

AD-A194 137

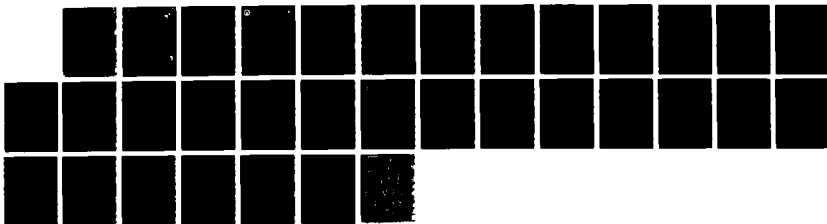
DEVELOPMENT OF STRESS LOADING FACILITY TEST TECHNIQUES
(DIRECTION AND NON. (U) ARMY ELECTRONIC PROVING GROUND
FORT HUACHUCA AZ J M SHAVER 01 FEB 88 MIPR-TO-46-85

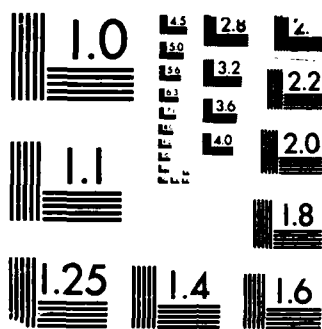
1/1

UNCLASSIFIED

F/G 15/4

ML

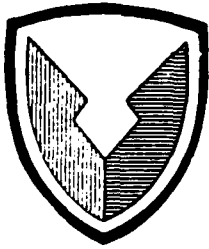




MICROCOPY RESOLUTION TEST CHART
NBS 1963-A

DTIC FILE COPY

3



AD-A194 137

AD NUMBER _____

TECOM PROJECT NOS. 7-CO-R85-EPO-003
7-CO-R85-EPO-004

METHODOLOGY INVESTIGATION

FINAL REPORT

DEVELOPMENT OF STRESS LOADING FACILITY TEST TECHNIQUES
(DIRECTION AND NON-DIRECTION FINDING SYSTEMS)

BY

MR. J. W. SHAVER

Modernization and Advanced Concepts Office

US ARMY ELECTRONIC PROVING GROUND
FORT HUACHUCA, ARIZONA 85613-7110

FEBRUARY 1988

Prepared for:

US Army Test & Evaluation Command
Aberdeen Proving Ground, MD 21005-5055

DTIC
COLLECTED
APR 12 1988
E

Approved for Public Release;
Distribution unlimited.

88 4 11 219

DISPOSITION INSTRUCTIONS

Destroy this report in accordance with appropriate regulations when no longer needed. Do not return it to the originator.

DISCLAIMER

Information and data contained in this document are based on input available at the time of preparation. Because the results may be subject to change, this document should not be construed to represent the official position of the U.S. Army Materiel Command unless so stated.

The use of trade names in this report does not constitute an official endorsement or approval of the use of such commercial hardware or software. This report may not be cited for purposes of advertisement.



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY TEST AND EVALUATION COMMAND
ABERDEEN PROVING GROUND, MARYLAND 21005-5555



AMSTE-TC-M (70-10p)

MEMORANDUM FOR: Commander, U.S. Army Electronic Proving Ground,
ATTN: STEEP-MO,

SUBJECT: Stress Loading Facility (SLF) Final Report

1. Subject report is approved.
2. Point of contact, this headquarters, is Mr. Joseph Knox,
AMSTE-TC-M, amstetcm@apg-4.arpa, AV 298-2170/3677.

FOR THE COMMANDER:

GROVER H. SHELTON
Chief, Meth Imprv
Directorate for Technology

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No 0704-0188
Exp Date Jun 30, 1986

