (X5) PGM4 Y 4 0.154
.0096 .0769 2 MD OBJ-6 (X6) PGM1 R 8 0.077
.0385 .308 8 ES OBJ-7 (X7) PGM2 Y 4 0.154
.0193 .154 4/26 HD OBJ-8 (X8) PGM3 R 8 0.154
.25 4/16 HD BF-3
.0625 .5 4 HD OBJ-3 (X3) PGM3 R/Y 5.25 0.328
.0625 .5 4/8 HD OBJ-9 (X9) PGM4 Y 4 0.250
.5 8/16 ES MA-2
.667 8 ES BF-4
.0667 .20 4 HD OBJ-10 (X10) PGM1 R/Y 5.25 0.350
.0667 .20 4 HD OBJ-11 (X11) PGM2 R/Y 5.25 0.350
.0667 .20 4 HD OBJ-12 (X12) PGM3 R/Y 5.25 0.350
.1334 .40 4/20 HD OBJ-13 (X13) PGM2 R/Y 5.25 0.367
.333 4/12 HD BF-5
.1111 .667 4 HD OBJ-14 (X14) PGM3 R 8 0.889
.0556 .333 2/6 MD OBJ-15 (X15) PGM4 R/Y 5.25 0.292

Figure 1-3b.

Calculation of Criterion 3 Score: $\Sigma (D_j * C_j)$

PGM1: 1.000 + 0.077 + 0.383	= 1.460 / 5.405 = 0.270
PGM2: 0.250 + 0.154 + 0.383 + 0.367	= 1.154 / 5.405 = 0.213
PGM4: 0.172 + 0.111 + 0.154 + 0.359 + 0.383 + 0.889	= 2.068 / 5.405 = 0.383
PGM5: 0.154 + 0.250 + 0.319	= 0.723 / 5.405 = 0.134
	5.405 = 1.000

