TECHNICAL REPORT RD-SS-01-08

# INTEGRATED VIRTUAL ENVIRONMENT TEST CONCEPTS AND OBJECTIVES

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**March 2001**


U.S. ARMY AVIATION AND MISSILE COMMAND
*Redstone Arsenal, Alabama 35898-5000*

## REPORT DOCUMENTATION PAGE

| 1. REPORT DATE (DD-MM-YYYY) | 2. REPORT TYPE | 3. DATES COVERED (FROM - TO) |
|---|---|---|
| 01-03-2001 | Final | xx-xx-2001 to xx-xx-2001 |

| | |
|---|---|
| **4. TITLE AND SUBTITLE**<br>Integrated Virtual Environment Test Concepts and Objectives<br><br>Unclassified | **5a. CONTRACT NUMBER** |
| | **5b. GRANT NUMBER** |
| | **5c. PROGRAM ELEMENT NUMBER** |
| **6. AUTHOR(S)**<br>Tackett, Gregory B. ; | **5d. PROJECT NUMBER** |
| | **5e. TASK NUMBER** |
| | **5f. WORK UNIT NUMBER** |
| **7. PERFORMING ORGANIZATION NAME AND ADDRESS**<br>Commander, U. S. Army Aviation and Missile Command<br>Missile Research, Development, and Engineering Center<br>ATTN: AMSAM-RD-AS-SS<br>Redstone Arsenal , AL 35898-5000 | **8. PERFORMING ORGANIZATION REPORT NUMBER** |
| **9. SPONSORING/MONITORING AGENCY NAME AND ADDRESS**<br><br>, | **10. SPONSOR/MONITOR'S ACRONYM(S)** |
| | **11. SPONSOR/MONITOR'S REPORT NUMBER(S)** |

**12. DISTRIBUTION/AVAILABILITY STATEMENT**
A
PUBLIC RELEASE

,

**13. SUPPLEMENTARY NOTES**

**14. ABSTRACT**

In preparation for the Rapid Force Projection Initiative (RFPI) Advanced Concept Technology Demonstration (ACTD), a series of integration and verification tests were conducted to provide development milestones for the simulation architecture and tools that would be needed for the full-up live/virtual field experiment. These tests fell into two types: RFPI Integrated Virtual Environment Tests (RIVET), and Multiple Semi-automated Forces Integration Tests (MSFIT). The objectives of these test series ensured the necessary maturity of the simulation architecture during the three years prior to the execution of the final experiment. This document provides the test concepts and objectives for these series, along with the scheduled integration events to execute them.

**15. SUBJECT TERMS**

Simulation; DIS; RFPI; VV&A; RIVET; MSFIT; Correlated Terrain

| **16. SECURITY CLASSIFICATION OF:** | | | **17. LIMITATION OF ABSTRACT** | **18. NUMBER OF PAGES** | **19a. NAME OF RESPONSIBLE PERSON** |
|---|---|---|---|---|---|
| | | | | | Fenster, Lynn<br>lfenster@dtic.mil |
| **a. REPORT**<br>Unclassified | **b. ABSTRACT**<br>Unclassified | **c. THIS PAGE**<br>Unclassified | Public Release | 23 | **19b. TELEPHONE NUMBER**<br>**International Area Code**<br>**Area Code Telephone Number**<br>703 767-9007<br>**DSN** 427-9007 |

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# REPORT DOCUMENTATION PAGE

*Form Approved*
*OMB No. 074-0188*



| 1. AGENCY USE ONLY | 2. REPORT DATE | 3. REPORT TYPE AND DATES COVERED |
|---|---|---|
| | March 2001 | Final |

**4. TITLE AND SUBTITLE**
Integrated Virtual Environment Test Concepts and Objectives

**5. FUNDING NUMBERS**

**6. AUTHOR(S)**
Gregory B. Tackett

**7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**
Commander, U. S. Army Aviation and Missile Command
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Redstone Arsenal, AL 35898-5000

**8. PERFORMING ORGANIZATION REPORT NUMBER**
TR-RD-SS-01-08

**9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)**

**10. SPONSORING / MONITORING AGENCY REPORT NUMBER**

**11. SUPPLEMENTARY NOTES**

**12a. DISTRIBUTION / AVAILABILITY STATEMENT**
Approved for Public Release, Distribution Unlimited.

**12b. DISTRIBUTION CODE**
A

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**15. NUMBER OF PAGES**
23

**16. PRICE CODE**

| 17. SECURITY CLASSIFICATION OF REPORT | 18. SECURITY CLASSIFICATION OF THIS PAGE | 19. SECURITY CLASSIFICATION OF ABSTRACT | 20. LIMITATION OF ABSTRACT |
|---|---|---|---|
| UNCLASSIFIED | UNCLASSIFIED | UNCLASSIFIED | UNLIMITED |