1a. REPORT SECURITY CLASSIFICATION		1b. RESTRICTIVE MARKINGS	
2a. SECURITY CLASSIFICATION AUTHORITY		3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for Public release; distribution unlimited.	
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE		4. PERFORMING ORGANIZATION REPORT NUMBER(S)	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)		5. MONITORING ORGANIZATION REPORT NUMBER(S) Same as Item 4.	
6a. NAME OF PERFORMING ORGANIZATION U.S. Army Electronic Proving Ground	6b. OFFICE SYMBOL (if applicable) STEEP-MO-M	7a. NAME OF MONITORING ORGANIZATION U.S. Army Test and Evaluation Command	
6c. ADDRESS (City, State, and ZIP Code) Fort Huachuca, Arizona 85613-7110		7b. ADDRESS (City, State, and ZIP Code) Aberdeen Proving Ground, Maryland 21005-5055	
8a. NAME OF FUNDING/SPONSORING ORGANIZATION Same as Item 7.a.	8b. OFFICE SYMBOL (if applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER MIPR-TO-46-85 MIPR-TO-47-85	
8c. ADDRESS (City, State, and ZIP Code) Same as Item 7.b.		10. SOURCE OF FUNDING NUMBERS	
		PROGRAM ELEMENT NO.	PROJECT NO.
		TASK NO.	WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) Methodology Investigation Final Report (Unclassified)			
12. PERSONAL AUTHOR(S)			
13a. TYPE OF REPORT Final	13b. TIME COVERED FROM _____ TO _____	14. DATE OF REPORT (Year, Month, Day) 88 Feb 1	15. PAGE COUNT
16. SUPPLEMENTARY NOTATION			
17. COSATI CODES		18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)	
FIELD	GROUP	SUB-GROUP	Methodology Investigation, Test Instrumentation, Measures of Functional Performance, EWI (Electronic Warfare/Intelligence) Systems.
19. ABSTRACT (Continue on reverse if necessary and identify by block number) This document develops a standard method for determining Measures of Functional Performance for Complex Electronic Warfare/Intelligence Systems. The document contains procedures for both Electronic and Communications Intelligence Systems. <i>copy to be included</i>			
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT <input type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS		21. ABSTRACT SECURITY CLASSIFICATION	
22a. NAME OF RESPONSIBLE INDIVIDUAL		22b. TELEPHONE (Include Area Code)	22c. OFFICE SYMBOL

TABLE OF CONTENTS

Page

FOREWORD

ii

SECTION 1. SUMMARY

Paragraph
Number

1.1	BACKGROUND.	1
1.2	OBJECTIVE	1
1.3	SUMMARY OF PROCEDURES	2
1.4	SUMMARY OF RESULTS.	2
1.5	ANALYSIS.	2
1.6	CONCLUSION.	2
1.7	RECOMMENDATION.	2

SECTION 2. DETAILS OF INVESTIGATION

2.0	DETAILS OF INVESTIGATION.	3
-----	-----------------------------------	---

SECTION 3. APPENDIXES

A.	DIRECTIVES AND METHODOLOGY INVESTIGATION PROPOSALS.	A-1
B.	ACRONYMS AND ABBREVIATIONS.	B-1
C.	NTIA/ITS REPORT	C-1
D.	REFERENCES.	D-1
E.	DISTRIBUTION.	E-1

Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

Office
COPY
INSPECTED

FOREWORD

The Institute for Telecommunications Sciences (ITS) in Boulder, Colorado, (a laboratory that is part of the National Telecommunications and Information Administration, U.S. Department of Commerce) has performed the study reported here. The support was provided under two Military Interdepartmental Purchase Requests, TO 46-85 and TO 47-85 (which were funded from TRMS No. 7-CO-R85-EPO-003 and 7-CO-R85-EPO-004) under guidance provided by the US Army Electronic Proving Ground. While initially, there were two projects, it was determined that similarities between the Direction Finding and Non-Direction Finding tasks were such that a common procedure for development of Measures of Performance could be developed for both tasks and described in the final report.

SECTION 1. SUMMARY

1.1 BACKGROUND

1.1.1 The US Army Electronic Proving Ground (USAEPG) has extensive test capabilities known as the Electromagnetic Environmental Test Facility (EMETF) that are used to determine the EMC/EMV of the US Department of Defense C-E systems and equipment. As increasingly sophisticated C-E systems and equipment are being developed, these test capabilities need to be upgraded substantially to ensure that sufficient testing is performed to assure satisfactory operation of the system or equipment and that this testing is performed as economically as possible. The Stress Loading Facility (SLF) is envisioned as a capability that will respond to these requirements.

1.1.2 This report and the attached NTIA Report 87-228 (App C) were prepared to develop a standard approach to the problem of developing measures of functional performance (MOFP) for complex EW systems.

1.1.3 The detailed information for this document is contained in the document prepared by the National Telecommunications and Information Administration, Institute for Telecommunications Sciences, Boulder, Colorado 80303, entitled "Investigations of Test Methodology for the Stress Loading Facility" and which is attached as Appendix C to this document. Following is a brief description of the document:

1.1.3.1 Material in Section 1 provides an introduction to the SLF Test Methodology development work undertaken by ITS. Sections 2 and 3 describe the test capabilities of USAEPG's existing EMETF and the SLF equipment and the concept of use of the SLF in the EMETF.

1.1.3.2 Section 4 describes a "Structured Approach to Performance Description" and is used to outline that procedure. Section 5 introduces the unclassified parameters of two EW systems and defines measures of functional performance for them. Section 6 provides an approach for test design and the development of the required data collection, reduction, and analysis plan. Section 7 describes measurement methods for typical electronic surveillance systems.