Figure 1-3c Example 2 Criterion 4 Calculations: $\Sigma (D_j * \Delta C_j)$

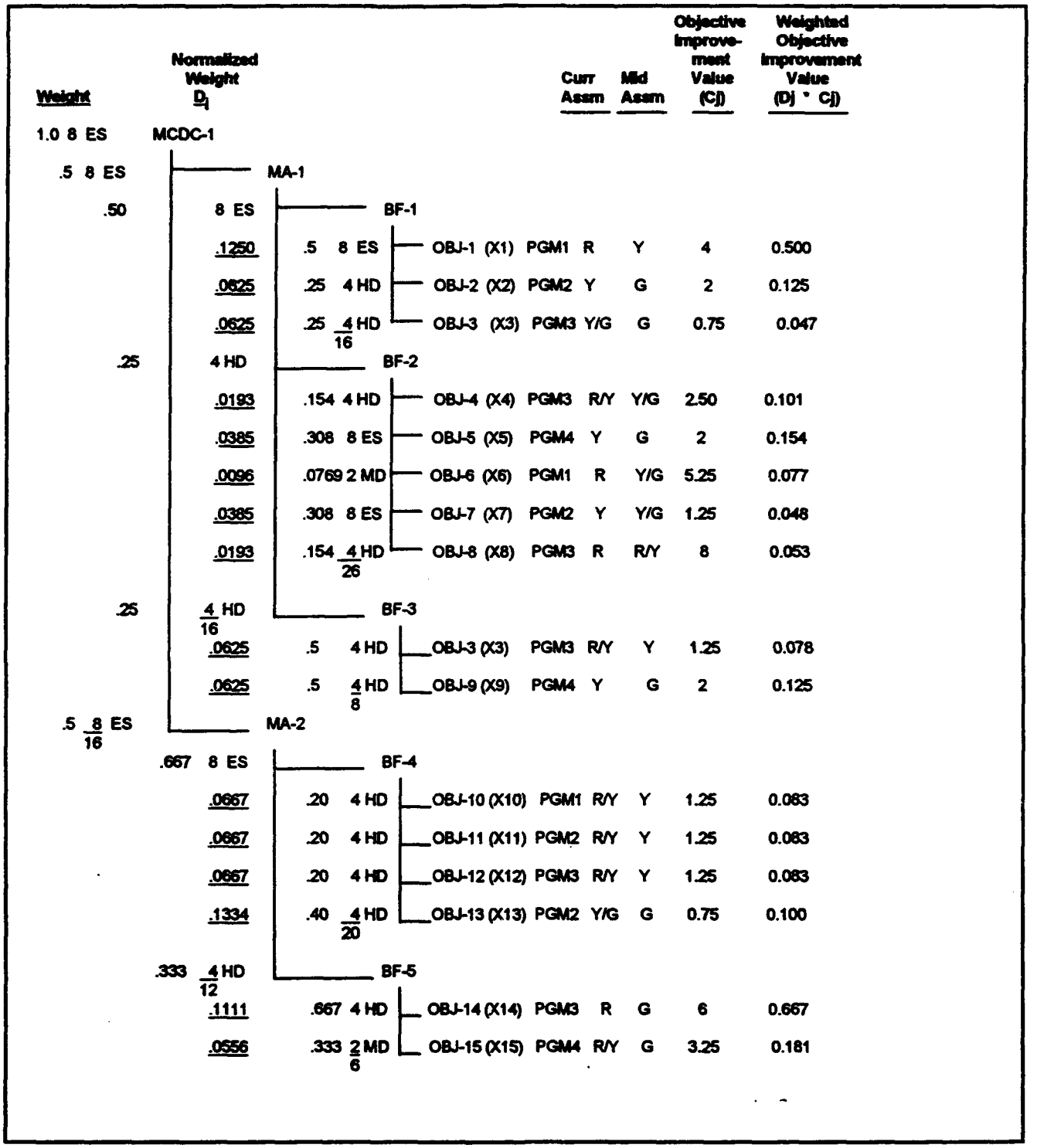

Weight
Normalized Weight D_i
Curr Assm
Mid Assm
Objective Improvement Value (Cj)
Weighted Objective Improvement Value (Dj * Cj)
1.0 8 ES MCDC-1
.5 8 ES MA-1
.50 8 ES BF-1
.1250 .5 8 ES OBJ-1 (X1) PGM1 R Y 4 0.500
.0625 .25 4 HD OBJ-2 (X2) PGM2 Y G 2 0.125
.0625 .25 4/16 HD OBJ-3 (X3) PGM3 Y/G G 0.75 0.047
.25 4 HD BF-2
.0193 .154 4 HD OBJ-4 (X4) PGM3 R/Y Y/G 2.50 0.101
.0385 .308 8 ES OBJ-5 (X5) PGM4 Y G 2 0.154
.0096 .0769 2 MD OBJ-6 (X6) PGM1 R Y/G 5.25 0.077
.0385 .308 8 ES OBJ-7 (X7) PGM2 Y Y/G 1.25 0.048
.0193 .154 4/26 HD OBJ-8 (X8) PGM3 R R/Y 8 0.053
.25 4/16 HD BF-3
.0625 .5 4 HD OBJ-3 (X3) PGM3 R/Y Y 1.25 0.078
.0625 .5 4/8 HD OBJ-9 (X9) PGM4 Y G 2 0.125
.5 8/16 ES MA-2
.667 8 ES BF-4
.0667 .20 4 HD OBJ-10 (X10) PGM1 R/Y Y 1.25 0.083
.0667 .20 4 HD OBJ-11 (X11) PGM2 R/Y Y 1.25 0.083
.0667 .20 4 HD OBJ-12 (X12) PGM3 R/Y Y 1.25 0.083
.1334 .40 4/20 HD OBJ-13 (X13) PGM2 Y/G G 0.75 0.100
.333 4/12 HD BF-5
.1111 .667 4 HD OBJ-14 (X14) PGM3 R G 6 0.667
.0556 .333 2/6 MD OBJ-15 (X15) PGM4 R/Y G 3.25 0.181

Figure 1-3c.

