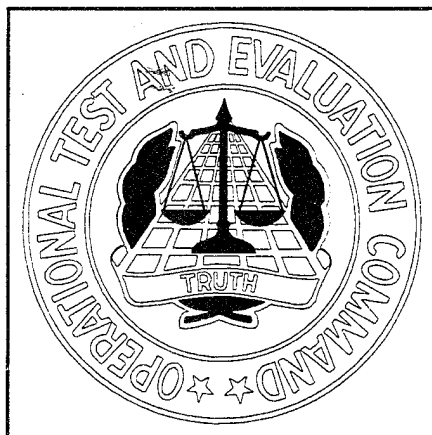# TEST AND EVALUATION PLAN (TEP)

FOR THE PATRIOT ADVANCED

CAPABILITY-3 (PAC-3) CONFIGURATION-2

FOLLOW-ON OPERATIONAL TEST AND EVALUATION (FOTE)

UNITED STATES ARMY
OPERATIONAL TEST AND EVALUATION COMMAND
PARK CENTER IV, 4501 FORD AVENUE
ALEXANDRIA, VIRGINIA 22302-1458

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TEST AND EVALUATION PLAN (TEP) FOR THE
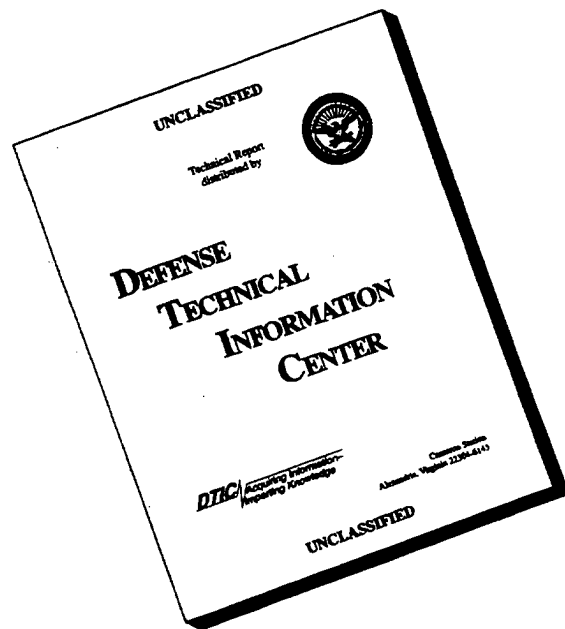## PATRIOT ADVANCED CAPABILITY-3 (PAC-3) CONFIGURATION-2 FOLLOW-ON OPERATIONAL TEST AND EVALUATION (FOTE)
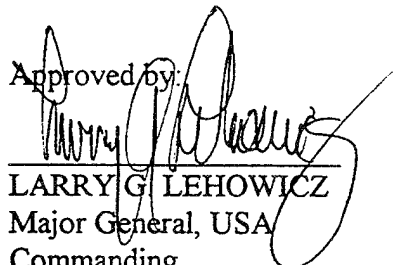
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Approved by:

LARRY G LEHOWICZ
Major General, USA
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26 April 1996
Date Signed

COORDINATION SHEET

TEST AND EVALUATION PLAN (TEP)
FOR THE PATRIOT ADVANCED
CAPABILITY-3 (PAC-3) CONFIGURATION-2
FOLLOW-ON OPERATIONAL TEST AND EVALUATION (FOTE)

UNITED STATES ARMY
OPERATIONAL TEST AND EVALUATION COMMAND
PARK CENTER IV, 4501 FORD AVENUE
ALEXANDRIA, VIRGINIA 22302-1458

per Larry Leiby CSTE-EAD
6/28/96

OEC: TEXCOM:

Concur/Nonconcur   Concur/Nonconcur

_____   _____ 21/4/96
EDWARD F. IRICK, III   A. J. MADORA
COL, FA   Brigadier General, USA
Commanding   Commanding

24 APR 91,
_____   _____
Date   Date

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TABLES

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FIGURES

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CHAPTER 1

INTRODUCTION

1.1 PURPOSE OF THE OPERATIONAL TEST AND EVALUATION. This Test and Evaluation Plan (TEP) presents overall strategy and guidance for the conduct of Follow-on Operational Test and Evaluation (FOTE) for Configuration-2 of the Phased Array Tracking Radar to Intercept of Target (PATRIOT) Advanced Capability-3 (PAC-3) Program. The Operational Evaluation Command (OEC) will prepare an operational evaluation of Configuration-2 of the PAC-3 modifications to support a materiel release decision for this Acquisition Category (ACAT) 1D program.

1.2 SCOPE OF THE OPERATIONAL TEST AND EVALUATION. The evaluation has three objectives. The first is to assess the improvements in performance provided by the modifications in terms of how they contribute to attainment of the requirements in the PAC-3 Operational Requirements Document (ORD), the second is to verify that the modifications do not cause degradation to the PATRIOT system capabilities that existed prior to the modifications, and the third is to support the evaluation for Tactical Command System (TCS) type classification. The baseline for the comparative assessment of Configuration-2 effectiveness and suitability will be the PATRIOT system with PAC-2 and Quick Response Program (QRP) upgrades. The full PAC-3 ORD requirements will be met with the fielding of Configuration-3, Post Deployment Build-5 (PDB-5) and the PAC-3 missile in FY 99. This TEP focuses on the FOTE for Configuration-2; however, the dendritics and measures of effectiveness/measures of performance (MOEs/MOPs) have been developed to address the full ORD requirements. The MOEs/MOPs that will not be evaluated for the PAC-3 Configuration-2 during FOTE are indicated on the dendritic charts at Chapter 3.

1.3 SYSTEM DESCRIPTION. The PATRIOT missile system consists, at the battery level, of an engagement control station (ECS), one radar set (RS), an electric power plant (EPP); eight launching stations (LS); and associated communications equipment. At the battalion level, command and control is exercised through the Information and Coordination Central (ICC) and associated communications equipment including communications relay groups (CRG). PATRIOT was initially fielded in 1985 to provide air defense against fixed- and rotary- wing aircraft. Two previous modifications to the PATRIOT system, PAC-1 and PAC-2, were fielded in 1988 and 1990, respectively, to provide a limited capability for defense against Tactical Ballistic Missiles (TBMs). Additional modifications were made under the Quick Reaction Program (QRP) that was based on requirements identified in Operation Desert Shield/Storm. The QRP modifications further enhanced the system capabilities against TBMs.

The PAC-3 Operational Requirements Document (ORD), dated 1 May 1992 with an 8 December 1993 revision (version 1.2), has identified additional performance requirements against the following advanced threats: Tactical Ballistic Missile; Stealth Technology; Electronic Counter Measures Techniques by Air Breathing Threats (ABTs); Unmanned Aerial Vehicles (UAVs); Tactical Air-to-Surface Missiles (TASMs) to include Anti-Radiation Missiles (ARMs);

Cruise Missiles (CMs). The Materiel Developer is addressing the PAC-3 requirements through a series of incremental system improvements managed and funded by the Department of the Army and the Ballistic Missile Defense Organization (BMDO). These improvements include 12 Materiel Change Packages (MCPs), PDB software releases and a new hit-to-kill PAC-3 missile. The MCPs consist of three software improvements and nine hardware improvements, each of which requires an independent acquisition decision. These MCPs are grouped in three configurations to simplify fielding (See Table 1-1).

TABLE 1-1. PAC-3 CONFIGURATIONS

Area of Enhancement	Configuration-1	Configuration-2	Configuration-3
System Software	Configuration-1 S/W	PDB-4 Software	PDB-5 Software
ICC/ECS	EWCC	CE Phase I	
ICC/ECS	Optical Disk		
ICC/ECS	EDR		
Radar	RE Phase II (H/W)	RE Phase II (S/W)	
CDI		CDI Phase I	CDI Phase III
Missile			PAC-3 Missile
ECS			RL/CEU
Others		Counter ARM	- Joint TMD Interoperability - PATRIOT/THAAD Interoperability - Launch Point Determination

Note: EWCC = Expanded Weapon Control Computer
       ICC   = Information and Coordination Central
       ECS   = Engagement Control Station
       CE   = Communications Enhancement
       EDR   = Embedded Data Recorder
       RE   = Radar Enhancement
       CDI   = Classification, Discrimination, and Identification
       RL/CEU = Remote Launch/Communications Enhancement Upgrades
       ARM   = Anti-Radiation Missile

Configuration-2 consists of four major improvements - One hardware MCP: Communications Enhancement (CE) Phase I; two software improvements: Counter ARM (CARM) and Classification, Discrimination, and Identification (CDI) Phase I; and implementation , via software, the full capability of the Radar Enhancement (RE) Phase II hardware. The CE-I will improve the dissemination of digital data and voice external to the PATRIOT Battalion through ICC communication enhancements. The RE-II will provide improved multifunction capabilities, TBM detection, low altitude performance, and performance in the presence of clutter. The CARM improvement will minimize the PATRIOT system's vulnerability to ARMs through software modifications to utilize CDI and flight profile data to identify real and potential ARM carriers and ARMs in flight. CDI-I upgrades will include the replacement of the Tactical Information Broadcast System (TIBS) Receive Unit in the TCS with the Commander's Tactical Terminal-Hybrid Receiver (CTT-H/R) and the implementation of a new TIBS Message Set in the TCS communications processor software.

1.4 BACKGROUND. Each of the PATRIOT improvements (PAC-1, PAC-2 and QRP) has undergone operational test (OT) or combined development test (DT)/OT prior to fielding. A combined DT/OT of the most recent upgrade, QRP, was conducted in 1992 and an operational assessment was prepared by OEC. A follow-on operational test was conducted in 1993 to address suitability issues for which insufficient data had been collected in the previous DT/OT. An abbreviated operational assessment was prepared to document the results of the FOTE and support the QRP materiel release decision.

a. Configuration-2 DTE (CDTE-2) was conducted in October and November 1995 and FDTE for Configuration-2 was completed in March 1996.

b. The QRP FOTE identified emplacement time, remote launcher operational rate, missile reload and resupply time, and march-order time as areas where QRP did not meet performance standards or degraded PATRIOT performance. In addition, the lack of published support plans and training plans led to other system degradations. Each of the issues except missile reload and resupply will be reassessed during the PAC-3 Configuration-2 FOTE. The missile reload and resupply will be assessed during PAC-3 Configuration-3 IOTE.

1.5 KEY MILESTONES. Table 1-2 depicts the current PAC-3 Configuration-2 planning and product events.

TABLE 1-2. PAC-3 CONFIGURATION-2 PLANNING AND PRODUCT EVENTS

Document or Milestone	Actual or Planned Date	Status
ORD	1 May 1992	Completed
ORD Version 1.2	8 December 1993	Completed
COIC	22 October 1993	Completed
COIC Version 1.0	16 March 1994	Completed
TEMP Revision 2	April 1994	Completed
TEMP Revision 2, Update 1	1 March 1996	Being staffed
TEP - Draft	July 1995	Completed
OTP- Approval	21 November 1995	Completed
TEP - OPTEC Approval	26 April 1996	Pending
TEP - DOTE Approval	10 May 1996	Pending
EOP - Draft	July 1995	Completed
EOP - OEC Approval	10 May 1996	Pending
TOP - Draft	January 1996	Completed
TOP - TEXCOM Approval	10 May 1996	Pending
OTRR-1	18 August 1995	Completed
OTRR-2	27 March 1996	Completed
OTRR-3	16 May 1996	Pending
T-Date	20 May 1996	Pending
Missile Firing	21 June 1996	Pending
E-Date	22June 1996	Pending
C-Date	12July 1996	Pending
Emerging Results Brief to OEC Commander	27 July 1996	Pending
TER	23 September 1996	Pending
Materiel Release Date	4 November 1996	Pending

CHAPTER 2

EVALUATION APPROACH

2.1 OVERVIEW OF THE EVALUATION APPROACH. This evaluation is designed to investigate the performance of the PAC-3 Configuration-2 upgrades within a range of stressing, validated scenarios in terms of threat, means of employment, natural and induced environments. It addresses the various aspects of operational effectiveness and suitability as they relate to or support the PAC-3 engagement sequence. The efforts will be based on established measures of effectiveness/performance (MOEs/MOPs) which indicate how well the PAC-3 system upgrades contribute to the accomplishment of each engagement function. The evaluation process will be conducted from both a technical and operational perspective to determine whether or not the PAC-3 upgrades will ultimately satisfy the ORD requirements. This process will include live missile flight tests, tactical sustainment exercise, and the PAC-3 system operating with the Flight Mission Simulator (FMS) supplemented with the results of the Pre-Production Qualification Testing (PPQT). Software metrics will be presented at the Operational Test Readiness Reviews (OTRRs) and FOTE test conduct is dependent upon the software meeting defined metric constraints.

2.2 METHODOLOGY FOR AGGREGATING OPERATIONAL EFFECTIVENESS. The evaluation of the PAC-3 Configuration 2 modifications will focus upon whether the improved performance due to four MCPs is achieved while not degrading the current capability of the baseline system. As such, the critical operational issue dealing with mission performance (COI 1) will take priority with emphasis on the FOTE measures dealing with proportion of targets correctly evaluated (MOPs 1-1-8 and 1-2-5) and the proportion of TBMs intercepted (MOP 1-1-14) and non-TBMs intercepted (MOP 1-2-8). These measures will be compared to the baseline system. Improved mission performance should not reduce survivability. As such, the ability of PAC-3 Configuration 2 to engage SOJ/SSJ and RSTA aircraft at extended ranges (MOP 3-1-1) and survive simulated ARM attacks (MOP 3-2-1) will be used to shape the survivability portion of the operational effectiveness evaluation. The enhancements to both intra and extra battalion communications will be examined as related to mission performance and survivability. Military judgment will be used to determine whether PAC-3 enhancements have the potential to achieve COIC 1 and COIC 3 by Milestone III.

2.3 METHODOLOGY FOR AGGREGATING OPERATIONAL SUITABILITY. The evaluation will focus on the effect of the PAC-3 Configuration 2 modifications to enable the PATRIOT fire unit to perform its air defense mission. As such, the operational suitability criteria associated with RAM, specifically mean time between critical mission failures (MOP 4-2-1), and software charged critical mission failures (MOP 4-3-1) will form the basis of the evaluation. Furthermore, the ability of the PAC-3 Configuration 2 to overcome the QRP system's inability to meet performance standards in the following areas will contribute to the determination of whether the PAC-3 Configuration 2 is suitable for deployment: emplacement times, remote launcher operational rate, and march order time.

2.4 DATA SOURCES FOR THE EVALUATION. OEC is conducting a continuous evaluation of the overall PAC-3 programs. Appendix C, Evaluation Data Source Matrix (DSM) lists the primary and secondary data sources to be used during the evaluation portion of FOTE for each MOE/MOP. A short description of each data source follows:

Follow-on Operational Test and Evaluation. An FOTE will be conducted at WhiteSands Missile Range (WSMR) and Fort Bliss by the Air Defense Artillery Test Directorate (ADATD) with support from Materiel Test Directorate (MTD). The FOTE will be conducted with Configuration-2 modified PATRIOT equipment operated by representative soldiers. FOTE will consist of tactical sustainment exercises, PAC-3 system operating with the Flight Mission Simulator (FMS), and a missile flight test consisting of two PATRIOT missiles against two threat representative targets. During the tactical sustainment phase, live targets will be flown in the non-firing mode of operation.

Force Development Test and Experimentation. A FDTE was completed on 15 Mar 96 and verified the adequacy of TRADOC products and Test Support Packages (TSP). The ADATD conducted the FDTE for US Army Air Defense Artillery School (USAADASCH), and used the same general structure as FOTE, but with reduced duration and scope, as it was focused on doctrine, tactics techniques and procedures (DTTP); training; and organization. The FDTE did not include a missile flight test.

Configuration Developmental Test and Evaluation. A CDTE-2 was conducted by MTD and is the primary source of data for the independent technical evaluator (AMSAA). The CDTE included missile flight tests, HWIL tests (FMS) and tactical sustainment exercises.

Logistics Demonstration (Log Demo). The Log Demo was performed by the government during CDTE-2 to determine the adequacy of the Integrated Logistics Support (ILS) and manpower and personnel integration (MANPRINT) elements. A Log Demo was performed for each MCP.

Pre-Production Qualification Test. A PPQT was performed for each of the PAC-3 Configuration-2 MCPs, to support production decisions.

2.5 SUPPLEMENTAL MODELING AND SIMULATION REQUIREMENTS. Given that the following models and simulations focus on the PAC-3 missile, each will be considered in evaluating the hit-to-kill missile. If a particular model or simulation becomes a primary data source for the operational evaluation in support of the FY99 PAC-3 Configuration 3 Milestone III decision, it will undergo an accreditation by the Operational Test and Evaluation Command (OPTEC). As noted at the FOTE Data Source Matrix (Appendix C), these models and simulations are not a primary data source for the PAC-3 Configuration 2 operational evaluation.

- <u>GTSF</u> - The Guidance Test and Simulation Facility provides full hardware pre-launch through midcourse guidance and up to seeker acquisition capability for the PATRIOT system. A digital seeker model and endgame lethality simulation completes the end-to-end simulation capability.

- <u>HWIL</u> - The Research Development and Engineering Center (RDEC), Redstone Arsenal, HWIL simulation provides guidance simulation capabilities to include the support of performance assessments of active terminal seeker guidance and range profiling for guidance functions in a dynamic flight environment.

- <u>MFSIM</u> - Multifunction Simulation is an all digital, deterministic simulation that models PATRIOT system features impacted by radar loading. The MFSIM supports statistical evaluations of search, track and engagement capabilities under radar loading.

- <u>PAC-3 SIM</u> - The PATRIOT Advanced Capability (PAC-3) simulation is an end-to-end digital simulation used for modeling of the PAC-3 system. It contains models of the PATRIOT surveillance function, guidance, PAC-3 missile dynamics, and the endgame lethality function.

- <u>PATRIOT Simulation (PATSIM)</u> - PATSIM is a 6-DOF simulation for evaluating the tactical guidance capability of the PATRIOT PAC-2 and GEM Missiles against both ABT and TBM. PATSIM provides time of flight information for force level models and provides intercept geometries for use by the lethality (LEGS) model.

2.6 EVALUATION LIMITATIONS. None.

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CHAPTER 3

EVALUATION CONCEPT

3.0 OPERATIONAL ISSUES. The PAC-3 system will be evaluated for operational effectiveness and operational suitability. Under each division, there are specific critical and additional operational issues as depicted in Figure 3-1.

* **Indicates COI**
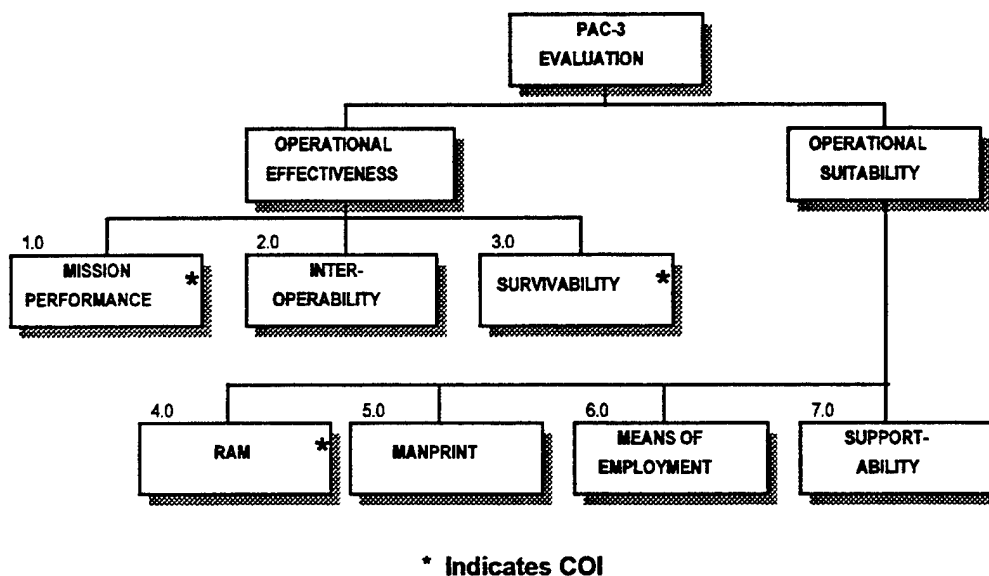
Figure 3-1. PAC-3 Critical and Additional Operational Issues

3.1 CRITICAL OPERATIONAL ISSUE 1 - MISSION PERFORMANCE. Does the PAC-3 enhance the effectiveness of the PATRIOT system? The evaluation dendritic is shown in Figure 3-2. The dendritic shows the decomposition of Operational Issue 1 into criteria and associated MOE/MOP. Definitions of the associated data sets are found in Appendix C, Data Source Matrix.

3.1.1 Criterion 1-1. An operational PATRIOT system must defend an asset, to include itself, located up to __ km down range of the system, against up to __ simultaneously arriving (within __ seconds) TBMs , with no more than __ % leakage. The system must detect, track, engage, and destroy, __ km or greater above ground level (AGL), TBMs with radar cross sections (RCS) of __ m^2 or more, that have minimum ranges of __ km to a maximum __ km and enter the fire unit's (FU) maximum surveillance range and surveillance sector.

Note: **All underlined areas are classified numbers and can be found in the PAC-3 ORD, dated May 1992, with revisions dated December 1993.**
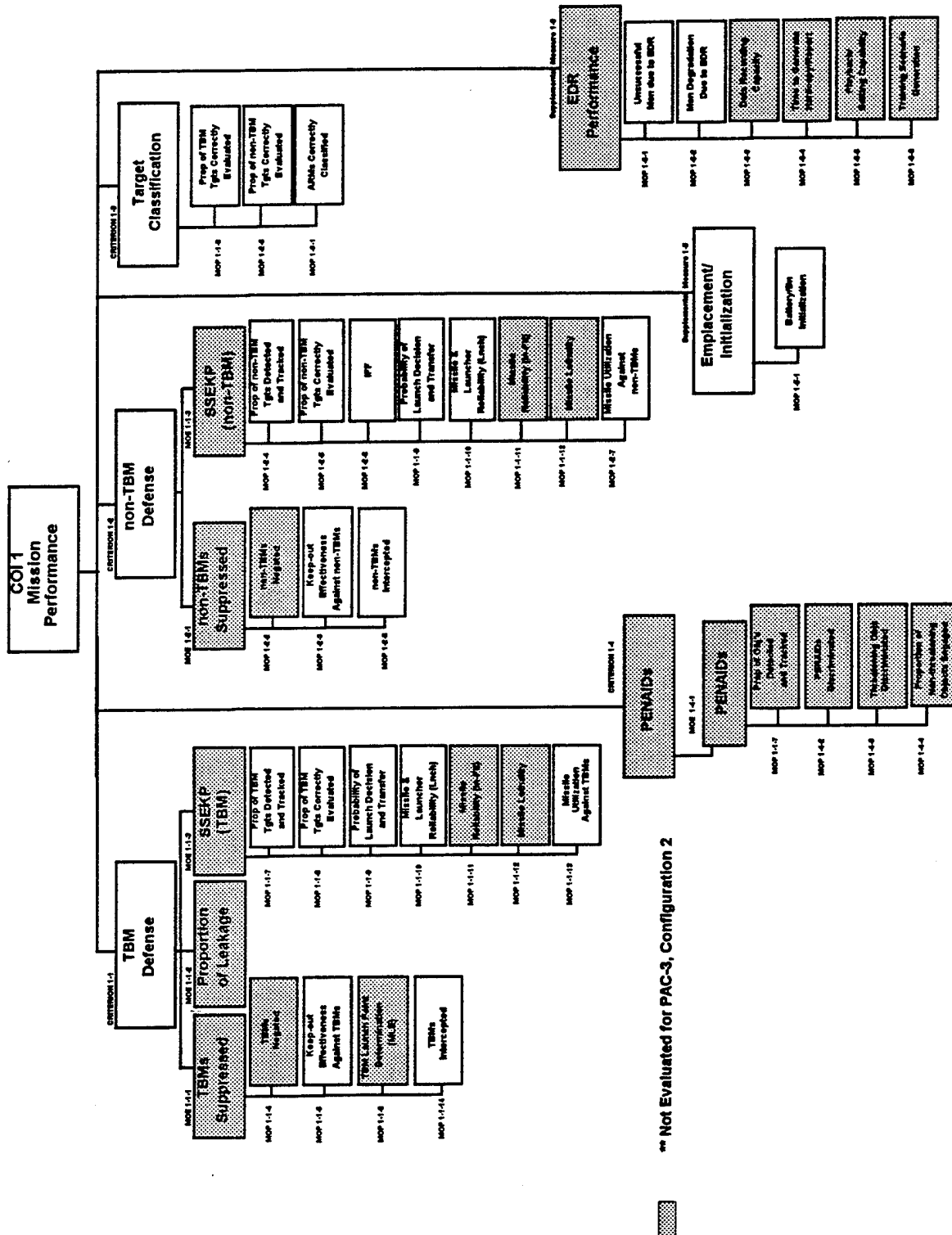
Figure 3-2. Evaluation Dendritic for COI 1, Mission Performance.