1.1.3.3 Section 8 contains the conclusion and recommendation. Section 9 provides the references. Appendix A defines acronyms and abbreviations. Appendix B applies the methodology to the development of performance parameters to digital communications systems. Appendix C provides an expanded generalized test plan for a non-specific test item using the SLF.

1.2 OBJECTIVE. This study is directed to the development of determining measure of function performance to be used in testing with the SLF. There are three tasks that have been addressed in performing the study. These tasks are (1) a review of the existing SLF-type test capabilities, (2) the development of measures of functional performance as the basis for evaluating the performance of electronic surveillance systems, and (3) the development of a framework for general methodology for SLF utilization incorporating these measures of functional performance.

1.3 SUMMARY OF PROCEDURES. ITS reviewed existing SLF-like capabilities including the EMETF (USAEPG) and the TEWES (Naval Research Laboratory [NRL]). The procurement specifications for the Communications Threat Simulator (CTS) were reviewed. The CTS is being developed based upon existing technology by Unisys, Reston, Virginia.

1.3.1 Based upon that review and further analysis and a review of the functions required for the Communications-Electronics (C-E) systems likely to be tested, ITS defined those functions which would be necessary to adequately test such systems. The functions were further defined such that they could be determined/measured at natural system boundaries and/or interfaces. ITS then determined that the set of system functions could be mapped into one of three outcomes: (1) intended performance, (2) incorrect performance, and (3) no performance. These outcomes were further characterized by the primary performance parameters of speed, accuracy, and dependability. Secondary parameters were then defined as the statistical function of availability as determined from multiple tests for the primary parameters. This procedure became the model for MOFP.

1.3.2 To demonstrate the technique of developing MOFP, ITS developed the MOFP for the QUICKLOOK and TEAMPACK systems at an unclassified level.

1.4 SUMMARY OF RESULTS. The development of measures of functional performance used a structured approach to defining system functions and selecting parameters to describe the performance of the system. The approach followed step-by-step procedures to ensure that the selected set of performance parameters was complete, efficient, and measurable. The parameter development was approached from the point of view of the user which produces parameters that are measures of user-perceived performance rather than measures of the causes (of user-perceived performance) within the system. Such parameters were system independent and, thus, very useful for specifying the performance requirements for systems not yet specified or designed and for comparing performance of systems.

1.5 ANALYSIS. This process led to nine primary parameters and two secondary parameters that are defined as the recommended measures of functional performance for these EW systems. These parameters would be applicable to any electronic surveillance system for which the primary functions are signal detection, signal characterization, and emitter identification and location.

1.6 CONCLUSION. The conclusion was developed in the attached document in detail and is briefly stated below:

The structured approach to the development of measures of functional performance using functions and parameters that are user-oriented and system independent offers wide opportunity for specifying desired system performance in terms that are meaningful to users and for comparing system performance results on a common basis.

1.7 RECOMMENDATION. Further study is required to understand the relationships between overall SLF test frequency capabilities, physical size required for the enclosure, and methods for coupling rf energy at all test frequencies and evaluate the impact of these factors on continued SLF development.

SECTION 2. DETAILS OF INVESTIGATION

Details of the investigation are contained in the NTIA Report 87-228, Appendix C of this document.

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX A.

DIRECTIVES AND METHODOLOGY INVESTIGATION PROPOSALS



DEPARTMENT OF THE ARMY Mr. Miller/brt/AUTOVON
HEADQUARTERS, U. S. ARMY TEST AND EVALUATION COMMAND 283-3677
ABERDEEN PROVING GROUND, MARYLAND 21005

REPLY TO
ATTENTION OF

AMSTE-AD-M

21 SEP 1984

SUBJECT: RDTE Methodology Improvement Program Directive, Techniques
for Using SLF in Testing Direction Finding Systems, TRMS No.
7-CO-R85-EPO-003

Commander
US Army Electronic Proving Ground
ATTN: STEEP-TM-TO
Fort Huachuca, AZ 85613

1. Reference TECOM Regulation 70-12, dated 1 June 1973.
2. This letter and attached STE Forms 1188 and 1189 (Enclosure 1) constitute a directive for the subject investigation under the TECOM Methodology Improvement Program 1W665702D625.
3. The MIP at Enclosure 2 is the basis for headquarters approval of the subject investigation.
4. Special Instructions:
 - a. All reporting will be in consonance with paragraph 9 of the reference. The final report will be submitted to this headquarters, ATTN: AMSTE-AD-M, in consonance with Test Event 570/580. Each project shall be completed in FY85 as reflected in the scheduling in attached STE Forms 1188 and 1189.
 - b. Recommendations for new TOPs or revisions to existing TOPs will be included as part of the recommendation section of the final report. Final decision on the scope of the TOP effort will be made by this headquarters as part of the report approval process.
 - c. The addressee will determine whether any classified information is involved, and will assure that proper security measures are taken when appropriate. The OPSEC guidance will be strictly followed during this investigation.
 - d. Prior to test execution, the test activity will verify that no safety or potential health hazards to humans participating in testing exist. If safety or health hazards do exist, the test activity will provide a safety/health hazards assessment statement to this office prior to test initiation.
 - e. Environmental documentation for support tests or special studies is the responsibility of the test activity and will be accomplished prior to initiation of the investigation/study.