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18
298-102

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# I. INTRODUCTION

In preparation for the Rapid Force Projection Initiative (RFPI) Advanced Concept Technology Demonstration (ACTD), a series of integration and verification tests were conducted to provide development milestones for the simulation architecture and tools that would be needed for the full-up live/virtual field experiment. These tests fell into two types: RFPI Integrated Virtual Environment Tests (RIVET), and Multiple Semi-automated Forces Integration Tests (MSFIT). The objectives of these test series ensured the necessary maturity of the simulation architecture during the three years prior to the execution of the final experiment. This document provides the test concepts and objectives for these series, along with the scheduled integration events to execute them.

# II. RFPI INTEGRATED VIRTUAL ENVIRONMENT TEST I (RIVET I) CONCEPT AND OBJECTIVES

## A. Purpose

The RIVET was an engineering test of the virtual environment developed in support of RFPI and RFPI related activities. The purpose of the test was to characterize the evolving capabilities of this virtual environment. This characterization supported risk mitigation for participation in the Anti-Armor (A2) ATD Experiment #6 and follow-on RFPI virtual experiments, Verification, Validaiton, & Accreditation (VV&A) of virtual components, and final definition of simulation scopes and budgets for FY96. It was not intended to be a complete VV&A test of virtual components including statistically significant sample sizes. The primary focus of this test was to ensure that each of the virtual components under development could function together in an integrated environment, and to highlight further development required for functions that could not be integrated at the executed time.

## B. Approach

The RIVET was conducted over a three-day period at the end of August 1995. The test was limited to the Missile Command (MICOM) Distributed Interactive Simulation (DIS) Local Area Network (LAN), specifically between the Battlefield Environment Weapon System Simulation (BEWSS) Test Bed (BTB) and the DIS Center (DISC). Simulators residing at other installations were not included in the test. The data and conduct of the test was unclassified, using surrogate data as required. This test was done within the support defined in the FY95 System Simulation & Development Directorate (SS&DD) Scope of Work (SOW) for RFPI. Engineer operators were utilized in lieu of soldier participation due to the nature of the test and to avoid conflict with A2 ATD troop requests. Specific RFPI-related simulators were invited to participate in the test based on availability at no cost.

## C. Responsibilities

The RIVET was conducted jointly by BTB and DISC personnel. The DISC Point of Contact (POC) was responsible for coordination of all DISC participating reconfigurable simulators including two copies of the Hunter VPS and potentially Javelin and TOW. The BTB

POC was responsible for coordination of all BTB participating components including the terrain database, Operations Management Cell, Modular Semi-Automatic Forces (MODSAF), Aerial Scout Sensor Integration (ASSI) stimulator, Enhanced Fiber-Optic Guided Missile (EFOG-M) stimulator, Intelligent Minefield (IMF) emulator, Battlemaster, data logging and analysis, video, and potentially TACAWS and Ballistic Aerial Target (BAT). Responsibilities for stealth view and other functions that were not supportable purely at one facility were shared and coordinated between the BTB and DISC. Test plans, procedures, and documentation were developed jointly between the BTB and DISC. The RFPI Analysis POC was responsible for providing the RFPI Command and Control Testbed (RC2T), defining message sets and encode/decode routines, coordinating the interface with the SINCGARS simulator, and reviewing detailed plans and procedures involving the RC2T. The RFPI Simulation Manager was responsible for developing detailed objectives, approving test plans and procedures, providing Single Channel Ground and Airborne Radio Systems (SINCGARS) simulators from Simulations, Training and Instrumentation Command (STRICOM), and coordinating Army Material Systems Analysis Activily (AMSAA) and STRICOM oversight.

## D. Objectives

The RIVET detailed objectives were as follows:

1. **Confirm A2 ATD Experiment #6 Terrain Database Correlation.** Through pre- or post-test analysis, and use of the database during the test, confirm that the four versions of the terrain database (Multigen Flight, E&S MIP, S1000 Vistaworks, and CTDB) have a one-for-one correlation between vertices, and have consistent features and textures to support a level-playing field. The measures of performance are:

    a. Pre-test vertex-to-vertex comparison of terrain skins for all four database formats using IST or in-house tools.

    b. Measured graphical throughput of the Multigen Flight version on the Hunter VPS, and the Multigen Flight and Vistaworks versions on stealth during the test to determine adequacy of levels of detail on real-time platforms.

    c. SME review of side-by-side stealth views in Multigen Flight and Vistaworks formats throughout the test to determine consistency of visual appearance (visual textures only, unless IR textures available in timeframe), special effects, feature placement, and moving model interaction with terrain.

    d. SME review of pre- or post-test, side-by-side Three-Dimensional (3-D) views between Multigen Flight and E&S MIP formats to determine consistency of visual appearance (visual and IR textures) and feature placement. (This could be done in stealth view during the test in conjunction with 1.3 if a real-time E&S engine is available.)