3.1.1.1 Criterion Evaluation Design and Procedure. The PATRIOT system, with Configuration-2 upgrades, must perform its mission without any degradation to its existing capabilities. To enhance its effectiveness, the upgrades must increase its effectiveness against TBMs. Therefore the analysis of Criterion 1-1 will address the operational effectiveness of the PAC-3 Configuration-2 system against a specified number and range of TBMs. The evaluation will compare Configuration-2 capabilities against the baseline system (PAC-2 plus QRP) and ORD requirements. The threat portrayed will be in accordance with (IAW) the approved threat TSP, the climatic conditions will be as existing during the test, and all tasks will be performed IAW the approved training and doctrinal TSPs. The PATRIOT system will be operated and maintained by representative soldiers (Battalion minus), using a representative logistic support system. Primary sources of data include: Patriot crew rotations through the FMS located at LC-38 and DT/OT flight test phases.

3.1.1.2 MOP 1-1-5: Keepout effectiveness against TBMs

3.1.1.3 MOP 1-1-7: Proportion of targets detected and tracked.

3.1.1.4 MOP 1-1-8: Proportion of TBM targets correctly evaluated (CDI).

3.1.1.5 MOP 1-1-9: Probability of successful launch decision and transfer of launch command.

3.1.1.6 MOP 1-1-10: Missile and launcher reliability at launch.

3.1.1.7 MOP 1-1-13: Missile utilization against TBMs.

3.1.1.8 MOP 1-1-14: Proportion of correctly presented TBMs intercepted

3.1.2 Criterion 1-2. The PATRIOT system must defend an asset against non-TBMs by destroying __ non-TBMs within a __ sec period while doing TBM mission. The PATRIOT system must detect, track, engage, and destroy non-TBMs with RCS of __ m² or more at worst aspect angle, that the FU has line-of-sight (LOS) to, at __ km in range and from __ m up to __ km AGL. When non-TBMs are in ground clutter and are LOS to the FU, they must be destroyed at ranges greater than __ km. The PATRIOT system must be able to destroy non-TBMs between __ km and __ km in range that are in ground clutter and electronic countermeasures (ECM).

3.1.2.1 Criterion Evaluation Design and Procedure. Criterion 1-2 addresses the operational effectiveness of the PAC-3 system against a specified number and range of non-TBMs, while performing the TBM mission. Criterion 1-2 uses an evaluation design and procedures similar to those addressed in paragraph 3.1.1.1. The MOEs for criterion 1-2 are the proportion of non-TBMs negated to total number of non-TBMs correctly presented, and the probability that the system detects, tracks, engages, and negates a single non-TBM target that enters its search and engagement volumes. Similar MOPs identified for TBM defense will be used, with slightly different data requirements and test conditions related to non-TBM targets. One additional MOP

has been identified for Criterion 1-2, to allow the identification of non-TBMs into friend, hostile, or unknown.

3.1.2.2 MOP 1-2-3: Keepout effectiveness against non-TBMs.

3.1.2.3 MOP 1-2-4: Proportion of non-TBM targets detected and tracked.

3.1.2.4 MOP 1-2-5: Proportion of non-TBM targets correctly evaluated (CDI).

3.1.2.5 MOP 1-2-6: Proportion of correctly presented non-TBMs correctly identified as Unknowns, Friends, or Hostiles.

3.1.2.6 MOP 1-2-8: Proportion of correctly presented non-TBMs intercepted.

3.1.2.7 MOP 1-1-9: Probability of successful launch decision and transfer of launch command.

3.1.2.8 MOP 1-1-10: Missile and launcher reliability at launch.

3.1.2.9 MOP 1-2-7: Missile utilization against non-TBMs.

3.1.3 Criterion 1-3. The PATRIOT system must correctly classify __ % of detected aerial vehicles as TBMs or non-TBMs with anti-radiation missiles (ARMs) as a special category of non-TBMs. Of the aerial vehicles classified as TBMs, __% must be correctly categorized by type. __% of all ARMs must be correctly categorized as ARMs.

3.1.3.1 Criterion Evaluation Design and Procedure. Criterion 1-3 addresses the operational effectiveness of the PAC-3 system's ability to correctly classify detected objects as TBMs or non-TBMs with ARMs as a special category of non-TBMs. The evaluation will compare the PAC-3 capability against the baseline system (to ensure no degradation) and the ORD requirements. Primary sources of data include: PATRIOT crew rotations through the FMS located at LC-38, and tactical sustainment exercises which include large scale search and track exercises.

3.1.3.2 MOP 1-1-8: Proportion of TBM targets correctly evaluated (CDI).

3.1.3.3 MOP 1-2-5: Proportion of non-TBM targets correctly evaluated (CDI).

3.1.3.4 MOP 1-3-1: Proportion of correctly presented ARMs correctly classified.

3.1.4 Criterion 1-4. The PATRIOT system must not have more than __ % erroneous engagements. This criterion will not be addressed during FOTE. It will be addressed during IOTE when PDB-5 software will have CDI-III enhancement incorporated.

3.1.5 Supplemental Measure 1-5. The emplacement and initialization of the PATRIOT system will not be degraded by PAC-3 upgrades.

3.1.5.1 Measure Evaluation Design and Procedure. An assessment of emplacement/ initialization timelines for the PAC-3 system will be conducted. The focus of the assessment is to ensure that battery and battalion operations can be initiated using the optical disk, and that tactical initialization (TACI) and battalion tactical initialization (BATI) software can run on the EWCC.

3.1.6 Supplemental Measure 1-6. Effectiveness of Embedded Data Recorder (EDR).

3.1.6.1 Measure Evaluation Design and Procedure. The evaluation of the EDR will be based on the Configuration-1 CDTE conducted during September 1994.

3.1.7 Issue Evaluation Design and Procedure. COI 1 addresses the basic system performance effectiveness against TBM and non-TBM threats. This issue will be answered favorably if MOPs 1-1-8 and 1-2-5 related to target evaluation performance data, and MOP 1-1-14 on TBM interception and MOP 1-2-8 on non-TBM intercept performance data show improvement compared to the baseline system performance data. Data collected for other MOPs related to mission performance coupled with military judgment will also be used to support the decision.

3.2 CRITICAL OPERATIONAL ISSUE 3 - SURVIVABILITY. Can the PAC-3 system defend itself against lethal weapons on the battlefield, and against Stand-Off Jammer (SOJ) platforms, and enemy Reconnaissance, Surveillance, and Target Acquisition (RSTA)? The evaluation dendritic is shown in Figure 3-3. The dendritic shows the decomposition of Operational Issue 3 into criteria and associated MOPs. Definitions of the associated data sets are found in Appendix C, Data Source Matrix.
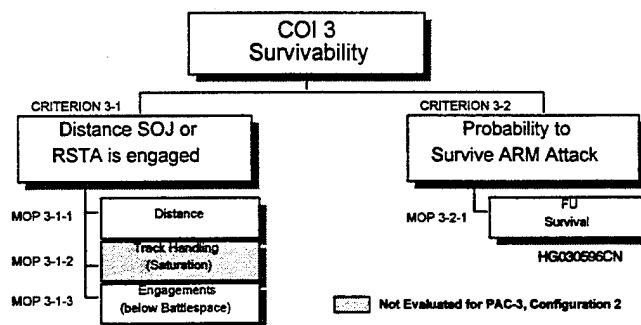
3.2.1 Criterion 3-1. PAC-3 FU must be able to engage fixed/rotary-wing (FW/RW) SOJ platforms and RSTA in original battlespace (range of __-__km from the FU radar).

3.2.1.1 Criterion Evaluation Design and Procedure. Criterion 3-1 addresses the operational effectiveness of the PAC-3 system to counter growing lethality on the battlefield and advances in enemy RSTA capabilities. The evaluation will compare PAC-3 capabilities against the baseline system (PAC-2 plus QRP) and ORD requirements. The threat portrayed will be IAW the approved threat TSP, the climatic conditions will be as existing during the test, and all tasks will be performed IAW the approved training and doctrinal TSPs. The PATRIOT system will be operated and maintained by representative soldiers (Battalion minus), using a representative logistic support system. Two MOPs have been established to measure PAC-3 operational performance during FOTE: 3-1-1 (Distance from the FU radar at which PAC-3 engaged FW/RW SOJ platforms and RSTA); and 3-1-3 (Proportion of successful engagements, initiated by operator below designated battlespace). Primary source of data will be the large scale search and track exercises.

3.2.1.2 MOP 3-1-1. Distance from the FU radar at which PAC-3 engaged FW/RW SOJ platforms and RSTA.

3.2.1.3 MOP 3-1-3. Proportion of successful engagements, initiated by operator below designated battlespace.

3.2.2 Criterion 3-2. PAC-3 must have a ___ probability of surviving a single ARM attack.

3.2.2.1 Criterion Evaluation Design and Procedure. The evaluation will compare PAC-3 Configuration-2 capabilities against the baseline system and ORD requirements. The threat portrayed will be IAW the approved threat TSP, the climatic conditions will be as existing during the test, and all tasks will be performed IAW the approved training and doctrinal TSPs. The PATRIOT system will be operated and maintained by representative soldiers (Battalion minus), using a representative logistic support system. Areas of focus in evaluating Criterion 3-2 include: reduction in signatures; survival measures (should not increase movement times, personnel requirements, or number of vehicles in a unit); radar non-radiating emplacement; active defense measures; and EMCON. Primary sources of data include: PATRIOT crew rotations through the FMS located at LC-38; large scale search and track exercises; and data resulting from modeling/simulations.

3.2.2.2 MOP 3-2-1. Proportion of single ARM attacks survived by PAC-3 FUs.

3.2.3 Issue Evaluation Design and Procedure. System survivability issue will be answered favorably if MOP 3-1-1 dealing with the engagement of SOJ/SSJ and RSTA aircraft at extended ranges and MOP 3-2-1 concerning the FU survival against simulated single ARM attack are comparable to the baseline system performance data.

3.3 CRITICAL OPERATIONAL ISSUE 4 - RAM. Can the PAC-3 be sustained in an operational environment? The evaluation dendritic is shown in Figure 3-4. The dendritic shows the decomposition of Operational Issue 4 into criteria and associated MOPs. Definitions of the associated data sets are found in Appendix C, Data Source Matrix.
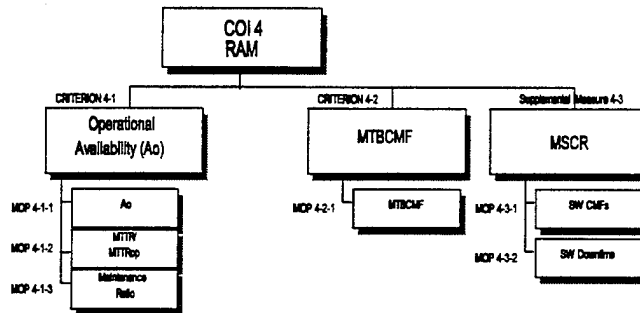
Figure 3-4. Evaluation Dendritic for COI 4 - RAM.

3.3.1 Criterion 4-1. PAC-3 FU must have a minimum A_o of ___.

3.3.1.1 Criterion Evaluation Design and Procedures. This operational suitability issue will examine the A_o of the PAC-3 system in its expected operational environment and when operated IAW its wartime OMS/MP. The evaluation will compare PAC-3 Configuration-2 capabilities against the baseline system and ORD requirements. The threat portrayed will be IAW the approved threat TSP, the climatic conditions will be as existing during the test, and all tasks will be performed IAW the approved training and doctrinal TSPs. The PATRIOT system will be operated and maintained by representative soldiers (Battalion minus), using a representative logistic support system.

3.3.1.2 Key MOE/MOP to Measure Criterion. Key MOPs are: MOP 4-1-1 (operational availability); MOP 4-1-2 (mean time to repair); and MOP 4-1-3 (maintenance ratio).

3.3.2 Criterion 4-2. Mean time between critical mission failure (MTBCMF) will exceed 20 hours.

3.3.2.1 Criterion Evaluation Design and Procedures. Criterion 4-2 will examine the number of critical mission failures and the associated time interval between each failure.

3.3.2.2 Key MOE/MOP to Measure Criterion. MOP 4-2-1 (MTBCMF) will assess the recorded number of critical mission failures and the time interval between each failure.

3.3.3 Supplemental Measure 4-3. The Materiel System Computer Resources (MSCR) must not degrade system RAM.

3.3.3.1 Measure Evaluation Design and Procedures. The evaluation will compare PAC-3 capabilities against the baseline system and ORD requirements. The threat portrayed will be IAW the approved threat TSP, the climatic conditions will be as existing during the test, and all tasks will be performed IAW the approved training and doctrinal TSPs. The PAC-3 system will be operated and maintained by representative soldiers (Battalion minus), using a representative logistic support system. RAM data will be scored IAW the FD/SC and stored in the RAM database.

3.3.4 Issue Evaluation Design and Procedure. This issue will be answered favorably if mean time between critical mission failures (MOP 4-2-1) and software charged critical mission failures (MOP 4-3-1) are comparable to the baseline system data.

3.4 ADDITIONAL OPERATIONAL ISSUE 2 - INTEROPERABILITY. Can the PATRIOT system interoperate with higher echelon units (HEU), adjacent ADA units, external sensors, and intelligence sources via secure communication means? The evaluation dendritic is shown in Figure 3-5. The dendritic shows the decomposition of Operational Issue 2 into complementary measures, and associated MOE/MOP. Definitions of the associated data sets are found in Appendix C, Data Source Matrix.
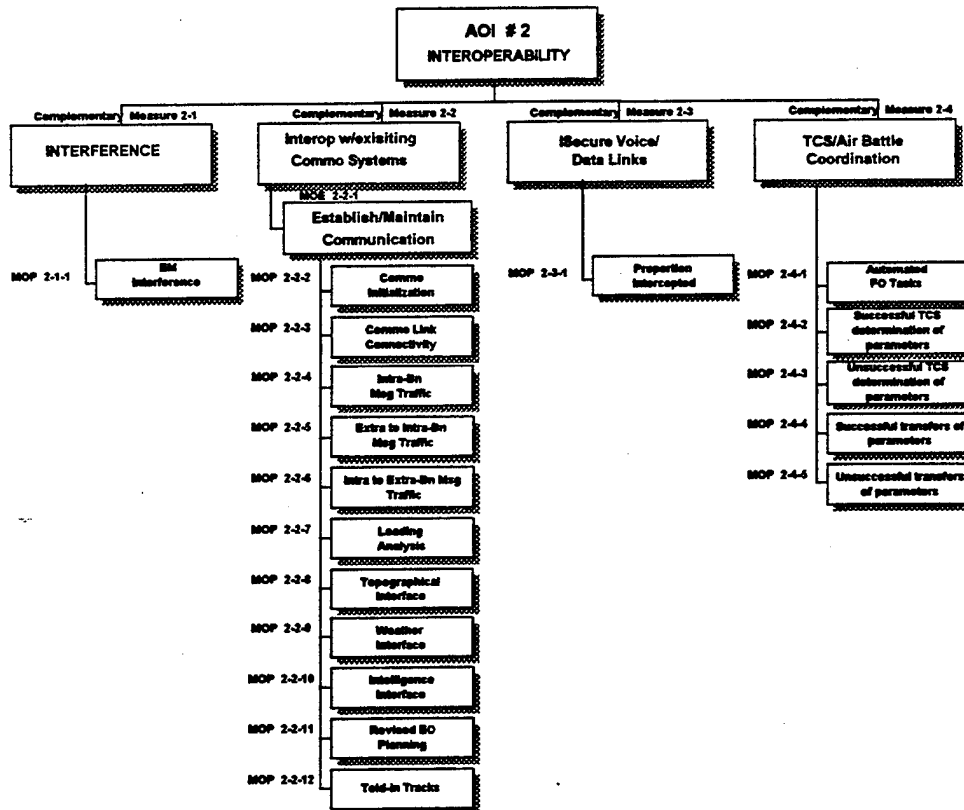
Figure 3-5. Evaluation Dendritic for AOI 2 - Interoperability.

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3.4.1 Complementary Measure 2-1. Interference by Army, Air Force, Navy, or allied electro-magnetic (EM) emitters to PATRIOT with PAC-3 Configuration-2 upgrades will not degrade required performance.

3.4.1.1 Measure Evaluation Design and Procedure. The PATRIOT system, with PAC-3 Configuration-2 upgrades must perform its mission without degradation in the presence of EM emitters. Complementary Measure 2-1 will compare the PAC-3 capabilities against the baseline system's existing capability and ORD requirements to exchange voice and data link information without interference from EM emitters. An assessment will also be made as to the effect the interference has on the operational mission. The number of incidences of EM interference and its source will be recorded. Test controller and test monitor notes will be used to assess the effect of the EM interference in performance of the mission.

3.4.2 Complementary Measure 2-2. PAC-3 must be interoperable with existing and planned ADA C³I systems of the Army, Joint, and Combined Services.

3.4.2.1 Measure Evaluation Design and Procedure. Complementary Measure 2-2 will compare the PAC-3 capabilities against the baseline (PAC-2 plus QRP) system's existing capability to exchange voice and data link information, with existing and planned C³I systems. Complementary Measure 2-2 will evaluate PAC-3 Configuration-2 modifications effect on initialization, communication link connectivity, and intra- and extra- battalion communication. A loading analysis will be conducted. Interfaces with intelligence and meteorological links will be evaluated. Primary data sources will include: PAC-3 Configuration 2 system operating with the FMS, live aircraft tests, and live missile flight tests.

3.4.2.2 Key MOE/MOP for Measure. The MOE for Complementary Measure 2-2 is the proportion of time that PATRIOT is able to establish and maintain effective intra-/extra battalion communications to all required interfacing systems. Key MOPs include: 2-2-2 (Communication systems properly initialized within designated timelines); 2-2-3 (Communication link options identified, analyzed and connectivity established within designated timelines); and MOPs 2-2-4 through 2-2-6 (intra-/extra-battalion communication). MOPs 2-2-8 through 2-2-10 address the intelligence, topographical and meteorological interfaces. MOPs 2-2-11 and 2-2-12 address the impact of the intelligence interfaces on Engagement Operations (EO).

3.4.3 Complementary Measure 2-3. PATRIOT must have the capability to exchange secure voice and data link information with current/planned Army ADA systems that use standard communication and data languages including FAAD C³I, CORPS SAM, and high altitude theater missile defense (HATMD).

3.4.3.1 Measure Evaluation Design and Procedure. Complementary Measure 2-3 evaluates the PATRIOT system's (with PAC-3 modifications) capability to exchange secure voice and data

link information. TEMPEST tests were performed using an upgraded PATRIOT ICC placed in a shielded anechoic chamber at Fort Huachuca, Arizona. Other data will be evaluated through contractor and developmental tests and through HWIL simulations involving the FMS.

3.4.3.2 Key MOE/MOP for Measure. MOP 2-3-1 (Proportion of transmissions which can be covertly intercepted and interpreted) was used to measure the number of messages transmitted, the number of messages intercepted using RF/TEMPEST covert communication monitoring equipment. The source of the intercepted message will also be recorded.

3.4.4 Complementary Measure 2-4. PAC-3 Bn must provide automated support to coordinate the overall air battle execution between the upper tier (HATMD) and lower tier, and direct the ABT battle.

3.4.4.1 Measure Evaluation Design and Procedure. Complementary Measure 2-4 addresses the operational effectiveness of the PAC-3 communication, software and hardware modifications which automates PATRIOT's existing capability to the coordination and execution of the overall air battle and the role of the TCS in Force Operations (FO). Complementary Measure 2-4 will measure the PAC-3 Configuration-2's ability by evaluating the system operating with the FMS and live aircraft tests involving PATRIOT and available HATMD systems.

3.4.4.2 Key MOE/MOP for Measure. Key MOPs for this measure are MOP 2-4-1, proportion of FO tasks automated, and MOP 2-4-2 through 2-4-5 measure the ability of the TCS to successfully determine and transfer initialization parameters.

3.4.5 Issue Evaluation Design and Procedure. Interoperability issue will be considered met if Complementary Measure 2-2 (interoperability with existing communication systems) shows improvement over the baseline system performance. Special attention will be given to performance of the Routing Logic Radio Interface Unit (RLRIU) which is the major portion of CE Phase I enhancement. Complementary Measures 2-1, 2-3, and 2-4 coupled with military judgment will also be used to help support the decision. Also, Complementary Measure 2-4 will be used to support the TCS type classification effort.

3.5 ADDITIONAL OPERATIONAL ISSUE 5 - MANPRINT. Can appropriate MOS qualified soldiers, with, the training given, perform tasks to standards under operational conditions using the PAC-3 system? The evaluation dendritic is shown in Figure 3-6. The dendritic shows the decomposition of Operational Issue 5 into added measures and associated MOPs. Definitions of the associated data sets are found in Appendix C, Data Source Matrix.

3.5.1 Complementary Measure 5-1. PAC-3 modification will result in no increase in manpower personnel per battalion.

AOI 5
MANPRINT

Complementary Measure 5-1 | Complementary Measure 5-2 | Complementary Measure 5-3 | Complementary Measure 5-4

| Manpower | Training | Human Factors Engineering (HFE) | Health & Safety |

MOP 5-1-1 — Task List

MOP 5-2-1 — Efficiency in Performing Tasks

MOP 5-3-1 — HFE Standards

MOP 5-4-1 — Health & Safety Standards

MOP 5-5-1 — MANPRINT Probs By Rating/Type

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MOP 5-1-2 — Performance of Critical Tasks

MOP 5-3-2 — User Friendliness
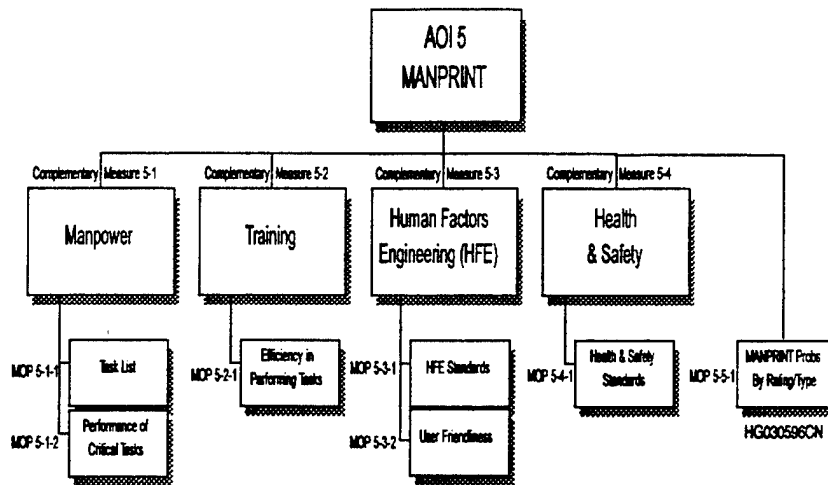
Figure 3-6. Evaluation Dendritic for AOI 5 - MANPRINT.

3.5.1.1 Measure Evaluation Design and Procedures. Complementary Measure 5-1 will focus on how the design features and operating characteristics of the PAC-3 Configuration-2 modifications affect/impact the baseline (PAC-2 plus QRP) system in required manpower (personnel) at the battalion level to accomplish required tasks. The evaluation will focus on the PAC-3 modifications to operator and maintainer task lists and that the tasks are correctly identified critical or noncritical. The evaluation will address the performance of the critical tasks. During all tasks, maintenance evaluators and data collectors will observe the required number and training level of personnel required to accomplish PAC-3 mission tasks. The threat portrayed will be IAW the approved threat TSP, the climatic conditions will be as existing during the test, and all tasks will be performed IAW the approved training and doctrinal TSPs. The PAC-3 system will be operated and maintained by representative soldiers (Battalion minus), using a representative logistic support system.

3.5.1.2 Key MOE/MOP for Measure. Specific MOPs include: 5-1-1 (Quantitative assessment of operator/maintainer task lists provided to support all required operations/functions of PAC-3 system); and 5-1-2 (Observed capability of personnel authorization and distribution to accomplish mission).