AMSTE-AD-M

21 SEP 1984

SUBJECT: RDTE Methodology Improvement Program Directive, Techniques
for Using SLF in Testing Direction Finding Systems, TRMS No.
7-CO-R85-EPO-003

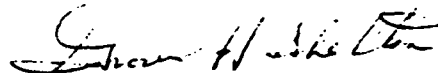
f. Upon receipt of this directive, test milestone schedules as established in TRMS II data base will be reviewed in light of other known workload and projected available resources. If rescheduling is necessary, a letter citing particulars, together with recommendations, will be forwarded to Commander, US Army Test and Evaluation Command, ATTN: AMSTE-AD-M, with an information copy to AMSTE-TO-0, within 15 calendar days.

g. The HQ, TECOM point of contact is Mr. Larry W. Miller, AMSTE-AD-M, AUTOVON 283-2170/2375.

h. FY85 RDTE funds in the amount of \$100,000 have been authorized for this investigation, DARCOM Form 1006 will be forwarded by the Comptroller.

FOR THE COMMANDER:

2 Encl
as



GROVER H. SHELTON
C, Meth Imprv Div
Analysis Directorate

January 1984

METHODOLOGY INVESTIGATION PROPOSAL

1. TITLE. Techniques for Using an SLF in Testing Direction Finding Systems.
2. CATEGORY. VISTA, Sensors.
3. INSTALLATION. US Army Electronic Proving Ground, Fort Huachuca, Arizona 85613.
4. PRINCIPAL INVESTIGATOR. R. Grinnell, Modernization Planning Office, STEEP-MS, AUTOVON 879-7651/7622, FTS 769-7651/7622.
5. PROBLEM. Available draft information and briefings on the planned electromagnetic Stress Loading Facility (SLF) indicate that there may be peculiar problems with testing Direction Finding (DF) Systems totally in the SLF closed loop type arrangement. Detailed methodology for conducting an adequate, valid test program on DF systems, using the SLF in conjunction with other test facilities, has not been fully developed.
6. BACKGROUND. The proposed SLF is an integrated testing system and facility designed to achieve an unprecedented electromagnetic threat test environment while simultaneously monitoring key performance parameters. The SLF concept includes the use of extensive software to: generate test scenarios, control all aspects of real-time operation, and expedite the reduction and analysis of the recorded test data. The SLF concept is applicable to development testing of USA DF systems such as Improved TRAILBLAZER, TEAMPACK, and QUICK FIX ALQ-151. The SLF is intended to provide the tester with the ability to accurately replicate tests or portions of a test by maintaining positive control over the test process. A drastic savings in test time will result from: the expediting of test scenario generation, faster testing, the automation of test control and data reduction, and the need for less retesting. The primary use of the SLF will be for the conduct of government development tests. However, it will also be capable of supporting contractor design testing. It is vitally important that this capability be supported by/based on valid methodology that is practical to implement.
7. GOAL. To develop detailed application methodology required to conduct functional performance testing of complex DF systems, using the SLF together with related test capabilities; and to recommend any technical or operational improvements to the SLF that surface during preparation of detailed test methodology.
8. DESCRIPTION OF INVESTIGATION.
 - a. This investigation will develop specific methodology required to support functional performance testing of RF VISTA DF systems using the proposed SLF together with related computer simulation, bench testing and controlled field tests to complement/validate the SLF testing. Detailed planning for testing an actual complex RF VISTA DF system would be accomplished to include a valid Detailed Test Plan for the complete functional performance test using the SLF in conjunction with other related test capabilities.

b. USAEPG personnel will:

(1) Review the SLF capabilities as they relate specifically to the testing of DF type systems, especially the techniques for RF coupling to the System Under Test (SUT).

(2) Identify and coordinate with all appropriate agencies and individuals and research appropriate literature, including the Oquest Report ("EWI DT Test Methodology", 15 February 1980) to determine the generic and specific measures of functional performance, as available, for a candidate RF VISTA DF type system, such as the Improved TRAILBLAZER.

(3) Specify which measures of functional performance (MOFP) for the selected system should be tested in the SLF, through bench tests, in controlled field tests, or through computer simulation and show how these test modes relate to each other.

