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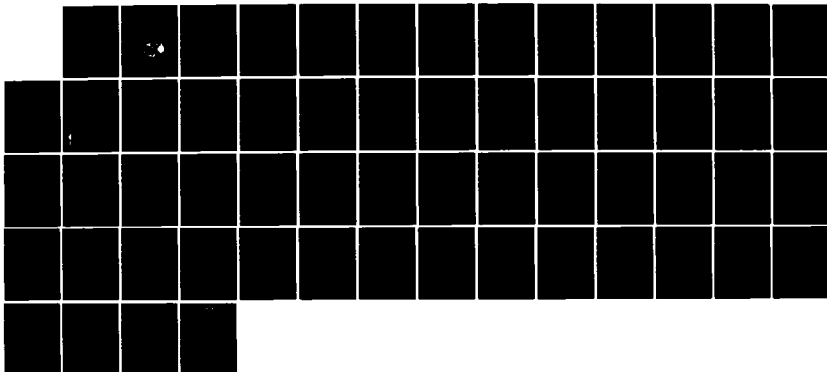
TROPIC TEST OF BRADLEY FIGHTING VEHICLE SYSTEMS(U) FMC
CORP SAN JOSE CA ORDNANCE GROUP 23 MAY 85
DARE07-84-C-R006

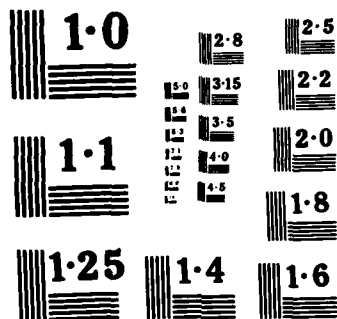
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NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

AD-A156 580

BFV TEST PLAN
TROPIC TEST
OF BRADLEY FIGHTING VEHICLE SYSTEMS

To be Conducted at
U.S. ARMY TROPIC TEST CENTER
PANAMA, R.P.
Contract DAAE07-84-C-R006
Statement of Work, Para. C.1.4



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~~SPA NO. 837-403-208~~

TECOM PROJECT #1-VC-030-IFV-053

Prepared by: FMC Corporation
Ordnance Group (BFV)
San Jose, California

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JUN 26 1985
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DISTRIBUTION STATEMENT A

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Table of Contents

- 1.1 Background
- 1.2 Description of Material
 - 1.2.1 Infantry Fighting Vehicle
 - 1.2.2 Cavalry Fighting Vehicle
- 1.3 Test Objective
- 1.4 Scope
 - 1.4.2.1 Contractor Baseline
 - 1.4.2.2 Pre-Open Storage Testing
 - 1.4.2.3 Open Storage
 - 1.4.2.4 Mid-Test After Open Storage Testing and Pre-Jungle Storage Testing
 - 1.4.2.5 Jungle Storage
 - 1.4.2.6 After Jungle Storage Test.
- 2.0 Shipping Preparation
- 2.1 Logistic Support
- 2.2 Data/Analysis Requirements
- Appendix A - Pre-Test Contractor Baseline
- Appendix B - Water Barrier
- Appendix C - Fuel
- Appendix D - Support Requirements
- Appendix E - Vision Devices
- Appendix F - Grounding Circuit Resistance
- Appendix G - Human Factors
- Appendix H - Distribution List

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SECTION 1. INTRODUCTION

1.1 BACKGROUND

The Bradley Fighting Vehicle System (BFVS) is the follow-on program which resulted from a March 1977 DA decision to terminate the Mechanized Infantry Combat Vehicle (MICV) program and to develop a vehicle that mounted a two-man turret which incorporates a 25-mm cannon (Instead of a one-man turret with a 20mm cannon), and a tube-launched, optically-tracked, wire-guided (TOW) antitank missile. The two primary vehicles of the BFVS are an Infantry Fighting Vehicle (IFV), designated the M2, and the Cavalry Fighting Vehicle (CFV), the M3.

For the 25mm (hardstand test) PQG, Program Manager (PM), BFVS was directed to test and evaluate two candidate 25mm weapons for the role as the main armament for the IFV/CFV. Before PQG, each of the contractors demonstrated that his weapon was prepared to enter into PQG testing. Hardstand testing commenced on 1 March 1978 at APG and concluded on 9 November 1978. With the submission of both hardstand data and OT-1A gun-related information, a gun decision was made on 19 January 1979. The Hughes Helicopters externally powered gun was selected as the main armament for the IFV/CFV.

The OT-1A test was an OTEA-directed separate operational test of the two competing 25mm guns installed in BFVS turrets to provide preliminary data on the relative operational capability of the gun systems. Such data were submitted to the selection board for consideration in gun selection. The OT-1A was conducted at Camp Roberts, CA, from 8 November 1978 through 13 December 1978, under prevailing weather conditions. This test was preceded by a 10-week training period which began in August 1978 and concluded in October 1978.

This test provided the operational tester insight into issues relating to reliability, availability, maintainability (RAM), human factors, training, personnel selection, system capability, and operational effectiveness of the 25mm gun candidates. The vehicles were operated for approximately 806km (500mi) each, and approximately 5000 rounds were fired from each of the 25mm guns.

Vehicles used for OT-1A had MICV chassis and IFV turrets with Phase 1 and improved Phase 1 sights.

A PQT-C was conducted between January through June 1979 under prevailing weather conditions over existing terrain at the contractor's facility, Camp Roberts, CA, the Nevada Automotive Test Center (NATC) Carson City, NE and Ft. Carson, CO. Originally two prototype vehicles were to engage in this test, however, based on the agreements reached during the February Special Test Meeting, a third vehicle was added to increase the contractor data base, and to provide experience at the OT II (Ft. Carson) test site. The three vehicles, each with the EP gun, achieved a total of 13,674 miles of operation (11,500 miles were planned), 20,883 rounds of 25mm ammunition, and four TOW missiles to demonstrate the capability of the system to meet specification requirements, and to determine if the system is ready to proceed into PQT-G testing.

1.1 BACKGROUND (continued)

PQT-G testing was performed at APG over existing terrain and test courses under prevailing weather conditions. Testing was conducted during the June 1979 through 1980 time-frame.

Three prototype vehicles (two IFVs and one CFV) were available for testing. At the Initiation of testing, two vehicles were dedicated to RAM operations, while the third vehicle was dedicated to weapons station performance testing. Upon completion of most of the weapons station subtests in early May 1980, this vehicle (CFV) was shipped, per direction of the Program Manager, BFVS to Fort Knox, KY, to be used in the CFV Force Development Test and Experimentation (FDT&E). The three vehicles underwent a total of 21,975 km (13,655 Mi) of operation and fired 27,302 rounds from the 25mm armament at APG.

The US Army Materiel System Analysis Activity (AMSAA) had identified 19 October 1979 as the data cut-off date for their Interim Independent Evaluation Report (IER) for the 20 December 1979 IFV ASARC meeting. The APG test schedule provided as much essential information as was possible to AMSAA and TECOM by date cut-off without having jeopardized or compromised the test data provided.

During the Development Test II (DT II) PQT-G of the M2/M3 IFV/CFV, TECOM Project No. 1-VC-030-IFV-004, lack of system-peculiar test sets and appropriate system technical manuals resulted in the need for contractor/subcontractor maintenance support to maintain the test schedule. Maintainability indices derived from this test were, therefore, not indicative of those to be expected if the proper manuals and test sets had been available.

The M2 IFV and the M3 CFV were type-classified in February 1980 before the completion of DT II. The purpose of the continued testing was to verify fixes, to test production and second-source items, and to accomplish selected subtests not completed during DT II. DT IIA was initiated in August 1980 and completed in January 1981.

The prototype vehicles were used for testing (one IFV and one CFV). IFV 103 was operated for 4049 test km (2516 Mi) and fired 5170 25mm rounds, 14 TOW missiles, and 4912 7.62mm rounds. CFV (FV108) was the primary performance vehicle.

The Operational Test II (OT II), which began in September 1979 at Ft. Carson, CO, was completed in November 1979. Its purpose was to provide data and associated analysis on the operational effectiveness and suitability of the FVS prior to ASARC III. Four test vehicles accumulated 8,900 miles and fired 39 TOW missiles and 30,500 rounds of 25mm ammunition. Results of this test were provided to ASARC/DSARC III.

Because of Type Classification and production decisions from ASARC and DSARC respectively, and because of the design similarities of the IFV/CFV, a Force Development Test and Experimentation (FDTE) was approved for the CFV. This test, conducted at Ft. Knox, KY, from 2 June 1980 until 8 August 1980, validated tactical employment doctrine and techniques and assessed.

1.1 BACKGROUND (continued)

the adequacy of training literature. Five CFVs participated in the test accumulating 4751 miles, firing 28 missiles and 7.682 rounds of 25mm ammunition. Results of this test resulted in important redesign of the crew hatch and seating configurations.

One Fighting Vehicle (FV107) underwent vulnerability testing at APG from November 1980 to November 1981.

FA-PPT-C testing utilizing three production vehicles started on June 1981 and was completed on 5 March 1982. Over 18,000 miles were run and more than 36,000-25mm rounds were fired. Reliability goals for IPT-G were 240 MMBF: PPT-C experience was 309 MMBF. A number of performance tests were marginal or slightly below the requirements but due to the single sample tests and further evaluation it was deemed justifiable to start IPT-G and continue to work on design improvements and/or revise specification requirements when it became more cost effective to the government. This is currently part of the STS program.

IPT testing APG started on schedule on 15 June 1982. Seven production vehicles, six IFVs and one CFV, were being utilized in the conduct of this test. Five vehicles were run 6,000 RAM miles and fired 12,000-25mm RAM rounds each. One vehicle utilized to conduct automotive performance tests, and one to conduct weapons performance tests. After a slow start, due in part to test measurement and Diagnostic Equipment (TMDE) vehicle interface problems, testing was completed in July 1983.

A combined contractor/government test was conducted at YPG. Testing, utilizing a production vehicle, started on 1 March 1982, and included vehicle and weapons performance environmental, and desert conditions tests. In addition, a 1,500 mile durability test with periodic firings was planned. The production vehicle being utilized in this test was shipped to FMC, San Jose, CA, on 8 September 1982, to undergo modifications prior to a scheduled environmental test at the Cold Regions Test Center (CRTC) in Alaska. The vehicle arrived at CRTC on 3 October 1982, where it underwent testing through 15 March 1983.

Extended Comparison Production Test (EXT-CPT) was conducted at APG from April 1983 through June 1984 on one IFV and two CFVs. The purpose of this was to:

- a. Obtain additional data on system and subsystem reliability
- b. Compare existing vehicle quality with previous standards and reveal deficiencies of workmanship or materiel.
- c. Verify test data obtained during FA-IPT.
- d. Verify that corrective action on previously reported deficiencies and shortcomings have been accomplished and are adequate.