2. **Confirm Performance of New MODSAF Representations.** Through comparison to truth data and implemented BEWSS performance data, given the constraint of an unclassified exercise without statistically significant numbers of data points, confirm the functionality and performance of each individual MODSAF representation throughout engagements consistent with the A2 ATD Experiment #6 scenario. The measures of performance are:

    a. Demonstration of the ability of each new MODSAF system to engage targets using the red and blue positions and routes from the HRS 33.7 scenario.

    b. SME stealth review of moving models representing new MODSAF systems to identify anomalous behaviors.

    c. Measured engagement timelines for each new MODSAF system compared to truth and BEWSS data.

    d. Post-processed analysis of entity state, fire, and detonate PDU's compared to expected functionality.

3. **Support Hunter VPS and IMF Emulator VV&A.** Through comparison to truth data and implemented BEWSS performance data, given the constraint of an unclassified exercise without statistically significant numbers of data points, confirm the functionality and performance of the two Hunter VPS's and IMF Emulator throughout engagements consistent with the A2 ATD Experiment #6 scenario. The measures of performance are:

    a. Demonstration of the ability of Hunter VPS and IMF emulator to interact with targets using the red and blue positions and routes from the HRS 33.7 scenario.

    b. SME reviews of moving models in stealth and operator/simulator interactions during test to identify anomalous behaviors.

    c. Measured engagement timelines for Hunter VPS and IMF emulator compared to truth and BEWSS data.

    d. Post-processed analysis of entity state, fire, and detonate PDU's compared to expected functionality.

    e. Measured target acquisition ranges for Hunter VPS and IMF emulator compared to truth and BEWSS data.

    f. Documented response by red MODSAF to IMF engagements, to determine ability of IMF emulator to vary tactics.

    g. Unique data collection TBD for Hunter VPS and IMF emulator based on VV&A plans.

4. **Evaluate Battlemaster, Network, and Data Collection Capabilities.** Through conduct of the test, data collection, and data analysis, determine the capability for currently implemented Battlemaster, network, and data collection resources to support the other RIVET objectives and measures of performance and the anticipated requirements for A2 ATD Experiment #6. The measures of performance are:

    a. Documented exercise control using SIMAN PDU's and the DISMAN tool, as well as any in-house control tools, voice, and video nets required to meet other RIVET objectives.

    b. Data logs of all PDU's for the test using in-house data loggers (and A2 ATD data logger if available) sufficient for playback and post-test analysis.

    c. Voice and video recording and editing sufficient to meet other RIVET objectives and support documentary video.

5. **Explore Integration with RFPI and A2 ATD Experiment #6 Related Simulators.** Through conduct of the test using A2 ATD Experiment #6 scenario and excursions, integrate (based on availability at no cost and proponent interest) related simulators into the virtual environment to identify future compatibility and utility. Related simulators to be considered are the BTB stimulators, JAVELIN, TOW, TACAWS, and BAT. The measures of performance are:

    a. Demonstration of the ability of simulators to interact with targets using the red and blue positions and routes from the HRS 33.7 scenario or variant where required.

    b. SME reviews of moving models in stealth and operator/simulator interactions during test to identify anomalous behaviors.

    c. Post-processed analysis of entity state, fire, and detonate PDU's compared to expected functionality.

6. **Evaluate RC2T/SINCGARS Simulator Integrated Performance.** Through use of at least three STRICOM-supplied SINCGARS simulators; one integrated into the Hunter VPS, one associated with the RC2T, and one at a MODSAF station, ensure that RFPI messages can be sent across the entire hunter-C2-shooter link, and measure the effects of SINCGARS simulator range attenuation without repeater capability on the ability to execute the Experiment #6 scenario. The measures of performance are:

    a. Pre-test integration to determine if modifications are required to SINCGARS simulator or RC2T to allow any RFPI message passing in order to proceed with this test objective.

    b. Pre-test connectivity check to determine optimum Tactical Operations Center (TOC) placement to ensure lines of communication between all anticipated hunter and killer positions.

c. Documented SME operation of RC2T as TOC element performing weapon-target pairings consistent with planned A2 Advanced Technology Demonstration (ATD) Experiment #6 approach.

d. Post-test analysis of logged data traffic to determine percentage of messages completed and identify anomalies.