Figure 1-3c Example Criterion 4 Calculations (Continued)

Calculation of Criterion 4 Score: $\Sigma (D_j * \Delta C_j)$

PGM1: 0.500 + 0.050 + 0.117	= 0.667 / 2.508 = 0.266
PGM2: 0.125 + 0.048 + 0.117 + 0.100	= 0.390 / 2.508 = 0.156
PGM4: 0.047 + 0.058 + 0.043 + 0.109 + 0.117 + 0.667	= 1.041 / 2.508 = 0.415
PGM5: 0.077 + 0.125 + 0.208	= 0.410 / 2.508 = 0.163
	2.508 = 1.000

1.5 Criterion 5: Impact of program across MCDCs

This criterion computes the impact of a program across all OPCAPs based on the criterion 4 scores. For the MCCDC user, this criterion will be used to compute the criterion 6 scores which is the program impact across MEFs. The formula for computing this criterion is shown below. As with the other criteria, the criterion 5 scores will be normalized in the final step.

Criterion 5 (Program Impact Across MCDCs) =

1 - [(1-(Q1)CTR1) * (1-(Q2)CTR2) * ... * (1-(Q5)CTR5)]

where

Qj = normalized weight on MCDCj (using the hierarchical dependence values for MCDC j)

CTRj = contribution of a program to MCDC j

This score is a function of the value from criterion 4. Figure 1-4 and Table 1-5 show the conversion from the criterion 4 value to the contribution value.

Note: The range of numbers used for the CTR value are samples only based on the values for criterion 4 from the example in Figure 1-3c. The actual range of values will be determined based on the actual data (probably closer to the range 0 to 0.01). The algorithm will first find the maximum of the criterion 4 scores. The maximum criterion 4 score will be assigned the contribution value of 1.0. The range from zero to the maximum will then be divided into 5 equal intervals.

Figure 1-4 Sample Contribution Value vs. Criterion 4 Score

Table 1-5 Sample Contribution Value for the Criterion 4 Score

Criterion 4 Score Σ (Dj * ΔCj)	Contribution Value CTRj
0 - 0.10	.2
0.1001 - 0.20	.4
0.2001 - 0.30	.6
0.3001 - 0.40	.8
> 0.40	1.0

Example of Calculation of Criterion 5 Score

An example of the computation of the criterion 5 value for a few programs is shown below. The values used in computing the MCDC3 scores are taken from Figure 1-3c for criterion 4 using $\Sigma (D_j * \Delta C_j)$.

Table 1-6 shows the contribution values which are determined by a look-up in Table 1-5 using the criterion 4 scores.

Table 1-6 Example Contribution Values Computed from Criterion 4 Scores

	Criterion 4 Score (Σ (D_j * ΔC_j))	Contribution Value CTRj	
PGM1	0.266	0.6	Criterion 4 Scores (Figure 1-3c)
PGM2	0.156	0.4	CTRj values (using Table 1-8)
PGM4	0.415	1.0	
PGM5	0.163	0.4	

Table 1-7 shows the contribution values (CTR) from each MCDC for each program. The total CTR score is computed by summing up the contributions from each MCDC using the formula below. The criterion 5 score is the normalized total CTR score computed by dividing the total CTR score for each program by the sum for all programs.

Criterion 5 (Program Impact Across MCDCs) =

1 - [(1-(Q1)CTR1) * (1-(Q2)CTR2) * ... * (1-(Q5)CTR5)]

where Qj = normalized weight on MCDC j (using the hierarchical dependence value for OPCAP j)
CTRj = contribution of a program toMCDCj

Example: Program 1

Criterion 5 score
= 1 - [(1 - (8/28)(1.0)) * (1 - (4/28)(.6)) * (1 - (4/28)(.4))]
= 1 - [(1 - 0.2857(1.0)) * (1 - 0.1429(.6)) * (1 - 0.1429(.4))]
= 1 - [(1 - 0.2857) * (1 - 0.08571) * (1 - 0.05714)]
= 1 - [0.7143 * 0.9143 * 0.9429]
= 1 - 0.6158
= 0.3842

Table 1-7 Criterion 5: Program Impact Across MCDCs Calculation

Program Impact Across MCDCs							Criterion 5	
Hier Dep	ES	ES	HD	HD	HD	Sum	1.3169	1.0000
Value	8	8	4	4	4	28		
Qj	8/28	8/28	4/28	4/28	4/28			

1.6 Criterion 6: Impact of program across MEFs (MCCDC user only)

This criterion computes the impact of a program across all MEFs based on criterion 5 (Program Impact Across MCDCs) scores for each MEF. The formula for computing this criterion is shown below.