1.1 BACKGROUND (continued)

Production RAM Verification Testing (PRVT) is being conducted at APG on four M3 4th Year Production and on one M2 4th Year Production vehicle. Testing began in July 1984 and will be completed in April 1985. The objective of the test is:

- a. To obtain a measure of 4th Year Production reliability of transmissions, integrated sight units, and other critical components.
- b. To establish 4th Year Production System Reliability.
- c. To obtain additional maintainability data emphasizing the use of troubleshooting procedures and the use of TMDE.

1.2 DESCRIPTION OF MATERIEL

The BFVS is comprised of the IFV (M2) for use by the infantry as a troop carrier and the CFV (M3) for use by armor units as a scout vehicle. The vehicles have two-man turrets which incorporate the TOW anti-tank weapon, a 25mm automatic cannon, and an M240C coaxially mounted 7.62mm machinegun (mg). The TOW anti-tank guided missile (ATGM) system imparts the capability of defeating enemy tanks and other armored vehicles from a fully protected position. The 25mm automatic weapon is capable of engaging and defeating lightly armored vehicles and unarmored materiel and personnel. It has a dual feed capability which can deliver either high-explosive or armor-piercing projectiles at various rates of fire including single-shot, 100 spm, and 200 spm. The characteristics for the BFVS are in Table 1.2.1.

TABLE 1.2.1 MATERIEL DESCRIPTION

<u>Characteristics</u>	<u>Measurement or Type</u>
Personnel capacity, IFV	10
Personnel capacity, CFV	5
Engine make and model	Cummins VTA-903T
Displacement	903 in. ³ (14.8 L)
Type	4 cycle
Fuel	Diesel
Gross horsepower	500 (506 metric)
Transmission make and model	GE HMPT-500
Type	Hydromechanical
Steering	Hydrostatic
Brake Type	Multidisc, oil-cooled
Suspension type	Return roller
Springing media	Torsion bar
Nuber of wheels (duals)	6 per side
Wheel size	610-mm (24 in) diameter, 102mm (4 in) wide
Track type	Steel single pin with detachable rubber pad

TABLE 1.2.1 (continued)

Shock Absorbers	4 per side	
Number of shoes	84, left; 82, right	
Track pitch	152mm (6 in)	
Track width	533mm (21 in)	
Night vision sight, gunner	Thermal imagery	
Night vision sight, commander	Optical relay from gunner's sight	
Night vision sight, driver	ANVVS/2-3 Image Intensifier	
Turret armament	25mm automatic cannon, TOW missile launcher (2 tubes), 7.62mm M240C coaxial machine gun.	
Stabilization system	Electric	
Ring gear, pitch diameter	1524mm (60 in)	
XM231 submachinegun 5.56mm IFV only	6 ball-mounted firing port weapons	
Machinegun, M60, 7.62mm	1	
Rifles, M16A1, 5.56mm	10 (IFV), 5 (CFV)	
Grenade Launcher, 40mm M203	2	
	IFV	CFV
Ammunition capacity	Ready/stowed	Ready/stowed
25mm	300/600	300/1200
7.62mm (M240C)	800/1400	800/3600
7.62mm (M60)	2200 stowed	3200 stowed
5.56mm M193 (for M16A1)	2160 stowed	1460 stowed
5.56mm M196 (for M231)	4000 stowed	0
TOW missiles	2 in launcher	2 in launcher
TOW/Dragon missiles	5 stowed, any combination	10 TOW stowed
LAW (M72A2)	3 stowed	3 to 5 stowed
Generator:		
Amperes	220	
Volts	28	
Batteries	4, type 6TN, 100 A-hr, 12-V each; 2 type 2HN, 12-V each, for turret back-up emergency power	
Radio, IFV	AN/VRC-46, 1 set	
Radio, CFV	AN/GRC-160, 1 set	
	AN/PRC-12, 1 set	
	AN/PRC-77, 1 set	
Armor, (top and front slopes)	5083 aluminum	
Armor, (vertical sides and rear)	Spaced laminate armor	
Armor, (side slopes)	7039 aluminum	
Fixed fire extinguisher	3.2 kg (7 lb) halon in engine compartment	
	2.3 kg (5 lb) halon in personnel compartment	
Portable fire extinguisher	1.2 kg (2.75 lb) halon	

1.2.1 Infantry Fighting Vehicle

The IFV is a lightly armored track-laying vehicle that is to provide protected cross-country mobility, firepower to support mechanized infantry operations in mounted and dismounted roles, communications between all elements of the unit, and support to the main battle tank in combined-arms battlefield operations. The vehicle is to provide mobility to or through an objective using the vehicle's organic firepower and armor protection. In an offensive role, combat-equipped troops are able to exit rapidly without exposure to flat-Trajectory fire from forward of the vehicle. It will provide additional firepower to assist in an area-type defense against personnel and light armor and rapid movement during a retrograde operation.

1.2.2 Cavalry Fighting Vehicle

The CFV shall be employed as a transport and a fighting vehicle for regimental and divisional cavalry units and for maneuver battalion scout platoons. The CFV is identical to the IFV in its mobility and firepower characteristics. The only differences between the two vehicles are in the interior configuration, i.e., stowage and seating capacities, and the absence of firing ports for the 5.56mm firing port weapon. The cavalry missions of reconnaissance, security, movement to contact, etc., require differences in equipment which necessitate additional stowage requirements in terms of specialized equipment and increased ammunition. The CFV must facilitate only five squad members whereas the IFV must accommodate the ten-man infantry squad.

1.2.3 Test Maintenance and Diagnostic Equipment

The M2/M3 is supported by the following maintenance and diagnostic equipment:

- o STE M1/FVS, Simplified Test Equipment, is a portable electronic device used at the organizational maintenance level, capable of automatically testing and isolating faults within the turret and selected hull subsystems of the M2/M3 vehicles. STE has the diagnostic capability to identify and isolate malfunctions to a LRU (Line Replacable Unit). STE also displays information applicable towards intermediate (direct support or field) maintenance level troubleshooting from STE organizational maintenance level troubleshooting data. STE provides adjustment procedures for on-vehicle position sensing devices.
- o TSS-SE, TOW Subsystem/Support Equipment is a portable test set used at the intermediate or Direct Support maintenance level. The test set is capable of functionally verifying the operation of the TSS (TOW Subsystem) as a system on the M2/M3 vehicle. This verification meets the periodic maintenance test requirements of the TSS and serves to verify the effectiveness of repairs made to the TSS. This support equipment will fault isolate the TSS to its LRU and its subcomponents (ISU, CGE, PCU, and Launcher).
- o DSESTS M1/FVS, Direct support Electrical Systems Test Set, is a portable test set that is used at the intermediate maintenance level, capable of automatically testing and isolating faults within electronic assemblies removed from the BFVS hull and turret electrical system.

1.3 TEST OBJECTIVE

- 1.3.1 The objective of this test is to determine the effects of short term storage and the operation of the M2/M3 system in a humid tropic environment in terms of materiel degradation and performance, in accordance with the Basic Climatic Design Type (Constant and Variable High Humidity Daily Cycle, described in Army Regulation AR 70-38). Designated TMDE along with potential ammo stowage degradation will also be evaluated. Of prime concern are the potential degradations of electrical/electronics system and functional materials. Performance, RAM, and Safety considerations have been prior evaluated, thus while not a formal part of this test, the data will be provided. A Human Factors Test of Weapon Systems Loading is contained in Appendix G.
- 1.3.2 Two 10 week storage periods are planned to achieve the Basic Climate conditions defined in Army Regulation AR 70-30. The storage aspects of this test are important in terms of the degrees of degradations associated with the storage and operational scenarios. Due to the acceleration of the degradational effects of static materiel in tropic storage, the planned 10 week storage durations will allow for a significant change in the degradation of the vehicle systems and TMDE to evaluate their life cycles and still retain maintainability for further testing.
- 1.3.3 The Basic Climatic Conditions (Variable and Constant High Humidity Daily Cycles) are accomplished by utilizing two test sites in the Republic of Panama that are indicative to the conditions stated, and are presented below.

The Variable High Humidity Daily Cycle storage scenario will be conducted during the beginning of the wet season in the open, on the Pacific side of the Isthmus of Panama. The Variable High Humidity is achieved by the intermittent rainfall and the associated weather patterns typical to this location.

The Constant High Humidity Daily Cycle storage scenario will be conducted during the wettest period of the wet season under the CANOPY on the Atlantic side of the Isthmus of Panama. The Constant High Humidity is achieved by the effects created by the weather patterns typical to this area and the added effects incurred by the protection of the canopy.

1.4 SCOPE

- 1.4.1 USATTC will conduct a 9-month test of one 4th Year production M3 Cavalry Fighting Vehicle. This test will be conducted in the Republic of Panama at test sites representative of the Basic Climatic Design Type, Constant and Variable High Humidity Daily Cycle, described in Army Regulation (AR) 70-38.

1.4.2 The conduct of the test is itemized in the subparagraphs below and consists of contractor tests at San Jose, CA, prior to shipment to Panama plus the Operational and Diagnostic Tests both prior to and after the storage periods. The intention is to have all of the tests consist of the same specific tests to allow comparison of specific results as the test progresses from start to finish. Specific tests are listed in appendix A and shown in table 1.4.2 under each subparagraph of 1.4.2 in which they are to be performed.

- o 300 miles of operation
- o Time-on-Target Baseline Tests
- o Selected electrical and grounding circuit resistances
- o Armament Firing (25mm, 7.62mm and TOW)
- o Fire Suppression System Validation
- o TMDE Validation Tests
- o Validation of all vehicle subsystems

Details are included as Appendix A.

1.4.2.1 Contractor Baseline

In order to identify non-test related infant mortality failures and to establish a traceable TMDE baseline, the contractor (FMC) will conduct a three-week baseline test at Camp Roberts, and San Jose, CA., prior to shipment. Reference FMC Test Plan 10186.

1.4.2.1.1 TMDE Baseline and Health Check

This test will be done in addition to the factory pre-delivery TMDE check out. This will serve two purposes: 1) Establish a baseline with the same diagnostic equipment to be used at the Tropic Test Center and 2) Serve as a training/demonstration for the TTC personnel assigned to the Bradley program.

1.4.2.1.2 FMC 300 Mile Capability and Function Test

Ref: Table 1.4.2 for a list of each test and Appendix A for details of each test.

1.4.2.1.3 Post Contractor Capability Test: Baseline/TMDE Health Test, and Selected Electrical Tests

Ref: Table 1.4.2 and Appendix A.

