THE LIVE FIRE TEST and TRAINING PROGRAM – A SUCCESSFUL PARTNERSHIP SUPPORTING OUR WARFIGHTERS

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ABSTRACT

The Live Fire Test & Training (LFT&T) Program responds to Secretary of Defense and Congressional mandates for the training and testing communities to work more closely together, where possible. The LFT&T Program provides funding for innovative projects that support this basic theme of combining training and testing efforts and products – including common development and use of realistic training and test/analysis modeling and simulation environments and procedures, and shared use of data and models. By providing a source of funding and a management structure that bridges both the training and the test/analysis communities, the LFT&T Program serves as a sounding board and a challenge for government and industry, encouraging innovation and a broad range of experimentation within the overall program objectives. Thus, the program has included diverse projects from all services and warfare environments. The LFT&T Program is succeeding on a number of fronts. This paper includes some of those success stories, descriptions of the projects currently funded, and areas of particular interest. The objective is a broader understanding of the LFT&T Program – with the hope that we will stimulate ideas for future projects.

Additional information on the LFT&T Program, including instructions for submission of project ideas and proposals can be found at the LFT&T Broad Agency Announcement (BAA) website at:
http://www.afams.af.mil/programs/projects/lftt/

Biographical Sketch:

Ernest R. (Rick) Seymour is currently the Live Fire Test & Training Program Manager in the Live Fire Test & Evaluation Office under the Deputy Director, Operational Test & Evaluation within the Office of the Secretary of Defense (OSD). A Naval Air Warfare Center Training Systems Division (NAWCTSD) employee with over 20 years experience in the development and acquisition of Navy aircraft and training systems, he has been assigned to the LFT&E Office in the Pentagon since March 1998. Mr. Seymour received a Bachelor of Science Degree in Electrical Engineering from Virginia Polytechnic Institute and State University and he subsequently competed for and won a fellowship to return to VPI&SU to undertake graduate studies in systems engineering, and was awarded a Master of Science Degree in Systems

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William A. Duncan is the Technical Team Leader/Project Manager for the Live Fire Test & Training Program at the Naval Air Warfare Center Training Systems Division (NAWCTSD). Mr. Duncan is a NAWCTSD employee with over twenty-two years experience in the development and acquisition of training systems for the Navy, Marine Corps, and Army. He received a Bachelor of Science degree in Industrial Management from the Florida State University. He later received a BS and an MS degree in Instructional Systems Development from the University of West Florida. Mr. Duncan is a graduate of the NAVAIR Senior Executive Development Program and the Defense Systems Management College Program Management Course. Mr. Duncan has received the Navy Superior Civilian Service Medal for successfully managing large and complex programs in support of the Marine Corps and Army. He also received the Navy Meritorious Civilian Service Medal for his support of Marine Corps anti-armor training during Operation Desert Shield.

Russ Hauck is Executive Director of the National Center for Simulation (NCS), a non-profit corporation that represents the modeling, simulation, and training industry and serves as a link between government, industry, and academia. The mission of NCS is to serve as the nation's primary facilitator for promoting and enhancing simulation and related technologies. Mr. Hauck has more than 21 years experience in the simulation and training systems community. He received a Bachelor of Science degree from the United States Naval Academy and was awarded a Master of Science in Administration degree (Public Administration) from the George Washington University.

INTRODUCTION

The Live Fire Test & Training (LFT&T) Program addresses two specific Secretary of Defense themes: combining testing and training; and additional use of modeling and simulation. The program was initiated in Fiscal Year (FY) 1997 when Congress provided funding and directed that the LFT&E Office within OSD transition simulation and synthetic environment technologies being used within the training community to the live fire test community. The program has grown substantially since its inception, supporting a wide range of projects across all services. Project successes also have been substantial and individual projects have demonstrated great potential for major benefits as they are transitioned to users.

The objectives of this paper include:

- Provide information on the LFT&T Program, its background and objectives;
- Provide a description of projects currently funded, including challenges and some past success stories;
- Provide information on the procedures and schedules for submission and consideration of LFT&T project ideas and proposals; and
- Challenge members of the test and training communities – stimulate new project ideas by modeling success and describing areas of special interest.