Criterion 6 (Program Impact Across MEFs) = 1 - [(1-(Q1)CTR1) * (1-(Q2)CTR2) * ... * (1-(Q13)CTR13)]

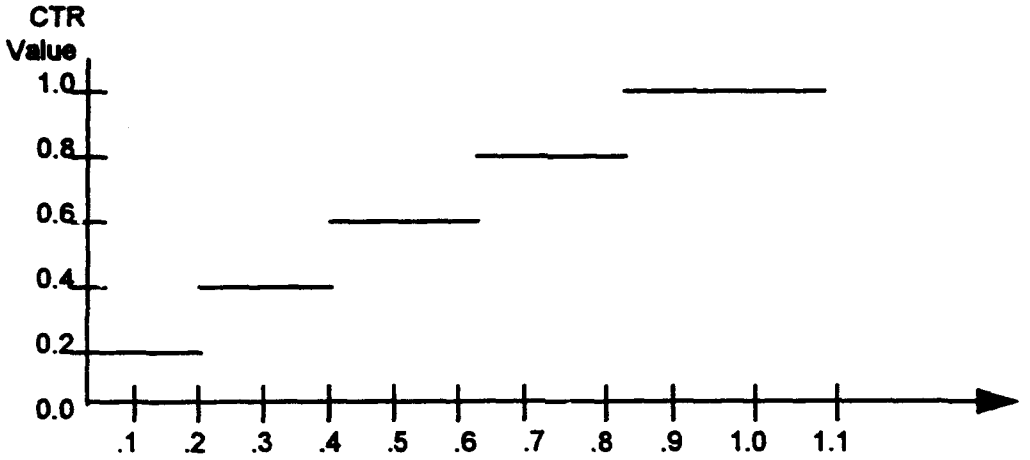
where Qj = normalized weight on MEF j (using the hierarchical dependence value for MEF j)

CTRj = contribution of a program to MEF j

This score is a function of the value from criterion 5. Figure 1-5 and Table 1-8 show the conversion from the criterion 5 value to the contribution value.

The range of numbers used for the CTR value are examples only. The actual range of values will need to be determined based on the actual data. The program will first find the maximum of the criterion 5 scores. The maximum criterion 5 score will be assigned the contribution value of 1.0. The range from zero to the maximum will then be divided into 5 equal intervals.

Figure 1-5 Sample Contribution Value vs. Criterion 5 Score



Criterion 5 Score (Impact across MCDCs)

Table 1-8 Sample Contribution Value for the Criterion 5 Score

Criterion 5 Score Impact across MCDCs	Contribution Value CTRj
0 - 0.06	.2
0.0601 - 0.12	.4
0.1201 - 0.18	.6
0.1801 - 0.24	.8
0.241	.0

Example of Calculation of Criterion 6 Score

An example of the computation of the criterion 6 value for a few programs is shown below. The values used in computing the scores for MEF 1 are taken from Table 1-7 for criterion 5 (Program Impact across MCDCs).

Table 1-8 shows the contribution values which are determined by a look-up in Table 1-7 using the criterion 5 scores.

Table 1-9 Example Contribution Values Computed from Criterion 5 Scores

	Criterion 5 Score Impact Across WFEs	Contribution Value CTRj	
PGM1	0.2917	1.0	
PGM2	0.1796	0.6	CTRj values (using Table 1-8)
PGM4	0.2498	1.0	
PGM5	0.2355	0.8	
PGM5	0.0434	0.2	

Table 1-10 shows the contribution values (CTR) from each MEF for each program. The total CTR score is computed by summing up the contributions from each MEF using the formula below. The criterion 6 score is the normalized total CTR score computed by dividing the total CTR score for each program by the sum for all programs.