3.5.2 Complementary Measure 5-2. Training required as a result of PAC-3 Configuration-2 modifications will provide sufficient operator/maintainer proficiency to support mission accomplishment.

3.5.2.1 Measure Evaluation Design and Procedures. See 3.5.1.1.

3.5.2.2 Key MOE/MOP for Measure. MOP 5-2-1 (Qualitative assessment of operator/ maintainer efficiency in performing critical tasks) will be used to analyze complementary measure 5-2.

3.5.3 Complementary Measure 5-3. PAC-3 must comply with applicable HFE standards of

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design, performance, and operation prescribed in MIL-STD 1472. PAC-3 must be able to be operated and maintained by 5th through 95th percentile males and females, in all mission oriented protective posture (MOPP) levels.

3.5.3.1 Measure Evaluation Design and Procedures. Human Factor Engineering and user friendliness will be examined in areas in which operator and maintainer tasks have been changed or added as a result of PAC-3 modifications. Structured surveys and questionnaires will be administered. The HFE and user friendliness will be observed on the equipment items being operated and maintained by representative soldiers (Battalion minus), using a representative logistic support system.

3.5.3.2 Key MOE/MOP for Measure. MOP 5-3-1 (Qualitative assessment of HFE design compliance to MIL-STD 1472) and MOP 5-3-2 (Qualitative assessment of user friendliness) will be used to measure 5-3.

3.5.4 Complementary Measure 5-4. PAC-3 must meet health and safety requirements stated in MIL-STD 882. PAC-3 upgrades must not contribute to health hazards that restrict or endanger operators or maintainers.

3.5.4.1 Measure Evaluation Design and Procedures. Observer / operator will provide MANPRINT problem statements, describing any hazard or non-compliance with satety and health standards.

3.5.4.2 Key MOE/MOP for Measure. MOP 5-4-1 (PAC-3 compliance with safety and health standards as prescribed in MIL-STD 882, AR 385-16 and AR 40-10) will be used.

3.5.5 Issue Evaluation Design and Procedure. The impetus of HFE (Complementary Measure 5-3) will be on the user-friendliness of the system from the user's vantage point. Health and safety (Complementary Measure 5-4) objective will be to identify any situation or condition that presents a real or potential threat to the health and well-being of the operators/maintainers, and/or the possibility of damage to system equipment. MANPRINT issues identified during QRP will be reviewed to see if these issues have been resolved, or if they continue to be of concern. MANPRINT issue will be considered met if Complementary Measures 5-3 and 5-4 show no degradation. Other complementary measures and military judgment will also be used to help support this decision.

3.6 ADDITIONAL OPERATIONAL ISSUE 6 - MEANS OF EMPLOYMENT. Can the PAC-3 system be employed to accomplish its mission using the prescribed organization, doctrine, and tactics? The evaluation dendritic is shown in Figure 3-7. The dendritic shows the decomposition of Operational Issue 6 into complementary measures and associated MOPs. Definitions of the associated data sets are found in Appendix C, Data Source Matrix.

3.6.1 Complementary Measure 6-1. PAC-3 organization (including number of authorized personnel, personnel distribution, required skill levels, and equipment authorizations and optimization) will be sufficient to accomplish the wartime and peacetime mission IAW OMS/MP.

3.6.1.1 Measure Evaluation Design and Procedures. Measure 6-1 will focus on the operational suitability of the PAC-3 organization in accomplishing its wartime and peacetime mission. See Paragraph 3.5.1.1.
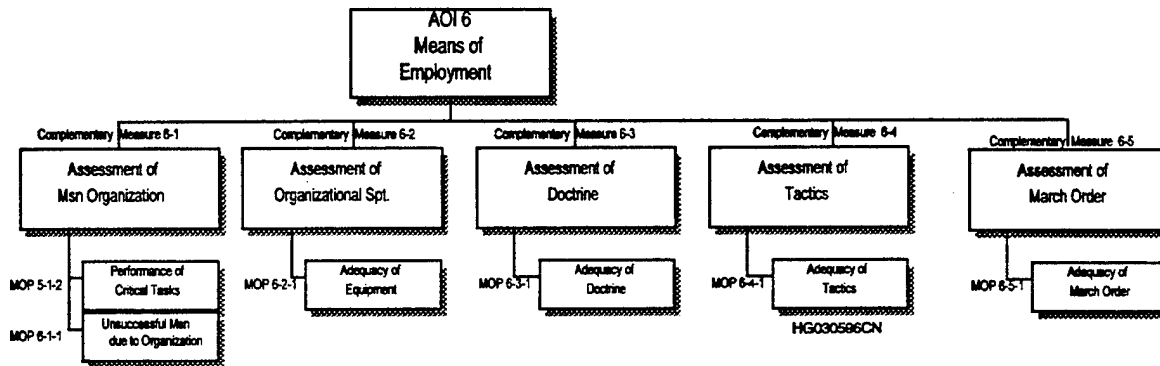
Figure 3-7. Evaluation Dendritic for AOI 6 - Means of Employment.

3.6.1.2 Key MOE/MOP For Measure. See Paragraph 3.5.1.2 and MOP 6-1-1 (unsuccesful mission due to organization).

3.6.2 Complementary Measure 6-2. PAC-3 organization will provide sufficient support personnel and equipment to achieve the approved ORD and OMS/MP requirements.

3.6.2.1 Measure Evaluation Design and Procedures. During performance of mission support tasks, observations will be made by evaluators/data collectors as to the achievement of the approved peacetime and wartime OMS/MP requirements and PAC-3 system capability in accomplishing the stated ORD values.

3.6.2.2 Key MOE/MOP for Measure. MOP 6-2-1 (Observed capability of authorized and distributed equipment to support the mission), will measure 6-2.

3.6.3 Complementary Measure 6-3. Doctrinal procedures will facilitate operators in achieving their required performance and provide for required interoperability with other services and allied TMD systems/assets.

3.6.3.1 Measure Evaluation Design and Procedures. Doctrinal procedures will be evaluated during the performance of tactical sustainment exercises, HWIL simulations using the FMS, and

flight testing, where: the threat portrayed will be IAW the approved threat TSP, the climatic conditions will be as existing during the test, and all tasks will be performed IAW the approved training and doctrinal TSPs; and the PAC-3 system will be operated and maintained by representative soldiers (Battalion minus), using a representative logistic support system.

3.6.3.2 Key MOE/MOP for Measure. MOP 6-3-1. Observed capability of defined doctrine to support mission accomplishment.

3.6.4 Complementary Measure 6-4. Tactics employed will permit the accomplishment of the ORD-level of protection and will accommodate supporting and supported functional requirements.

3.6.4.1 Measure Evaluation Design and Procedures. Same as 3.6.3.1, except emphasis will be on evaluating the approved tactics for the PAC-3 system.

3.6.4.2 Key MOE/MOP for Measure. MOP 6-4-1. Observed capability of defined Tactics, Techniques, and Procedures (TTPs) to support mission accomplishment.

3.6.5 Complementary Measure 6-5. The march order timelines of PATRIOT system will not be degraded by PAC-3 upgrades.

3.6.5.1 Measure Evaluation Design and Procedures. During sustainment field exercises, obsevation will be made by evaluators/data collectors as to the achievement of the approved peacetime and wartime OMS/MP requirements.

3.6.5.2 Key MOE/MOP for Measure. MOP 6-5-1. Recorded march order timelines for PAC-3 FU.

3.6.6 Issue Evaluation Design and Procedure. Evaluator and subject matter expert assessment of the adequacy of Doctrine (Complementary Measure 6-3) and Tactics (Complementary Measure 6-4) will form the basis to address this issue. Observation of organization support to mission performance made by evaluator/data collector and military judgment will also be used to help support this decision.

3.7 ADDITIONAL OPERATIONAL ISSUE 7 - Supportability. Is the PAC-3 system supportable? The evaluation dendritic is shown in Figure 3-8. The dendritic shows the decomposition of Operational Issue 7 into complementary measures and associated MOPs. Definitions of the associated data sets are found in Appendix C, Data Source Matrix.

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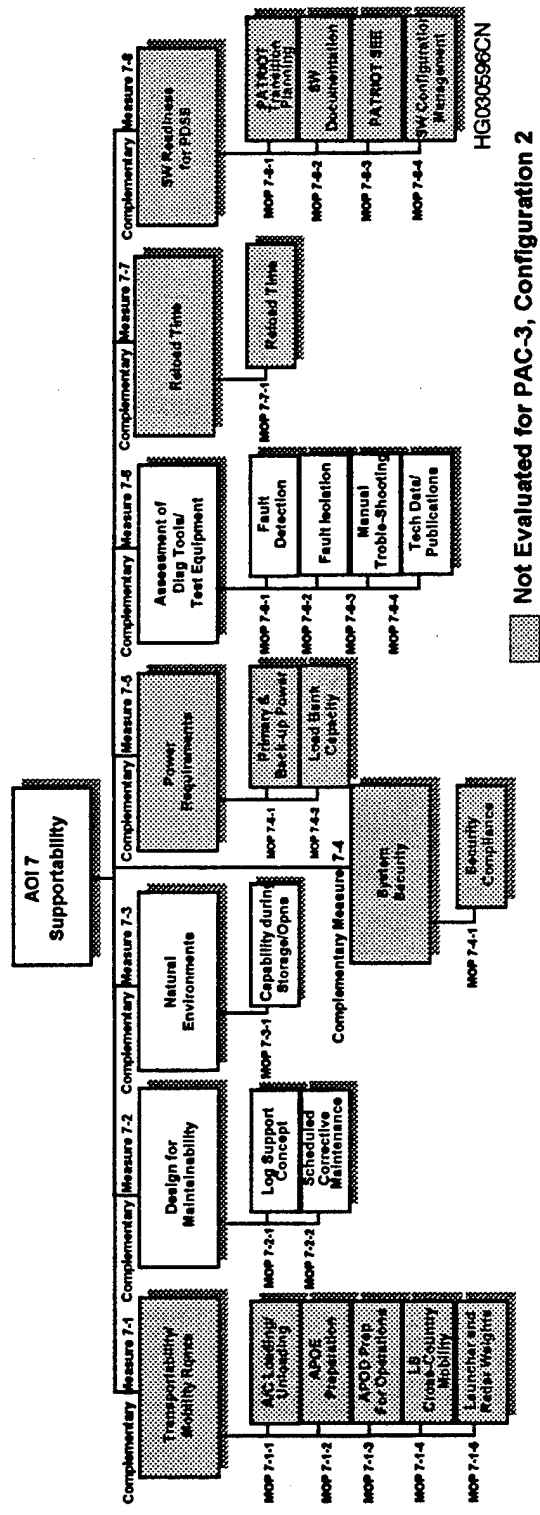
Figure 3-8. Evaluation Dendritic for AOI 7 - Supportability.

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3.7.1 Complementary Measure 7-2. The PAC-3 Configuration-2 system upgrades should be designed for maintainability, and require the same level or less in frequency or duration of preventive maintenance (PM) and scheduled maintenance.

3.7.1.1 Measure Evaluation Design and Procedures. An assessment will be made to determine the effect of the PAC-3 Configuration-2 modifications on the design for maintainability to evaluate the accessibility and modularity of design of the PAC-3 equipment. Unit maintenance and supply systems will be evaluated for effectiveness and adequacy. This encompasses PAC-3 operator/maintainer performance and procedural errors and hardware/software malfunctions. Preventive and scheduled maintenance frequency and duration will be evaluated as to efficiency and effectiveness. Evaluator conclusions will be based on unit accomplishments relative to the MOPs and meeting the measure.

3.7.1.2 Key MOE/MOP For Measure. MOP 7-2-1. Qualitative assessment of the logistic support concept, will use data collected from evaluator/observer clipboard notes on soldier performance and Soldier responses from System Evaluation Questionnaire. The data will record any discrepancy observed or design defect that extends or interferes with the operations, repair, alignment or replacement functions of the PAC-3 system. These data will be correlated with questionnaires and interviews of operators, operator maintainers, and test observers. The evaluator/observer will record all maintenance performed and level performing maintenance. MOP 7-2-2. Level, frequency, and duration of scheduled and corrective maintenance, will use operator and maintenance logbooks; output from remote maintenance monitor (RMM); and EDR tapes to record the level, frequency, and duration of scheduled and corrective maintenance. Observations, interviews and surveys will record any discrepancy observed or design defect that extends or interferes with the operations, repair, alignment, or replacement functions of the PAC-3 system.

3.7.2 Complementary Measure 7-3. PAC-3 must be capable of operation and storage in all climatic conditions without performance degradation.

3.7.2.1 Measure Evaluation Design and Procedures. An assessment will be made to determine the effect of the PAC-3 modifications on the system performance (operation and storage) in all climatic conditions without degradation. This measure will evaluate data collected during the OT for operations in the ambient (desert) environment. PPQT (environmental) data will be compared to the requirements as defined in the PAC-3 ORD.

3.7.2.2 Key MOEs/MOPs For Measure. MOP 7-3-1. Observed capability of PAC-3 system during storage or operation in all climatic conditions.

3.7.3 Complementary Measure 7-6. PAC-3 system must detect relevant mission essential failures and isolate mission failures to a single LRU.

3.7.3.1 Measure Evaluation Design and Procedures. An assessment will be made to determine the effect of the PAC-3 Configuration-2 modifications on the detection and isolation of faults to a single LRU. The ORD requirements specify that both built-in test/built in test equipment (BIT/BITE) and manual trouble-shooting procedures (when not detected/ isolated by BIT).be evaluated. All BIT/BITE operations will be analyzed to ensure required tasks are properly identified as critical or non-critical based on impact to mission accomplishment. The data reduction team will compile and code failure data and failure detection and fault isolation data appropriately by type and subject. The adequacy of diagnostic troubleshooting tools and test equipment will be evaluated using a mix of narrative data provided by user personnel and evaluator observations. The adequacy of the PATRIOT equipment publications will be evaluated to determine if the PAC-3 system is described, providing clear operating and maintenance procedures at the applicable echelon. Repair parts and special tool lists will be reviewed to determine that the repair parts used during the test are listed and can be identified in the publication. Evaluator conclusions will be based on unit accomplishments relative to the MOPs and meeting the measure.

3.7.3.2 Key MOE/MOP for Measure. MOP 7-6-1. Proportion of Relevant Mission Essential (RME) failures correctly detected by BIT/BITE vs total number of RME failures. Data will be collected from Operator/Maintenance Logs, the RMM and hard copy unit (HCU) output. A record of all maintenance and level performed will be maintained, as well as a record of all RME failures correctly detected by BIT/BITE. The MOP will also record every time system fails to pass self-test, the failure indication, and all corrective actions required to pass self-test. MOP 7-6-2. Proportion of RME failures correctly isolated by BIT/BITE vs total number of RME failures. Data will be collected from operator and maintenance logs, and RMM and HCU output. MOP 7-6-3. Qualitative assessment of manual troubleshooting procedures and equipment. Narrative data from user and evaluator personnel will be collected through surveys and interviews. Any missing documentation (incomplete procedures, figures, or parts) will be recorded on DA Form 2028. Test Incident Reports (TIRs) will also be used as a data source. MOP 7-6-4. Qualitative assessment of technical data and publications.

3.7.4 Issue Evaluation Design and Procedure. Supportability issue will be answered favorably for PAC-3 Configuration 2 system if Complementary Measure 7-2 (Designed for Maintainability) and Complementary Measure 7-6 (Assessment of Diagnostic Tools/ Test Equipment) are met. The PAC-3 Configuration 2 system is not mature enough to satisfy Complementary Measures 7-1, 7-5, 7-7, and 7-8 as required in the ORD.

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CHAPTER 4

TEST CONCEPT

4.1 Test Description. The PAC-3 Configuration-2 FOTE will be conducted by the Test and Experimentation Command (TEXCOM) ADATD during the period 20 May through 22 June 1996. The test team organization will consist of test control personnel, data collection personnel, data analysis and reduction teams, and a data authentication group (DAG).

4.1.1 Test Location. Air defense missions and live aircraft scenarios will be conducted on the North Fort Bliss test area, in maneuver areas 4, 5, 6, and 7 (Figure 4-1). Flight Mission Simulator (FMS) scenarios, used to simulate TBM, anti-radiation missile (ARM), and ABT attacks, will be conducted at Launch Complex (LC) 38 located at White Sands Missile Range (WSMR), New Mexico. Missile flight tests (firings) will also be conducted at WSMR, New Mexico.
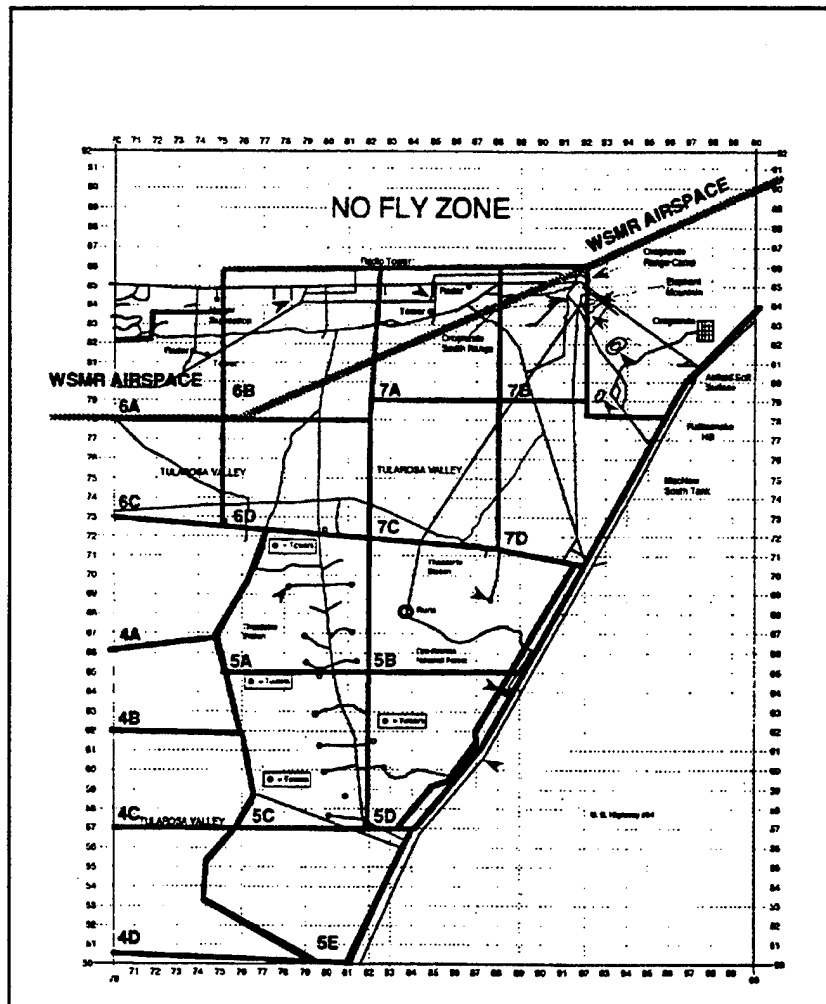
Figure 4-1. PATRIOT FOTE test areas.

4.1.2 Environment. The North Fort Bliss Test Range consists of a desert environment with temperatures ranging from approximately 32° to 100° Fahrenheit. The terrain consists of desert terrain, rolling hills, valleys, mountains, and plateau areas, and incorporates extensive background clutter. Mobility conditions within the test area include hard top, improved, and unimproved roads, and should closely replicate actual terrain conditions anticipated in a Southwest Asia (SWA) tactical scenario.

4.1.3 Duration. Dates for the pretest activities and the record test are provided in Table 4-1.

TABLE 4-1. TEST TIMELINE

Start date	End date	Activity	No. of Days
1 April 1996	19 April 1996	Instrumentation certification	15
22 April 1996	26 April 1996	FMS Pilot test	5
27 April 1996	5 May 1996	FMS data verification	9
29 April 1996	3 May 1996	Pilot test (Phase I)	5
4 May 1996	19 May 1996	End-to-end data verification	16
6 May 1996	10 May 1996	FMS Record Trials	5
20 May 1996	7 June 1996	Record test (Phase II)	15
21 June 1996	22 June 1996	Missile flight tests (Phase III)	2

4.1.4 Type of Player Unit. The test unit, organized under Table of Organization and Equipment (TOE) 44-636L200 and 44-637L000, will consist of a PATRIOT battalion (-) composed of three PAC-3 Configuration-2 firing batteries and one PAC-3 Configuration-2 ICC. Additional items of equipment will be used to stimulate operational message traffic to higher echelon, adjacent, and subordinate air defense-related units. These equipment items include a Tactical Command System (TCS), a Marine Corps Tactical Air Operations Module (TAOM); an air defense brigade tactical operations center (ADTOC); an adjacent PATRIOT battalion ICC; a JTAGS surrogate; and a TADIL-A and TADIL-J equipped Navy E-2C Hawkeye aircraft.

4.2 Test Methodology. A representative PATRIOT Battalion (-) Task Force will be employed and operated in a simulated combat environment IAW established doctrine and tactics and threat environment as described in the threat test support package (TSP). Air defense operations will be initiated to protect the task force and notional rear area assets during scheduled mission scenarios.

To implement these scenarios, scripted situational messages and selected higher-echelon command and control messages will be generated by the tester and passed to the ADTOC, TCS, and PATRIOT ICC. Messages will be passed before, during, and after live or simulated aircraft missions according to the time-ordered events list (TOEL). Command and control messages and force operations actions will be generated by the player unit in direct response to these message inputs.

4.3 Test Variables. Test factors, conditions, and the method of control are presented in Table 4-2.

TABLE 4-2. TEST VARIABLES

Factors	Conditions	Control
Aircraft NBC conditions (simulated) Scheduled mission, light conditions FMS crews Engagement mode • ABT • TBM	Fixed, rotary, and UAV MOPP 0 and MOPP 4 Day and night Representative Semi-automatic Automatic	Systematically varied
Flight profile Target identification Electronic countermeasures (ECM) Launcher location C³I Operations • ADW • WCO Weapons control status Identification mode	Per Threat TSP Friend and foe Benign and stand-off and self- screening jamming Remote and local Operational mode summary/ mission profile (OMS/MP) Hold, tight, and free Manual and automatic	Tactically varied
Ground level interference filter Search mode	On ABT, TBM (TBM On)	Held constant
Satellite date and time source Maintenance actions and system failures Weather	Manual and automatic As occurs As occurs	Uncontrolled

4.4 Schedule of Events. An individual time-ordered events list (TOEL) and test script will be developed for each test day using appropriate message traffic (for example, air defense warnings, weapons control orders, and movement warning orders) to drive the test scenario. The TOEL and script will be developed by following the requirements stated in the PATRIOT OMS/MP.

The TOEL and script will be used to acquire the test event data required to answer all evaluation issues. Table 4-3 shows the use of live aircraft. Prior to live aircraft missions, the C³I Engineering and Evaluation System (CEES) will be used to checkout the integrity of the electronic data link network. The CEES will also be used to certify instrumentation during pilot test and instrumentation checkout prior to mission start during record trials. The CEES will not be accredited for use during FOTE for data collection. Simulated TBM, ARM, and ABT mission scenarios will be conducted with the FMS.

TABLE 4-3. PATRIOT FOTE CONFIGURATION 2 PHASE II - LIVE AIRCRAFT TEST MATRIX

ECM	MOPP level	Hostile aircraft			Friendly aircraft	
		FW	RW	UAV	FW	RW
YES	0	74	8	6	6	2
	4	32	4	2	4	2
NO	0	32	4	6	6	2
	4	16	2	2	4	2
TOTAL		154	18	16	20	8

Note: Scheduled ECM presentations will be both stand-off and self-screening jammers.
Due to safety requirements, night missions are excluded.
TBMs, ARMs, ALCMs will be portrayed during FMS missions.

4.4.1 Start Dates. The Pilot Test (Phase I) will start on 29 April 1996. Record trials (Phase II) will start on 20 May 1996. Missile Flight Tests (Phase III) are scheduled for 21-22 June 1996.