7. **Evaluate Workload on RC2T Operator.** Through SME operation of the RC2T during the test, determine the ability of the operator to handle the weapon-target pairing workload. The measures of performance are:

   a. Timelines from operator actions logged internally to the RC2T.

   b. Timelines from DIS data logs to evaluate weapon-target pairing times through high and low activity periods during the battle.

   c. Post-test SME operator interview to identify workload problems and recommended solutions.

8. **Confirm DIS Net Load for BTB.** Through increasing the number of entities represented in the battle up until the full complement of BTB MODSAF resources are used, or until the net crashes, determine the ability of the BTB facility to handle the DIS net load in order to refine distribution of resources and PDU filtering requirements for A2 ATD Experiment #6. The measures of performance are:

   a. Logged net load as a function of time and number of entities in the battle.

   b. Identification of points in the battle that produce net load problems.

## E. Documentation

Test planning documentation consisted of the RIVET Concept and Objectives document, a detailed test plan including schedules, and detailed test procedures. Test reports consisted of a quick-look report including lessons learned, A2 ATD risk assessment, and results that could be derived without extensive data reduction; a final report including all reduced data, and a documentary video. Documentation delivery dates are given in the following table.

## MILESTONES

| Milestone | POC | DATE (1995) |
|---|---|---|
| Concept and Objectives | RFPI Sim Mgr | 8 Jun |
| Draft Test Plan (80%) | BTB/DISC | 30 Jun |
| SINCGARS Sims (3) in-house | RFPI Sim Mgr | 30 Jun |
| Test Plan Comments | All | 12 Jul |
| Final Test Plan | BTB/DISC | 21 Jul |
| Draft Test Procedures (80%) | BTB/DISC | 21 Jul |
| Lock-down RC2T message set | RFPI Analysis | 28 Jul |
| Final Test Procedures | BTB/DISC | 18 Aug |
| RIVET | All | 29-31 Aug |
| Quick-look Report | BTB/DISC | 15 Sep |
| Data Reduction Complete | BTB/DISC | 30 Sep |
| Final Report and Video | BTB/DISC | 31 Oct |

## III. RFPI INTEGRATED VIRTUAL ENVIRONMENT TEST II (RIVET II) CONCEPT AND OBJECTIVES

### A. Purpose

The purpose of RIVET II was to revisit the issues that arose as a result of RIVET I that directly related to risk reduction for A2 ATD Experiment #6, and to ensure that all related objectives and the resulting action items had been addressed and closed or properly documented so that solutions could be developed when circumstances allowed.

### B. Approach

The RIVET II was conducted over a three-day period at the end of October, 1995. The test was limited to the MICOM DIS LAN, specifically between the BTB and the DISC. Simulators residing at other installations were not included in the test. The data and conduct of the test were unclassified, using surrogate data as required. This test was done within the support defined in the FY96 SS&DD SOW for RFPI. Engineer operators were utilized in lieu of soldier participation due to the nature of the test, and to avoid conflict with A2 ATD troop requests. Specific RFPI-related simulators were invited to participate in the test based on availability at no cost.

### C. Responsibilities

The RIVET II was conducted jointly by BTB and DISC personnel. The DISC POC was responsible for coordination of all DISC participating reconfigurable simulators including two copies of the Hunter VPS, Javelin, and TOW. The BTB POC was responsible for coordination of all BTB participating components including the terrain database, Operations Management Cell, ModSAF, IMF emulator, Battlemaster, data logging and analysis, and video. Responsibilities for stealth view and other functions not supportable purely at one facility were shared and coordinated between the BTB and DISC. Test plans, procedures, and documentation were developed jointly between the BTB and DISC. The RFPI Analysis POC was responsible for providing the RFPI Command and Control Testbed (RC2T) and RC2T operator, as well as reviewing detailed plans and procedures involving the RC2T. The RFPI Simulation Manager was responsible for developing detailed objectives, approving test plans and procedures, and coordinating AMSAA and STRICOM oversight.

## D. Objectives

The RIVET II detailed objectives were as follows:

1. **Confirm A2 ATD Experiment #6 Terrain Database Correlation.** Through pre-test analysis, and use of the database during the test, confirm that the four versions of the terrain database (Multigen Flight, E&S MIP, S1000 VistaWorks, and CTDB) have a one-for-one correlation between vertices and elevation posts, and have consistent features and textures to support a level-playing field. Verify closeout of all related Simulation Problem Reports (SPRs) from RIVET I. The measures of performance are:

    a. Stealth or editor comparisons to confirm the major roads (those used by the forces) match up at critical junctures and intersections in all terrain formats.