Criterion 6 (Program Impact Across MEFs) =

1 - [(1-(Q1)CTR1) * (1-(Q2)CTR2) * ... * (1-(Q13)CTR13)]

where Qj = normalized weight on MEF j (using the hierarchical dependence value for MEF j)

CTRj = contribution of a program to MEF j

Example: Program 1

Criterion 6 score

= 1 - [(1 - (8/92)(1.0)) * (1 - (8/92)(.2) * (1 - (8/92)(.4))]

= 1 - [(1 - 0.08696(1.0)) * (1 - 0.08696(.2) * (1 - 0.08696(.4))]

= 1 - [(1 - 0.08696) * (1 - 0.01739) * (1 - 0.03478)]

= 1 - [0.9130 * 0.9826 * 0.9652]

= 1 - 0.8660

= 0.1340

Table 1-10 Criterion 6: Program Impact Across MEFs Calculation

	Program Impact Across MCDCs													Criterion 6	
	MCDC													Normalized	
Hier Dep	ES	ES	HD	ES	ES	HD	ES	ES	HD	ES	ES	ES	ES	Sum .7171	1.0000
Value	8	8	4	8	8	4	8	8	4	8	8	8	8	92	

Qj	8/92	8/92	4/92	8/92	8/92	4/92	8/92	8/92	4/92	8/92	8/92	8/92	8/92

2. Proposed Method for the Prioritization of T&E Programs

The programs will be prioritized using either a normalized Simple Additive Weighting Method (SAW) or TOPSIS. The SAW method sums up the product of the criterion score and its relative weight for all criteria.

$$\text{Program Score} = \sum_{j=1}^{n} (W_j * X_{ij})$$

where W_j = weight on criterion j

X_{ij} = decision matrix value for criterion j and program i

The matrix values have been normalized for each criterion.

The TOPSIS method is based on the concept that a high ranked program should be close to the ideal solution and far from the negative-ideal solution. The details of this method are more complex and will not be explained here.

An example of the decision matrix for the prioritization problem for MEF-1 is shown below. Nine programs (A1-A9) are ranked using the five criteria: NUM_OBJ (the number of objectives, translated using the logarithm function), REL_IMPORT (relative importance of the task level capability objective), DEFICIENCY (seriousness of current deficiency), IMPROVE (the improvement in capability color over the FYDP), and IMPACT-W (impact of program across MCDCs) or IMPACT-C (impact of program across MEFs) for the MCCDC user. The weight or relativeimportance of each criteria is also given.

Example Decision Matrix for the Prioritization of the Programs

	1	2	3	4	5
	NUM_OBJ	REL_IMPORT	DEFICIENCY	IMPROVE	IMPACT-W
Weights	0.3000	0.0000	0.0000	0.4000	0.3000
P1	0.2239	0.2013	0.270	0.2665	0.2917
P2	0.2545	0.3011	0.213	0.1563	0.1796
P3	0.0000	0.0000	0.000	0.0000	0.2498
P4	0.2978	0.3414	0.383	0.4154	0.2355
P5	0.2239	0.1374	0.134	0.1638	0.0434

An example of the result of the prioritization using the normalized SAW method is shown below. The programs will be shown in order of their rank. The computed rank score shows how much better or worse the program is compared to the others.

Prioritized List of Programs

Rank Order

Program	Rank	Score
P4	1	0.3262
P1	2	0.2613
P2	3	0.1927
P5	4	0.1457
P3	5	0.0749

Prioritization using only One Criterion

The prioritization can be carried out using only one or two of the criteria by appropriately setting the weights on the criteria. Example 1 below shows the assignment of weights for three criteria. Example 2 shows the assignment of weights for only one criterion. Both examples are for the MEF user. For the MCCDC user, criterion 5 would be replaced by the criterion "Impact of Programs Across MEFs".

The weights are entered in the second column (0 to 10) and the values are normalized and displayed in the third column.

ASSIGN CRITERIA WEIGHTS

Example 1: Weights on Several Criteria

ASSIGN CRITERIA WEIGHTS

CRITERIA	NORMALIZED WEIGHT	VALUE
1) Criterion based on Number of Objectives	3	0.3000
2) Relative Importance of the Task Level Capability Objective	0	0.0000
3) Seriousness of the Current Deficiency	0	0.0000
4) Improvement in Capability Color over the FYDP	4	0.4000
5) Impact of Program Across MCDCs	3	0.3000

Example 2: Weights on One Criterion

ASSIGN CRITERIA WEIGHTS

CRITERIA	NORMALIZED WEIGHT	VALUE
1) Criterion based on Number of Objectives	0	0.0000
2) Relative Importance of the Task Level Capability Objective	0	0.0000
3) Seriousness of the Current Deficiency	0	0.0000
4) Improvement in Capability Color over the FYDP	0	1.0000
5) Impact of Program Across MCDCs	0	0.0000