(4) Develop and document a Detailed Test Plan (DTP) for the SLF and field tests of the candidate system in paragraph b (2) above, discussing in detail the relative roles of computer simulation, SLF testing, bench testing and controlled field testing. It is anticipated that the documents generated may be classified up to TOP SECRET/SI since methodology developed, specifications of threat, and possibly some measures of functional performance may be extremely sensitive. The DTP should also include any applicable DVAL test methodology that has been documented up to that time.

(5) Develop and document a planning checklist by both time and event for the pre-test, during-test, and post-test events that must take place in order to adequately prepare for and use the SLF and related computer simulation capabilities for the candidate DF system test.

(6) Develop and document technical/operational areas of the SLF that must be modified/improved/researched in order to enhance the use of the SLF for testing of DF type systems.

c. Investigation will be completed as follows:

	<u>SCHEDULE</u> <u>FY85 (Otrs)</u>			
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
SLF DF Test Capability Review	X			
Coordination + Literature Search	X	X		
MOFP Specification		X		
Develop/Document Detailed Test Plan		X	X	X
Develop/Document Planning Checklist			X	X
Develop/Document SLF Improvements Report			X	X

9. JUSTIFICATION.

a. Association with Mission. TECOM is, and will be, required to test most of the expanding number of complex C³/EWI/BAS including RF VISTA DF systems under current development.

b. Present Capability, Limitations, Improvements, and Impact on Testing if not Approved. TECOM's current capability to test the extremely complex C³/EWI/BAS including RF VISTA systems does not allow stressing such systems sufficiently to completely determine design performance. The SLF is conceived to resolve this limitation, but must be supported by adequate methodology that is valid and practical. This investigation will enable development of that methodology for DF type systems. If the effort is not accomplished, TECOM faces a substantial risk of not being able to conduct adequate tests of complex RF VISTA DF systems when tasked to do so.

c. Dollar Savings. Direct dollar savings are not anticipated to result from this investigation.

d. Workload. The following DT II/PIP programs will benefit from the conduct of this investigation:

	<u>FISCAL YEAR</u>			
	<u>85</u>	<u>86</u>	<u>87</u>	<u>88</u>
Improved TRAILBLAZER AN/TSO-114B	X	X		
TEAMPACK - AN/MSQ-103A	X	X	X	
QUICK FIX ALQ-151 (ECM/DF)	X	X	X	

e. Association with Requirements Documents. All specifications/ROC documents support test programs in paragraph 9d above.

10. RESOURCES:

a. Financial.

	Dollars (Thousands)	
	<u>FY85</u>	
	<u>In-House</u>	<u>Out-of-House</u>
Personnel Compensation	64.0	
Travel	5.0	
Contractual Support		30.0
Materials & Supplies	1.0	
Subtotal	<u>70.0</u>	<u>30.0</u>
Total	<u>100.0</u>	

b. Explanation of Cost Categories.

(1) Personnel Compensation. Principal investigator, two engineers, and support personnel.

(2) Contractual Support. Support will be required for approximately 30 percent of the effort.

c. Obligation Plan.

	FO	1	2	3	4	TOTAL
Obligation Rate (Thousands)		17	33	34	16	100

d. In-House Personnel.

(1) Requirements.

	FY 85 MANHOURS		
	<u>NUMBER</u>	<u>REQUIRED</u>	<u>AVAILABLE</u>
Electronic Engineer	3	2800	2800

(2) Resolution of nonavailable personnel: N/A.

11. INVESTIGATION SCHEDULE.

	FY 85											
	O	N	D	J	F	M	A	M	J	J	A	S
In-house												
Contract												R

Symbols: - - Active investigation work (all categories)

... Contract monitoring (in-house only)

12. ASSOCIATION WITH TOP PROGRAM.

No TOPs are anticipated to result exclusively from this investigation.

FOR THE COMMANDER:

for Robert E. Reiner
 ROBERT E. REINER
 Chief, Modernization Planning Office

THIS PAGE IS INTENTIONALLY BLANK



DEPARTMENT OF THE ARMY Mr. Miller/brt/AUTOVON
HEADQUARTERS, U S ARMY TEST AND EVALUATION COMMAND 285-3677
ABERDEEN PROVING GROUND, MARYLAND 21005

REPLY TO
ATTENTION OF

AMSTE-AD-M

21 SEP 1984

SUBJECT: RDTE Methodology Improvement Program Directive, Development
of SLF Test Techniques (Non-DF), TRMS No. 7-CO-R85-EPO-CO-

Commander
US Army Electronic Proving Ground
ATTN: STEEP-TM-TO
Fort Huachuca, AZ 85613