    FROM RIVET I - Roads match each other from format to format, but not all road intersections are connected. Some key roads used by forces in BEWSS are non- existent. Fairly good correlation between S1000 and Multigen feature sizer. Correlation between editors not there yet.

    b. Stealth or editor comparisons to confirm the minor roads match up in all terrain formats.

    FROM RIVET I - Some minor roads are not connected. Some key roads used by forces in BEWSS are non-existent.

    c. Stealth or editor comparisons to confirm the following issues have been corrected with respect to roads and landscape inside applicable databases:

        (1) Verify Switch in/out distances are consistent across the various formats.

        (2) Verify correlation of tree canopies in all formats so that they do not cross roads.

        (3) Verify texture maps in E&S and VistaWorks are correlated with Multigen.

        (4) Verify Multigen textures for roads correlate to the roads' size.

        (5) Verify there is no scintillation in S1000 textures.

        (6) Verify the back sides of trees in Multigen flight are textured.

        (7) Verify ground color is not different in E&S and flight.

        (8) Verify E&S tree sides have alpha (transparency) applied to places as appropriate.

        (9) Verify there are no holes in E&S terrain and all polygons meet correctly.

d. Manned simulator confirmations that there are no LOS problems at the weapon system level.

FROM RIVET I - Most participants commented that LOS problems were the result of system placement on the terrain. All manned simulators should have the freedom to move as required to achieve tactically reasonable LOS. Eye point height should be revisited for all manned simulators

e. Manned simulator determinations where micro terrain areas are required for concealment.

FROM RIVET I - The only system which might have benefited from micro terrain was the Remote Sentry. Given the amount of effort required to generate micro terrain, intelligent site moves will probably be sufficient.

f. Stealth review to verify that icon representations of each vehicle are appropriate.

FROM RIVET I:

(1) Need some work on HVPS icon in ModSAF. Are articulated icons possible? If so, we would be able to see which way mast is pointed by looking at ModSAF?

(2) In Stealth, HVPS was displayed as a HMMWV

(3) Wide disparity in model details. This was due to model substitution.

(4) Multigen Stealth of FOFAC, HVPS, EFOG-M were 90 degrees out of orientation/prone.

(5) ModSAF Stealth icon was too small.

g. Stealth and manned simulator reviews that all models and special effects work as designed.

FROM RIVET I:

(1) JAVELIN gunner and assistant gunner switch beads were faulty.

(2) Dust clouds on VistaWorks Stealth may need re-examining. We were getting dust clouds on roads, not when over terrain.

h. Stealth and manned simulator confirmation that visual appearance and feature placement is consistent across models.

FROM RIVET I:

(1) X, Y correlation does OK from E&S to Multigen.

(2) Need S1000 VistaWorks textures.

(3) Some anomalies in transparencies in Multigen (i.e. ground textures showed through-others didn't) .

(4) Some polygons were flashing in VistaWorks.

(5) Some rivers dropped off in E&S database.

i. Stealth confirmation that X,Y, and Z values correlate across Multigen, Vistaworks, and ModSAF databases, allowing test execution without ground-clamping of entities.

j. Editor confirmation that X, Y, and Z values correlate between E&S and Multigen flight formats.

2. **Confirm Performance of New ModSAF Representations.** Through comparison to truth data and implemented BEWSS performance data, given the constraint of an unclassified exercise without statistically significant numbers of data points, confirm the functionality and performance of each individual ModSAF representation as implemented as an extension to ModSAF 2.0 throughout engagements consistent with the A2 ATD Experiment #6 scenario. Verify closeout of all related Simulation Problem Reports (SPRs) from RIVET I. The measures of performance are:

a. Implementation of vignette to confirm the engagement area overlays provide for effective engagement of targets in the HSOK concept.

FROM RIVET I - This was only tested to a limited extent due to communications difficulties in the ModSAF. Appeared to be OK.

b. Verification during test that ModSAF operators are able to communicate effectively with the RC2T.

FROM RIVET I:

(1) When we read from scenario file then status reports were not sent. But, manual entities sent status. The result of not sending status reports was that the RC2T did not know that the ModSAF generated entities existed. So, no reports or orders could flow.

(2) ModSAF FOFAC could not communicate.

c. Verification during test that sufficient data sent to the ModSAF operator to trigger the appropriate fire mission.

FROM RIVET I - except as discussed in the previous finding.

d. Verification during test that ModSAF entities interface with the DISMAN PDU set.

FROM RIVET I - except for Set Data.

e. Stealth review of moving models representing new ModSAF systems showing no inappropriate behavior.