4.4.2 Test Phases. The test will be conducted in three phases.

4.4.2.1 Phase I: Pilot Test. The purpose of the pilot test is to check test instrumentation, test control procedures, and end-to-end data collection, encompassing quality control of data, data reduction that provides the level 3 database, and evaluation/analytical procedures. Events will consist of preventive maintenance checks and services (PMCS), march order, emplacement, exercising the communications systems of the PATRIOT battalion (-), and conducting simulated and live aircraft operations. Trials will be conducted under MOPP 0 and MOPP 4 conditions in active and benign ECM environments under both day and night conditions. The test scenario will use a step-by-step approach to allow for a thorough assessment of the test concept and resources prior to entering record trials. During the conduct of the pilot test, operations will be restricted to maneuver areas 7A, 7B, 7C, and 7D (Figure 4-1). Live aircraft flight operations will be conducted over McGregor Range airspace, east of Highway 54. (NOTE: Prior to the start of

FOTE record trials, an FMS pilot test will be conducted (during the week of 22-26 April 1996) to verify data collection and data reduction procedures. FMS record trials will be conducted during the week of 6-10 May 1996. Each of the three ADA batteries will send three ECS fire control crews to LC-38 during the FMS portion of the test. Each of the crews will be presented the MT23E scenario at least two times during their stay at the FMS complex at LC-38.)

4.4.2.2 Phase II: Sustained Operations. The objective of this phase is to test the improvements in performance provided by the PAC-3 Configuration-2 enhancements in attaining the PAC-3 ORD requirements. Meeting this objective ensures that these modifications have not degraded existing capabilities. Type classification of the TCS will also be supported. Testing during this phase will consist of three 72-hour exercises. During the field exercises, the battalion HQ and the FUs will be tested and evaluated on their ability to march order, emplace, initialize, perform PMCS, and engage in tactical operations in a simulated combat environment under the approved OMS/MP. Live fixed-wing, rotary-wing, and UAV aircraft, flying threat profiles IAW the Threat TSP, will be integrated into the test scenarios. The US Navy E-2C Hawkeye will provide the battalion ICC with target data link information. The TCS operators will be required to implement airspace control measures, rules of engagement, aircraft identification rules, and IFF tables and to react to early warning messages required for a viable air defense operation. Scripted scenarios and the TOEL will include sufficient detail to exercise mission performance, interoperability, and survivability capabilities. Assessment of RAM, MANPRINT, means of employment, and supportability will be derived from applicable portions of the exercises. Tables 4-4 through 4-6 show the number of trials required per Bn ICC, TCS, and FUs.

TABLE 4-4. ICC TRIALS

Event	Day		Night		Total
	MOPP 0	MOPP 4	MOPP 0	MOPP 4	
March order	1	1	1	0	3
Emplace	1	1	1	0	3
PMCS	1	1	1	0	3
Fault	As occurs	As occurs	As occurs	As occurs	Variable

TABLE 4-5. TCS TRIALS

Event	Day		Night		Total
	MOPP 0	MOPP 4	MOPP 0	MOPP 4	
March order	1	1	1	0	3
Emplace	1	1	1	0	3
PMCS	1	1	1	0	3
Fault	As occurs	As occurs	As occurs	As occurs	Variable

TABLE 4-6. FIRE UNIT TRIALS

Event	Day		Night		Total
	MOPP 0	MOPP 4	MOPP 0	MOPP 4	
March order	3	1	1	1	6
Emplace	3	1	1	1	6
PMCS	3	1	1	1	6
Fault	As occurs	As occurs	As occurs	As occurs	Variable
NOTE: Entries represent the total number of moves for one fire unit.					

4.4.2.3 Phase III: Missile Flight Tests. A PATRIOT PAC-3 Configuration-2 fire unit will conduct a simultaneous intercept mission against a surrogate short-range TBM and a surrogate ABT target. The FU will be deployed at SW-70 on North WSMR (33° 22' 07.529" north latitude; 106° 23' 54.850" west longitude), using both local and remote launchers. The TBM target, a PATRIOT-as-a-Target (PAAT), will be launched from (32° 24' 23.685" north latitude; 106° 23' 59.836" west longitude). WSMR personnel using their own equipment will launch the PAAT. The ABT target, or MQM-107 drone, will also be launched from the vicinity of LC-32 and directed toward the target area. Target flight times will be scheduled to require the FU to conduct two engagements with near simultaneous intercepts.

4.5 Tactical Context.

4.5.1 The 72-hour sustained operations exercises will be conducted in an operationally realistic combat environment as outlined in the PATRIOT OMS/MP. The sustained operations will take place in existing weather conditions, day and night, in both benign and simulated active nuclear,

biological and chemical (NBC) conditioning, and in benign and active electronic countermeasures environments. The PATRIOT battalion (-) will conduct a critical asset defense, using applicable doctrine, tactics, techniques and procedures (DTTP). The air threat in Phase II will be portrayed by live aircraft flying USAADASCH approved threat profiles in accordance with the Threat Support Package. The threat profiles scripted in the FMS will include simulated ABT and TBM targets. These profiles have been approved by the Threat Office of USAADASCH. The threat for the Phase III will be simulated by a PAAT (TBM) and an MQM 107 drone (for ABT) . Chapter 7 of the Detailed Test Plan (DTP) will contain detailed information on test scenarios.

4.5.2 Test scenarios, tactics, doctrine, and the portrayed threat will be IAW the TRADOC-developed scenarios (Southwest Asia [SWA]ADA III Scenario), FMS scenarios, and the OMS/MP that include ABT, TBM, and ARM threats. These scenarios are illustrative of the combat development scenarios used for the evaluation of theater missile defense (TMD) systems.

4.5.3 The SWA ADA III scenario will be used as the basic scenario for the FOTE, providing three separate cases: Riyadh, Masqat, and Cairo. Characteristics of the scenario include host nation assets with defense of aerial and sea ports of debarkation (APOD/SPOD), population areas, military units, supply points, and self defense. For the purpose of the FOTE, several vignettes will be developed to assess PAC-3 Configuration-2 modifications. Those modifications will be assessed during Phase II. SWA ADA III scenario, at D+3, is a 1-day snapshot of a larger conflict. The vignettes will be designed to evaluate the operational aspects of PAC-3 engagement operations. The Riyadh and Masqat vignettes will also be used during FMS operations. The Riyadh vignettes will exercise the PATRIOT Bn (-) defending against and engaging both TBM and ABT targets. The Masqat vignette will exercise PATRIOT in a search and track role for non-TBMs in benign and ECM environments.

4.6 Test Control Procedures. The ADATD will establish a controller group (Figure 4-2) responsible for implementing test scenarios that will require test players to respond with specific courses of action. Controller personnel will be familiar with their responsibilities associated with required events within each scenario and with tactics and doctrine contained within the Doctrinal and Organizational Test Support Package (DOTSP) and the Doctrine and Tactics Impact Package (DTIP), ST 44-85-3. Aircraft flight profiles will be properly scripted in accordance with the Threat TSP. Careful scripting of each aircraft flight path in coordination with the tactical placement of the notional defended asset(s) will ensure that live aircraft presentations provide for line of sight with the FU(s).

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                        ┌──────────────┐
                        │     TEST     │
                        │   OFFICER    │
                        └──────┬───────┘
                               │
   ┌──────────────┐            │            ┌──────────────┐
   │  PLANNING    │────────────┼────────────│     TEST     │
   │  ANALYST     │            │            │     NCO      │
   └──────────────┘            │            └──────────────┘
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        │     TEST     │              │   AIR TRAFFIC    │
        │ COORDINATOR  │              │   CONTROLLER     │
        └──────┬───────┘              └────────┬─────────┘
   ┌───────┬───┴────┬──────────────────┬───────┴──────┐
┌──┴────┐ ┌┴──────┐ ┌────────┐   ┌──────────┐
│ ADTOC │ │  TCS  │ │   ICC  │   │   ECS    │
│CONTROLLER│ │CONTROLLER│ │CONTROLLER│ │CONTROLLER│
└───────┘ └───────┘ └────────┘   └──────────┘
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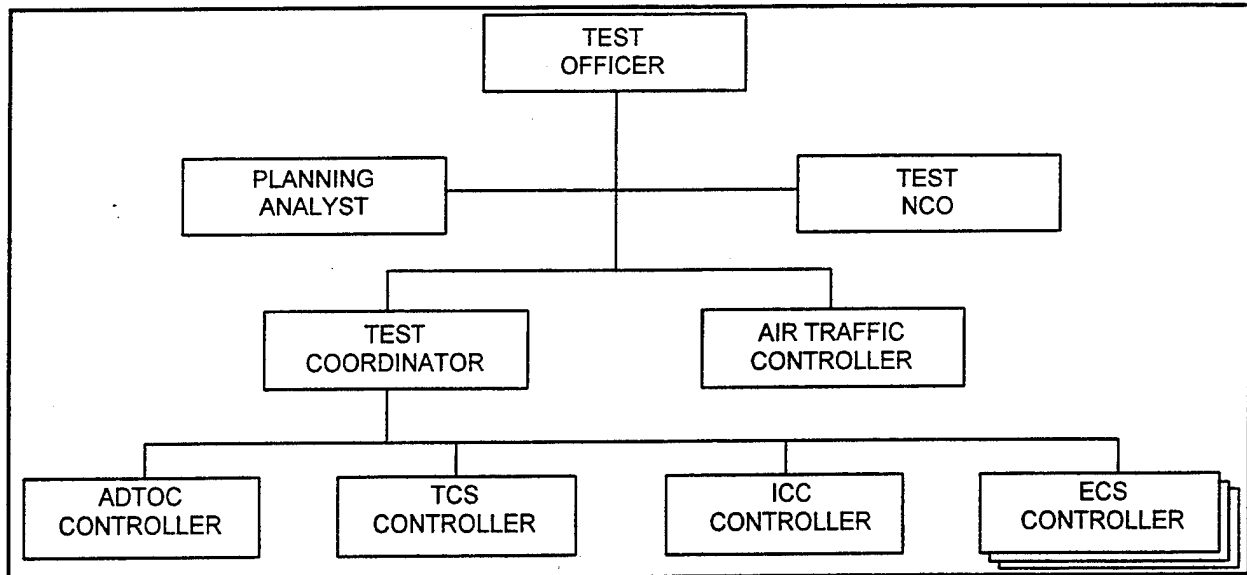
Figure 4-2. Controller group organization.

4.7 Test Training Concept. System training of player and test directorate personnel was accomplished by the materiel and combat developers. Update training will be required prior to the start of FOTE.

4.7.1 Test Player Personnel. Individual operator and organizational maintenance training was conducted from 19 June through 28 July 1995. Intermediate maintenance training was conducted during the same period. New equipment training was conducted from 19 June through 1 August 1995. This training included all MOS training, Bn (ICC) training, battery training, and intermediate maintenance training. A training update was conducted from 2-13 January 1996 to incorporate lessons learned during CDTE.

4.7.2 Test Directorate Personnel. Key personnel training was conducted for ADATD government and contractor analysts during the period 15-26 May 1995 by the PATRIOT Project Office and Raytheon instructors. Test conduct training will focus on the training of ADATD government and contractor data collectors, data reducers, and electronic technicians. This training will be conducted by ADATD personnel who attended system training mentioned above. It is not intended to make the data collectors or reducers system experts; rather, it will introduce them to the system under test and make them proficient with data collection and reduction forms to be used during the test.

4.8 Test Limitations. Test limitations include the restrictions on live target flight profiles and constraints on actual TBM and ARM attacks. The respective MOPs will be answered based on simulated TBM and ARM attacks.

4.8.1 The nature of the PATRIOT live target profiles, Federal Aviation Agency (FAA) guidelines, and WSMR/Fort Bliss range terrain set certain restrictions that limit the full use of threat player tactical deployment and execution. The FAA rules limit the use of electronic emissions against the PATRIOT fire unit.

4.8.2 Safety requirements and cost restraints preclude actual ARM and TBM attacks against the PAC-3 system during the sustained phase. (Note: A simulated TBM target will be employed during the live fire tests).

4.9 Environmental Impacts. There are no anticipated environmental constraints that have not been considered and integrated into the planned test scenarios. The approval authority is the Environmental Management Office, Fort Bliss, Texas. The Environmental Assessment was approved on August 23, 1995, with no limitations.

4.10 Instrumentation, Simulation, and Stimulation.

4.10.1 Instrumentation. Instrumentation support for the PAC-3 Configuration-2 FOTE has been designed to collect digital, video, and audio data from the various test nodes during all phases of the test. Major instrumentation items include video cameras with accompanying recorders, microphones, data link recorders, and the PATRIOT system's embedded data recorder (EDR) and remote maintenance monitor (RMM). The instrumentation package also includes items such as time insertion units, time code generators, standard range units, and modems. Range time space position information (TSPI) instrumentation will be supported by Multiple Target Tracking System (MTTS)/Inertial (Ground Positioning System) Integration (IGI) and the Nike Hercules radar. Key designated nodes (ICC, ECS, TCS) will be fully instrumented to record digital data and audio/visual data. Other nodes (ADTOC, TAOM, adjacent ICC) will be instrumented to record data link (digital) information only. All instrumentation will be certified to ensure validity of data collected and to ensure that it does not interfere with PATRIOT system operation. The EDR, although part of the system under test, will undergo certification by ADATD prior to its use and will be part of the accreditation process for PAAS. See Figure 4-3. NOTE: The complete Instrumentation Support Plan is in the detailed test plan.
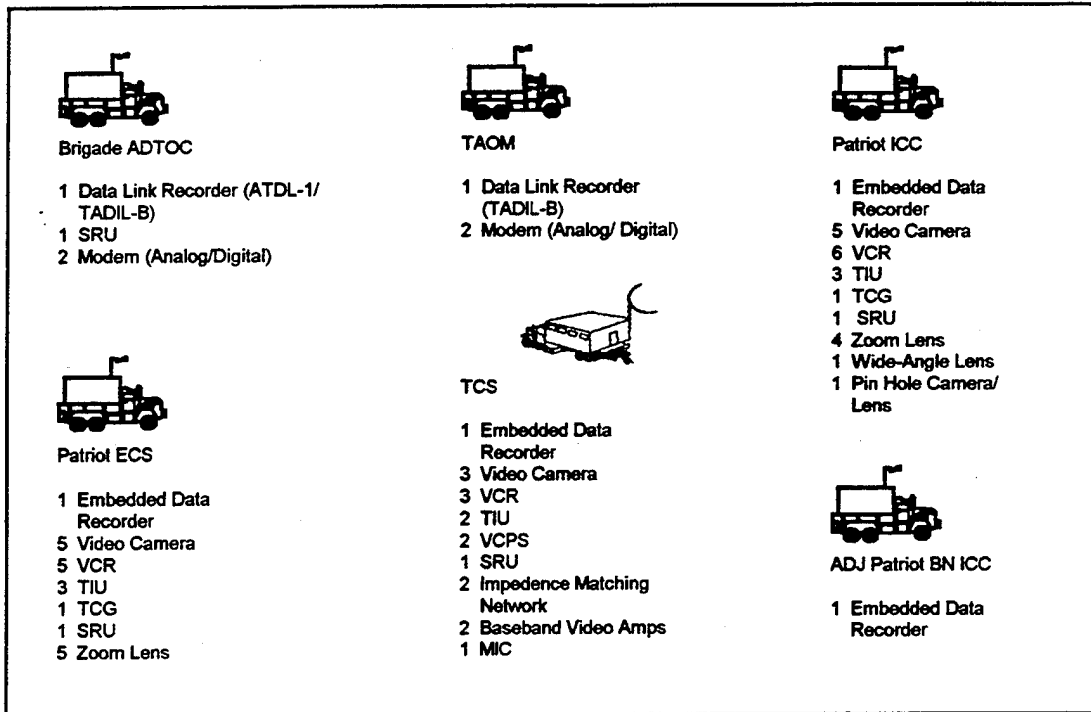
Figure 4-3. FOTE instrumentation.

Brigade ADTOC

1 Data Link Recorder (ATDL-1/
  TADIL-B)
1 SRU
2 Modem (Analog/Digital)

Patriot ECS

1 Embedded Data
  Recorder
5 Video Camera
5 VCR
3 TIU
1 TCG
1 SRU
5 Zoom Lens

TAOM

1 Data Link Recorder
  (TADIL-B)
2 Modem (Analog/ Digital)

TCS

1 Embedded Data
  Recorder
3 Video Camera
3 VCR
2 TIU
2 VCPS
1 SRU
2 Impedence Matching
  Network
2 Baseband Video Amps
1 MIC

Patriot ICC

1 Embedded Data
  Recorder
5 Video Camera
6 VCR
3 TIU
1 TCG
1 SRU
4 Zoom Lens
1 Wide-Angle Lens
1 Pin Hole Camera/
  Lens

ADJ Patriot BN ICC

1 Embedded Data
  Recorder

4.10.2 Simulation and Stimulation.

4.10.2.1 Simulation. The FMS located at WSMR will be used during FOTE to simulate ARM and TBM targets. Each PATRIOT FU will alternate fire control crews to the FMS where they will be presented threat-approved air battle scenarios. These scenarios will allow the tester and evaluator to gather data on the PAC-3 system's performance against this type of targets. To create as much realism as possible, the crews will use PATRIOT equipment (ECS, radar set) while each crew alternates through the FMS. The FMS has been extensively used during technical and operational testing since the early 1980s; however, no formal validation, verification, and accreditation has been performed. The ADATD, in coordination with OEC, will conduct an accreditation of the FMS from existing data, data collected from FDTE, and pilot test data from FOTE. The system will be accredited prior to the FOTE record trials.

4.10.2.2 Stimulation. In order to stimulate data links and other communications channels prior to live air missions (thus checking operability and possibly precluding costly mission delays), the C^3I Engineering and Evaluation System (CEES) will be used by the test control element. The CEES can simulate the various test nodes (external to PATRIOT) and their associated data links.

CHAPTER 5

TEST DATA MANAGEMENT

5.1 Data Collection Concept.

5.1.1 Organization. The data collection team will be part of the data collection and reduction task force (figure 5-1). The task force will be under the operational control of the Chief, Technical Support Division. The task force will coordinate daily, as required, with the test officer and test coordinator. Responsibilities for management and execution of the data collection team will be delegated to the chief data collector, under guidance from Chief, Technical Support Division.
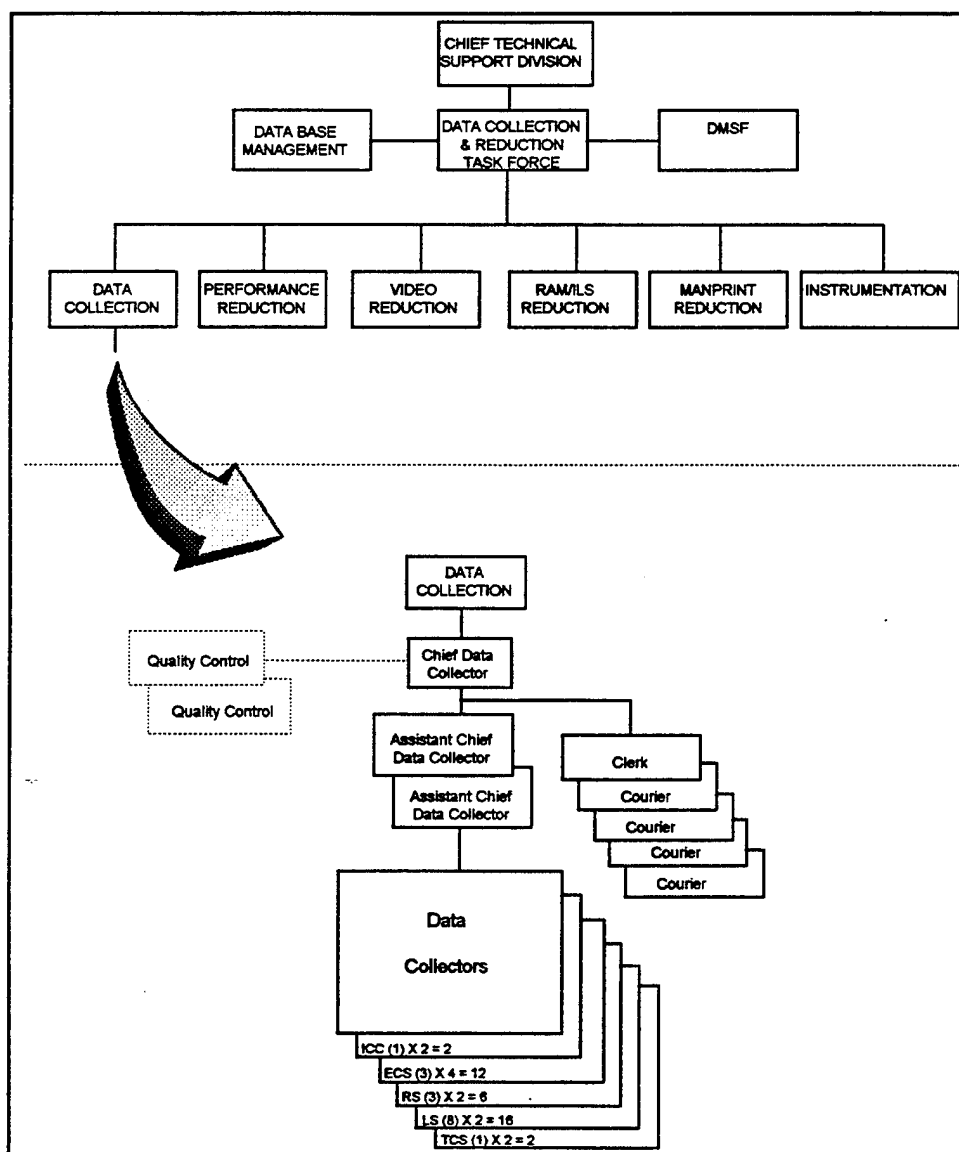
Figure 5-1. Data collection and reduction organization.

5.1.2 Collection Methods. The data collection methods are presented in Table 5-1.

TABLE 5-1. DATA COLLECTION METHODS

Data source	Media type	Data collected	Data type
MTTS/GPS	8-mm cassette Data cartridge	Aircraft TSPI Test unit TSPI	Digital
Video camera and audio	8-mm video tape	MANPRINT and performance	Video
Remote maintenance monitor	3 1/2-inch floppy disk	RAM	Digital
Video Capture processing system (VCPS)	8mm cartridge tape	TCS performance TIBS display video	Digital
Data link instrumentation recorder	3-1/2 inch floppy disk	ATDL-1, TADIL-B data link msg	Digital
Embedded data recorder	Exabyte tape	Msg events Switch actions Performance (sys & pers) Status monitor	Digital
E-2C Hawkeye	Exabyte tape	Air track msg E-2C TSPI TSRD data	Digital
FMS (ECS EDR)	Exatype tape	Performance (sys and pers) Switch Actions	Digital
Joint Command and Control Warfare Center (JC2WC)	3 1/2-inch floppy disk Plots	ECM Frequency Power Levels	Digital Hard copy
Data collectors & Analyst / Interviewer	Manual data collection forms & Questionnaries	Performance RAM MANPRINT Test Officer (TO) logs Test Conductor (TC) logs MTTS logs Weather log Operator &Soldier feedback	Hard copy

Note: Electronic data collection is time stamped by Inter-Range Instrumentation Group-B (IRIG-B) and GPS IRIG time.

5.1.3 Quality Control. Data collection media will consist of manual data collection forms and questionnaires, ½-inch VHS videotapes, 8-mm videotapes, digital diskettes, test officer and aircraft mission logs, and MTTS data cartridge tapes and logs. Once received by the chief or assistant chief data collector on duty, the manual data collection forms, along with video and audio tapes, data cartridge tapes, and computer diskettes will be inventoried, logged, and stamped with the appropriate codes and security classification. Each manual data collection form will be quality checked for correct and complete entries to include proper completion of the bar code information. All videotapes will undergo a review by the instrumentation technician prior to delivery to the data collection team.

5.2 Data Reduction Concept.

5.2.1 Organization. The data reduction teams (DRT) will be part of the data collection and reduction task force. The DRTs will be operating under the guidance of the Chief, Technical Support Division. Analysts will be assigned as team leaders to each reduction team to manage the data flow into, within, and out of the team. Additionally, they will coordinate with test personnel external to the DRT. All coordination with external sources must be routed through Chief, Technical Support Division.

5.2.2 Reduction Methods.

5.2.2.1 Performance and MANPRINT data will be reduced concurrently by the performance and MANPRINT DRTs. Performance and MANPRINT data reduction will focus on reducing selected data from VCR tapes (video and audio data), manual performance and MANPRINT data collection forms, and test logs. The results will be either entered directly into a working data base file or entered on separate manual performance and MANPRINT data reduction forms for later entry into the working data base. Data reduction priority will be given to data collected during scheduled test events (march order, emplacement) and live aircraft missions. The PATRIOT FU equipment performance data (EDR tapes) will be reduced using the PATRIOT Automated Analysis System (PAAS). The PAAS system, a PPO developed tool, went thru a validation process during the FDTE. The validation process was done by ADATD personnel. Anomolies encountered were resolved during this process.