1.4.2.2 TTC Pre Open Storage Testing

1.4.2.2.1 TTC - Receipt Inspection, Baseline TMDE Health Test and Selected Electrical Tests

Ref: Table 1.4.2 and Appendix A.

1.4.2.2.2 TTC - 300 Mile Capability and Functional Test

Ref: Table 1.4.2 and Appendix A.

1.4.2.2.3 Pre-Open Storage: Baseline TMDE Health Test and Selected Electrical Tests

Ref: Table 1.4.2 and Appendix A.

1.4.2.3 Open Storage

Ref: Table 1.4.2 and Appendix A.

- 1.4.2.4 Mid-Test
- 1.4.2.4.1 After Open Storage Inspection and Start-Up
Ref: Table 1.4.2 and Appendix A.
- 1.4.2.4.2 After Open Storage Baseline, TMDE Health Test, and Selected Electrical Tests.
Ref: Table 1.4.2 and Appendix A.
- 1.4.2.4.3 After Open Storage 300 Mile Capability and Functional Test
Ref: Table 1.4.2 and Appendix A.
- 1.4.2.4.4 Pre-Jungle Storage: Baseline, TMDE Health Tests, and Selected Electrical Test.
Ref: Table 1.4.2 and Appendix A.
- 1.4.2.5 Jungle Storage
Ref: Table 1.4.2 and Appendix A.
- 1.4.2.6 After Jungle Storage Tests.
- 1.4.2.6.1 After Jungle Storage Inspection and Start-Up
Ref: Table 1.4.2 and Appendix A.
- 1.4.2.6.2 After Jungle Storage: Baseline, TMDE Health Test, and Selected Electrical Tests.
Ref: Table 1.4.2 and Appendix A.
- 1.4.2.6.3 After Jungle Storage 300 Mile Capability and Functional Test.
Ref: Table 1.4.2 and Appendix A.
- 1.4.3 USATTC shall not be responsible to bring the vehicle to Class B condition prior to shipment.
- 1.4.4 RAM Evaluation is not a specific element of this test, however, EPRs will be written for all RAM related incidents and included in the final report. EPRs will not be scored for RAM and any RAM related evaluation will be of a qualitative nature only.
- 1.4.5 Safety evaluations are not specific elements of this test, however, EPRs will be written for all problems observed and included in the final report.
- 1.4.6 A Safety Assessment Report and a Safety Release required by AR385-16 will be provided by HQ, TECOM to USATTC. USATTC will not begin testing until these documents are received.

- 1.4.7 The test officer and the USATTC Environmental Quality Coordinator will assess the environmental impact of this test. An environmental assessment/impact statement will be composed if required. A record of environmental consideration will be made and filed in the test officer's project file.
- 1.4.8 Contractor personnel will supplement USATTC personnel as required. A trained military driver (TTC) with contractor gunner (FMC) will conduct the initial, mid and final 300 mile Capability Tests. A commander is TTC option. Basic contractor support consisting of one FMC Field Service Representative (FSR), one HAC technician/TSS-SE operator. Supplemental personnel for specific tests instrumentation work or problems will be furnished as required.
- 1.4.9 Normal PMCS will be performed by the military supplied crew. Equivalent organizational and direct support maintenance/repair will be performed by contractor personnel with the support of USATTC personnel and equipment.
- 1.4.10 Security classification of the M3 and its armament systems will be supplied to USATTC through HQ, TECOM.
- 1.4.11 Special Engineering tests may be conducted supplemental to the formal TTC test. Components may be installed in the vehicle by the contractors. These will be not functional and will be located so as to cause no interference to the formal test. These will be furnished and installed by the contractor and identified as elements separate from the Maintenance Support returned unopened to the contractor. Purpose of this test is to enable a quantification of corrosion growth rates and to measure potential performance degradation.
- 1.4.12 Material, Personnel and Support requirements are summarized in Appendix D.

1.5 SCHEDULE

Schedule Milestones (See Schedule for Dates)

- o Prepare for CR Test 300 Miles
- o Prepare for 300 Miles and Performance Test - Camp Roberts (completed 8 Feb 85)
- o Complete Performance Test - San Jose
- o Prepare for Shipment to TTC
- o Ship to TTC and Arrival Date
- o Complete Initial Baseline Check
- o Complete Open Storage
- o Complete Mid-Test Check
- o Complete Jungle Storage
- o Complete Test
- o Complete Shipment to San Jose
- o Complete Evaluation - San Jose
- o Draft Report
- o Final Report



PROJECT: TTC TEST VEHICLE
4TH YEAR NOV PROD VEHICLE-CFV

SHEET 1 OF 1
C.D. DECKER NOV 84

FUNCTION	1985 1 QTR	1985 2 QTR	1985 3 QTR	1985 4 QTR
RECEIVE INSPECT	JAN 4 W 10/12/85	MAY 10/17/85	AUG 10/15/85	NOV 10/15/85
PREP FOR CX TEST 300 MILES				
300 M & PERF TEST-CX				
COMPLETE PERF TEST-SAN JOSE				
PREPARE FOR SHIPMENT TO TTC				
SHIP TO TTC & ARRIVE				
TURN OVER TO TTC				
RECEIVE INSPECT				
PRE TEST CX				
CAPABILITY TEST #1				
BASE LINE CX				
OPEN STORAGE				
END TEST CX & CAPAB. TEST #2				
JUNBLE STORAGE				
BASE LINE CX				
CAPABILITY TEST #3				
PREP FOR SHIPMENT				
The Human Factors addition to the test plan will be integrated into this schedule by the TT-C Test Director.				
1986				
WEEK ENDING FRIDAY				
PREP FOR SHIPMENT				
SHIP TO SAN JOSE				
RECEIVE INSPECT-SAN JOSE				
EVALUATE-SAN JOSE				
DRAFT REPORT DUE				
FINAL REPORT DUE				

2.0 SHIPPING PREPARATION

- o Clean Vehicle
- o Repackage all BII
- o Repackage FMC Designated Repairable Items
- o Repackage unused Logistic Support Package
- o Assure all ammo is removed from vehicle
- o Remove 25mm gun ass'y and stow within vehicle in original container
- o Return all contractor furnished equipment to on-site contractors
- o Prepare and ship TM 55-2350-252-14

2.1 LOGISTIC SUPPORT

- o Initial Support Package

An Initial Support Package will be prepared by the contractor (FMC) and shipped with the vehicle. Because of the rapid response and capabilities of replenishment/replacement logistics, the Initial Support Package will be minimized to include only normal maintenance and known high demand items.

- o Replenishment Support

Replenishment will be accomplished from the contractor (FMC) through GBL on the Charleston, SC., to Howard AFB, Canal Zone military cargo flights. Emergency replenishment will be accomplished by commercial air carriers.

- o Returning Failed Parts

Parts being returned for failure analysis will be sent by contractor (FMC) personnel to the appropriate subcontractor. Shipping from Panama will be via GBL or commercial carrier if urgency dictates.

2.2 DATA/ANALYSIS REQUIREMENTS

The tropic test report will be an amalgamation of contractor-supplied baseline history data, contractor specific tests conducted and their analysis and USATTC test results. USATTC is responsible for final report. A status letter report will be supplied by USATTC to BFV PM no later than 30 days following completion of both Mid-Test and Final Test Capability Tests.

Contractor Supplied Data

- o Baseline STE-M1/FVS Results (FMC)
 - Pre-delivery
 - Pre-storage
 - Mid-test
 - Post-Storage Test
- o Baseline TSS-TS Records (HAC)
 - Pre-delivery
 - Pre-storage
 - Mid-Test
 - Post-Storage
- o Time-on-Target Data (FMC Test Plan 10186)
 - Pre-delivery
 - Pre-Storage
- o Electrical and Circuit Resistance Data (FMC)
 - Pre-delivery results
 - Instructions for Post-Test (See Appendix F)
 - Checks to be performed by USATTC (See Appendix F)
- o Fire Suppression Check Out (FMC)
 - Pre-delivery records
 - Post-storage records

2.2 DATA/ANALYSIS REQUIREMENTS (continued)

Contractor Supplied Data (continued)

- o TOW Flight Results (HAC)
- o Post Test Electrical and Circuit Resistance Data

USATTC Supplied Data

- o Receiving Inspection and Inventory Records
- o EPRs for all incidents and maintenance actions
- o All test records
- o TOW Missile Firing Forms
- o Human Factors and Safety Reports of all problems/hazards
- o Meteorological data at site during storage phase:
 - Total rainfall (nearest mm)
 - Ambient Air Temperature
 - o Maximum
 - o Mean
 - o Minimum
 - M3 Internal Air Temperature
 - o Maximum
 - o Mean
 - o Minimum
 - Ambient Relative Humidity
 - o Maximum
 - o Mean
 - o Minimum
 - M3 Internal Relative Humidity
 - o Maximum
 - o Mean
 - o Minimum
 - Total atmospheric salt fall (nearest 0.1 mg of Cl/M2)
- o Representative photographs and/or video recordings of all testing.
- o Photographs documenting any observed material deterioration or damage.
- o Narrative descriptions of unusual events or problems encountered.
- o Water barrier fabric and seam deterioration test data. Test per Appendix B.
 - Pre-storage
 - Mid-storage
 - Post-storage

2.2 DATA/ANALYSIS REQUIREMENTS (continued)

USATTC Supplied Data (continued)

- o Fuel sample analysis will be limited to measurement of water, fungus growth and sediment. Test per Appendix C. Samples will be analyzed:
 - Pre-storage
 - Mid-storage
 - Post-storage
- o AOAP analysis of lube samples taken during normal PMCS as specified in Lube Order.
- o Vehicle Usage Log
- o Gun Log Book

TABLE 1.4.2

FMC-SAN JOSE/CAMP ROBERTS			TROPIC TEST CENTER REPUBLIC OF PANAMA			
1.4.2.1 3 WEEK BASELINE TEST			1.4.2.2 PRE-OPEN STORAGE TEST			
1.4.2.1.1 o Baseline o TMDE o Health Test o Selected o Electrical o Tests o Preparation	1.4.2.1.2 300 Mile Capability & Functional Test (Performance)	1.4.2.1.3 o Baseline o TMDE o Health Test o Selected o Electrical o Tests	1.4.2.2.1 Receipt Insp. o Baseline o TMDE o Health Test o Selected o Electrical o Tests	1.4.2.2.2 300 Mile Capability & Functional Test (Performance)	1.4.2.2.3 Pre-Open Storage o Baseline o TMDE o Health Test o Selected o Electrical o Tests	1.4.2.3 Open Storage Empire Range 10 Weeks Pacific Side
A.1	-	-	A.1	-	-	
A.2	A.5	A.2	A.2	-	A.2	-
A.3	-	A.3	A.3	-	A.3	-
A.4	-	-	A.4	-	-	-
-	-	-	-	A.5	-	-
-	-	-	-	-	A.6	-
-	-	-	-	-	-	-
-	-	-	-	-	-	A.7
-	-	-	-	-	-	A.8