FROM RIVET I - Several artillery and mortar units were originally designed to be stationary entities. Movement of towed artillery and mortars (perhaps through a modified mount/dismount routine) needs further work.

f. Verification during test that ModSAF operators can maintain relevant RC2T messages on-screen long enough to give the proper response.

g. Verification during test that the RIVET II vignette generates sufficient activity for all RFPI elements to be used as the BDS-D vignette for Experiment #6.

3. **Support Hunter VPS and IMF Emulator VV&A.** Through comparison to truth data and implemented BEWSS performance data, given the constraint of an unclassified exercise without statistically significant numbers of data points, confirm the functionality and performance of the two Hunter VPS's and IMF Emulator throughout engagements consistent with the A2 ATD Experiment #6 scenario. Verify closeout of all related Simulation Problem Reports (SPRs) from RIVET I. The measures of performance are:

a. Verification during test that all HVPS target interrogation functions work (zoom, range finder etc.)

FROM RIVET I - The Data logger did not receive Hunter VPS detection PDU. Suspect that this is a logger interface error - not HVPS.

b. Verification during test that the firing mechanism in the IMF impacts and kill targets.

FROM RIVET I - Note, it was noticed that IMF will fire more than one mine if a target is in range for both. This is a problem with the "point of closest approach" (PCA) calculation. This PCA calculation will be updated before VV&A.

c. Stealth model representation providing a realistic presentation of HVPS.

FROM RIVET I - HVPS was displayed as a HMMWV due to an enumeration error.

d. Stealth review of IMF and HVPS models displaying appropriate behaviors.

FROM RIVET I - The Stealth observed IMF gateways appearing & disappearing. When the Stealth was attached to the gateway, it shifted position and then returned to the original location. This was caused by velocities in the entity state PDU causing the Stealth's dead reckoning algorithms to move the gateway icon.

e. Data collection to ensure that Fire PDU's were implemented in the IMF.

f. Pre-test assessment that HVPS and IMF meet VV&A criteria to the maximum extent possible by start of RIVET II.

FROM RIVET I - Many enhancements need to be made to IMF operation prior to VV&A. For RIVET, IMF was modeled with perfect detection and no errors on track positions.

g. Data collection to ensure the RC2T receives IMF and HVPS messages.

FROM RIVET I - On Day 1, the IMF messages intermittently caused the RC2T to fail. This was corrected on Day 2. Note: Even though the IMF was sending improper messages, the RC2T probably should be robust enough to filter improper messages rather than core dump.

4. **Explore Integration with RFPI and A2 ATD Experiment #6 Related Simulators.** Through conduct of the test using A2 ATD Experiment #6 scenario and excursions, integrate (based on availability at no cost and proponent interest) related simulators into the virtual environment to identify future compatibility and utility. Related simulators to be considered are JAVELIN, and TOW. The measures of performance are:

a. Verification during test that the manned simulator developers have examined the following:

(1) PDU filtering to allow increased frame rates.

(2) azimuth information to the operator to aid in experiment control.

(3) implementing larger entity file sizes to allow for larger scale exercises.

(4) taking necessary measures to increase the robustness of their simulators to corrupted or unknown type PDU's. All should understand that large scale distributed exercises will produce new phenomenon, the simulations should be able to handle it.

5. **Evaluate SINCGARS Simulator Integrated Performance.** Through use of three STRICOM-supplied SINCGARS simulators; one integrated into the Hunter VPS, one associated with the RC2T, and one at a MODSAF station, ensure that voice communication can be sent across the DIS network, and measure the effects of SINCGARS simulator range attenuation without repeater capability on the ability to execute the Experiment #6 scenario. The measures of performance are:

a. Pre-test connectivity check to determine optimum TOC placement to ensure lines of communication between related hunter and killer positions.

b. Assignment of a portion of tactical voice communication to the SINCGARS simulator net during the experiment.

c. Post-test analysis of voice communication to determine the ability to support Experiment #6 and to identify anomalies.

6. **Evaluate integration of SUN datalogger into data collection process.** Through implementation of the SUN datalogger along with existing datalog assets used in RIVET, determine the ability to integrate and log data on the SUN logger in support of AMSAA data analysis. The measures of performance are:

a. Collection of RIVET II data on SUN logger.

b. Post-test confirmation from AMSAA that RIVET II logs sent to LORAL can be read for analysis.