5.2.2.2 RAM and ILS data will be reduced separately from the performance and MANPRINT data by a RAM DRT. RAM data reduction will focus on reducing selected data from manual RAM data collection forms and test logs, and entering the results on separate manual RAM data reduction forms for later entry into the working OTERAM data base. ILS data will be reduced and controlled in the same manner as RAM data; the primary difference is that the ILS files will be constructed and maintained in a SAS® data base rather than OTERAM.

5.2.3 Quality Control and Data Base Summary. Raw digital data collected by automated means will be read, translated into usable forms, and input into working data base files by automated data processing programs designed and implemented by personnel assigned to the

ADP Section. This data will then be further reduced by automated data reduction programs (also designed and implemented by ADP Section personnel) and automatically input into Intermediate SAS® Data Sets, according to criteria and scoring rules developed by test analysts. Quality control checks will be built into the automated programs to ensure the data meet predetermined type and length specifications, and fall within predetermined bounds or equal one or more predetermined values. Additionally, manual review of automated data reduction printouts will be performed early in the test to ensure automated data reduction programs are performing as designed. Automated data processing and reduction programs will be verified and validated by DRT and DAG personnel, respectively, using related data from manual, video, audio, and/or digital sources. Raw data collected by manual means (manual data collection forms, questionnaires, and individual interviews), and analog data collected by automated means (video and audio tapes) will be reviewed and manually reduced onto manual data reduction forms or directly entered into working data base files by personnel assigned to the DRT according to criteria and scoring rules developed by test analysts. Manual data reduction form data will be entered into the working data base files by personnel assigned to the ADP Section. The ADP Section will then generate computer listings showing the manual working data base entries for the DRT personnel to review and compare with the original reduced data. The DRT personnel will annotate any corrections required on the computer listings and return them to the ADP Section for reentry. New listings will be generated and compared with the previous listings to ensure the corrections were made. This process will continue until no new corrections or changes are required for the segment of data. Verified manual or analog data will then be moved into appropriate Intermediate SAS® Data Sets.

5.2.4 Data Control and Storage. The DMSF will be the central storage facility for all original collected and reduced data generated during the FOTE. Original data will remain in the direct control of the DMSF; wherever practical, reproductions of the original data will be used for data reduction and analysis efforts. For example, manual data collection forms will be reproduced and provided to authorized members of the DRT and/or DAG. Prior to the start of testing, the DRT and DAG chiefs will provide the Data Management and Storage Facility (DMSF) with a list of personnel authorized to receive and sign out data, to include the types of data to which each person is authorized access. The authorized DRT or DAG personnel are responsible for maintaining proper control of original and reproduced data they have received and signed for, while the data are used for the data reduction process. All classified data collection media will be transferred by courier from the data collection team to the DMSF using a DD Form 1369 (Classified Receipt) signed by both the courier and the DMSF personnel. Data will be classified IAW with the Security Classification Guide for the PATRIOT Air Defense Missile System, 1 November 1994.

5.3 DAG Requirements.

5.3.1 Composition. The DAG will include the DAG chairman from OEC, a deputy DAG chairman from the TEXCOM ADATD (lead ORSA), a representative from the materiel developer (PPO), and a TSM representative. These representatives will participate in the authentication of test data -- performance, MANPRINT, and RAM/ILS -- for the PAC-3 Configuration-2 FOTE test data base.

5.3.2 Purpose. The purpose of the DAG will be to verify and validate the intermediate data base, and then transfer the data to the authenticated data base. The DAG will review the collected and reduced test data to ensure that the data is accurate, complete, and representative of the events having occurred during the test, and that the testing was conducted IAW with the test plan and the approved OMS/MP. Authentication will be performed in four phases: test process certification, test data verification, test data validation, and results reporting. The DAG also will perform research and quality control (QC) type functions in the conduct of the authentication process. The DAG meetings will be scheduled by the DAG chairman and ample notice will be given to participants. Results of anomaly investigations will be documented and reviewed by the DAG. The RAM/ILS DRT will review all RAM test incident reports prior to submitting this information to the RAM scoring conference committee. The DAG chairman and/or co-chairman will review the DAG reports and anomaly investigations. See Appendix D for information pertaining to the DAG Charter.

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CHAPTER 6

KEY TEST RESOURCE REQUIREMENTS

6.1 TEST PRELIMINARY COST ESTIMATES. Table 6-1 summarizes the preliminary cost estimates for PAC-3 Configuration-2 FOTE.

TABLE 6-1. OT PRELIMINARY COST ESTIMATES

DIRECT COST ESTIMATES (IN THOUSANDS)

DATE PREPARED: 21 Nov 1995

TEST NUMBER   1996-FO-ADA-1739A
TEST TITLE   PATRIOT PAC-3/C2
TEST TYPE   Follow on Test & Evaluation (FOTE)

CATEGORY OF COST	PROG BY	APPN	FY 1995	FY 1996	FY 1997	FY 1998
(a) Civilian Hire (Civilian Pay)	OPTEC	OMA	200.00	120.00		
(b) Civilian Overtime	OPTEC	OMA		77.10		
(c) Temporary Duty (Tester/Players)	OPTEC	OMA	15.00	15.00		
(d) Transportation of Test Article	OPTEC	OMA				
(e) Lease/Rental-Commo Utility	OPTEC	OMA	5.20	202.60		
(f) Contracts	OPTEC	OMA	577.60	2455.20		
(g) POL	OPTEC	OMA	1.20	32.30		
(h) Supplies/Materiel	.OPTEC	OMA	10.00	10.00		
(i) Equipment			173.00			
(j) Instrumentation	OPTEC	RDTE	350.00			
(k) Threat Simulators	OPTEC	OMA				
(l) Other Simulators						
(m) Targets	PM PAT	RDTE		1000.00		
(n) Army Aviation Support	OPTEC	OMA		52.50		
(o) Other Services Direct Support	OPTEC	OMA		957.00		
(p) Player Support Costs	OPTEC	OMA		872.70		
DIRECT COST PROG BY	OPTEC	OMA	809.00	4794.40		
DIRECT COST PROG BY	OPTEC	RDTE	523.00			
DIRECT COST PROG BY	PM PAT	RDTE		1000.00		
TOTAL DIRECT TEST COSTS			1332.00	5794.40		
EVAL COST PROG BY	OPTEC	OMA		365.00		
TOTAL EVALUATION COSTS				365.00		
DIRECT TEST AND EVALUATION COST SUMMARY						
	OPTEC	OMA	809.00	5159.40		
	OPTEC	RDTE	523.00			
	PM PAT	RDTE		1000.00		
(q) Other Services Support Costs						
(r) Ammunition Costs						
TOTAL TEST COSTS			1332.00	6158.4		

6.2 TEST SUPPORT LONG LEAD/HIGH DOLLAR ITEM REQUIREMENTS.

6.2.1 TEST DIRECTORATE PERSONNEL.

    a.   Personnel requirements.

    b.   Equipment requirements.

    (1)   Data collection and processing system.

    (2)   Automatic data processing facility support.

6.2.2 PLAYER PARTICIPANTS.   11th Brigade.

6.2.3 ITEM(S) TO BE TESTED.

    a. Test items. PATRIOT Bn(-) consisting of--

        1 ICC
        3 PATRIOT FUs

    b. Support requirements.

    (1)   1 Mobile Subscriber Equipment (MSE) slice consisting of:
        1 node center switch
        2 MSE small extension nodes with LOS V4 Radio shelters

    (2)   1 Navy E-2C Hawkeye aircraft equipped with JTIDS and TADIL-A HF

    (3)   1 BDE ADTOC equipped with MSE ADI equipment

    (4)   1 TIBS network source (Joint Tactical Ground Station surrogate)

    (5)   1 PATRIOT TCS

    (6)   1 TAOM

    (7)   1 adjacent ICC (WSMR)

    (8)   1 UAV

6.2.4 AMMUNITION, MISSILES, AND PYROTECHNICS.   Missiles.

6.2.5 SPECIAL INSTRUMENTATION. C³I Engineering and Evaluation System (CEES).

6.2.6 TEST FACILITIES/INSTALLATION SUPPORT.

    a.   Test facility and range support.

    b.   Communications and engineering support.

    c.   Installation support.

6.2.7 THREAT SIMULATORS/OTHER SIMULATORS/TARGET VEHICLES.

    a.   Threat Simulators.

    (1)   Attack, reconnaissance, and SOJ aircraft.

    (2)   ALQ-184 self-screening and SOJ pods.

    b.   Other simulators. FMS.

    c.   Target vehicles.

    (1)   Full-scale threat, Allied, and US ABT with ECM PODS (C and Ka Band).

    (2)   TBM target with minimum cross section of ___ with minimum range of ___ km to a maximum range of __ km.

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APPENDIX A

BASELINE CORRELATION MATRIX (BCM)

PAC-3 BCM (NOTE: A MOE/MOP number in parentheses indicates that the MOE/MOP was used earlier)

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP
I. Effectiveness 1 Mission Performance			1 Critical Operational Issue: Does the PAC-3 enhance the effectiveness of the PATRIOT System.		
	4.a.(1)(a)	Defended Area: - Area Bounded by PAC-3 FU track Sector +/- xx relative to PTL. - Keepout altitude is __ km (R), dd km (PO). Defended Assets: Located up to __ km (R), __ km (PO) down range. Threat: TBMs with minimum range of __ km (R), __ km (PO).	1-1 Criterion: PATRIOT must defend an asset (and itself), located up to __ km down range against up to __ TBMs (arriving within a max time of __ sec.), with no more than __% leakage. The sys must detect, track, engage, destroy TBMs with __ x-section	1-1-1 Proportion of TBMs suppressed.	1-1-4 Proportion of correctly presented TBM's negated
			of __ with min range of __ km to max range of __ km and enter the FU's max surveillance range and sector.		1-1-5 Keep-out effectiveness against TBMs
					1-1-14 TBMs Intercepted
	4.a.(9)	PAC-3 will calculate TBM launch point coordinates from normal TBM tracking data (R). Launch point determination will be accomplished w/o degradation to ABT/TBM missions (R). Info will be passed (external-Bn) on existing, std, & doctrinal nets.			1-1-6 TBM Launch Point Mean location error
	4.a.(1)(i)	PAC-3 FU must defend itself against __ simultaneously arriving TBMs, with no more than __% (R) leakage. This single FU capability must be transferable to any single critical asset in FU's defended area.			
	4.a.(1)(i)	A PAC-3 Bn should be able to defend any single designated asset within its defended area against __ TBMs simultaneously arriving, with no more than __% leakage (R).		1-1-2 Proportion of leakage	
	4.a.(1)(f)	TBM SSEKP= __(R), __(PO)against TBM WHs at max engagement zone and keepout altitude. TBMs are capable of deliberate maneuvers as described in STAR. Kill equates to <__% warhead lethal effects reaching ground.		1-1-3 Probability that a single target is negated when it enters the systems search and engagement volumes.	1-1-7 Proportion of TBM targets detected and tracked.
	4.a.(1)(c)	PAC-3 must detect, track, engage, & destroy TBMs having RCS of __ (R) in ECM environment as specified in STAR & weather conditions specified in base requirements documents.			
					1-1-8 Proportion of TBM detected objects correctly evaluated (CDI)

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP
					1-1-9 Prob. of successful launch decision and transfer.
					1-1-10 Missile and launcher reliability at launch.
					1-1-11 Missile reliability (in-flight).
					1-1-12 Missile lethality
					1-1-13 Missile utilization against TBMs
	4.a.(1)(a)	Non-TBMs. PAC-3 1st intercept against targets __km (R), __km (PO), at up to __km AGL (R). PAC-3 must engage targets down to line of sight in intense ground clutter for ranges > __ km (R). At ranges <__km, the FU must	1-2 Criterion: PATRIOT must defend an asset against non-TBMs, by destroying them within __sec period while performing TBM mission. The system must detect, track, engage, & destroy non-TBMs with RCS of __, at __km in range, from __ to __ AGL.	1-2-1 Proportion of correctly presented non-TBMs suppressed.	1-2-2 Proportion of correctly presented non-TBMs negated.
					1-2-8 Non-TBMs intercepted
	4.a.(1)(c)	engage a/c within line of sight down to ( ) m AGL in intense ground clutter and ECM (R) A dead zone of no more than ( ) km hemispherical above the sensor is acceptable (R).	When non-TBMs are in ground clutter & are LOS to FU, they must be destroyed at ranges >__. The sys must destroy non-TBMs between __ & __ in range that are in ground clutter & ECM.		
					1-2-3 Keep-out effectiveness against non-TBMs.
	4.a.(1)(e)	Against non-TBMs, an SSEKP of __ (R), __ (PO) must be achieved at all altitudes and ranges specified by the defended area, to include targets in intense ground clutter and ECM, and against targets described in the STAR.		(1-1-3)	1-2-4 Proportion of non-TBM targets detected and tracked.

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP
					1-2-5 Proportion of detected non-TBMs correctly evaluated (CDI)
	4.a.(1)(d) 2	PAC-3 must Id non-TBM targets as Friend, Foe, Unk (R). Of targets detected & processed, __% must be identified correctly at ICC/ECS (R). Targets Id'ed as Friend/Foe __% (R) , __% (PO) must be categorized by platform at ICC/ ECS.			1-2-6 Proportion of correctly presented non-TBMs correctly identified as Unknowns, Friends, or Foes.
					(1-1-9)
					(1-1-10)
					(1-1-11)
					(1-1-12)
					1-2-7 Missile utilization against non-TBMs
	4.a.(1)(d)	PAC-3 must incorporate organic classification, identification, and discrimination techniques. Identification must be declared at sufficient ranges to support engagement envelopes. Classification logic at FU must correctly identify __% required, __% (PO)	1-3 Criterion: The system must correctly classify __% of detected aerial vehicles as TBM/non-TBM, with ARMs a special category of non-TBM. TBMs must be classified correctly by type __%, ARMs must be correctly categorized __% correct.		(1-1-8)
	4.a.(1)(d) 1	targets as either TBM or non-TBM. For TBMs, __% (R), __% (PO) must be classified by TBM type.			
					(1-2-5)
					1-3-1 Proportion of correctly presented ARMs correctly classified.
	4.a.(1)(d) 3	PAC-3 Discrimination must not have more than __% (R), __% (PO) erroneous engagements against deliberate or inadvertent PENAIDS, spurious targets, artillery shells, & friendly missiles. Non-TMD PENAIDS include: RPV/ UAV, drones, jamming.	1-4 Criterion: PATRIOT System must not have more than __% erroneous engagements	1-4-1 Proportion of erroneous PENAID engagements vs actual targets.	(1-1-7)
					1-4-2 Proportion of correctly presented PENAIDs correctly discriminated.
					1-4-3 Proportion of non-Threatening objects classified as threatening.
					1-4-4 Proportion of non-threatening objects engaged.

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP
			1-5 Supplemental Measure: The emplacement and initialization of the PATRIOT System, will not be degraded by PAC-3 upgrades.		1-5-1 Timelines for emplacement/initialization for FU & ICC (Bn).
	4.a.(5)	System must provide built-in/integral data recording for all key operational & technical data at ICC & ECS w/o system degradation or operator distraction, and playback & analysis at external workstations at BN/FU in ICC/ECS (R).	1-6 Supplemental Measure: Effectiveness of the Embedded Data Recorder (EDR).		1-6-1 Proportion of unsuccessful missions attributed to sys degradation caused by EDR.
	4.2.(5)	PAC-3 must provide for built-in/integral data recording of all key operational & technical data at the ICC and ECS w/o system degradation or operator distraction and playback & analysis at external workstations at BN & FU (R).			1-6-2 No. of system degradations and operator distractions attributed to EDR.
	4.a.(5)	It is desired that PAC-3 also record voice in ICC & ECS and synchronize it with the display data (PO). An external workstation should record data when built-in/integrated recorder is degraded or non-operational.			
	4.a.(5)(a)	Data recording capacity must be sufficient for 4 (R) to 24 (PO) hrs of continuous recording under heavy load conditions.			1-6-3 Data recording capacity.
	4.a.(5)(b)	Originating source (Bn/FU) must be capable of copying data recording media (R) and archiving selected portions in a master data base (PO). Originating source should have over-the-air transferring capabilities to other locations(PO).			1-6-4 Mean time to generate hardcopy/report.
	4.a.(5)(c)	PAC-3 must provide for off-line (external to ICC/ECS) post-mission playback of recorded data at both Bn & FU (R). A capability is required for interaction w/recorded playback to include selective zoning, event focus, & editing (R).			1-6-5 Proportion of recorded data which can be played back and/or edited.
		Reduced hardcopy output as well as report generation must be available upon operator request (R). Recorded data must be capable of feeding scenario generation for embedded trainers (R).			1-6-6 Proportion of recorded data with position, time & state vector accuracy required to support scenario generation.
2.0 INTER-OPERABILITY			2 Additional Operational Issue: Can the PATRIOT system interoperate with HEU, adjacent ADA units, external sensors, & intel sources via secure communication means.		
	4.c.(5)	Interference by Army, Air Force, Navy or allied electro-magnetic (EM) emitters to PATRIOT system w/ PAC-3 upgrades will not degrade required performance (R).	2-1 Complementary Measure: Interference by Army, Navy, or allied electro-magnetic (EM) emitters to PATRIOT w/PAC-3 upgrades will not degrade required performance.		2-1-1 Number of incidences of EM interference.

PAC-3 BCM (NOTE: A MOE/MOP number in parentheses indicates that the MOE/MOP was used earlier)

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP
	4.a.(3) 6.a.(3)	PAC-3 must interoperate with existing (R) and planned (PO) air defense C3I systems of Army, joint and combined services. Current communication will be used in PAC-3 until time phased implementation of objective communication system.	2-2 Complementary Measure: PAC-3 must inter-operate with existing (R) & planned (PO) ADA C3I systems of the Army, Joint, & Combined Services.	2-2-1 Proportion of time that PATRIOT is able to establish and maintain effective PAC-3 external/internal Bn communications to all required interfacing systems.	2-2-2 Proportion of communication initializations correctly completed within designated timelines.
	4.a.(3)(a)	PAC-3 ICC(R) & ECS (PO) must attain certification as a participation unit in Army/joint/combined service protocols: ATDL-1, TADIL-A, TADIL-B, & TADIL-J (Fixed Word Format). The ICC (R) & when autonomous ECS (R) must directly receive & process JTIDS PPLIs			2-2-3 Proportion of communication link options correctly identified, analyzed, & connectivity established within designated timelines.
	4.a.(3)(b)	PAC-3 must receive and process organic intelligence. (cut short since classified)			2-2-4 Proportion of correctly received and interpreted messages, which are transmitted internal to Bn.
	4.a.(3)(c)	PAC-3 ICC (R) and the ECS (PO) must be capable of interfacing with and processing (in combination as external data transmission mediums): IATACS-modified, ACUS, ADDS, HFCNR, troposcatter, SATCOM, and commercial leased circuits.			2-2-5 Proportion of externally generated messages which are transmitted to the Bn that are correctly received & interpreted.
	4.a.(3)(c)	PAC-3 ECS will internally integrate common MSE to allow integration with ACUS (R). The ICC & ECS will integrate JTIDS for internal Bn Comm (R).			2-2-6 Proportion of internally generated messages which are correctly transmitted external to Bn.
	4.a.(3)(d)	PAC-3 FU must be capable of 2-way data exchange with other Army or joint/combined ADA systems using TADIL-J (R) and ATDL-1, TADIL-A, TADIL-B (PO), when the ICC is not available.			2-2-7 Loading analysis conducted and effects of commo links on system coverage.
	4.a.(3)(e)	PAC-3 FU must be capable of exchanging air picture and engagement status data (not full c2) directly with a HAWK FU (R) or any future HIMAD ADA system that uses standard (data links).			(Load levels)
	4.a.(3)(e)	PAC-3 FU must be capable of performing as a master battery (w/ full C2 over resources of up to two other FUs (PATRIOT, HAWK or future HIMAD ADA system) while...			
	4.a.(3)(e)	A master FU should be capable of exchanging air picture and engagement status information with up to two adjacent master FUs/ICCs (PO).			
	4.a.(4)	A capability of world-wide over-the-air copying and validating from SW generation facility directly to the BN or FU is desired (PO).			
	4.a.(9)	PAC-3 will calculate and make available launch point coordinates to outside (extra-Bn) agencies on existing, standard communications doctrinal nets (R).			

PAC-3 BCM (NOTE: A MOE/MOP number in parentheses indicates that the MOE/MOP was used earlier)

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP
	5.d.(3)	All EO and FO electronic interfaces and peripheral equipment outside the ICC/ECS WILL BE through ATCCS (to include ATCCS approved commercial). All electronic interfaces and peripheral equipment inside the ICC/ECS SHOULD BE through ATCCS (...).			
	6.a.(1)(a)	PAC-3 will allow the PATRIOT FU (ECS) to participate directly in the AD C3I systems w/o interfacing thru the BN control node.			
	6.a.(1)(b)	PAC-3 BNs and FUs will integrate into the Standardized Theater Army Command and Control System (STACCS) at EAC and with ATCCS for BNs assigned to the corps.			
	6.a.(2)(d)	PATRIOT must have the capability to exchange and process PPLI messages with JTIDS equipped aircraft.			
	6.a.(3)(a)	PAC-3 will employ organic JTIDS networks as the primary means of conducting BN and below EO data communications.			
	6.a.(3)(b)	PATRIOT will use the MSE to pass EO voice traffic and to support FO voice and data communications. Additionally, outside BN EO data will be passed using ACUS.			
	6.a.(3)(c)	PATRIOT will use CNR for backup, mobile operations, and launcher data link.			
	6.a.(3)(d)	External communications from PATRIOT will be satisfied by a combination of organic and non-organic communication.			
	6.a.(3)(d).1	Organic JTIDS will be used for air-to-ground and ground-to-air TADIL-J comm.			
	6.a.(3)(d).2	HF TADIL-A capability will be provided.			
	6.a.(3)(d).3	Terrestrial comm to the joint interface (e.g. CRC) normally will be provided by a non-organic signal support organization.			
	6.d.(1)	PAC-3 will be capable of interfacing with engineer topographic units and other databases IAW MIL STDs/ SPECs to obtain digital topographic data.			2-2-8 Qualitative assessment of interfaces to obtain digital topographic data to support defense planning process.
	6.e.	PAC-3 will interface with the Integrated Meteorological System (IMETS) for weather and environmental forecasts, observations and decision aid information. The environmental support software will be US Army standard [software picks up last sentence].			2-2-9 Qualitative assessment of interfaces to obtain weather data to support defense planning process.
	4.a.(1)(b)	. . . PAC-3 must accept, correlate and process told-in data at ICC (R), and if ICC is not available at ECS (R).			2-2-10 Qualitative assessment of interface to intelligence system to support defense planning process.

PAC-3 BCM (NOTE: A MOE/MOP number in parentheses indicates that the MOE/MOP was used earlier)

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP
	4.a.(1)(d)	PAC-3 accepts and incorporates told-in intel data. Told-in data (external to Bn) will be assumed true. Processing of adjunct sensor data (within Bn) & told-in data will be accomplished at ICC.FU must have capability to receive data if ICC not avail.			2-2-11 No. of instances of correctly revised engagement planning, affected by interface to intelligence systems.
	4.a.(3)(b)	PAC-3 must receive & process organic & told-in intel info via army approved devices at ICC (R)/ECS (PO)... Data must be automatically eval'ed and of quality consistent w/ PAC-3 radar data, fused into engagement decision logic, avail on operator request.			2-2-12 Proportion of told in tracks correctly fused.
	6.a.(2)(a)	PATRIOT must have the capability to exchange secure voice and data link information w/ current and planned Army ADA systems that use standard comm and data languages including HAWK, FAAD C3I, Corps SAM, & HATMD.	2-3 Complementary Measure: PATRIOT must have the capability to exchange secure voice and data link information with current/planned Army ADA systems that use standard comm and data languages including HAWK, FAAD C3I, Corps SAM, & HATMD.		2-3-1 Proportion of transmissions which can be covertly intercepted and interpreted.
	4.a.(3)(c)	All incoming PATRIOT communications must be encrypted for transmission and decrypted for receipt at ICC (R) and ECS (R).			
	6.a.(2)(b)	PATRIOT must have the capability to exchange secure voice and data link information with Army Command and Control Systems, including MCS, ASAS, AFATDS, and CSSCS.			
	6.a.(2)(c)	PATRIOT must have the capability to exchange secure voice and data link information with joint AD C3I systems including: 1. USAF TACS and AWACS, 2. USMC TACS, TOAM, and TOAC, 3. USN NTDS and ATDS, 4. National/ Service intelligence networks.			
	6.a.(3)(d)4.	PATRIOT must access immediate voice connectivity to USSPACECOM organically or via ACUS for TBM warning.			
	4.a.(7)	PAC-3 must provide fully automated & integrated support for all FO activities, IAW ATCCS architecture (R). Must provide automated FO decision aids at Bn (R) and FU(R) separate from ICC/ECS and not interfering with EO.	2-4 Complementary Measure: PAC-3 Bn must provide automated support to coordinate the overall air battle execution between the upper tier (HATMD) and lower tier and direct the ABT battle.		2-4-1 Proportion of FO tasks automated.
	4.a.(7)(a)	PAC-3 must include automated decision aids to support defense design & planning w/ hard-copy output in the ICC /ECS tabular formats & auto transfer of defense designs into ICC/ECS, for automatic, time-phased crew implementation (R).			
	4.a.(7)(a)	Defense design automated tools must provide for radar visibility & coverage estimates (R), communication profiling (R), frequency allocation (R), air space control, to include auto interface with USAF Contingency Tactical Air Plan System (ACTAPS) (PO),			
	4.a.(7)(a)	& analysis of defense design alternatives via interactive simulation (R).			