TABLE 1.4.2 (continued)

TROPIC TEST CENTER REPUBLIC OF PANAMA					
1.4.2.4 MID-TEST CHECK-OUT				1.4.2.5	
1.4.2.4.1 After Open Storage Inspect and Start-Up	1.4.2.4.2 After Open Storage: o Baseline o TMDE o Health Test o Selected Electrical Tests	1.4.2.4.3 After Open Storage: 300 Mile Capability & Function Test (Performance)	1.4.2.4.4 Pre-Jungle Storage: o Baseline o TMDE o Health Test o Selected Electrical Test	Jungle Storage Fort Sherman 10 Weeks Atlantic Side	
-	A.2	-	A.2	-	
-	A.3	-	A.3	-	
-	A.4	-	-	-	
-	-	-	-	-	
-	-	A.5	A.6	-	
-	-	-	-	-	
-	-	-	-	A.7	
-	-	-	-	A.8	
A.9	-	-	-	-	

TABLE 1.4.2 (continued)

TROPIC TEST CENTER REPUBLIC OF PANAMA					
1.4.2.6 AFTER JUNGLE STORAGE TESTS					PREPARE FOR SHIPMENT
1.4.2.6.1 After Jungle Storage Inspect and Start-Up	1.4.2.6.2 After Jungle Storage: o Baseline o TMDE Health Test o Selected Electrical Tests	1.4.2.6.3 After Jungle Storage: Capability & Functional Test (Performance)	1.4.2.6.4 After Jungle Storage: o Baseline o TMDE Health Test o Selected Electrical Test		
-	A.2	-	A.2	-	-
-	A.3	-	A.3	-	-
-	A.4	-	A.4.10	-	-
-	-	-	-	-	-
-	-	A.5	-	-	-
-	-	A.5 NOTE	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
A.9	-	-	A.10	-	A.11

Appendix A

This Appendix list specific tests to be conducted as part of the Bradley Tropic Test. SEE APPENDIX G FOR HUMAN FACTORS SUBTEST.

A.1 Receipt Inspection

- A.1.1 An inventory of each container/crate shall be performed and shortages listed as compared to the packing list. BII shall be inventoried and appropriate elements stowed on the vehicle.
- A.1.2 All damages, whether physical damage or the result of water shall be noted. Photographic coverage shall be at the discretion of the Project Officer.

A.2 Baseline Checks

The tests/inspections are to insure that all systems are functioning/operational prior to proceeding with the Capability tests, failures/descrepancies will be noted and repaired prior to proceeding with test. Before shipment the 13 LRU's will be run on FMC DSESTS set plus GFP DSESTS set destined for Panama. Printouts for record are required from both DSESTS tests run at FMC only. Retest following return to FMC at end of Panama test.

- A.2.1 Boresight Retention
- A.2.2 ISU Clarity and Night Sight Functionality (See Appendix E)
- A.2.3 Back-up Sight vision clarity (See Appendix E)
- A.2.4 Bilge pumps (4). (Back flushing is permissible--intent is to insure operation prior to storage)
- A.2.5 Proper ramp operation, use FRH fluid to refill
- A.2.6 Driver's Instrument Panel Indicators
- A.2.7 Weapon Control Panel
- A.2.8 Intercom (all stations)
- A.2.9 Deck clearance and interlock system (with and without override)
- A.2.10 Interior Lights
- A.2.11 Exterior lights including turn signals
- A.2.12 Fire bottles at acceptable charge pressure (record)
- A.2.13 Lo ammo indicators functioning
- A.2.14 Sight door operation
- A.2.15 Periscope clarity

Appendix A (continued)

A.2 Baseline Checks (continued)

A.2.16 Vent Fans (3)

A.2.17 Stab Drift

A.2.18 A fuel sample shall be taken from the fuel filter after approximately one hour of operation. Test per Appendix C.

A.3 TMDE Health Tests and Selected Electrical Tests.

A.3.1 Turret Health Check

o A health check of the turret, including TOW Subsystem shall be conducted to assure readiness.

A.3.1.1 STE-M1/FVS: Conduct Test 2500 and 2501

o These are "fast-run" tests intended for quick performance validation rather than fault isolation. Procedures are attached. Ref. TM9-2350-252-20-1 pg 3-1339 thru 3-1342. LRU's failed should be run on DSESTS and failure I.D. codes recorded for analysis.

A.3.1.2 TSS-TS:

o Hook-up Test Set: Ref. TM9-1425-474-34 pg 3-83

o Run Self Test: Ref. TM9-1425-474-34 pg 3-105

o Perform the following System Test Numbers:

- 1) Turret precondition
- 2) PCU
- 3) CGE
- 4) CGE LNCHR
- 5) ISU/ISU TOW Visual Module (TVM) and Night Vision
- 6) Basic Sight Assembly (BSA)
- 7) ISU/Super Elevation Mirror Servo

A.3.2 Electrical and Grounding Circuit Resistance check will be performed to assess shipping degradation and to form baseline for test. Specific details of test are Appendix F of this test plan.

Appendix A (continued)

- A.3.3 Deleted.
- A.3.4 The fire suppression system will be validated by FMC with check-out equipment obtained from SBRC and shipped with vehicle to Panama.
- A.4 Preparation for Capability Tests.
- A.4.1 Ballast shall not be installed, as it has insignificant effect on the purpose of this test.
- A.4.2 Radios and antennas shall be installed and internal/external communication checked.
- A.4.3 CVC helmet shall be issued to Driver, Gunner and Commander and functionality checked.
- A.4.4 The M242 cannon with its barrel shall be installed.
- A.4.5 The M240C (MAG-58 7.62mm) machine gun shall be installed.
- A.4.6 A full complement of 25mm TPT ammo shall be loaded in each ready round box. Actual loading will be deferred to appropriate time of firing during capability test.
- A.4.7 A full complement of 7.62mm ammo shall be loaded in the ready round box. The weapon shall not be loaded. Actual loading will be deferred to appropriate time of firing during capability test.
- A.4.8 Smoke grenades shall be loaded in the launchers. Rubber caps shall be installed. Actual loading will be deferred to appropriate time of firing during capability test.
- A.4.9 The M240C, M242 and TOW shall be boresighted.
- A.4.10 Cut the following samples from the water barrier.
1 - Warp & Fill Test Sample
1 - Tear Strength Sample
1 - Seam Sample

See Appendix B for details.
- A.4.11 Two boxes of unopened 25mm ammo (1 ea of AP and HE) shall be placed in the bilge storage space. Location and lot shall be recorded.

Two additional boxes of 25mm ammo (1 ea of AP and HE) that have been opened at both ends and re-closed shall be placed in the bilge storage space. Location and lot shall be recorded.

Appendix A (continued)

A.4 Preparation for Capability Tests. (continued)

A.4.11 Note:

This to be performed as part of TTC preparation Para 1.4.2.2.1 only. The ammo is to remain stowed in the vehicle throughout the two 10 week storage periods then fired during the conduct of test Para 1.4.2.6.3. (Ammo and Links should be inspected per Par., A.9.3).

A.5 Capability Tests

A.5.1 300-Mile Operation

- o A total of approximately 300 miles will be performed over established test course with the following.

Approximate Mix:

21% Paved
45% Secondary Road
34% Cross-Country

- o Details and sequencing, shall be at the discretion of the test Officer/Director/Engineer. Percentages of mileage may be revised to reflect less paved and more secondary road at the discretion of the test officer.
- o Insure drain plugs are installed and tightened closed prior to operation.
- o Approximately 50% of all operation will be performed with the stab system engaged and the ISU night sight ON.

A.5.2 25MM Gun System Firing

One ready box (300 rounds) 25mm TPT will be fired. The following capabilities shall be verified:

- Elevation from level to maximum allowable on range
- All firing rates: Single shot, Lo rate, Hi rate
GHS (Gunners Hand Station)
CHS (Commanders Hand Station)

Specific details of the preceeding are at Test Director discretion. An attempt shall be made to assess the cause of any stoppages before proceeding. Accuracy and dispersion is not part of Tropic Test and need not be recorded. Of particular interest is any evidence of degradation of the ISU, Back-Up Sight, tracking and boresight retention.

NOTE: After jungle storage the four boxes of ammo (HE and AP) stowed in the bilge area shall be opened and inspected per A.9.3. Photographs to show ammo condition should be made. Fire this ammo only following both open and jungle storage phases if ammo is determined to be servicable.

Appendix A (continued)

A.5 Capability Tests (continued)

A.5.3 7.62mm Gun System Firing

One ready box complement of 7.62 (800 rounds) will be fired. Elevation shall be from level to the maximum allowable on range. An attempt shall be made to assess the cause of any stoppages before proceeding. Accuracy and dispersion is not part of Tropic Test and need not be recorded.

A.5.4 TOW Missile Firing

Two TOW missiles will be fired, from the inboard tube. Minimum acceptable range is 1000 meters. Special instrumentation will be installed and monitored by contractor (HAC) personnel in order to identify any performance anomalies.

A.5.5 Smoke Grenade Firing

Eight smoke grenades will be fired to insure system functionality.

A.5.6 Time on Target

Time on Target capability of the system shall be tested through validation of the control, sighting and servo drive systems. This will be accomplished by measurement of the amount of time the gunner is able to maintain the gun on target (Time-on-Target) while traversing rough terrain. Measurement equipment, gunner and data reduction will be supplied by contractor (FMC). Data will be compared throughout the test to determine if degradation has occurred.

A.5.7 The engine exhaust smoke system shall be exercised to insure functionality.

A.5.8 Fire Suppression System

o Fire bottle pressure shall be verified and bottles replaced if below acceptable limits. A pan fire shall be ignited in the crew compartment. Automatic discharge of both crew compartment fire bottles shall be verified. Actuation and extinguishing times have been prior validated, thus need not be measured for this test.

A.5.9 Normal PMCS (including guns) will be performed during this phase. (Mark lube order to use FRH in ramp hydraulic system)

A.5.10 TMDE will be available as required. Test sets will be stored in the equivalent of normal tropic area maintenance facilities. Location and type of storage facility will be documented. All TMDE failure codes should be recorded for analysis.