1. Reference TECOM Regulation 70-12, dated 1 June 1973.
2. This letter and attached STE Forms 1188 and 1189 (Enclosure 1) constitute a directive for the subject investigation under the TECOM Methodology Improvement Program 1W665702D625.
3. The MIP at Enclosure 2 is the basis for headquarters approval of the subject investigation.
4. Special Instructions:
 - a. All reporting will be in consonance with paragraph 9 of the reference. The final report will be submitted to this headquarters, ATTN: AMSTE-AD-M, in consonance with Test Event 570/580. Each project shall be completed in FY85 as reflected in the scheduling in attached STE Forms 1188 and 1189.
 - b. Recommendations for new TOPs or revisions to existing TOPs will be included as part of the recommendation section of the final report. Final decision on the scope of the TOP effort will be made by this headquarters as part of the report approval process.
 - c. The addressee will determine whether any classified information is involved, and will assure that proper security measures are taken when appropriate. The OPSEC guidance will be strictly followed during this investigation.
 - d. Prior to test execution, the test activity will verify that no safety or potential health hazards to humans participating in testing exist. If safety or health hazards do exist, the test activity will provide a safety/health hazards assessment statement to this office prior to test initiation.
 - e. Environmental documentation for support tests or special studies is the responsibility of the test activity and will be accomplished prior to initiation of the investigation/study.

21 SEP 1984

AMSTE-AD-M

SUBJECT: RDTE Methodology Improvement Program Directive, Development of SLP Test Techniques (Non-DF), TRMS No. 7-CO-R85-EPO-004

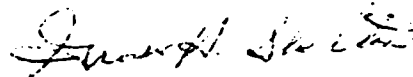
f. Upon receipt of this directive, test milestone schedules as established in TRMS II data base will be reviewed in light of other known workload and projected available resources. If rescheduling is necessary, a letter citing particulars, together with recommendations, will be forwarded to Commander, US Army Test and Evaluation Command, ATTN: AMSTE-AD-M, with an information copy to AMSTE-TO-O, within 15 calendar days.

g. The HQ, TECOM point of contact is Mr. Larry W. Miller, AMSTE-AD-M, AUTOVON 283-2170/2375.

h. FY85 RDTE funds in the amount of \$95,000 have been authorized for this investigation, DARCOM Form 1006 will be forwarded by the Comptroller.

FOR THE COMMANDER:

2 Encl
as



GROVER H. SHELTON
C, Meth Imprv Div
Analysis Directorate

January 1984

RDTE METHODOLOGY INVESTIGATION PROPOSAL

1. TITLE. Development of SLF Test Techniques (Non-DF).
2. CATEGORY. VISTA Sensors.
3. INSTALLATION. US Army Electronic Proving Ground, Fort Huachuca, Arizona 85613.
4. PRINCIPAL INVESTIGATOR. Mr. R. Grinnell, Modernization Planning Office, STEEP-MS, AUTOVON 879-7651/7622, FTS 769-7651/7622.
5. PROBLEM. Available draft information and briefings on the planned electromagnetic Stress Loading Facility (SLF) present a capability design for testing Command, Control, Communications/Electronic Warfare and Intelligence/Battlefield Automated Systems (C³/EWI/BAS) in a closed loop environment, presently unavailable in a single facility. However, the detailed methodology for conducting adequate valid testing of the functional performance of such systems has not been fully developed for the SLF.
6. BACKGROUND. The proposed SLF is an integrated testing system and facility designed to achieve an unprecedented electromagnetic threat test environment while simultaneously monitoring key performance parameters. The SLF concept includes the use of extensive software to: generate test scenarios, control all aspects of real-time operation, and expedite the reduction and analysis of the recorded test data. The SLF concept is applicable to development testing of USA intercept/DF/jamming systems such as Improved TRAILBLAZER, Improved QUICKLOOK, Improved GUARDRAIL, and TEAMPACK, as well as less complex systems such as TLO-17A and TRR-27. The SLF will provide the tester with the ability to accurately replicate tests or portions of a test by maintaining positive control over the test process. A drastic savings in test time will result from: the expediting of test scenario generation, faster testing, the automation of test control and data reduction, and the need for less retesting. The primary use of the SLF will be for the conduct of government development tests. However, it will also be capable of supporting contractor design testing. It is vitally important that this capability be supported by/based on valid methodology that is practical to implement.
7. GOAL. To develop detailed application methodology required to conduct functional performance testing of complex non-DF systems (to include those with integral voice/data communication links) using the SLF together with related test capabilities; and to develop a basic generic handbook on the use of the SLF for all applicable C³/EWI/BAS testing.
8. DESCRIPTION OF INVESTIGATION.
 - a. This investigation will develop specific methodology required to support functional performance testing of RF VISTA non-DF systems including those with integral voice/data links and interfaces into DC³I systems, using the proposed SLF together with related computer simulation, bench tests, and

controlled field tests to complement/validate the SLF testing. This investigation will develop an initial version (strawman) of a basic generic handbook on the use of the SLF for all applicable C³/EWI/BAS testing.

b. USAEPG will:

(1) Review the SLF capabilities as they relate specifically to the testing of non-DF type systems, especially the techniques for RF coupling to the System Under Test (SUT) for the systems with integral communication links and the use of the Communications Threat Simulator simultaneously with the Radar Threat Simulator.