Milestones are shown in the following table:

| Milestone | POC | DATE |
|---|---|---|
| Concept and Objectives | RFPI Sim Mgr | 6 Oct |
| RIVET SPRs | BTB/DISC | 6 Oct |
| Draft Test Plan (80%) | BTB/DISC | 18 Oct |
| Test Plan Comments | All | 20 Oct |
| Final Test Plan | BTB/DISC | 24 Oct |
| Draft Test Procedures (80%) | BTB/DISC | 24 Oct |
| Final Test Procedures | BTB/DISC | 27 Oct |
| TRR | All | 27 Oct |
| RIVET II | All | 30 Oct - 1 Nov |
| Flash Report | RFPI Sim Mgr | 1 Nov |
| RIVET video script | RFPI Sim Mgr | 15 Nov |
| Quick-look Report | BTB/DISC | 15 Nov |
| Data Reduction Complete | BTB/DISC | 30 Nov |
| Final Report and Video | BTB/DISC | 31 Dec |

# IV. MULTIPLE SEMI-AUTOMATED FORCES INTEGRATION TEST (MSFIT) CONCEPT AND OBJECTIVES

## A. Purpose

The MSFIT was a series of engineering tests of Semi-Automated FORces (SAFOR) available to support RFPI virtual experimentation. The purpose of these tests was to define the integrated suite of SAFOR that would be used to represent all the entities required for the RFPI Virtual Rehearsal BLWE and the RFPI Field Experiment. MSFIT was not intended to be a complete development or VV&A test of SAFOR representations of all entities. The primary focus of this test series was to ensure that each of the SAFOR to be used in RFPI experiments could function together in an integrated environment, and to highlight further development required for functions that could not be integrated in the execution timeframe.

## B. Approach

The MSFIT was conducted in three phases over the period August through October, 1996. The test was limited to the MICOM DIS LAN, specifically between the BTB and the DISC. The SAFOR under evaluation consisted of ModSAF, Interactive Distributed Engineering Evaluation and Assessment Simulation (IDEEAS), Interactive Tactical Environment Management System (ITEMS), and Target Acquisition and Fire Support Model (TAFSM). The data and conduct of the test was unclassified, using surrogate data as required. This test was done within the support defined in the FY96-97 SS&DD and NRC SOWs and AMSAA MOA for RFPI. Support was also coordinated with ATCOM for the use and evaluation of aviation SAFOR. Engineer operators were utilized in lieu of soldier participation due to the nature of the test.

The first phase of the MSFIT consisted of running separate IDEEAS workstations for red and blue, and comparing against stand-alone runs on a single machine. Runs were made using the HRS 33.8 scenario to compare against constructive runs, and A2 ATD VV&A vignettes to compare against ModSAF VV&A runs.

The second phase of the test was the execution of IDEEAS and ModSAF in various combinations, using each model to represent different entities in the established vignettes.

The third phase included ITEMS and TAFSM to represent aviation and field artillery respectively along with a combination of IDEEAS and ModSAF to be determined during the second phase. In this phase a ModSAF or IDEEAS sensor would pass a Call for Fire to TAFSM and a TAFSM to live C2 system (TBD) interface was demonstrated.

## C. Responsibilities

The MSFIT was conducted jointly by BTB, DISC, and AMSAA personnel. The DISC POC was responsible for coordination of all DISC participating ModSAF stations and the DIS hub during the latter two phases. The BTB POC was responsible for coordination of all BTB participating components including MODSAF, IDEEAS, TAFSM, and ITEMS workstations;

Battlemaster functions; data logging; stealth; and video. Test plans, procedures, and documentation were developed by the BTB based on the objectives stated below. AMSAA was responsible for providing certified unclassified performance data, or certifying existing data for the purposes of these integration tests, providing VV&A vignettes used in A2 ATD, and was lead in analysis and documentation of final results. ATCOM provided software and support for execution of the ITEMS model to represent aviation assets in the third phase. The RFPI Simulation Manager was responsible for developing detailed objectives, approving test plans and procedures, and coordinating efforts between MICOM, AMSAA, and ATCOM.

## D. Objectives

The MSFIT detailed objectives were as follows:

1 **Evaluate IDEEAS Vignette Development Capability.** Assess the ability to duplicate existing ModSAF vignettes in IDEEAS by integrating AMSAA A2ATD VV&A vignettes into IDEEAS for use in the test. The measures of performance are:

   a. Ability of joint AMSAA/BTB team to integrate A2ATD VV&A vignettes into IDEEAS using existing IDEEAS user interface.

   b. Ability of joint AMSAA/BTB team to certify vignette implementations using existing IDEEAS plan view and user interface.

2. **Certify IDEEAS MSFIT Performance Data.** Through review of existing IDEEAS performance parameters, AMSAA-certified ModSAF unclassified data, and BEWSS input values, develop one or more IDEEAS input data parameter sets sufficient to execute MSFIT. The measures of performance are:

   a. AMSAA input correlation of IDEEAS data to BEWSS data for AMSAA pre-defined critical functions.

   b. AMSAA performance correlation of IDEEAS data to ModSAF data for AMSAA pre-defined critical functions sufficient for consistancy of results and effects.