Appendix A (continued)

A.6 Preparation for Storage

- A.6.1 Fill fuel tank to top with VV-F-800 DF2 or MIL-S-16884 Marine Diesel mixed with Stabilizer or additive per MIL-S-53021.
- A.6.2 Operate engine at a fast idle for approximately 15 minutes to assure complete preservative/fuel mixture.
- A.6.3 Operate smoke system for two minutes to insure preservative/fuel mixture in system.
- A.6.4 Operate vehicle heater for 10 minutes to insure preservative/fuel mixture in system.
- A.6.5 Insure batteries (vehicle and turret) are at 90 - 100% charge (S.G. reading). Replace if any cell is abnormally low.
- A.6.6 A fuel sample will be taken from the fuel filter. Test per Appendix C.
- A.6.7 The interior shall be washed of excessive mud accumulation. Hi pressure hose washing of turret or electrical components is not permitted. Low flow garden hose rinsing acceptable.

Normal PMCS (including guns) will be performed.

A.7 Configuration for Storage

- A.7.1 Hatches, ramp, ISU sight cover closed and locked.
- A.7.2 Water barrier stowed.
- A.7.3 All external OVE not stowed - Stow inside of vehicle.
- A.7.3.1 Engine stop control handle must be in full "OFF" position during vehicle storage. (Malfunction can cause crankcase oil dilution) See page 28E.
- A.7.4 Batteries disconnected - turn fire suppression switch OFF before disconnecting batteries.
- A.7.5 Bilge plugs (4) open - (2 main large plugs and 2 final drive pipe plugs). Course mesh screens shall be installed to permit drainage.
- A.7.6 TOW launcher canvas cover installed.
- A.7.7 M242 gun and Barrel installed.
- A.7.8 M242 muzzle plug installed.
- A.7.9 Gun chutes installed.
- A.7.10 Gun bag closed.
- A.7.11 25mm Ready boxes loaded with full complement of 300 rounds of TPT ammo, 230 rounds in the HE side and 70 rounds in the AP side.

Appendix A (continued)

A.7 Configuration for Storage (continued)

- A.7.12 Rotor rain cover installed.
- A.7.13 Gun at max depression.
- A.7.14 25mm Ammo Stowed in bilge. Ref. A.4.11.
- A.7.15 Full complement of 7.62mm ammo stowed in 7.62mm ready box.
- A.7.16 BII tarp installed over top of turret.
- A.7.17 Gun at maximum depression.

A.8 Storage Weekly Checks

Visual inspection will be performed at weekly intervals. Attention will be given to electrical, optical, cabling and gun system. All problems or abnormalities shall be documented. No operation, maintenance or corrective action will be performed during storage.

A.9 After Storage Inspection

- A.9.1 A detailed inspection shall be performed prior to starting. Attention will be given to electrical, electronic, optical, cabling and gun systems. All problems or anomalies shall be documented. Battery state of charge shall be measured (vehicle and turret).
- A.9.2 Starting shall be attempted with the batteries after initial inspection. Jump/slave starting if required is permissible if initial starting attempts are unsuccessful. Jump/slave starting will be documented in the test reports and interim letter reports.
- A.9.3 25mm & 7.62mm ready round ammo shall be visually inspected for evidence of swelling or corrosion. Defective rounds will be removed and links cleaned prior to firing. Gage 25mm links using link gage H.H.1. P/N 1470T01.
- A.9.4 The four bilge-stowed 25mm ammo boxes shall be opened and the ammo inspected, after jungle storage only. (REF A.4.11).
- A.9.5 A fuel sample shall be taken from the fuel filter after approximately one hour of operation. Test per Appendix C.
- A.9.6 The water barrier shall be erected and visually inspected for degradation. Samples of material shall be cut from the water barrier for degradation assessment. See Appendix B for details.
- A.9.7 All interior components shall be inspected for corrosion or mold growth.

Appendix A (continued)

A.9 After Storage Inspection (continued)

A.9.8 Special attention shall be given to the gun/gun mounting system for rust and corrosion.

A.10 Final Inspection prior to shipping

A final inspection shall be performed at completion of contractor and TTC tests. Particular attention should be addressed to possible loosening fasteners and sticking/binding mechanisms.

A.11 Shipping

Vehicle shipping configuration shall be as follows:

- o Fuel tanks drained to no more than 1/4 tank.
- o All external components shall be stored within vehicle.
- o All BII shall be stored within vehicle.
- o The M242 gun shall be stored within the vehicle in its (3) shipping containers.
- o Chutes shall be removed from the ammo cans, 25mm and 7.62mm and packed to prevent shipping damage.
- o Shipping guidance is provided per TM 55-2350-252-14.

The Logistics Support Package shall be shipped with the vehicle.

Appendix B
Water Barrier

Specification:

- o Material: Cloth, nylon, vinyl coated type I or type II. Spec MIL-C-43086, except weight to be 22.5 + 1.5 ounce per square yard and color to be olive drab to match No. 24087 of FED-STD-595, 60 inches wide. The coating material shall contain the mildew inhibitor specified in spec MIL-C-10799. The inhibitor content shall be tested according to the method specified by paragraph 4.3.6 of spec MIL-C-10799.
- o All seams, stitchings and stitches per FED-STD-751. All seams shall be waterproofed with adhesive/sealant. All seams shall be backstitched 1.00 minimum. Stitches to be Type 301, five to eight stitches per inch.
- o Window/fabric seam peel strength shall be 7.5 lb. per inch when pulled at 11.5-12.5 inches per minute.

Tests Required: (Test Method FED-STD 191)

o Material

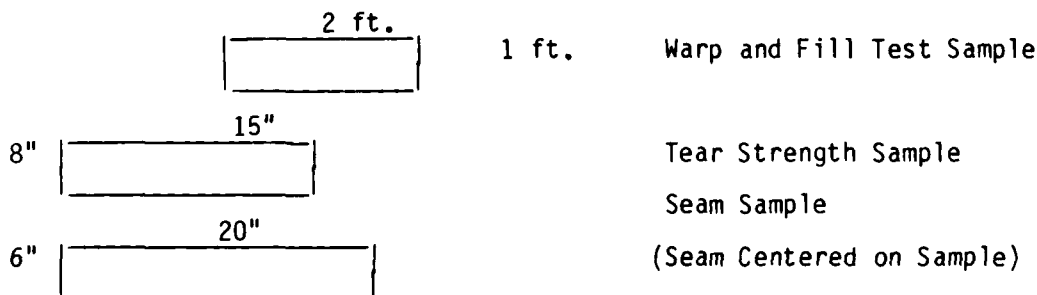
- Breaking Strength Warp
- Breaking Strength Filling
- Tearing Strength Warp
- Tearing Strength Filling
- Folding Cracking Resistance

o Seam/Stitching

- Breaking Strength

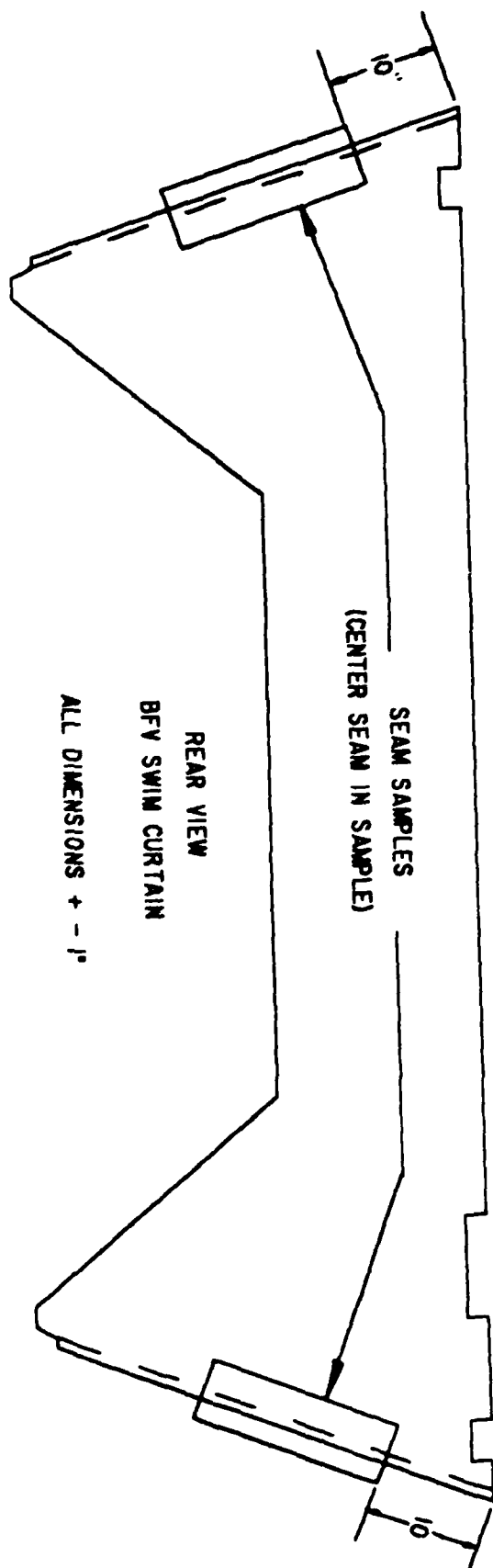
- o Window material tests are not required. The windows are being deleted from new production water barriers. Repair procedures are being developed to replace the windows with the vinyl coated nylon material.

Test Samples:



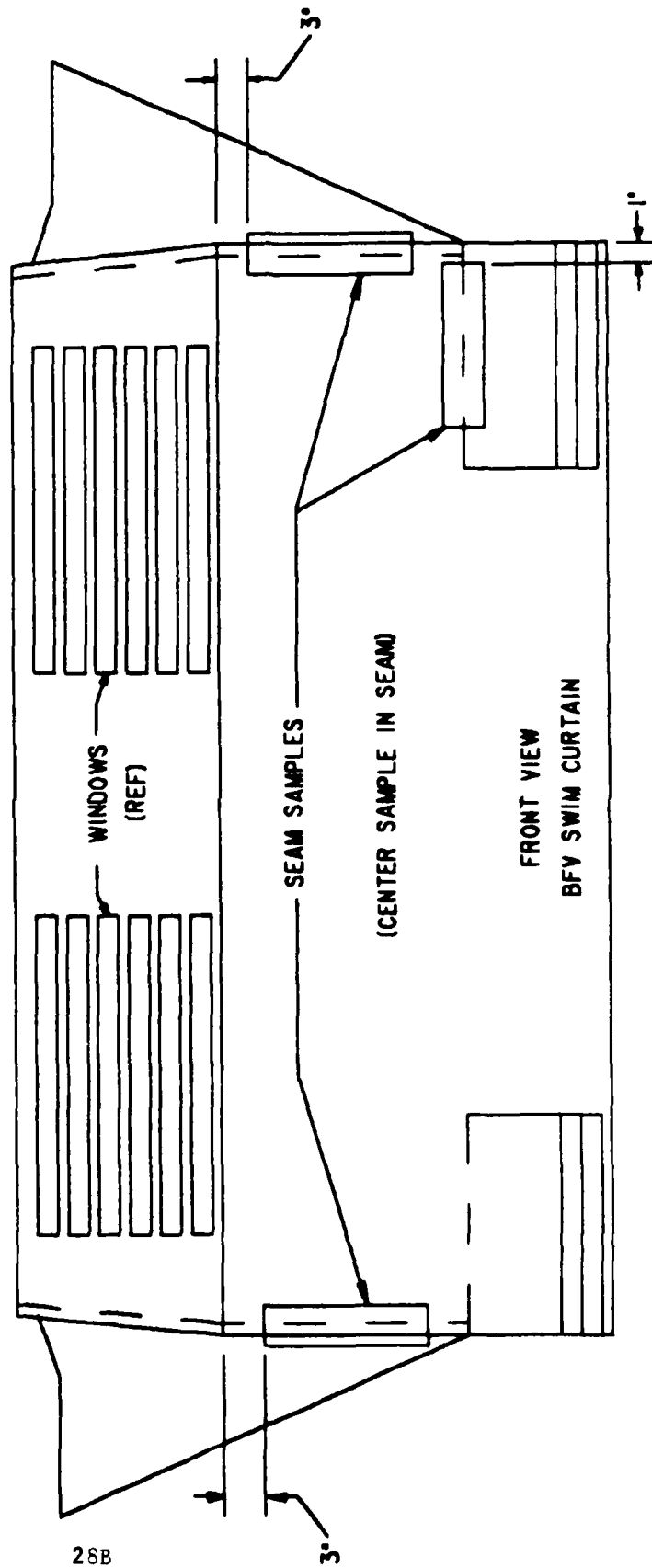
Initial Test Sample:

The 1st test samples cut from the water barrier during the contractor test will be sent directly to the TTC test officer for TTC materials lab testing to establish a baseline for potential degradation assessment.



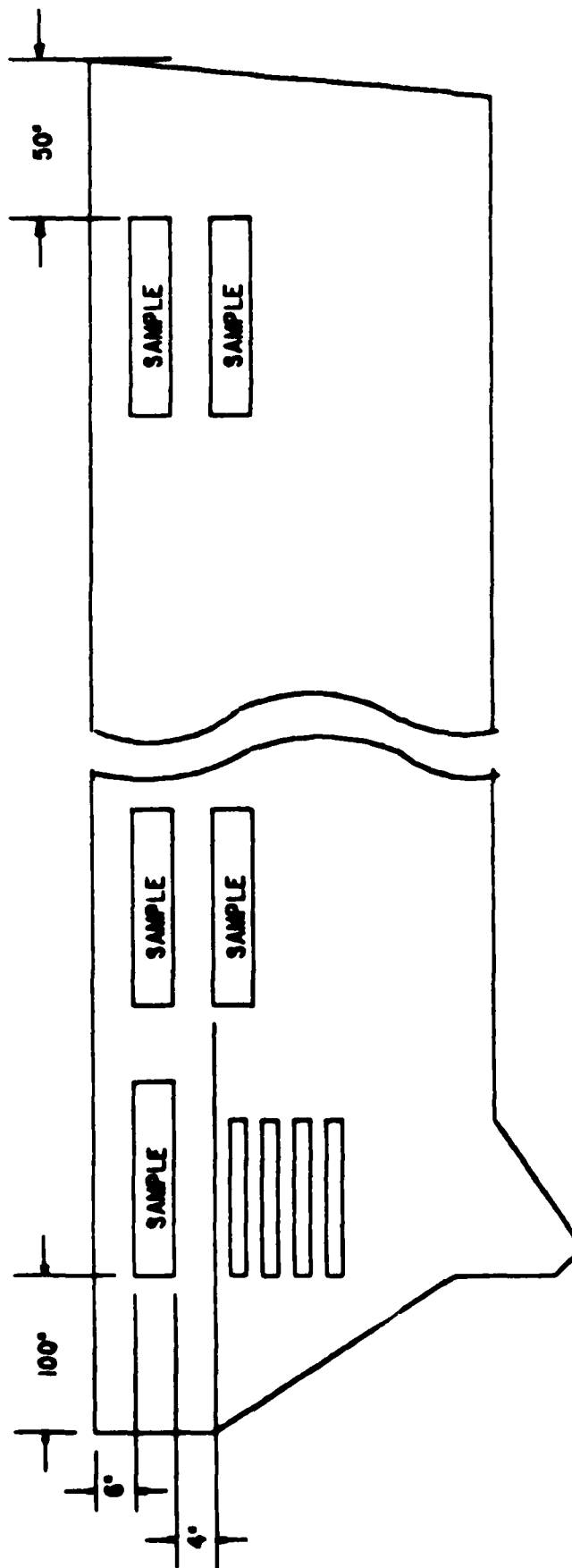
REAR VIEW
BFV SWIM CURTAIN
ALL DIMENSIONS $\pm .1"$

SAMPLE SIZE 6"X20"



SAMPLE SIZE 6"X20"

ALL DIMENSIONS + - 1"

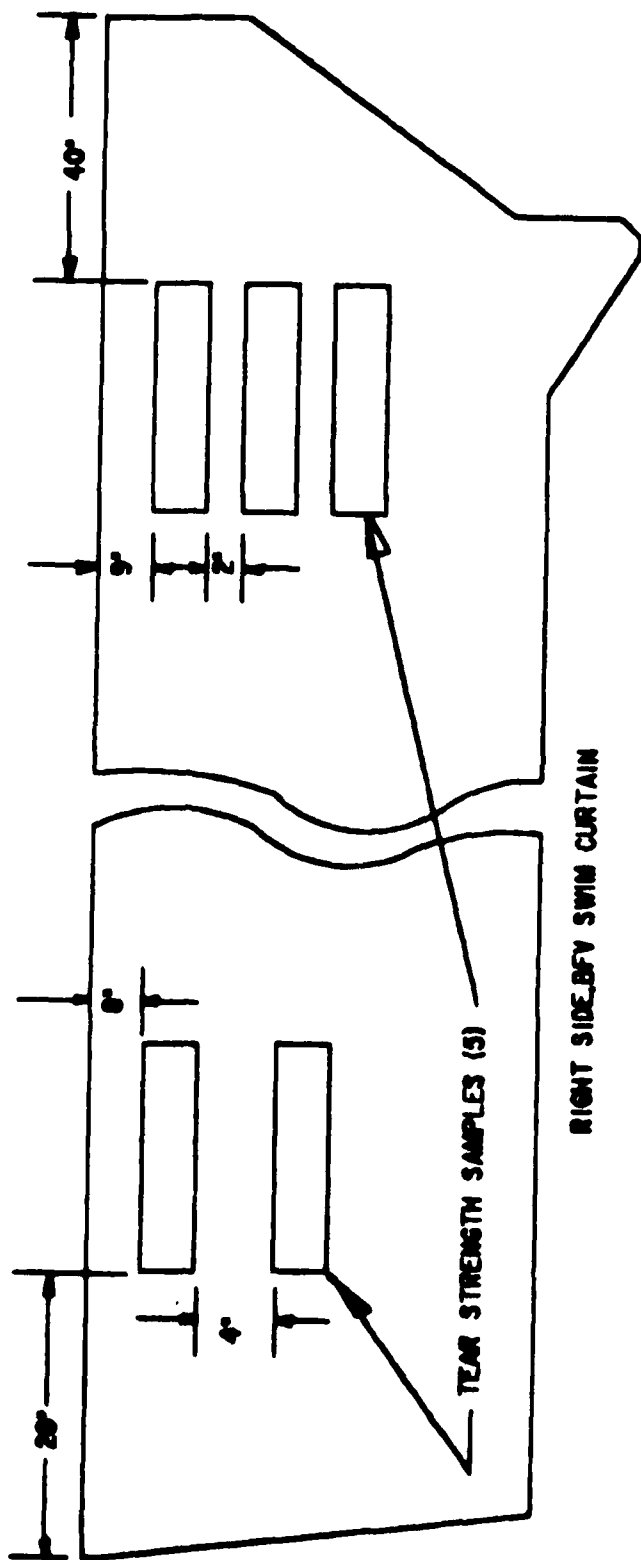


LEFT SIDE, BFTV SWIM CURTAIN

SAMPLE SIZE 14"X26"

ALL DIMENSIONS + - 1

WARP & FILL SAMPLE



ALL DIMENSIONS + - 1

NOT TO SCALE

SAMPLE SIZE 8"X15"



**BRADLEY FIGHTING VEHICLE
ENGINE START/STOP INSTRUCTIONS**

**MASTER POWER ON
TRANSMISSION SELECTOR IN NEUTRAL
PRESS FUEL CONTROL IN
AND START ENGINE**

**TO STOP ENGINE
PULL FUEL CONTROL ALL THE
WAY TO OFF UNTIL ENGINE
STOPS. THEN RELEASE BUTTON.**

DO NOT PUSH CONTROL BACK IN.

**TURN OFF ENGINE ACCESSORY SWITCH.
TURN OFF MASTER POWER SWITCH.
DO NOT CHANGE POSITION OF OTHER
SWITCHES AND CONTROLS.**

FMC/SAN JOSE MARCH 1985

Appendix C

Fuel

Fuel Specification:

VV-F-800 DF 2 or MIL-S-16884 Marine Diesel

Storage Additive:

Stabilizer Additive, Diesel Fuel per MIL-S-53021 shall be mixed with in-tank fuel during storage. Either of two qualified products may be used:

- BIOBOR JF NSN 6840-01-173-6940

U.S. Borax Chemical Corp.
3075 Wilshire Blvd.
Los Angeles, CA 90010

Mixture ratio: 270 ppm by volume (227 mg/liter)

FOA-15 (FSP-55) NSN 6850-01-167-4789

Amalgamated Coal & Petroleum Specialists, Inc.
9124 Erust Road
Fort Wayne, IN 46809

Fuel Tests Required:

- Particulates (1.2 micrometer, milligram/liter as tested per ASTM D2276)
- Water (%)
- Fungus, TT-C Determination

Appendix D

Support Requirements

1.0 Tropic Test GFE Required at TTC NLT 22 March 1985

<u>NSN</u>	<u>Description</u>	<u>Quantity</u>
1. 1305-01-092-0429	25mm TPT	1000 Rds. (In Plastic Boxes)
2. 1410-01-007-2508	TOW Missile	3 Rds. Inert War Head
3. 1330-01-002-0504	Smoke Grenades	24 Rds.
4. 1305-01-094-1035	25mm HE	60 Rds. (In Plastic Boxes)
5. 1305-01-092-0428	25mm AP	60 Rds. (In Plastic Boxes)
6. _____	TOW Missile Cannister	10 Ea.