(2) Identify and coordinate with all appropriate agencies and individuals and research appropriate literature, including the Oquest Report ("EWI DT Test Methodology", 15 February 1980) to determine the generic and specific measures of functional performance, as available, for a candidate RF VISTA non-DF type system. This, preferably, would be one with an integral voice/data communications link, such as the Improved QUICKLOOK.

(3) Specify which measures of functional performance (MOFP) for the selected system should be tested in the SLF, through bench tests, in controlled field tests, or through computer simulation and show how these test modes relate to one another.

(4) Develop and document a Detailed Test Plan (DTP) for the SLF and related test capabilities for the candidate system in paragraph b (2) above, discussing in detail the relative roles of computer simulation, SLF testing, bench testing and controlled field testing. It is anticipated that the documents generated may be classified up to TOP SECRET/SI since methodology developed, specifications of threat, and possibly some measures of functional performance may be extremely sensitive. The DTP should also include any applicable DVAL test methodology that has been documented up to that time.

(5) Develop and document a planning checklist by both event and time relative to the start of testing for the pre-test, during-test, and post-test events that must take place in order to adequately prepare for and use the SLF and related computer simulation capabilities for the candidate non-DF system.

(6) Develop and document a basic generic handbook on the use of the SLF for all applicable C³/EWI/BAS testing to include such areas as test scenario generation, data base updating, Test Data Monitoring System programming and use, statistical test/analysis tools, RF coupling techniques, etc. This would be a basic version which would be updated as more information/experience became available.

(7) Develop and document technical/operational areas of the SLF that must be modified/improved/researched in order to enhance the use of the SLF for testing of non-DF type systems, especially those with integral voice/data communication links.

c. Investigation will be completed as follows:

	<u>SCHEDULE</u>			
	<u>FY85 (Qtrs)</u>			
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
SLF non-DF Test Capability Review	X			
Coordination + Literature Search	X	X		
MOFP Specification		X		
Develop/Document Detailed Test Plan		X	X	X
Develop/Document Planning Checklist			X	X
Develop/Document Generic SLF Handbook			X	X
Develop/Document SLF Improvements Report			X	X

9. JUSTIFICATION.

a. Association with Mission. TECOM is, and will be, required to test most of the expanding number of complex C³/EWI/BAS including RF VISTA non-DF systems under current development.

b. Present Capability, Limitations, Improvements, and Impact on Testing if not Approved. TECOM's current capability to test the extremely complex C³/EWI/BAS including RF VISTA systems and their interoperability with related DC³I systems does not allow stressing such systems sufficiently to completely determine design performance. The SLF is conceived to assist in resolving this limitation, but must be supported by adequate methodology that is valid and practical. This investigation will enable development of that methodology for non-DF type systems. If the effort is not accomplished, TECOM faces a substantial risk of not being able to conduct adequate tests of complex C³/EWI/BAS systems when tasked to do so.

c. Dollar Savings. Direct dollar savings are not anticipated to result from this investigation.

d. Workload. The following DT II/PIP programs will benefit from the conduct of this investigation:

	<u>FISCAL YEAR</u>			
	<u>85</u>	<u>86</u>	<u>87</u>	<u>88</u>
Improved GUARDRAIL V			X	
Improved QUICKLOOK	X	X	X	
Advance RADAR Freq. CM	X	X	X	X
Advance Threat RF Warning Eq.		X	X	X
Advanced Threat - AN/ALO-136	X	X	X	
Remotely Monitored Battlefield Sensor	X	X	X	X
HOME RUN	X	X	X	
TACJAM - AN/MLO34	X	X	X	
TRAFFIC JAM - AN/ALO-17A	X	X	X	
AN/MLO-XX JAMMER REPLACEMENT for AN/TLO-17A	X	X	X	
ADEWS	X	X	X	

e. Association with Requirements Documents. All specifications/ROC documents support test programs in paragraph 9d above.

10. RESOURCES.

a. Financial.

	Dollars (Thousands)	
	<u>FY85</u>	
	<u>In-House</u>	<u>Out-of-House</u>
Personnel Compensation	59.0	
Travel	5.0	
Contractual Support		30.0
Materials & Supplies	1.0	
Equipment	_____	_____
Subtotal	65.0	30.0
Total	_____	
		95.0

b. Explanation of Cost Categories.

(1) Personnel Compensation. Principal investigator, two engineers, and support personnel.

(2) Contractual Support. Support will be required for approximately 30 percent of the effort.

c. Obligation Plan.