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP
	4.a.(7)(b)	Data displays in the PAC-3 Bn & FU CPs must provide near real time display of operational status info (R): Engagement Status; Communication Status; Missile inventory. Air situational data avail at ICC/ECS must be displayed in Bn/FU CPs (R).			
	4.a.(7)(b)	Complete situational displays are desired (PO).			
	4.a.(10)	PAC-3 Bn software and decision logic must be sufficient to support the defense design requirements of a HIMAD enclave defense to include determination and transfer of weapon systems' initialization parameters (R).			2-4-2 Proportion of times TCS successfully determines weapon systems' initialization parameters using automated support.
					2-4-3 Reasons TCS could not successfully determine weapon systems' initialization parameters using automated support.
					2-4-4 Proportion of times weapon systems' initialization parameters are automatically passed from TCS to FU successfully.
					2-4-5 Reasons weapon systems' initialization parameters could not be successfully passed from TCS to FU.
	4.a.(10)	PAC-3 Bn will coordinate the overall air battle execution between the upper tier (HATMD) and lower tier (PATRIOT and CORPS SAM) (R) and will direct the ABT battle (R).			
3.0 Survivability			3 Critical Operational Issue: Can the PAC-3 system defend itself against lethality on the battlefield, and against SOJ platforms, and enemy RSTA?		
	4.a(1)(i)	PAC-3 FU must maintain current PATRIOT cap of countering FW/RW SOJ platforms and against RSTA in ongoing battlespace (up to max rg of ___ km from the FU radar) (R). At rgs beyond the 1st intercept rg of ___ km (R), SSEKP of ___ (R) must be achieved against a ___ m square target (RCS).	3-1 Criterion: PAC-3 FU must be able to engage FW/RW SOJ platforms and RSTA at rg out to ___ km from the FU's radar.		3-1-1 Distance from the FU radar at which PAC-3 engaged FW/RW SOJ platforms and RSTA.
	4.a.(1)(g)	PAC-3 FU must increase track handling capacity under max engagement load by ___% (R) to ___% (PO) and must provide user selectable priorities for saturation prevention (R). The ICC must be capable of track management for ___ (R), ___ (PO) tracks.			3-1-2 Proportional increase of track handling load, w/o degradation to TBM/ABT mission.

PAC-3 BCM (NOTE: A MOE/MOP number in parentheses indicates that the MOE/MOP was used earlier)

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP
	4.a.(1)(a) 4.a(1)(j) .	PAC-3 will have capability to initialize keepout altitudes (R). Operator judgment must be allowed for engagements beyond optimum designed/ required battlespace (e.g., TBM engagements beyond ___ km must not be precluded) (R).			3-1-3 Proportion of successful engagements, initiated by operator below designated battlespace.
	4.a(6)	PAC-3 must have increased survivability (R), but measures must not degrade system performance (R).	3-2 Criterion: PAC-3 FU must have a ___ probability of surviving a single ARM attack.		
	4.a(6)(b)	PAC-3 FU, w/o significant msn degradation, must have a ___ (R) probability of surviving an attack by a single ARM.			3-2-1 Proportion of single ARM attacks survived by FU.
	4.a(6)(d)	PAC-3 must incorporate passive opns to include radar non-radiating emplacement (R).			
	4.c(1)	PAC-3 must operate effectively (meet performance characteristics delineated in para 4a) under the ECM conditions as specified in the PATRIOT STAR and summarized in Table 2-1 of the ORD (R). PAC-3 ECM must reduce/eliminate the effects of enemy ECM which will include a variety of basic, responsive, and reactive wave-forms available to the threat (R).			
	4.c(2)	PAC-3 will have Wartime Reserve Modes (WARM) (R) and radars will .....(R).			
	4.c(3)	PAC-3 will increase its survivability against chemical threats, to include ....(R).			
	4.c(3)(a)	The exterior and interior of all PAC-3 equipment will be designed such that NBC contamination (remaining on, or desorbed from, or re-aerosolized from the surface) following decontamination will not result in more than a negligible risk (see ORD Table 4-2) to unprotected personnel working inside, on or one meter from the item (R).			
II. SUITABILITY 4.0 RAM	-.-		4 Critical Operational Issue: Can the PAC-3 be sustained in an operational environment?		
	4.b(1) 4.b(1)(a)	PATRIOT msn cap rate will not be degraded by mods incorp'd in PAC-3 and will be enhanced as required by the revised OMS/MP at App. B of the ORD (R) (all values are based on the most stressing (wartime) scenario). PAC-3 FU must have an Ao of __(R).	4-1 Criterion: PAC-3 FU must have a minimum Ao of _____.		4-1-1 Operational Availability (Ao).
	4.b(1)(b)	PAC-3 MTTR will not exceed 3.8 hrs. (R).			4-1-2 MTTR.

PAC-3 BCM (NOTE: A MOE/MOP number in parentheses indicates that the MOE/MOP was used earlier)

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP
	4.b(1)(f)	MR will not exceed 0.11 hrs. (R).			4-1-3 Maintenance Ratio (MR).
	4.b(1)(c) 4.b(1)(d)	MTBOMF will not be less than 20 hours (R). MTBF will not exceed 40 hours.	4-2 Criterion: MTBCMF will exceed 20 hours.		4-2-1 Mean Time Between Critical Mission Failures (MTBCMF).
			4-3 Supplemental Measure: The Materiel System Computer Resources (MSCR) must not degrade system RAM		4-3-1 Proportion of CMFs chargeable to SW.
					4-3-2 Proportion of down-time chargeable to SW.
5.0 MANPRINT			5 Additional Operational Issue: Can appropriate MOS qualified soldiers, with the training given, perform mission tasks to standards under operational conditions using PAC-3 sys?		
5.1 MANPOWER	5.c.(2)(a)	PAC-3 will require no increase in manpower per BN	5-1 Complementary Measure: PAC-3 modification will result in no increase in manpower personnel per battalion.		5-1-1 Qualitative assessment of operator/ maintainer task lists provided to support all required operations/functions of PAC-3 system.
	4.a.(5)	System must provide built-in/integral data recording for all key operational & technical data at ICC & ECS w/o system degradation or operator distraction, and playback & analysis at external workstations at BN/FU in ICC/ECS (R).			
	4.2.(5)	PAC-3 must provide for built-in/integral data recording of all key operational & technical data at the ICC and ECS w/o system degradation or operator distraction and playback & analysis at external workstations at BN & FU (R).			
	--				5-1-2 Observed capability of personnel authorization & distribution to accomplish mission.
5.2 TRAINING	5.c.(2)(b)	PAC-3 will not change the operator/ maintainer skill and general knowledge requirements as in the current target audience description (TAD).	5-2 Complementary Measure: Training required as a result of PAC-3 Mods will provide sufficient operator/ maintainer proficiency to support mission accomplishment.		5-2-1 Qualitative assessment of operator/maintainer efficiency in performing critical tasks.
	4.c(3)(b)	PAC-3 must permit the performance of mission essential opns, communications, maintenance, resupply, and decontamination tasks by trained and acclimated soldiers in MOPP IV over a typical msn profile in a contaminated environment with < 15% deviation in performance (R).			

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP
5.3 HUMAN FACTORS ENGINEERING	4.c.(8)	PAC-3 will conform to applicable Human Factors Engineering (HFE) military standards to ensure that the soldier machine interface (SMI) is consistent with soldier capabilities and limitations.	5-3 Complementary Measure: PAC-3 must comply with applicable HFE standards of design, performance, & operation prescribed in MIL-STD 1472. PAC-3 must be able to be operated & maintained by 5th thru 95th percentile males & females, in all MOPP levels.		5-3-1 Qualitative assessment of HFE design compliance to MIL-STD 1472.
					5-3-2 Qualitative assessment of user-friendliness.
	5.c.(2)(c)	PAC-3 modifications to training devices will be in compliance with requirements for the 5th percentile female and 95th percentile male personnel critical body dimensions.			
	5.2.(2)(c)	Training devices at the PATRIOT BN and FU must be compatible with current personnel protection equipment and be capable of being maintained and operated by personnel wearing individual protective clothing/ equipment.			
	5.d.(3)	(Computer) Peripheral equipment will be consolidated to max extent possible.			
	5.d.(4)	All software implemented will emphasize user friendly techniques which include on line help where appropriate without impacting system performance.			
	5.d.(5)	Future (i.e. replacement/new) video displays should be high resolution and reconfigurable, and should support menu shading, color, 3D displays, scalable graphics and fonts.			
	5.d.(7)	A maximum number of displays will incorporate soft switches (i.e. on-screen, touch switches or automatically reconfigurable (switches)) and/or menu systems.			
	5.d.(8)	Full electronic documentation is desired.			
	6.d.(1)	In support of EO and FO decision aides, PAC-3 will use DMA map products such as DTED, Interim Terrain Data (ITD), and Future Tactical Terrain Data (TTD).			
	6.d.(1)	PAC-3 will be capable of using topographic data from engineer topographic units IAW MIL STDs/ SPECs.			
	6.d.(2)	PAC-3 FO situational displays will support the display of standard military maps (i.e. 1:25k, 1:100k, 1:250k, 1:500k and 1:1000k) through the use of standard DMA supplied digital topographic data products.			
5.4 SYSTEM SAFETY & HEALTH HAZARDS	4.c.(6) 4.c.(7)	Safety hazards present at any point throughout PAC-3 implementation will be eliminated by design or controlled by procedure and design, IAW safety program requirements (R). Health Hazards identified at any point throughout	5-4 Complementary Measure: PAC-3 must meet health & safety requirements stated in MIL-STD 882. PAC-3 upgrades must not contribute to health hazards that restrict or endanger operators or maintainers.		5-4-1 PAC-3 compliance with safety & health standards as prescribed in MIL-STD 882, AB 385-16 & AR 40-10.

PAC-3 BCM (NOTE: A MOE/MOP number in parentheses indicates that the MOE/MOP was used earlier)

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP
		PAC-3 implementation will be eliminated by design or controlled by procedure and design, in compliance with existing health standards (R).			
					5-5-1 Types of MAN-PRINT problems identified, by impact rating, for each of the above criteria.
6.0 MEANS OF EMPLOYMENT			6 Issue: Can the PAC-3 system be employed to accomplish its mission using the prescribed organization, doctrine, and tactics?		
	7	PAC-3 will be employed at EAC, in the corps ADA Bde, and in TF configurations; force structure consists of 9 PAC-3 Bns with 6 firing batteries each for a total of 54 firing batteries.	6-1 Complementary Measure: PAC-3 organization (including no. of authorized personnel, personnel distribution, required skill levels, and equipment authorizations and optimization) will be sufficient to accomplish the wartime and peacetime mission IAW OMS/MP.		(5-1-2)
	4.b.(3)	PAC-3 must be supportable within current manpower and skill level constraints (R).			6-1-1 Proportion of unsuccessful missions attributed to manpower/skill level constraints.
	7	Additional PAC-3 equipment supports institutional tng, ORFs, and RDT&E programs.			
	4.b(3)	PAC-3 must have organic support necessary to accomplish the msn (R).	6-2 Complementary Measure: PAC-3 organization will provide sufficient support personnel and equipment to achieve the approved ORD and OMS/MP requirements.		6-2-1 Observed capability of authorized and distributed equipment to support the msn.
			6-3 Complementary Measure: Doctrinal procedures will facilitate operators achieving their required performance and provide for required inter-operability with other service and allied TMD systems/assets.		6-3-1 Observed capability of defined doctrine to support msn accomplishment.
			6-4 Complementary Measure: Tactics employed will permit the accomplishment of the ORD-level of protection and to accommodate supporting and supported functional requirements.		6-4-1 Observed capability of defined TTPs to support msn accomplishment.
			6-5 Complementary Measure: The march order timelines of PATRIOT system will not be degraded by PAC-3 upgrades.		6-5-1 March order timelines for FU.
7.0 SUPPORTABILITY (Logistics)			7 Issue: Is the PAC-3 system supportable?		
	4.a(2)	PATRIOT FU (with PAC-3 upgrades) outsized equipment (i.e., battery equipment which must be transported on a C5-A) must be reduced in size to allow a 50% (R) reduction in the number of C5-A aircraft required to move a PATRIOT FU based on USAF max peacetime allowable loading factors with no reduction in equivalent FU firepower.	7-1 Complementary Measure: PAC-3 must meet transportation and mobility requirements specified in the base requirement documents.		7-1-1 Observed capability of PAC-3 crew to load and unload system from prescribed number and type a/c and prepare system for operation.

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP
		Components of the PATRIOT system capable of being loaded on C-141 class aircraft must be able to be prepared for shipment within 2 hours of arrival at the aerial port of embarkation (APOE) without special handling equipment.			7-1-2 Amount of time to prepare components for shipment w/o special MHE at the APOE.
		It must also be capable of being returned to operational configuration without special handling equipment within 2 hours (less road march time) of aircraft landing at the APOD (R).			7-1-3 Time to return FU to operational configuration w/o special MHE upon arrival at APOD.
	4.a.(8)	PAC-3 launch station must be capable of cross-country mobility (R)			7-1-4 Proportion of movements successfully completed during road marches and tests.
					7-1-5 Launcher and Radar Weights
	4.b(2)	PAC-3 will require the same level of or less frequency or duration of preventive or scheduled maintenance actions (R).	7-2 Complementary Measure: The PAC-3 system upgrades should be designed for maintainability, and require the same level or less in frequency or duration of PM & scheduled maint.		7-2-1 Qualitative assessment of the logistic support concept.
					7-2-2 Level, frequency, and duration of PM & corrective maintenance.
	4.c(4)	PAC-3 must be capable of operations & storage in hot, basic, cold, & severe cold conditions without degradation in performance (R).	7-3 Complementary Measure: PAC-3 must be capable of operation and storage in all climatic conditions without performance degradation.		7-3-1 Observed capability of PAC-3 system during storage or operation in all climatic conditions.
	4.c(9)	Modifications to PATRIOT equipment required by PAC-3 upgrades will comply with existing system security requirements (R).	7-4 Complementary Measure: PAC-3 mods must comply with existing system security requirements.		7-4-1 Observed compliance w/existing system security requirements.
	4.c(10)	PAC-3 power requirements will be satisfied by power generation equipment type classified by the U.S. Government. It will have the capability of cabling to Army standard generators and commercial motor generators (convertors) as substitutes (R).	7-5 Complementary Measure: PAC-3 power requirements must be satisfied by type classified US Government power gen. equip. (primary), and have the ability to cable to Army standard generators or commercial generators as temporary substitutes for organic generators.		7-5-1 Observed capability of PAC-3 sys to operate on type classified US Gov't generation equipment (primary) and std US Army generators or commercial motor generators as backup to organic generators.
		Load bank capability will be provided to support operations of each item of piston driven diesel power generation equipment at greater than 50% rated output power (R).			7-5-2 Equipment electrical loads must be 50% or greater than rated capacity of assigned generators.
	4.c(12)(a)	BIT/BITE capacity to detect 99% (R) and 75% (R) to isolate all system msn failures to a single LRU; areas not detected/isolated by BIT will do so by manual troubleshooting procedures using appropriate technical documents and standard TMDE & tools (R).	7-6 Complementary Measure: PAC-3 system must detect Relevant Mission Essential (RME) failures and isolate mission failures to a single LRU.		7-6-1 Proportion of RME failures correctly detected by BIT/BITE.
					7-6-2 Proportion of detected RME failures correctly isolated by BIT/BITE.

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP
					7-6-3 Qualitative assessment of manual trouble-shooting procedures & equipment.
					7-6-4 Qualitative assessment of technical data and publications.
	4.a.(1)(f)	PAC-3 LS must be capable of reloading (up to max number of missiles/launcher) within __min. (R) to __min. (PO).	7-7 Complementary Measure: The PAC-3 LS must meet reload timelines specified in base requirement documents.		7-7-1 Mean time to reload.
	4.d.(8)	Sufficient explanatory documentation must accompany each SW release. Full electronic documentation is desired.	7-8 Complementary Measure: PAC-3 SW must demonstrate the adequacy of documentation, configuration management, transition planning, and SW engineering environment (SEE) to successfully transition to PDSS.		7-8-1 Assessment of PATRIOT transition planning.
					7-8-2 Assessment of PATRIOT SW documentation.
					7-8-3 Assessment of PATRIOT SEE.
					7-8-4 Assessment of PATRIOT SW CM.

APPENDIX B

OPERATIONAL ISSUES AND CRITERIA (OIC)

OPERATIONAL ISSUES AND CRITERIA

1 Critical Operational Issue: Does the PAC-3 enhance the effectiveness of the Patriot System.

1-1 Criterion: Patriot must defend an asset (and itself), located up to ___ km down range against up to ___ TBMs (arriving within a max time of ___ sec.), with no more than ___% leakage.

The sys must detect, track, engage, destroy TBMs with ___ x-section of ___ with min range of ___ km to max range of ___ km and enter the FU's max surveillance range and sector.

1-2 Criterion: Patriot must defend an asset against non-TBMs, by destroying them within ___ sec period while performing TBM mission. The system must detect, track, engage, & destroy non-TBMs with RCS of ___, at ___ km in range, from ___ to ___ AGL.

When non-TBMs are in ground clutter & are LOS to FU, they must be destroyed at ranges >___. The sys must destroy non-TBMs between ___ & ___ in range that are in ground clutter & ECM.

1-3 Criterion: The system must correctly classify ___% of detected aerial vehicles as TBM/non-TBM, with ARMs a special category of non-TBM. TBMs must be classified correctly by type ___%, ARMs must be correctly categorized ___% correct.

1-4 Criterion: Patriot System must not have more than ___% erroneous engagements

1-5 Supplemental Measure: The emplacement and initialization of the PATRIOT System, will not be degraded by PAC-3 upgrades.

1-6 Supplemental Measure: Effectiveness of the Embedded Data Recorder (EDR).

2 Additional Operational Issue: Can the PATRIOT system interoperate with HEU, adjacent ADA units, external sensors, & intel sources via secure communication means.

2-1 Complementary Measure: Interference by Army, Navy, or allied electro-magnetic (EM) emitters to PATRIOT w/PAC-3 upgrades will not degrade required performance.

2-2 Complementary Measure: PAC-3 must inter-operate with existing (R) & planned (PO) ADA C3I systems of the Army, Joint, & Combined Services.

2-3 Complementary Measure: Patriot must have the capability to exchange secure voice and data link information with current/planned Army ADA systems that use standard comm and data languages including HAWK, FAAD C3I, Corps SAM, & HATMD.

2-4 Complementary Measure: PAC-3 Bn must provide automated support to coordinate the overall air battle execution between the upper tier (HATMD) and lower tier and direct the ABT battle.

3 Critical Operational Issue: Can the PAC-3 system defend itself against lethality on the battlefield, and against SOJ platforms, and enemy RSTA?

3-1 Criterion: PAC-3 FU must be able to engage FW/RW SOJ platforms and RSTA at rg out to ___ km from the FU's radar.

3-2 Criterion: PAC-3 FU must have a ___ probability of surviving a single ARM attack.

4 Critical Operational Issue: Can the PAC-3 be sustained in an operational environment?

4-1 Criterion: PAC-3 FU must have a minimum Ao of _____.

4-2 Criterion: MTBCMF will exceed 20 hours.

4-3 Supplemental Measure: The Materiel System Computer Resources (MSCR) must not degrade system RAM

OPERATIONAL ISSUES AND CRITERIA

5 Additional Operational Issue: Can appropriate MOS qualified soldiers, with the training given, perform mission tasks to standards under operational conditions using PAC-3 sys?
5-1 Complementary Measure: PAC-3 modification will result in no increase in manpower personnel per battalion.
5-2 Complementary Measure: Training required as a result of PAC-3 Mods will provide sufficient operator/ maintainer proficiency to support mission accomplishment.
5-3 Complementary Measure: PAC-3 must comply with applicable HFE standards of design, performance, & operation prescribed in MIL-STD 1472. PAC-3 must be able to be operated & maintained by 5th thru 95th percentile males & females, in all MOPP levels.
5-4 Complementary Measure: PAC-3 must meet health & safety requirements stated in MIL-STD 882. PAC-3 upgrades must not contribute to health hazards that restrict or endanger operators or maintainers.
6 Additional Operational Issue: Can the PAC-3 system be employed to accomplish its mission using the prescribed organization, doctrine, and tactics?
6-1 Complementary Measure: PAC-3 organization (including no. of authorized personnel, personnel distribution, required skill
levels, and equipment authorizations and optimization) will be sufficient to accomplish the wartime and peacetime mission IAW OMS/MP.
6-2 Complementary Measure: PAC-3 organization will provide sufficient support personnel and equipment to achieve the approved ORD and OMS/MP requirements.
6-3 Complementary Measure: Doctrinal procedures will facilitate operators achieving their required performance and provide for required inter-operability with other service and allied TMD systems/assets.
6-4 Complementary Measure: Tactics employed will permit the accomplishment of the ORD-level of protection and to accommodate supporting and supported functional requirements.
6-5 Complementary Measure: The march order timelines of PATRIOT system will not be degraded by PAC-3 upgrades.
7 Additional Operational Issue: Is the PAC-3 system supportable?
7-1 Complementary Measure: PAC-3 must meet transportation and mobility requirements specified in the base requirement documents.
7-2 Complementary Measure: The PAC-3 system upgrades should be designed for maintainability, and require the same level or less in frequency or duration of PM & scheduled maint.
7-3 Complementary Measure: PAC-3 must be capable of operation and storage in all climatic conditions without performance degradation.
7-4 Complementary Measure: PAC-3 mods must comply with existing system security requirements.
7-5 Complementary Measure: PAC-3 power requirements must be satisfied by type classified US Government power gen.
equip. (primary), and have the ability to cable to Army standard generators or commercial generators as temporary substitutes for organic generators.
7-6 Complementary Measure: PAC-3 system must detect Relative Mission Essential (RME) failures and isolate mission failures to a single LRU.

OPERATIONAL ISSUES AND CRITERIA
7-7 Complementary Measure: The PAC-3 LS must meet reload timelines specified in base requirement documents.
7-8 Complementary Measure: PAC-3 SW must demonstrate the adequacy of documentation, configuration management, transition planning, and SW engineering environment (SEE) to successfully transition to PDSS.
Note: COICs were DA approved 27 October 1993, version 1.0, with revision dated 16 March 1994.