2.0 Tropic Test GFE Required at FMC NLT 4 January 1985

1. 2350-01-049-2695 Vehicle S/N	M3-547 (CFV)	1 Ea.
2. 1410-01-007-2508	TOW Missile or	1Rd. Inert War Head
3. 1305-00-84-2150	7.62mm Ammo for M240C	As Req'd from STS Stock
4. 1040-01-070-1213	Grenade Launcher M-257 S/N	1 Set
5. 4910-01-112-9655 P/N 12310000	STE-M1/FVS S/N	1 Set
6. 4910-01-108-0442 P/N 13143600	TSS-SE S/N 2082 S/N 2082	1 Set
7. 4931-01-120-0764	DSESTS-M1/FVS, S/N 84309	1 Set Software DSP 5.2 (3/2/85)
8. 1305-01-092-0429	25mm TPT	As Req'd from STS stock
9. IC36-500K 4S	500 Amp Pwr. Supply	1 Ea. PM Action
10. HP 6269B	50 Amp Pwr. Supply	1 Ea. TTC Action
11. 1005-01-085-4758	M240-C Machine Gun	1 Ea. PM Action
12. 12328317	Missile Test Container	1 Ea. (Supports STE)
13. 4910-01-165-0500	Container (MTC) Fire Sup. Test Set S/N	1 Set

NOTE: All items 1 through 13 of GFE required at FMC, excluding 2, 3 and 8 will be shipped with the vehicle on 25 March 1985 to TTC.

Appendix D (continued)

3.0 Tropic Test to be Supplied by the Contractor

3.1 FMC Corporation

<u>Description</u>	<u>Quantity</u>
1. Deleted.	5 Gal.
2. FVS-SSP (including spare parts, manuals, extra fire extinguisher, and bottles for fixed systems)	See SSP Developed ILS List. FMC.
3. Time on Target Instrumentation	1 Set
4. Special Test Items	As Req'd
5. Deleted.	
6. Driver/Gunner/Mech	1
7. Electrician/TMDE	1
8. Time-On-Target Specialist (Eng'r)	1 (During T.O.T. baseline only)
9. FMC Field Service Representative	1 Ea.
10. Link Gage, 25mm. HH1 P/N 1470T01	1 Ea.

3.2 Hughes Aircraft Corporation

1. Tow Instr. Specialist/TSS-TS	1 Ea.
2. Instrumentation for Tow Firings	1 Ea.

3.3 GEOS

1. Turret Drive System Tech.	(On call)
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4.0 TTC Direct Supplied

1. CVC Helmets for Driver, Gunner, and Commander	3 Ea.
2. AN/VRC 46 Radio (including antenna, base and mount)	1 Set
3. Support Vehicles	As Req'd
4. Fire Extinguishers	As Req'd
5. Diesel Fuel	As Req'd (Approx. 1000 gallons)
6. Oil MIL-L-2104 (Xmsn oil 30Wt. above +90°F)	As Req'd
7. Grease - GAA	As Req'd
7a. Grease-Gun(for weapons) MIL-G-21164	As Req'd NSN 9150-00-754-2595
7b. Detergent NSN 7930-00-531-9715	As Req'd. (MIL-D-16791)

Appendix D (continued)

4.0 TTC Direct Supplied (continued)

<u>Description</u>	<u>Quantity</u>
7c. Stabilizer Additive, Diesel Fuel	As Req'd
8. Video Cameras	As Req'd
9. Cameras	As Req'd
10. Meteorological Equipment	As Req'd
11. Targets	As Req'd
12. Test Personnel	As Req'd
13. Human Factor Tech.	As Req'd
13a. Air Conditioned Van, 1/2 ton size	1 (For HAC equip.)
14. Photographer	As Req'd
14a. 115 VAC Power at TOW Range	1 (Approx. 1KW for HAC equip.)
15. Instrumentation Specialist	As Req'd

5.0 TTC/193d Infantry Battalion Supplied

1. M725 Ambulance	1 Ea.
2. M49C Fuel Tanker	1 Ea.
3. Recovery Vehicle	1 Ea.
4. LCM	1 Ea.
5. Security Personnel	As Req'd
6. Medics	As Req'd
7. Crew for LCM	As Req'd
8. Met Team	As Req'd
9. Recovery Vehicle Operators	As Req'd

Appendix D (continued)

CONUS Support Schedule

	<u>Event</u>	<u>Duration</u>
<u>CONTRACTOR (FMC)</u>		
Driver/Gunner/Mech Electrician/TMDE Sr. Field Service Rep. Engineer, Liaison	Start through Baseline	6 wks
	Mid-Test Check	6 wks
	Post-Test Check	6 wks
		A.R.
Time-on-Target Spec	Post-Test Special Test	2 wks
<u>CONTRACTOR (HAC)</u>		
Support/TMDE	Start through Baseline	6 wks
	Mid-Test Check	6 wks
	Post-Test Check	6 wks
<u>CONTRACTOR (GE)</u>		
	(On-Call)	A.R.
<u>Contractor (RCA)</u>	(On-Call)	A.R.
<u>Contractor (CHED)</u>	(On-Call)	A.R.

Appendix E

Vision Devices Optical Quality

1.0 Integrated Sight Unit Inspection

Perform a complete visual inspection of the ISU for evidence of moisture intrusion and fungus growth. Look through the periscope head day window, the unity window, and the commander's and gunner's eyepieces.

Using TSS-SE, perform a TOW subsystem verification test. During the course of this test two parameters dependent upon optical path quality will be checked:

1. Noise Equivalent Irradiance (NEI) - check of the tracker common portion of the day optics,
2. Minimum Resolvable Temperature (MRT) - check of the night optics.

At the end of the test, it is anticipated that HAC will perform a detailed inspection of all accessible components. Close attention should be given to identifying any evidence of moisture damage and/or fungus growth on optical elements.

2.0 Back-Up Sight Inspection

Perform a complete visual inspection of the backup sight for evidence of moisture and fungus growth obvious problems should be photographed. Verify the back-up sight tracks target and all adjustments including diopter can be made.

NOTE:

The ISU, backup sight, commander's relay and all vehicular periscopes will be subject to a visual clarity test. Baseline photographs will be taken at San Jose prior to shipment of the vehicle to USATTC. Copies of these photographs will be furnished to the USATTC Test Director along with light level and other necessary data. Attempting to duplicate this photo work is at the option of the USATTC Test Director.

Date _____

Test Sequence _____

Appendix F

Ground Circuit Resistance Testing

Objective: Determine the degradation of electrical/electronic systems with exposure to tropic environment.

This document establishes test procedures to accomplish the stated objective and specifically fulfill 1.4.2, bullet 3 of the basic test plan.

Equipment

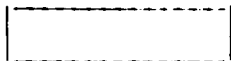
Milliohmeter, Hewlett-Packard Model #4328A
Probe cable, Hewlett-Packard #16143A
Test Lead adapter, Hewlett-Packard #16007A/B (Modified)
2 Ea. Test Leads, 5 Foot long with large clamps.
1 gun connector adaptor.

Vehicle Preparation

Prior to any measurements on the vehicle, place the Fire Suppression Switch in the manual position. Clean dirt accumulated and/or paint from the three ground references (see 1.1.0, 1.2.0, 2.0).

Equipment checkout

Zero the test meter before making any measurements. Do not allow loops to form in the test leads at any time during the test as it can influence the test meter reading. Measure resistance of the red and black leads clamped together and record the reading.

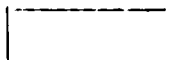


Note; The test vehicle was baselined at FMC/San Jose using the above specified Model Milliohmeter S/N 1828J06830.

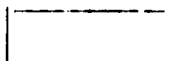
1.1.0 Procedure:

For the following tests, connect one test lead to the right rear bilge pump electrical ground stud on the hull. Connect the other test lead to the shell of the electrical connector (unless otherwise indicated) of the item being tested.

1.1.1 Right Rear Bilge Pump



1.1.2 Left Rear Dome Light - hull mounting screw nearest the on/off switch



Appendix F (continued)

- 1.1.3 Right Rear Dome Light - hull mounting screw nearest the on/off switch



- 1.1.4 Rear Hull Vent Fan - bottom mounting bolt nut, pointing rearward.



- 1.1.5 Slip Ring - rearmost mounting bolt

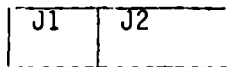


- 1.1.6 Fire Sensor Blocks The crew compartment contains three fire sensor blocks. One is located at the right rear near the ramp and two others are located on the ceiling behind the driver.



- 1.2.0 For the following tests, connect one test lead to the battery electrical ground stud for the vehicle batteries. This stud is located on the sponson near the drivers station. Connect the other test lead to the shell of the electrical connector (unless otherwise indicated) of the item being tested.

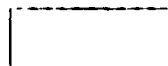
- 1.2.1 Fire Suppression Amplifier (Located on drivers forward bulkhead)



- 1.2.2 Forward Hull Vent Fan-bottom, forward mounting bolt to filter box

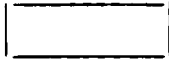


- 1.2.3 Vehicle Distribution Box - exterior metal surface of slave receptacle



Appendix F (continued)

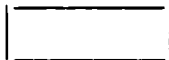
- 1.2.4 Drivers Instrument Panel - clamp to the panel between turn indicator and light switches



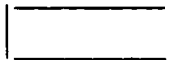
- 1.2.5 Drivers Dome Light - hull mounting screw nearest the on/off switch



- 1.2.6 Vehicle Battery - left rear battery negative terminal



- 1.2.7 Rear hull ground reference stud (ground stud for right rear bilge pump).



- 2.0 For the following tests, connect one test lead to the turret basket center ground stud located under the stepwell floorplate. Connect the other test lead to the shell of the electrical connector (unless otherwise indicated) of the item being tested.

- 2.1 Rear hull ground reference stud (ground stud for right rear bilge pump)



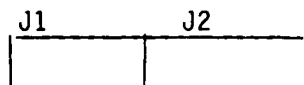
- 2.2 Encoder



- 2.3 Turret Battery - right side battery negative terminal



- 2.4 Power Converter Unit



Appendix F (continued)

- 2.5 Command Guidance Electronics - measure from ground wire mounting bolt.



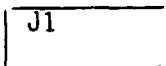
- 2.6 Turret Distribution box - cover screw above J4 connector



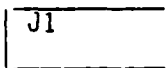
- 2.7 Relay Box - measure on J3 connector



- 2.8 Weapon Control Box



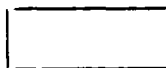
- 2.9 Turret Control Box



- 2.10 Turret Gyro - bottom mounting bolt.