3. **Confirm IDEEAS DIS Compatibility.** Through the use of real-time execution of IDEEAS, determine to what degree it interfaces with the DIS environment and generates and accepts the proper PDUs. Verify compatibility with datalogger, stealth, and DIS XXX Analytical Toolset (DCAT). The measures of performance are:

   a. Real-time and post-test analysis of PDU traffic utilizing the DIS datalogger and DCAT to identify any erroneous PDUs generated throughout the test.

   b. Ability of DCAT to determine loss ratios sufficiently from IDEEAS-reported PDUs to terminate HRS 33.8 runs based on attrition.

c. Measured bandwidth usage and entity state PDU rates throughout the test and documentation of anomalies to determine efficiency and sufficiency of entity state, fire, and detonate PDU transmission.

d. SME review of unclamped stealth view in Multigen Flight throughout the test to determine consistency of moving model entity behaviors and interactions with terrain.

e. SME review of passive ModSAF plan view throughout the test to determine consistency of behaviors of IDEEAS entities.

4. **Correlate IDEEAS Results to BEWSS Constructive Runs.** Through the use of a HRS 33.8 RFPI Residual case scenario, compare results when run real-time in IDEEAS to a monte-carlo run set of the BEWSS constructive model results using the same input data. The measures of performance are:

   a. Post-test statistical correlation between IDEEAS run results and BEWSS run results for system kills and losses versus time and range, numbers of targets engaged and hit per type, and ammunition use.

   b. Comparison of applicable DCAT real-time measures of parameters listed in 4.1 to BEWSS runs and actual logged/analyzed IDEEAS results

5. **Correlate IDEEAS Stand-alone Results to Multiple-IDEEAS Platform Results.** Through the use of AMSAA-provided A2 ATD VV&A vignettes and HRS 33.8 RFPI Residual case scenario runs, compare results of a single IDEEAS workstation running all battle entities to results when two IDEEAS systems are used to separately represent red and blue, and to results when entities are spread over as many IDEEAS workstations as existing hardware, scenario force stucture and current IDEEAS sensor-shooter pairing constraints allow. The measures of performance are:

   a. Post-test statistical correlation between results for system kills and losses versus time and range, numbers of targets engaged and hit per type, and ammunition use.

   b. SME review of real-time runs in stealth view, ModSAF view, and IDEEAS workstation views to identify changes in behavior between test conditions.

## E. Documentation

Test planning documentation consisted of the MSFIT Concept and Objectives document, a BTB detailed test plan including schedules, and BTB detailed test procedures. Test reports consisted of a BTB quick-look report for each phase including lessons learned, risk assessment, and results that could be derived without extensive data reduction; an AMSAA quick-look anecdotal assessment of test success; an AMSAA final report including all reduced data after all three phases are complete, and a final BTB documentary video. Documentation delivery dates are given in the following chart.

| Milestone | POC | DATE |
|---|---|---|
| Draft Concept and Objectives | RFPI Sim Mgr | 30 Jul |
| Concept and Objectives Comments | All | 6 Aug |
| Final Concept and Objectives | RFPI Sim Mgr | 7 Aug |
| Draft Test Plan (80%) | BTB | 16 Aug |
| Test Plan Comments | All | 23 Aug |
| Draft Test Procedures (80%) | BTB | 23 Aug |
| Final Test Plan | BTB | 30 Aug |
| Test Procedures Comments | All | 30 Aug |
| AMSAA Data Delivery | AMSAA | 30 Aug |
| Final Test Procedures | BTB | 6 Sep |
| IDEEAS Data Certification Complete | BTB/AMSAA | 13 Sep |
| A2ATD VV&A Vignette Integration Complete | BTB/AMSAA | 13 Sep |
| Pre-test BEWSS Runs Complete | BTB | 20 Sep |
| TRR | All | 23 Sep |
| MSFIT I | All | 24-25 Sep |
| Quick-look Reports | BTB/AMSAA | 30 Sep |

## V. CONCLUSIONS

RIVET I & II and MSFIT were critical risk reduction events in the evolution of the RFPI Field Experiment simulation and test architecture, both contributing significantly to success of interim experiments and analyses, as well as the final event. Data from these tests advanced state-of-the-art in the utilization of distributed simulation for analysis, and supported the capstone experiment of the A2 ATD program. Risk mitigation activities such as these should be considered for all substantially complex distributed simulation analysis events.

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