APPENDIX C

DATA SOURCE MATRIX (DSM)

FOTE DATA SOURCE MATRIX

I. Effectiveness
1 Mission Performance

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP	Data Requirement	TAC/SUS	FMS	MSL FLT TEST	ANLY/SIM	LOG DEMO	PPQT	CDTE
			1 Critical Operational Issue: Does the PAC-3 enhance the effectiveness of the PATRIOT System.										
	4.a.(1)(a)	Defended Area: - Area Bounded by PAC-3 FU track Sector +/- xx relative to PTL. - Keepout altitude is __ km (R), dd km (PO). Defended Assets: Located up to __ km (R), __ km (PO) down range. Threat: TBMs with minimum range of __ km (R), __ km (PO).	1-1 Criterion: PATRIOT must defend an asset (and itself), located up to __ km down range against up to __ TBMs (arriving within a max time of __ sec.), with no more than __% leakage. The sys must detect, track, engage, destroy TBMs with __ x-section.	1-1-1 Proportion of TBMs suppressed.	1-1-4 Proportion of correctly presented TBMs negated	DS1 No. of eligible TBM targets successfully engaged vs No. of eligible TBM targets correctly presented.		p	s				
		of __ with min range of __ km to max range of __ km and enter the FU's max surveillance range and sector.			1-1-5 Keep-out effectiveness against TBMs	DS2 Range and altitude when TBMs are detected, tracked, classified, discriminated, and identified. TBM range and altitude at PATRIOT launch and intercept.		p	s	s		s	s
					1-1-14 TBMs Intercepted	DS 63 Number of eligible TBM targets successfully intercepted vs. number of eligible TBM targets correctly presented.							
	4.a.(1)(f)	A PAC-3 Bn should be able to defend any single designated asset within its defended area against __ TBMs simultaneously arriving, with no more than __% leakage (R).		1-1-2 Proportion of leakage		DS4 Number of TBMs arriving simultaneously. Number of surviving TBMs. Number of surviving degraded TBMs. Ground effects of intercept.							
	4.a.(1)(f)	TBM SSEKPs __ (R), __ (PO)against TBM Wrts at max engagement zone and keepout altitude. TBMs are capable of deliberate maneuvers as described in STAR. Kill equates to < __% warhead lethal effects reaching ground.		1-1-3 Probability that a single target is negated when it enters the systems search and engagement volumes.	1-1-7 Proportion of TBM targets detected and tracked.	DS5 Volume searched. Required search area. Search rate. Time to cover volume searched. No. of targets presented; tgt conditions (RCS, vel, FPA, alt, etc) No. of tgts detected; no. of false tgts. Time intervals of tgts entering zone. Time intervals to detect successive tgts entering zone. Detection time/rate. Max detection range vs RCS. Time history of each track (initiation, drop, reacquire); report rate.		p	s	s			
	4.a.(1)(c)	PAC-3 must detect, track, engage, & destroy TBMs having RCS of __ (R) in ECM environment as specified in STAR & weather conditions specified in base requirements documents.			1-1-8 Proportion of TBM detected objects correctly evaluated (CDI)	DS6 No. of detected targets within zone. No. of targets classified as TBMs. No. of targets incorrectly classified as TBMs. No. of TBMs detected. No. of false targets identified. No. of correctly identified TBMs. No. of correctly identified TBMs correctly categorized by "Type". No. of threatening objects; no. of non-threatening obj's. No. of threatening obj's correctly discriminated.		p	s	s			

FOTE DATA SOURCE MATRIX

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP	Data Requirement	FOTE					D T	
							TAC/ SUS	FMS	MSL FLT TEST	ANLY/ SIM	LOG DEMO	PPOT	CDTE
					1-1-9 Prob. of successful launch decision and transfer.	DS7 Number of successful launch decisions and transfers. DS2			s	s		s	s
					1-1-10 Missile and launcher reliability at launch.	DS6 Time from launch command receipt to launch initiate. Time from Launch Initiate to Last Abort Opportunity		s	p				
					1-1-13 Missile utilization against TBMs	DS11 No. of missiles fired by type. No. of TBM intercepts by type of target and type of missile.			s				
	4.a.(1)(e)	Non-TBMs. PAC-3 1st intercept against targets __ km (R), __ km (PO), at up to __ km AGL (R). PAC-3 must engage targets down to line of sight in intense ground clutter for ranges > __ km (R). At ranges < __ km, the FU must	1-2 Criterion: PATRIOT must defend an asset against non-TBMs, by destroying them within __ sec period while performing TBM mission. The system must detect, track, engage, & destroy non-TBMs with RCS of __ at __ km in range, from __ to __ AGL.	1-2-1 Proportion of correctly presented non-TBMs suppressed.	1-2-2 Proportion of correctly presented non-TBMs negated.	DS12 No. of eligible non-TBM targets successfully engaged vs. No. of eligible non-TBM target correctly presented.	p	p	p			s	s
					1-2-8 Non-TBMs Intercepted	DS54 Number of non-TBM targets successfully intercepted vs. number of eligible non-TBM targets correctly presented.	p	s					
	4.a.(1)(e)	engage a/c within line of sight down to ( ) m AGL in intense ground clutter and ECM (R) A dead zone of no more than ( ) km hemispherical above the sensor is acceptable (R).	When non-TBMs are in ground clutter & are LOS to FU, they must be destroyed at ranges > __. The a/c must destroy non-TBMs between __ & __ in range that are in ground clutter & ECM.		1-2-3 Keep-out effectiveness against non-TBMs.	DS13 Range and altitude when non-TBMs are detected, tracked, classified, discriminated, and identified. Non-TBM target range and altitude at PATRIOT launch and intercept.	p	p	s			s	s
				(1-1-3)	1-2-4 Proportion of non-TBM targets detected and tracked.	DS5	s	p	s	s			
	4.a.(1)(e)	Against non-TBMs, an SSEKP of __ (R), __ (PO) must be achieved at all altitudes and ranges specified by the defended area, to include targets in intense ground clutter and ECM, and against targets described in the STAR.			1-2-5 Proportion of detected non-TBM targets correctly evaluated (CDI)	DS14 No. of detected targets within zone. No. of targets classified as non-TBMs. No. of tgts incorrectly classified as non-TBMs. No. of blue non-TBMs categorized correctly by platform vs no. of blue non-TBMs. No. of Red non-TBMs categorized correctly by platform vs no. of red non-TBMs.	p	p	s	s			

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP	Data Requirement	TAC/SUS	FMS	MSL FLT TEST	ANLY/SIM	LOG/DEMO	PPQT	CDTE
	4.a.(1)(6) 2	PAC-3 must Id non-TBM targets as Friend, Foe, Unk (R). Of targets detected & processed, __% must be identified correctly at ICC/ECS (R). Targets id'ed as Friend/Foe __% (R), __% (PO) must be categorized by platform at ICC/ ECS.			1-2-6 Proportion of correctly presented non-TBMs correctly identified as Unknowns, Friends, or Foes.	DS15 No. of non-TBM targets correctly presented. No. detected. No. identified as unknowns. No. identified as "blue". No. identified as "red".	P						
					(1-1-9)	DS7		P	S	S			
					(1-1-10)	DS8		S	P				
					1-2-7 Missile utilization against non-TBMs	DS16 No. of missiles fired. No. of PAC-3 missiles fired. No. of non-TBM intercepts.						S	
	4.a.(1)(6)	PAC-3 must incorporate organic classification, identification, and discrimination techniques. Identification must be declared at sufficient ranges to support engagement envelopes. Classification logic at FU must correctly identify __% required, __% (PO).	1-3 Criterion: The system must correctly classify __% of detected aerial vehicles as TBM/non-TBM, with ARMs a special category of non-TBM. TBMs must be classified by type __%, ARMs must be correctly categorized __% correct.		(1-1-8)	DS6	P	P	S	S			
	4.a.(1)(6) 1	targets as either TBM or non-TBM. For TBMs, __% (R), __% (PO) must be classified by TBM type.			(1-2-5)	DS14	P			S			
					1-3-1 Proportion of correctly presented ARMs correctly classified.	DS17 Number of ARM targets within zone. Number of targets classified as ARMs.		P		S			
	4.a.(5)	System must provide built-in/integral data recording for all key operational & technical data at ICC & ECS w/o system degradation or operator distraction, and playback & analysis at external workstations at BN/FU in ICC/ECS (R).	1-5 Supplemental Measure: The emplacement and initialization of the PATRIOT System, will not be degraded by PAC-3 upgrade.		1-5-1 Timelines for emplacement/initialization for PFU & ICC (Bn).	DS21 EDR tapes of TWUD Tests, MCS, TAC/BATT, and K7 boots.	P	P					
			1-6 Supplemental Measure: Effectiveness of the Embedded Data Recorder (EDR).		1-6-1 Proportion of unsuccessful missions attributed to eye degradation caused by EDR.	DS22 Number of incidents of system degradation attributed to EDR.	S	S				S	P
	4.2.(5)	PAC-3 must provide for built-in/integral data recording of all key operational & technical data at the ICC and ECS w/o system degradation or operator distraction and playback & analysis at external workstations at BN & FU (R).			1-6-2 No. of system degradations and operator distractions attributed to EDR.	DS23 EDR/MRT data tapes from ICC/PFUs; TCS reductions; Data reductions from supporting HFUs & HEUs. TC & test monitor logs; HCU data; ICC data bases (initialization & tactical); TCS data base; Comm operator logs.	S	S				S	P
2.0 INTER-OPERABILITY			2 Additional Operational Issue: Can the PATRIOT system interoperate with HEU, adjacent ADA units, external sensors, & intel sources via secure communication means.										
	4.c.(5)	Interference by Army, Air Force, Navy or allied electro-magnetic (EM) emitters to PATRIOT system w/ PAC-3 upgrades will not degrade required performance (R).	2-1 Complementary Measure: Interference by Army, Navy, or allied electro-magnetic (EM) emitters to PATRIOT w/PAC-3 upgrades will not degrade required performance.		2-1-1 Number of Incidences of EM Interference.	DS27 Number of incidences and source. TC/Test Monitor notes/ observations on the effect of EM Interference.						P	S

FOTE DATA SOURCE MATRIX

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP	Data Requirement	TAC/ SUS	FMS	MSL FLT TEST	ANLY/ SIM	LOG DEMO	D PPOT	T CDTE
	4.a.(3) 6.a.(3)	PAC-3 must interoperate with existing (R) and planned (PO) air defense C3I systems of Army, joint and combined services. Current communication will be used in PAC-3 until time phased implementation of objective communication system.	2-2 Complementary Measure: PAC-3 must inter-operate with existing (R) & planned (PO) ADA C3I systems of the Army, Joint, & Combined Services.	2-2-1 Proportion of time that PATRIOT is able to establish and maintain effective PAC-3 external/ internal Bn communications to all required interfacing systems.	2-2-2 Proportion of communication initializations correctly completed within designated timelines.	DS28 Data Sheets with test data, data base initialization information and TCS printout with final initialization parameters.	P					S	S
	4.a.(3)(a)	PAC-3 ICC(R) & ECS (PO) must attain certification as a participation unit in Army/joint/combined service protocols:ATDL-1, TADIL-A, TADIL-B, & TADIL-J (Fixed Word Format). The ICC (R) & when autonomous ECS (R) must directly receive & process JTIDS PPLIs			2-2-3 Proportion of communication link options correctly identified, analyzed, & connectivity established within designated timelines.	DS29 Connectivity of links, confirmed by operation of each link identified in the data base.	P			S		S	S
	4.a.(3)(b)	PAC-3 must receive and process organic intelligence. (cut short since classified)			2-2-4 Proportion of correctly received and interpreted messages, which are transmitted internal to Bn.	DS30 For each internal Bn system: number of messages transmitted to other internal Bn sites; number of messages correctly received and interpreted.	P		S			S	S
	4.a.(3)(c)	PAC-3 ICC (R) and the ECS (PO) must be capable of interfacing with and processing (in combination as external data transmission medium): IATACS-modified, ACUS, ADDS, HFCNR, troposcatter, SATCOM, and commercial leased circuits.			2-2-5 Proportion of externally generated messages which are transmitted to the Bn that are correctly received & interpreted.	DS31 For each PATRIOT and external-interfacing system: number of messages transmitted; number of messages correctly received and interpreted at PATRIOT and external-to-Bn sites.	P		S			S	S
					2-2-6 Proportion of internally generated messages which are correctly transmitted external to Bn.	DS85 Number of messages transmitted by PATRIOT Bn correctly received and interpreted at sites external to the Bn.	P						S
	4.a.(3)(d)	PAC-3 FU must be capable of 2-way data exchange with other Army or joint/combined ADA systems using TADIL-J (R) and ATDL-1, TADIL-A, TADIL-B (PO), when the ICC is not available.			2-2-7 Loading analysis conducted and effects of commo links on system coverage.	DS32 Throughput requirements for scenario. Data transferred on links vs system capability.	P					P	
	4.a.(3)(e)	PAC-3 FU must be capable of exchanging air picture and engagement status data (not full c2) directly with a HAWK FU (R) or any future HIMAD ADA system that uses standard (data links).			(Load levels)								
	4.a.(3)(e)	PAC-3 FU must be capable of performing as a master battery (w/ full C2 over resources of up to two other FUs (PATRIOT, HAWK or future HIMAD ADA system) while...											
	4.a.(3)(e)	A master FU should be capable of exchanging air picture and engagement status information with up to two adjacent master FUs/ICCs (PO).											
	4.a.(4)	A capability of world-wide over-the-air copying and validating from SW generation facility directly to the BN or FU is desired (PO).											

FOTE DATA SOURCE MATRIX

System Requirement	ORD Para	ORD Requirement	CONC / AOI	MOE	MOP	Data Requirement	TAC/ SUS	FMS	MSL FLT TEST	ANLY/ SIM	LOG DEMO	PPQT	CDTE
	4.a.(9)	PAC-3 will calculate and make available launch point coordinates to outside (extra-Bn) agencies on existing, standard communications doctrinal nets (R).											
	5.d.(3)	All EO and FO electronic interfaces and peripheral equipment outside the ICC/ECS WILL BE through ATCCS (to include ATCCS approved commercial). All electronic interfaces and peripheral equipment inside the ICC/ECS SHOULD BE through ATCCS (...).											
	6.a.(1)(a)	PAC-3 will allow the PATRIOT FU (ECS) to participate directly in the AD C3I systems w/o interfacing thru the BN control node.											
	6.a.(1)(b)	PAC-3 BNs and FUs will integrate into the Standardized Theater Army Command and Control System (STACCS) at EAC and with ATCCS for BNs assigned to the corps.											
	6.a.(2)(a)	PATRIOT must have the capability to exchange and process PPLI messages with JTIDS equipped aircraft.											
	6.a.(3)(a)	PAC-3 will employ organic JTIDS networks as the primary means of conducting BN and below EO data communications.											
	6.a.(3)(b)	PATRIOT will use the MSE to pass EO voice traffic and to support FO voice and data communications. Additionally, outside BN EO data will be passed using ACUS.											
	6.a.(3)(c)	PATRIOT will use CNR for backup, mobile operations, and launcher data link.											
	6.a.(3)(d)	External communications from PATRIOT will be satisfied by a combination of organic and non-organic communication.											
	6.a.(3)(d).1	Organic JTIDS will be used for air-to-ground and ground-to-air TADIL-J comm.											
	6.a.(3)(d).2	HF TADIL-A capability will be provided.											
	6.a.(3)(d).3	Terrestrial comm to the joint interface (e.g. CRC) normally will be provided by a non-organic signal support organization.											
	6.d.(1)	PAC-3 will be capable of interfacing with engineer topographic units and other databases IAW MIL STDs/ SPECs to obtain digital topographic data.			2-2-8 Qualitative assessment of interfaces to obtain digital topographic data to support defense planning process.	DS33 CDR/Staff Observations (survey forms) recorded as to capability of interface to support defense planning requirements.	p						s
	6.e.	PAC-3 will interface with the Integrated Meteorological System (IMETS) for weather and environmental forecasts, observations and decision aid information. The environmental support software will be US Army standard [software picks up last sentence].			2-2-9 Qualitative assessment of interfaces to obtain weather data to support defense planning process.	DS33	p						s

FOTE DATA SOURCE MATRIX

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP	Data Requirement	TAC/ SUS	FMS	MSL FLT TEST	ANLY/ SIM	LOG DEMO	PPQT	PPOT	CDTE
	4.a.(1)(b)	... PAC-3 must accept, correlate and process told in data at ICC (R), and if ICC is not available at ECS (R).			2-2-10 Qualitative assessment of interface to intelligence system to support defense planning process.	DS33	P					S		P
	4.a.(1)(d)	PAC-3 accepts and incorporates told-in intel data. Told-in data (external to Bn) will be assumed true. Processing of adjunct sensor data (within Bn) & told-in data will be accomplished at ICC. FÜ must have capability to receive data if ICC not avail.			2-2-11 No. of instances of correctly revised engagement planning, affected by interface to intelligence systems.	DS33	P					S		P
	4.a.(3)(b)	PAC-3 must receive & process organic & told-in intel info via army approved devices at ICC (RVECS (PO)... Data must be automatically evaled and of quality consistent w/ PAC-3 radar data, fused into engagement decision logic, avail on operator request.			2-2-12 Proportion of told-in tracks correctly fused.	DS34 EDR tapes. No. of told-in tracks. No. of tracks of adequate quality. No. of tracks fused into engagement logic.	P					S		P
	6.a.(2)(a)	2-3 Complementary Measure: PATRIOT must have the capability to exchange secure voice and data link information with current/planned Army ADA systems that use standard comm and data languages including HAWK, FAAD C3I, Corps SAM, & HATMD.	2-3 Complementary Measure: PATRIOT must have the capability to exchange secure voice and data link information with current and planned Army ADA systems that use standard comm and data languages including HAWK, FAAD C3I, Corps SAM, & HATMD.		2-3-1 Proportion of transmissions which can be covertly intercepted and interpreted.	DS35 No. of messages transmitted; No. of messages intercepted using RF/TEMPEST covert communications monitoring equip. Source of intercepted message.			S	S		P		S
	4.a.(3)(c)	All incoming PATRIOT communications must be encrypted for transmission and decrypted for receipt at ICC (R) and ECS (R).												
	6.a.(2)(b)	PATRIOT must have the capability to exchange secure voice and data link information with Army Command and Control Systems, including MCS, ASAS, AFATDS, and CSSCS.												
	6.a.(2)(c)	PATRIOT must have the capability to exchange secure voice and data link information with joint AD C3I systems including: 1. USAF TACS and AWACS, 2. USMC TACS, TOAM, and TOAC, 3. USN NTDS and ATDS, 4. National/ Service Intelligence networks.												
	6.a.(3)(b)4.	PATRIOT must access immediate voice connectivity to USSPACECOM organically or via ACUS for TBM warning.												
	4.a.(7)	PAC-3 must provide fully automated & integrated support for all FO activities, IAW ATCCS architecture (R). Must provide automated FO decision aids at Bn (R) and FU(R) separate from ICC/ECS and not interfering with EO.	2-4 Complementary Measure: PAC-3 Bn must provide automated support to coordinate the overall air battle execution between the upper tier (HATMD) and lower tier and direct the ABT battle.		2-4-1 Proportion of FO tasks automated.	DS36 List of FO tasks. List of critical FO tasks. FO tasks performed by SW.	P		S			S		S
	4.a.(7)(a)	PAC-3 must include automated decision aids to support defense design & planning w/ hard-copy output in the ICC /ECS tabular formats & auto transfer of defense designs into ICC/ECS, for automatic, time-phased crew implementation (R).												

FOTE DATA SOURCE MATRIX

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP	Data Requirement	FOTE TAC/ SUS	FMS	MSL FLT TEST	ANLY/ SIM	LOG DEMO	D PPQT	D CDTE
	4.a.(7)(a)	Defense design automated tools must provide for radar viability & coverage estimates (R), communication profiling (R), frequency allocation (R), air space control, to include auto interface with USAF Contingency Tactical Air Plan System (ACTAPS) (PO).											
	4.a.(7)(a)	& analysis of defense design alternatives via interactive simulation (R).											
	4.a.(7)(b)	Data displays in the PAC-3 Bn & FU CPs must provide near real time display of operational status info (R): Engagement Status; Communication Status; Missile Inventory. Air situational data avail at ICC/ECS must be displayed in Bn/FU CPs (R).											
	4.a.(7)(b)	Complete situational displays are desired (PO).											
	4.a.(10)	PAC-3 Bn software and decision logic must be sufficient to support the defense design requirements of a HIMAD enclave defense to include determination and transfer of weapon systems' initialization parameters (R).			2-4-2 Proportion of times TCS successfully determine weapon systems' initialization parameters using automated support.	DS37 Number of times TCS successfully determine initialization parameters using automated support. Number of times TCS successfully determines initialization parameters without automated support. Number of unsuccessful attempts by TCS to determine initialization parameters. Observer/operator logs.	P					S	S
					2-4-3 Reasons TCS could not successfully determine weapon systems' initialization parameters using automated support.	DS37	P					S	S
					2-4-4 Proportion of times weapon systems' initialization parameters are automatically passed from TCS to FU successfully.	DS38 Number of times TCS transmits weapon systems' initialization parameters to FU. Number of times weapon systems initialization parameters successfully received at FU. Observer/operator logs.	P					S	S
					2-4-5 Reasons weapon systems' initialization parameters could not be successfully passed from TCS to FU.	DS38	P					S	S
	4.a.(10)	PAC-3 Bn will coordinate the overall air battle execution between the upper tier (HATMID) and lower tier (PATRIOT and CORPS SAM) (R) and will direct the ABT battle (R).											
3.0 Survivability			3 Critical Operational Issue: Can the PAC-3 system defend itself against lethality on the battlefield, and against SOJ platforms, and enemy RSTA?										

FOTE DATA SOURCE MATRIX

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP	Data Requirement	TAC/ SUS	FMS	MSL FLT TEST	ANLY/ SIM	LOG DEMO	PPQT	CDTE
	4.a(1)(i)	PAC-3 FU must maintain current PATRIOT cap of countering FW/RW SOJ platforms and against RSTA in ongoing battlespace (up to max rg of ___ km from the FU radar) (R). At rgs beyond the 1st	3-1 Criterion: PAC-3 FU must be able to engage FW/RW SOJ platforms and RSTA at rg out to ___ km from the FU's radar.		3-1-1 Distance from the FU radar at which PAC-3 engaged FW/RW SOJ platforms and RSTA.	DS39 System tapes/logs pertaining to engagement of SOJ & RSTA FW/RW a/c (e.g. tapes from PAC-3 radar set that PAC-3 engages).	P						S
		Intercept rg of ___ km (R), 5SEKP of ___ (R) must be achieved against a ___ m square target (RCS).											
	4.a(1)(a) 4.a(1)(i)	PAC-3 will have capability to initiate keepout altitudes (R). Operator judgment must be allowed for engagement beyond optimum designed/ required battlespace (e.g., TBM engagements beyond ___ km must not be precluded) (R).			3-1-3 Proportion of successful engagements, initiated by operator below designated battlespace.	DS41 No. of successful operator initiated engagements. Total no. of operator initiated engagements.		P	S	S		S	S
	4.a(6)	PAC-3 must have increased survivability (R), but measures must not degrade system performance (R).	3-2 Criterion: PAC-3 FU must have a ___ probability of surviving a single ARM attack.										
	4.a(6)(b)	PAC-3 FU, w/o significant man degradation, must have a ___ (R) probability of surviving an attack by a single ARM.			3-2-1 Proportion of single ARM attacks survived by FU.	DS42 Number of single ARM attacks & total number of single ARM attacks survived by FU (Tapes, questionnaires, and logs).	P	P		S		S	S
	4.a(6)(d)	PAC-3 must incorporate passive opns to include radar non-radiating emplacement (R).											
	4.c(1)	PAC-3 must operate effectively (meet performance characteristics delineated in para 4a) under the ECM conditions as specified in the PATRIOT STAR and summarized in Table 2-1 of the ORD (R).											
		PAC-3 ECM must reduce/eliminate the effects of enemy ECM which will include a variety of basic, responsive, and reactive wave-forms available to the threat (R).											
	4.c(2)	PAC-3 will have Wartime Reserve Modes (WARM) (R) and radars will ....(R).											
	4.c(3)	PAC-3 will increase its survivability against chemical threats, to include ....(R).											
	4.c(3)(a)	The exterior and interior of all PAC-3 equipment will be designed such that NBC contamination (remaining on, or desorbed from, or re-aerosolized from the surface) following decon-lamination will not result in more than a negligible risk (see ORD Table 4-2) to unprotected personnel working inside, on or one meter from the item (R).										P	
II. SUITABILITY													
4.0 RAM			4 Critical Operational Issue: Can the PAC-3 be sustained in an operational environment?										