- 2.11 Commanders Hand Station

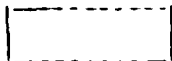


- 2.12 Gunners Hand Station



Appendix F (continued)

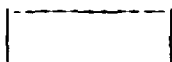
- 2.13 Azimuth Drive - ground strap bolt on the drive



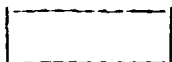
- 2.14 Commanders Dome Light - hull mounting screw nearest the on/off switch



- 2.15 Gunners Dome Light - hull mounting screw nearest the on/off switch



- 2.16 TOW Control Box/ Annunciator - left mounting screw holding the two units together



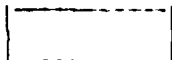
- 2.17 Integrated Sight Unit-(4 connectors)

Front	Mid	Back	Test

- 2.18 Electronic Control Assembly - measure from connector shells J1 through J9 plus from the ground strap bolt on the ECA

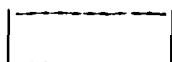
J1	J2	J3	J4	J5	J6	J7	J8	J9	gnd. bolt
----	----	----	----	----	----	----	----	----	-----------

- 2.19 Gun Elevation Drive - ground strap bolt on the drive



- 2.20 For the following test, disconnect the meter test lead from the ground reference stud

2W10 Gun Connector (25mm Gun) Measure between pin A and pin J using adaptor connector. Push in on connector pins A and J of adaptor connector to insure good contact when mated



The test is now complete. Be certain all measurements have been recorded.

Appendix G

HUMAN FACTORS SUBTEST PLAN

1. Purpose

The purpose of this test is to measure and document specific HFE time and error data of each functional exercise specified in Reference 14a of this plan. This test is not intended to impact Appendix A, preparation for capability test or preparation for storage test or stowage configuration. Human Factors aspects of firing, turret and vehicle operation shall be collected from the TTC Driver/Gunner by the TTC test director.

2. Scope

The time required to load the M3 Bradley (CFV) weapon systems with ammunition in a tropic environment will be determined. Individual time will be recorded for loading the HE and AP sides of the 25mm Gun System, loading of the 7.62mm coaxial machine gun and the TOW Missile Launcher (TML).

This loading exercise should be accomplished one time during the Phase 1 and one time during the Phase 3 portion of the tropic test. Video documentation of entire loading exercise is requested.

3. Personnel

The ability of vehicle crewmen to perform critical weapon loading tasks while dressed in standard fatigues will be determined.

Appendix G (continued)

Human Factors Subtest (continued)

The commander, gunner, and driver will wear the DH-132 CVC helmet and the squad members will wear the protective-armor system for ground troops (PASGT) (helmet and vest) with load-bearing equipment (LBE).

MOS-qualified military personnel, trained and experienced in the operation of the vehicle and its associated weapons, will perform the following exercises in a partially stowed vehicle. These personnel will be furnished by TECOM/APG.

4. Test Procedure

4.1 Ammunition Stowage

The 25mm ammunition shall be placed in the vehicle squad compartment, the 7.62mm ammunition shall be stowed in the Vehicle Left Side Interior, the weighted TOW missile cannisters shall be stowed in the vehicle. All of the above stowage locations are illustrated in appendix E of operations manual TM 9-2350-252-10-1.

4.2 Criteria

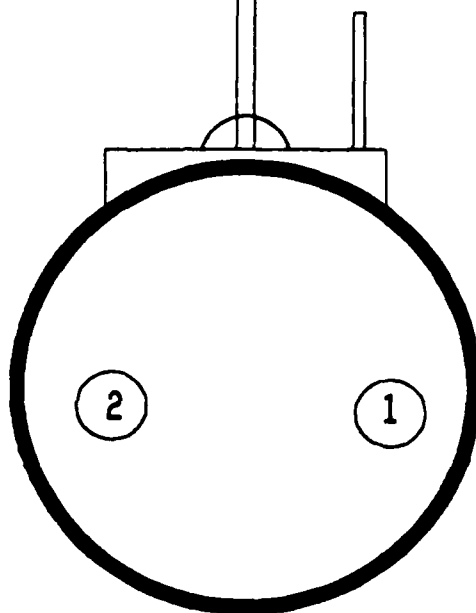
The loading of the 25mm AP and HE ammunition READY boxes plus the 7.62mm coaxial machine gun shall be accomplished concurrently to the greatest extent feasible. Ammunition handling/loading will be conducted during daylight. The M3 crew- and squad-seating arrangement during these exercises is shown in figure -1 (page 41A)

4.3 The 7.62-mm Coaxial Machinegun Loading

Turret/weapon systems will be positioned at 0° in azimuth and elevation. Timing will begin when the commander and squad member No. 4, seated in their respective stations, are cued to commence 7.62-mm machinegun loading. Squad member No. 4 will then remove 7.62-mm ammunition from stowage, check alignment, and hand ammunition through the turret opening to the commander. Time is stopped when a full complement of 800 rounds has been loaded into the 7.62-mm ready-ammunition container and the lead rounds have been forwarded up to the weapon.

RES 5-21-85

3



4

5

FIGURE 1

CREW AND SQUAD SEATING POSITIONS (CFV)

PAGE 41A

APPENDIX G TROPIC TEST PLAN

Appendix G (continued)

Human Factors Subtest (continued)

4.4 TOW Missile Loading

Turret will be rotated, and TOW launchers elevated to their designated positions for TOW loading prior to conduct of the timed run. Timing will begin when squad members No. 4 and No. 5 are cued to commence TOW loading. Squad member No. 4 will then open and secure the cargo hatch in the TOW-loading position and begin to remove and discard empty canisters from TOW launcher (assuming previous TOW fire). At the same time, squad member No. 5 removes the first missile from its stowed position and hands it to No. 4 who raises and loads the missile into the launcher. Procedure is repeated for the second missile. Time stops when cargo hatch is closed and latched.

4.5 The 25-mm Automatic Cannon Loading

Turret will be rotated to the right or left for positioning to upload/download HE or AP ammunition, respectively, prior to commencement of the timed run.

4.5.1 Uploading

Timing will begin upon cue to load 25-mm HE or AP ready-ammunition containers, at which point squad member No. 5 unstows 25-mm ammunition, links, and checks alinement. Squad member No. 4, having removed the container door, loads the ammunition that is handed to him by No. 5, counting rounds to obtain the required number within each vertically hung row. Squad member No. 5 continues to link and check alinement of ammunition. Time is stopped when a full compliment of HE (230) or AP (70) rounds have been loaded into the respective ready-ammunition containers, and squad member No. 4 has replaced and latched the container door.

Appendix G (continued)

Human Factors Subtest (continued)

4.5.2 Downloading

HE or AP ammunition has been forwarded up through the respective chutes; and no rounds are present in the feeder.

Timing will begin upon cue to download. The gunner will then begin to ratchet the rounds down through the feed chutes. Squad member No. 4, having removed the ammunition container door, pulls the rounds from the railings. Squad member No. 5 assists from behind. Timing is stopped when all rounds have been removed from the feed chutes and the ready ammunition container, and the container door is replaced and latched.

5. Safety Requirements

All of the safety requirements in the M2 and M3 Safety Statement, operators manual TM 9-2350-252-10-1 and TM 9-2350-252-10-2 shall be the topic of a safety meeting. This meeting, conducted by the tropic test center Bradley vehicle test director shall be conducted for the personnel used as the weapon systems loading crew. In addition to the TM safety requirements, the weapon system loading crew should be advised of the peculiarities of working in the TTC environment.

5.1 Reliability and Maintainability (RAM)

RAM is not a specific element of this HFE portion of the overall TTC test however EPRs should document all RAM related incidents and be included in the final report.

Any incident or condition that would invalidate the results of this HFE test should be recorded along with the time delay incurred.

Appendix G (continued)

Human Factors Subtest (continued)

6. Changes in Schedule and Scope

The HF Test Director may change the scope of work by making additions or deletions, revise the schedule or order of exercises or make other appropriate changes with concurrence of the Bradley PM Office. Such changes can be made as required to accomplish the HF test goals as may be impacted by availability of test parts or severe environmental conditions.

7. Documentation

- A. Recording of weapon system loading exercise times should be documented on appropriate forms and included in the final Tropic test report for the Bradley vehicle. Time and error data shall be recorded.
- B. Completed interview guides from each crew member for each exercise. STEAP-MT Form 402 Questionnaire as applicable or other documentation designated by the HF Test Director.
- C. These data from the various HFE tests will be used to evaluate the test criteria.
- C.1 The subjective data from the questionnaires, check lists, and user comments will be used to supplement the objective data.

Appendix G (continued)

Human Factors Subtest (continued)

7.1 Subjective Evaluation.

Questionnaires. Human factors questionnaires will be administered to all crew and squad personnel assigned to operate the vehicle. Questionnaires will be administered near the end of the test cycle so that all personnel will be thoroughly experienced with vehicle operations.

Questionnaires will pertain to the operation of the driver, gunner, commander, and squad stations.

Comments and informal interviews, in addition to HFE observations, will be documented throughout HFE testing to gain additional subjective input to the HFE assessment of the vehicle. These interviews, comments, and observations may be used to augment the data from other HFE subtests and will be integrated into the analysis of the test item.

8. Equipment Requirements

1 ea. Bradley M3 vehicle (M3-547, (Partially Stowed)
10 ea. TOW Missile Cannisters Ballasted to 62.5 LBS.
300 ea. Rounds of TPT 25mm ammo
800 ea. Rounds of 7.62mm ammo

9. Personnel Requirements

Designated by APG TECOM Test Director

Appendix G (continued)

Human Factors Subtest (continued)

10. Personnel Clothing Requirements

Helmet and vest, personnel armor system ground troops (PASGT) Battle dress uniforms (BDU's) (Personal property of crew) Quantity of sets to be determined by HF Test Director.

11. Instrumentation Requirements

Temperature, humidity and solar load measurement (intended to monitor at 10 minute intervals during weapon loading tests) record temperature and humidity inside and outside vehicle.

12. Video/Photographic Requirements

Video cameras and 35mm cameras as needed for following:

- a. Record each weapon system loading exercise on video tape.
- b. Photograph particular difficulties encountered.

Appendix G (continued)

Human Factors Subtest (continued)

13. Crew Profile

Anthropometric measurements (Weight and Height) and demographic data (MOS and BFV Experience) for loading crew members shall be recorded.

14. References

This subtest Appendix G was prepared from the following:

- a. TWX, TECOM APG/BFVS PMO, HF Subtest, Apr 85.
- b. Meeting at FMC on 5-2-85 on subject matter.
- c. Computer Letter #1017, FVS. PA/FMC, Gasparski/Scott, 5-13-85.
- d. Draft HFE Plan, TECOM, APG Received 5-21-85.

Appendix H
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