	<u>FQ</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>TOTAL</u>
Obligation Rate (Thousands)	15	32	33	15	95	95

d. In-House Personnel.

(1) Requirements.

	FY 85 MANHOURS		
	<u>NUMBER</u>	<u>REQUIRED</u>	<u>AVAILABLE</u>
Electronic Engineer	3	2600	2600

(2) Resolution of nonavailable personnel: N/A.

1. INVESTIGATION SCHEDULE:

	FY 85											
	O	N	D	J	F	M	A	M	J	J	A	S
In-house	-	-	-	-	-	-	-	-	-	-	-	R
Contract

Symbols: - - Active investigation work (all categories)

... Contract monitoring (in-house only)

12. ASSOCIATION WITH TOP PROGRAM:.

No TOPs are anticipated to result exclusively from this investigation.

FOR THE COMMANDER:

for *Robert R. Reiner*
ROBERT R. REINER
Chief, Modernization Planning Office

APPENDIX B. ACRONYMS AND ABBREVIATIONS

(Note: More complete definitions for some terms are found in the NTIA Report, Appendix C. (These are provided only for understanding this document.)

C-E	Communications-Electronics
CTS	Communications Threat Simulator
ELINT	ELectronic INTelligence
EMC	ELectroMagnetic Compatibility
EMETF	ELectroMagnetic Environmental Test Facility
EMV	ELectroMagnetic Vulnerability
EW	Electronic Warfare
EWI	EW/Intelligence
FSS	Functional System Simulator
ITS	Institute of Telecommunications Sciences
MOFP	Measures of Functional Performance
NCTS	Non-Communications Threat Simulator
NRL	Naval Research Laboratories, Washington DC
QUICKLOOK	Airborn, Non-Communications, ELINT System
SLF	Stress Loading Facility
SUT	System Under Test
TEAMPACK	AN/MSQ-103 Special-Purpose Receiver Set
TEWES	Tactical Electronic Warfare Environment Simulator
TIS	Test Item Stimulator (vice Simulator)
USAEPG	United State Army Electronic Proving Ground

THIS PAGE IS INTENTIONALLY BLANK

5

APPENDIX C.
NTIA/ITS REPORT
(SEE ATTACHMENT)

APPENDIX D. REFERENCES

1. Department of the Army (1976), Test and Evaluation During Development and Acquisition of Materiel, Army Regulation (AR) 70-10, January 1 (available from U. S. Army Material Command, Washington, D.C.).
2. Department of the Army (1983), Force Development Independent Evaluation Methodology and Procedures, Army Regulation (AR) 71-13 (available from U. S. Army Material Command, Washington, D.C.).
3. TRADOC Pam 71-13 (1983), Force Development Independent Evaluation Methodology and Procedures, Training and Doctrine Pamphlet (Available from U.S. Army Training and Doctrine Command, Ft. Monroe, VA).
4. TECOM Reg 70-12 (1985), Research, Development and Acquisition (Available from U.S. Army Test and Evaluation Command, Aberdeen Proving Ground, Maryland).
5. GSA (1986), Federal Standard 1037A, Glossary of Telecommunication Terms, February 1986.
6. USAEPG Publication (1987), Advanced SLF Test Techniques Volume I, EMETF Stress Loading Concept of Operations (Available from US Army Electronic Proving Ground, Fort Huachuca, AZ 85313-7110).
7. USAEPG Publication (1987), Advanced SLF Test Techniques Volume II, EMETF Stress Loading Facility Handbook (Available from US Army Electronic Proving Ground, Fort Huachuca, AZ 85613-7110).
8. USAEPG Publication (1987), Advanced SLF Test Techniques Volume III, Internal Operating procedures (Available from US Army Electronic Proving Ground, Fort Huachuca, AZ 85613-7110).

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX E. DISTRIBUTION

<u>Addressee</u>	<u>Number of Copies</u>
Commander U.S. Army Test & Evaluation Command ATTN: AMSTE-TC-M Aberdeen Proving Ground, MD 21005-5055	3
Defense Technical Information Center ATTN: FDAC Cameron Station Alexandria, VA 22304-6145	2
Commander U.S. Army Electronic Proving Ground ATTN: STEEP-TD STEEL-ET STEEL-DT STEEL-MO-M Fort Huachuca, AZ 85613-7110	1 1 1 4
Commander White Sands Missile Range ATTN: STEWS-PL-P (Art Foster) White Sands Missile Range, NM 88002	1
Headquarters U.S. Army Information Systems Engineering Command ATTN: ASB-SET-S (Nick) Fort Huachuca, AZ 85613-5300	1

THIS PAGE IS INTENTIONALLY BLANK

END

DATE

FILMED

8-88

DTIC