FOTE DATA SOURCE MATRIX

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP	Data Requirement	TAC/ SUS	FOTE FMS	FOTE MSL FLT TEST	FOTE ANLY/ SIM	FOTE LOG DEMO	D PPQT	D CDTE
	4.b(1) 4.b(1)(a)	PATRIOT man cap rate will not be degraded by mods incorp'd in PAC-3 and will be enhanced as required by the revised OMS/MP at App. B of the ORD (R) (all values are based on the most stressing (wartime) scenario). PAC-3 FU must have an Ao of __(R).	4-1 Criterion: PAC-3 FU must have a minimum Ao of __		4-1-1 Operational Availability (Ao).	DS43 Operator and Maint Logs; Output from RMM. EDR tapes. Record Fully Mission Capable and Mission Capable Time. Record Total Corrective and Preventive Maint times. Use estimate of TALDT from RRR.	P	S	S			S	S
	4.b(1)(b)	PAC-3 MTTR will not exceed 3.8 hrs. (R).			4-1-2 MTTR.	DS44 Operator & Maint Logs; Output from RMM; EDR tapes. Total corrective maint clock-hours vs No. of operational mission failures & time interval between each failure.	P	S	S			S	S
	4.b(1)(f)	MR will not exceed 0.11 hrs. (R).			4-1-3 Maintenance Ratio (MR).	DS45 Operator & Maint Logs; Output from RMM; EDR tapes. Total corrective maint clock-hours vs total operational time.	P	S	S			S	S
	4.b(1)(e) 4.b(1)(f)	MTBCMF will not be less than 20 hours (R). MTBF will not exceed 40 hours.	4-2 Criterion: MTBCMF will exceed 20 hours.		4-2-1 Mean Time Between Critical Mission Failures (MTBCMF).	DS46 Operator & Maint Logs; Output from RMM; EDR tapes. Record No. of Critical failures and operational time between each failure.	P	S	S			S	S
			4-3 Supplemental Measure: The Materiel System Computer Resources (MSCR) must not degrade system RAM		4-3-1 Proportion of CMFs chargeable to SW.	DS46	P	S	S		S	S	S
					4-3-2 Proportion of down time chargeable to SW.	DS46	P	S	S		S	S	S
5.0 MANPRINT			5 Additional Operational Issue: Can appropriate MOS qualified soldiers, with the training given, perform mission tasks to standards under operational conditions using PAC-3 sys?										
5.1 MANPOWER	5.c.(2)(a)	PAC-3 will require no increase in manpower per BN	5-1 Complementary Measure: PAC-3 modification will result in no increase in manpower personnel per battalion.		5-1-1 Qualitative assessment of operator/ maintainer task list as provided to support all required operations/functions of PAC-3 system.	DS47 EDR Tape of operators performing mission at PATRIOT workstations. Evaluator/observer clipboard notes on soldier performance. Soldier responses from System Evaluation Questionnaire.	P	S	S			S	S
	4.a.(5)	System must provide built-in/integral data recording for all key operational & technical data at ICC & ECS w/o system degradation or operator distraction, and playback & analysis at external workstations at BN/FU in ICC/ECS (R).											
	4.2.(5)	PAC-3 must provide for built-in/integral data recording of all key operational & technical data at the ICC and ECS w/o system degradation or operator distraction and playback & analysis at external workstations at BN & FU (R).											

FOTE DATA SOURCE MATRIX

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP	Data Requirement	FOTE TAC/ SUS	FOTE RMS	FOTE MSL FLT TEST	FOTE ANLY/ SIM	FOTE LOG/ DEMO	DT PPQT	DT COTE
					5-1-2 Observed capability of personnel authorization & distribution to accomplish mission.	DS47	P	S	S			S	S
5.2 TRAINING	5.c.(2)(b)	PAC-3 will not change the operator/ maintainer skill and general knowledge requirements as in the current target audience description (TAD).	5-2 Complementary Measure: Training required as a result of PAC-3 Mods will provide sufficient operator/ maintainer proficiency to support mission accomplishment.		5-2-1 Qualitative assessment of operator/maintainer efficiency in performing critical tasks.	DS47	P	S	S		S	S	S
	4.c(3)(b)	PAC-3 must permit the performance of mission essential opns., communications, maintenance, resupply, and decontamination tasks by trained and acclimated soldiers in MOPP IV over a typical men profile in a contaminated environment with < 15% deviation in performance (R).					P	S	S		S	S	S
5.3 HUMAN FACTORS ENGINEERING	4.c.(8)	PAC-3 will conform to applicable Human Factors Engineering (HFE) military standards to ensure that the soldier machine interface (SMI) is consistent with soldier capabilities and limitations.	5-3 Complementary Measure: PAC-3 must comply with applicable HFE standards of design, performance, & operation prescribed in MIL-STD 1472. PAC-3 must be able to be operated & maintained by 5th thru 95th percentile males & females, in all MOPP levels.		5-3-1 Qualitative assessment of HFE design compliance to MIL-STD 1472.	DS48 Observer/operator will provide MANPRINT problem statements, describing non-compliance to MIL-STD 1472. Narratives will cite page, para or table. Reports will describe problem & provide an impact rating for severity & frequency.	P	S	S		S	S	S
					5-3-2 Qualitative assessment of user-friendliness.	DS49 Responses to user-friendliness surveys.							
	5.c.(2)(c)	PAC-3 modifications to training devices will be in compliance with requirements for the 5th percentile female and 95th percentile male personnel critical body dimensions.											
	5.2.(2)(c)	Training devices at the PATRIOT BN and FU must be compatible with current personnel protection equipment and be capable of being maintained and operated by personnel wearing individual protective clothing/ equipment.											
	5.d.(3)	(Computer) Peripheral equipment will be consolidated to max extent possible.											
	5.d.(4)	All software implemented will emphasize user friendly techniques which include on the help where appropriate without impacting system performance.											
	5.d.(5)	Future (i.e. replacement/new) video displays should be high resolution and reconfigurable, and should support menu shading, color, 3D displays, scalable graphics and fonts.											
	5.d.(7)	A maximum number of displays will incorporate soft switches (i.e. on-screen, touch switches or automatically reconfigurable (switches)) and/or menu systems.											
	5.d.(8)	Full electronic documentation is desired.											

FOTE DATA SOURCE MATRIX

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP	Data Requirement	TAC/ SUS	FOTE FMS	FOTE MSL FLT TEST	FOTE ANLY/ SIM	FOTE LOG DEMO	DT PPQT	DT CDTE
	6.d.(1)	In support of EO and FO decision aides, PAC-3 will use DMA map products such as DTED, Interim Terrain Data (ITD), and Future Tactical Terrain Data (TTD).											
	6.d.(1)	PAC-3 will be capable of using topographic data from engineer topographic units IAW MIL STD/ SPECs.											
	6.d.(2)	PAC-3 FO situational displays will support the display of standard military maps (i.e. 1:25k, 1:100k, 1:250k, 1:500k and 1:1000k) through the use of standard DMA supplied digital topographic data products.											
5.4 SYSTEM SAFETY & HEALTH HAZARDS	4.c.(6) 4.c.(7)	Safety hazards present at any point throughout PAC-3 implementation will be eliminated by design or controlled by procedure and design, IAW safety program requirements (R). Health Hazards identified at any point throughout	5-4 Complementary Measure: PAC-3 must meet health & safety requirements stated in MIL-STD 882. PAC-3 upgrades must not contribute to health hazards that restrict or endanger operators or maintainers.		5-4-1 PAC-3 compliance with safety & health standards as prescribed in MIL-STD 882, AB 385-18 & AR 40-10.	DS50 Observer/operator will provide MANPRINT problem statements, describing any hazard or non-compliance to MIL-STD 882, AR 385-18 or AR 40-10.	P	S	S			S	S
						Narratives will cite page, para, or table for hazard.							
		PAC-3 implementation will be eliminated by design or controlled by procedure and design, in compliance with existing health standards (R).			5-5-1 Types of MAN-PRINT problems identified, by impact rating, for each of the above criteria.	DS47, DS48, & DS50.	P	S	S		S	S	S
6.0 MEANS OF EMPLOYMENT			6 Issue: Can the PAC-3 system be employed to accomplish its mission using the prescribed organization, doctrine, and tactics?										
	7	PAC-3 will be employed at EAC, in the corps ADA Bde, and in TF configurations; force structure consists of 9 PAC-3 Bns with 6 firing batteries each for a total of 54 firing batteries.	6-1 Complementary Measure: PAC-3 organization (including no. of authorized personnel, personnel distribution, required skill levels, and equipment authorizations and optimization) will be sufficient to accomplish the wartime and peacetime mission IAW OMSMP.		(6-1-2)	DS47	P	S	S			S	S
	4.b.(3)	PAC-3 must be supportable within current manpower and skill level constraints (R).			6-1-1 Proportion of unsuccessful missions attributed to manpower/ skill level constraints.	DS51 CDR/Staff Observations (survey forms) recorded as to capability of authorized/ distributed equipment to meet mission support requirements.	P	S	S		S	S	S
	7	Additional PAC-3 equipment supports institutional (trg, ORFs, and RDT&E programs.											
	4.b(3)	PAC-3 must have organic support necessary to accomplish the msn (R).	6-2 Complementary Measure: PAC-3 organization will provide sufficient support personnel and equipment to achieve the approved ORD and OMSMP requirements.		6-2-1 Observed capability of authorized and distributed equipment to support the msn.	DS51	P	S	S			S	S
			6-3 Complementary Measure: Doctrinal procedure will facilitate operations achieving their required performance and provide for required inter-operability with other service and allied TMD systems/assets.		6-3-1 Observed capability of defined doctrine to support msn accomplishment.	DS52 Observations (questionnaires) & recorded data ref capability of defined DTTPs to support mission accomplishment.	P	S	S		S	S	S

FOTE DATA SOURCE MATRIX

System Requirement	ORD Para	ORD Requirement	COIC / AOI	MOE	MOP	Data Requirement	TAC/ SUS	FOTE					D T	
								FMS	MSL FLT TEST	ANLY/ SIM	LOG DEMO	PPQT	PPQT	CDTE
			6-4 Complementary Measure: Tactics employed will permit the accomplishment of the ORD-level of protection and to accommodate supporting and supported functional requirements.		6-4-1 Observed capability of defined TTPs to support men accomplishment.	DS52	P	S	S		S		S	S
			6-5 Complementary Measure: The march order timeliness of the PATRIOT system will not be degraded by PAC-3 upgrades.		6-5-1 March order timeliness for PFU	DS54 Observer/data collector records start/stop times.	P		S					
7.0 SUPPORT-ABILITY (Logistics)			7 Issue: Is the PAC-3 system supportable?											
	4.b(2)	PAC-3 will require the same level of or less frequency or duration of preventive or scheduled maintenance actions (R).	7-2 Complementary Measure: The PAC-3 system upgrades should be designed for maintainability, and require the same level or less in frequency or duration of PM & scheduled maint.		7-2-1 Qualitative assessment of the logistic support concept.	DS56 Evaluator/observer clip-board notes on soldier performance. Soldier responses from System Evaluation Questionnaire	P	S	S	S	S	S	S	S
					7-2-2 Level, frequency, and duration of PM & corrective maintenance.	DS44; DS56	P	S	S	S	S	S	S	S
	4.c(4)	PAC-3 must be capable of operations & storage in hot, basic, cold, & severe cold conditions without degradation in performance (R).	7-3 Complementary Measure: PAC-3 must be capable of operation and storage in all climatic conditions without performance degradation.		7-3-1 Observed capability of PAC-3 system during storage or operation in all & operating in all climatic conditions.	DS57 Observations made on maint/ops logs to system storage conditions.	S	S	S		S	P		
	4.c(9)	Modifications to PATRIOT equipment required by PAC-3 upgrades will comply with existing system security requirements (R).	7-4 Complementary Measure: PAC-3 mode must comply with existing system security requirements.		7-4-1 Observed compliance w/existing system security requirements.	DS58 Maintenance & security logs tracking of mode. (PAC-3 system)	S							
	4.c(12)(a)	BIT/BITE capacity to detect 99% (R) and 75% (R) to isolate all system men failures to a single LRU; areas not detected/isolated by BIT will do so by manual troubleshooting procedures using appropriate technical documents and standard TMDE & tools (R).	7-6 Complementary Measure: PAC-3 system must detect Relevant Mission Essential (RME) failures and isolate mission failures to a single LRU.		7-6-1 Proportion of RME failures correctly detected by BIT/BITE.	DS61 Operator/Maint Logs, RMM & HCU output. Record all system failures & failures correctly detected by BIT/BITE.	P		S		S	S		S
					7-6-2 Proportion of detected RME failures correctly isolated by BIT/BITE.	(DS61)	P							
					7-6-3 Qualitative assessment of manual trouble-shooting procedure & equipment.	DS62= DS56 and any DA FORM 2028s, and TIRs.	P					S		
					7-6-4 Qualitative assessment of technical data and publications.	DS62	P							S

APPENDIX D

DATA AUTHENTICATION GROUP (DAG)

CHARTER

**PATRIOT (PAC-3, CONFIG-2) FOT&E
DATA AUTHENTICATION GROUP (DAG)**

CHARTER

1. Origin of Need. Per DA PAM 73-1, Part Five, 16 October 1992, OEC requires a DAG for the PAC-3, Config-2 Patriot FOT&E.

2. Goal and Objectives.

   a. Goal. The goal of the DAG is to authenticate test data, as suitable, accurate, complete, and representative of test events.

   b. Objectives. Review: test data collection and reduction process, summary quality check reports, engagement timelines, and investigate data anomalies.

3. DAG Resources.

   a. Personnel. The DAG has four core members: OEC (chair), PPO, TEXCOM, USAADASCH and support personnel as required. Material Test Directorate is supplying a Subject Matter Expert to advise the DAG on technical matters. Members should be prepared to work often during the DAG activity window from 29 Apr-28 Jun.

   b. Meetings. The DAG Chair will publish a schedule as soon as it is feasible to do so. Unscheduled meetings may be called by the chairman. Meetings will be held in the conference room at TEXCOM (ADATD) at Fort Bliss, TX. Target for authenticated database (level 3) is EOM Jun 96.

   c. Training. Initial training will be during the latter part of the pilot test when the first reduced data is available. OEC will provide data printout training focusing on engagement timelines. TEXCOM will provide training on data collection and reduction process and summary quality check reports.

   d. Funding. Each organizations will fund their own expenses.

4. Milestones.

2 or 3 May	DAG Training/Pilot Test Review
NLT 13 May	DAG Authenticates First Pilot Test Data
14 May*	- DAG "walk through" w/ADAED Tech Dir (a.m.)
	-"End-to-end data run" laydown for ADAED Dir

* may need all DAG members at these OEC DAG laydowns

PATRIOT DAG MEMBERSHIP

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APPENDIX E

TEST CHANGE PROPOSALS (TCP)

APPENDIX F

TEST EVALUATION PLAN (TEP) APPROVAL

**OPERATIONAL TEST
AND EVALUATION**

1 9 MAY 1996

MEMORANDUM FOR COMMANDER, US ARMY OPERATIONAL EVALUATION
COMMAND
ATTENTION: CSTE-EAD

SUBJECT: Approval of Test and Evaluation Plan (TEP) for the PATRIOT Advanced
Capability-3 (PAC-3), Configuration-2, Follow-on Operational Test and
Evaluation (FOT&E)

The Test and Evaluation Plan (TEP) for the PATRIOT Advanced Capability-3
(PAC-3), Configuration-2, Follow-on Operational Test and Evaluation (FOT&E), dated
April 26, 1996, is approved.

Philip E. Coyle
Director

ACRONYMS

A/C	Aircraft
ABT	Air Breathing Threat
AC	Alternating Current
ADA	Air Defense Artillery
ADATD	Air Defense Artillery Test Directorate
ADP	Automated Data Processing
ADTOC	Air Defense Tactical Operations Center
ADW	Air Defense Warning
AGL	Above Ground Level
ALDT	Administrative and Logistics Down Time
AMG	Antenna Mast Group
AMSAA	Army Materiel Systems Analysis Activity
A_o	Operational Availability
AOI	Additional Operational Issue
APOD	Aerial Port of Debarkation
AR	Army Regulation
ARM	Anti-Radiation Missile
ASIOE	Associated Support Items of Operable Equipment
ASVAB	Armed Services Vocational Aptitude Battery
BATI	Battalion Initialization
BII	Basic Issue Items
BIT	Built-In-Test
BITE	Built-in Test Equipment
BMDO	Ballistic Missile Defense Organization
BN	Battalion
BOIP	Basis of Issue Plan
BSFV-E	Bradley Stinger Fighting Vehicle-Enhanced
BTOC	Battalion Tactical Operations Center
C^3I	Command, Control, Communications and Intelligence
CADCI	Common Air Defense Communications Interface
CARM	Counter Antiradiation Missile
CD	Combat Disk
CDTE-2	Configuration-2 DTE
CDI	Classification, Discrimination, and Identification
CE	Communications Enhancements
CEES	C^3I Engineering and Evaluation System
CMF	Critical Mission Failure
COEI	Components of End Items
COI	Critical Operational Issue

COIC	Critical Operational Issues and Criteria
CP	Communications Processor
CRG	Communications Relay Group
CTA-50	Common Table of Allowances-50
CTT-H/R	Commander's Tactical Terminal/Hybrid Receiver
D&O	Doctrinal and Organizational
DA	Department of the Army
DAB	Defense Acquisition Board
DAG	Data Authentication Group
DAT	Digital Acquisition Tape
DC	Data Collectors
	Direct Current
DCF	Data Collection Form
DDC	Diagnostic Data Collection
DLR	Data Link Recorder
DMSF	Data Management Storage Facility
DOF	Degree of Freedom
DOTSP	Doctrinal and Organizational Test Support Package
DRMP	Design Reference Mission Profile
DRT	Data Reduction Team
DSM	Data Source Matrix
DTP	Detailed Test Plan
DTTP	Doctrine, tactics, techniques, and procedures
ECM	Electronic Countermeasures
ECS	Engagement Control Station
EDR	Embedded Data Recorder
EDWA	Engagement Decision and Weapon Assignment
EM	Electro-Magnetic
EO	Engagement Operations
EOP	Evaluator Operational Plan
EPP	Electric Power Plant
EPU	Electric Power Unit
ERINT	Extended Range Interceptor
EWCC	Expanded Weapons Control Computer
FAA	Federal Aviation Agency
FAAD	Forward Area Air Defense
FD/SC	Failure Definition/Scoring Criteria
FMC	Fully Mission Capable
FMS	Flight Mission Simulator
FO	Force Operations
FOTE	Follow-on Operational Test and Evaluation
FTX	Field Training Exercise
FU	Fire Unit

FW	Fixed Wing
GCFU	Ground Communications Filter Unit
GTSF	Guidance Test and Simulation Facility
HATMD	High Altitude Theater Missile Defense
HAWK	Homing All-the-Way Killer
HCU	Hard Copy Unit
HEU	Higher Echelon Unit
HFE	Human Factors Engineering
HQ	Headquarters
HWIL	Hardware-in-the-Loop
IAW	In Accordance With
ICC	Information and Coordination Central
ICS	Interim Contract Support
ID	Identification
IGI	Inertial Ground Positioning System Integration
ILS	Integrated Logistics Support
JCCWR	Joint Command and Control Warfare Center
JTIDS	Joint Tactical Information Distribution System
LC	Launch Complex
LCU	Launcher Control Unit
	Lightweight Computer Unit
LEGS	Lethality End Game Simulation
LOS	Line of Sight
LRU	Line Replaceable Unit
LS	Launching Station
MAC	Maintenance Allocation Chart
MANPRINT	Manpower and Personnel Integration
MC	Mission Capable
MCP	Materiel Change Package
	Maintenance Collection Point
MCS	Maintenance Control System
MEF	Mission Essential Function
MFSIM	Multifunction Simulation
MIL-STD	Military Standard
MOE	Measure of Effectiveness
MOP	Measure of Performance
MOPP	Mission Oriented Protective Posture
MOS	Military Occupational Specialty
MP	Mission Profile
MPS	MANPRINT Problem Statement

III

MR	Maintenance Ratio
MSCR	Materiel System Computer Resources
MSE	Mobile Subscriber Equipment
MSL	Mean Sea Level
MTBCMF	Mean Time Between Critical Mission Failure
MTD	Materiel Test Directorate
MTTR	Mean Time to Repair
MTTS	Multiple Target Tracking System
N/A	Not Applicable
NBC	Nuclear, Biological, and Chemical
NET	New Equipment Training
NTR	Net Time Reference
OEC	Operational Evaluation Command
OMF	Operational Mission Failure
OMS	Operational Mode Summary
OMS/MP	Operational Mode Summary/Mission Profile
OPFOR	Opposing Forces
OPTEC	Operational Test and Evaluation Command
ORD	Operational Requirements Document
OTERAM	Operational Test and Revaluation Reliability, Availability, and Maintainability
OTRR	Operational Test Readiness Review
PAAS	PATRIOT Automated Analysis System
PAAT	PATRIOT As A Target
PAC	PATRIOT Advanced Capability
PAC-1	PATRIOT Advanced Capability-1
PAC-2	PATRIOT Advanced Capability-2
PAC-3	PATRIOT Advanced Capability-3
PALS	PATRIOT Automated Logistics System
PATRIOT	Phased Array Tracking Radar to Intercept of Target
PATSIM	PATRIOT Simulation
PC	Personal Computer
PDB	Post Deployment Build
PDP	Pulse Doppler Processor
PENAID	Penetration Aid
PIN	Personnel Identification Number
PM	Preventive Maintenance
PMCS	Preventive Maintenance Checks and Services
POI	Program(s) of Instruction
PPQT	Pre-Production Qualification Testing
PTOD	Precise Time of Day

QC	Quality Control
QRP	Quick Response Program
RAM	Reliability, Availability, and Maintainability
RCS	Radar Cross Section
RE	Radar Enhancement
RL-CEU	Remote Launch/Communications Enhancement Upgrade
RME	Relevant Mission Essential
RMM	Remote Maintenance Monitor
ROM	Read Only Memory
RPV	Remotely Piloted Vehicle
RRR	RAM Rationale Report
RS	Radar Set
RSTA	Reconnaissance, Surveillance, and Target Acquisition
RW	Rotary Wing
SED	Software Engineering Directorate
SEE	Software Engineering Environment
SINCGARS	Single Channel Ground and Airborne Radio System
SOJ	Stand Off Jammer
SPOD	Seaport of Debarkation
SRU	Standard Range Unit
SSEKP	Single Shot Engagement Kill Probability
SSP	System Support Package
ST	Special Text
SW	Software
SWA	Southwest Asia
TACI	Tactical Initialization
TAD	Target Audience Description
TADIL	Tactical Digital Information Link
TALDT	Total Administrative and Logistics Downtime
TAOM	Tactical Air Operations Module
TASM	Tactical Air-to-Surface Missile
TBM	Tactical Ballistic Missile
TC	Test Coordinator
TCM	Total Corrective Maintenance
TCS	Tactical Command System
TEMP	Test and Evaluation Master Plan
TEP	Test and Evaluation Plan
TER	Test and Evaluation Report
TEXCOM	Test and Experimentation Command
THAAD	Theater High Altitude Area Defense
TIBS	Tactical Information Broadcast System
TIR	Test Incident Report
TIU	Time Insertion Unit

TM	Technical Manual
TMD	Theater Missile Defense
TMDE	Test, Measurement, and Diagnostic Equipment
TO	Test Officer
TOR	Table of Organization and Equipment
TOEL	Time-Ordered Events List
TOP	Tester Operational Plan
TPM	Total Preventive Maintenance
TPW	Tactical Planning Workstation
TRADOC	Training and Doctrine Command
TRI-TAC	Tri-Services Tactical Communication Links
TSM	TRADOC System Manager
TSP	Test Support Plan
	Threat Support Package
TSPI	Time Space Position Information
TSRD	Test Support Recording Device
TTP	Tactics, Techniques, and Procedures
UAV	Unmanned Aerial Vehicle
UHF	Ultra High Frequency
USAADASCH	US Army Air Defense Artillery School
UTM	Universal Transverse Mercator
VCPS	Video Capture Processing System
WSMR	White Sands Missile Range

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USATEC   1
ATTN: AMSTE-TA-A
Aberdeen Proving Ground, MD 21005-5005

USAMSAA   1
ATTN: AMXSY-ADH (Mr. Youngblood)
Aberdeen Proving Ground, MD 21005-5005

USATRADOC   1
ATTN: TSM-PATRIOT
Fort Bliss, TX 79916

USAADASCH   1
ATTN: ATSA-CDT
ATTN: ATSA-CDM-E
Fort Bliss, TX 79916

USATEXCOM   5
ATTN: CSTE-TAD-T (Mr. Hernandez)
Fort Bliss, TX 79916

USAOEC   5
ATTN: CSTE-ECA
Park Center IV, 4501 Ford Avenue
Alexandria, VA 22302-1458

PEO Missile Defense   1
ATTN: SFAE-MD-PA-TE (Mr Jerry Blaine)
P. O. Box 1500
Huntsville, AL 35807-3801

Defense Information Technical Center   1
Bldg 5, Cameron Station
Alexandria, VA 22304-6145

OPTEC Technical Library   2
ATTN: CSTE-IML
Park Center IV, 4501 Ford Avnue
Alexandria, VA 22302-1458

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Pentagon (Rm 1C730)
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