BACKGROUND

In May 1995, Secretary of Defense William Perry identified five initiatives for the defense acquisition test and evaluation community. The LFT&T Program responds directly to two of these initiatives: combine testing and training, where appropriate; and use models and simulations more effectively. The training community and the testing community have proceeded along parallel tracks and, until recently, shared development and use of simulation models and data between the two communities has been limited. Driven by a number of common factors, exercises and simulations used in both training and in test and analysis activities have grown to be quite robust and realistic – feeding a rising level of expectations among users. And, the perceived gap between the two communities is being quickly narrowed; primarily the result of a strong push toward – greater reliance upon – modeling and simulation. While modeling and simulation will not completely replace the need for testing or for actual hands-on training exercises, it is recognized that simulation can play a key role in both arenas, especially as we seek to make best use of available resources across organizational boundaries. Equally important, the LFT&E Office is gathering data and learning about how weapon systems operate in realistic, expected environments and can provide this knowledge to improve training scenarios and simulations. Thus, increased use of modeling and simulation in test/analysis activities, increased emphasis on realism in training and testing, and a

desire for more efficient use of resources in both communities are requirements that are being reflected and supported in the LFT&T Program.

Congressional support for the LFT&T Program was evidenced by language in the 1997 Defense Appropriations Bill, directing the OSD Live Fire Test & Evaluation Office to "develop a program that will explore, select, and implement alternative uses of simulation and synthetic environment technologies that are being used for education and training for implementation by the live fire test community." Although this language implies a one-way link from training to testing, the LFT&T Program recognizes and encourages initiatives that will have benefits for both communities.

Congress initiated the program by funding $3.0M in FY 1997 and has provided an increased level of support each year since. This funding profile is shown in Table 1.

Fiscal Year	Funding
FY 1997	$3.0M
FY 1998	$4.0M
FY 1999	$5.0M
FY 2000	$7.0M
FY 2001	$7.5M

Table 1. LFT&T Program Funding

PROGRAM OBJECTIVE

The overall objective of the LFT&T Program is closer coordination and cooperation between testing and training activities so that the ultimate customer - the warfighter - can be better supported. More specifically, the goals have been to exploit current technology, support the development of new technology, and promote technical interchange between the training and testing communities. A common thread among the projects has been to find ways to more closely integrate training and testing activities, including extending applications of modeling and simulation and promoting shared use of models and data.

Said another way, the driving force behind the LFT&T Program is a theme of providing projects and products that improve the ability of our trainers and testers to support our warfighters. That means that the program has a strong applications and product orientation, with a focus on users and an emphasis on utility, quick return on investment, and transition. LFT&T projects are intended principally as seed efforts, stimulating the development of useful products that can be relatively quickly demonstrated and transitioned.

From the beginning, the LFT&T Program has been oriented towards encouraging a "technology push" from within government, industry, and academia. Because the SAG represents a very broad customer base, and because they want to encourage innovation across service and traditional "community" lines, the approach has been to issue an open-ended call for projects based on general guidelines and broad *focus areas*.

LFT&T PROGRAM MANAGEMENT

Program management and oversight is provided by the LFT&T Senior Advisory Group (SAG), which consists of the four commanders of the Orlando-based simulation and training activities: NAWCTSD, STRICOM, AFAMS, and the Marine Corps Program Manager for Training Systems; and is chaired by the Director of Live Fire Test & Evaluation in OSD.

The SAG is responsible for ensuring that program objectives are being met. They meet on a regular schedule throughout the year to consider proposed new projects, participate in project selection and funding decisions, and review progress.

For day-to-day coordination and management, the LFT&T Program has established a training community liaison within the LFT&E Office at the Pentagon (currently, Rick Seymour) and an LFT&T Project Manager within the Orlando community (currently, Bill Duncan at NAWCTSD).

LFT&T PROJECT GUIDELINES

In March of each year, the SAG initiates a call for project ideas in the form of discussion or white papers. Starting with the FY 2002 projects, this call has been in the form of a dedicated Live Fire Test & Training Broad Agency Announcement (BAA) (N61339-01-R-0019), issued by NAWCTSD on 15 May 2001 via the LFT&T website. The LFT&T website is: http://www.afams.af.mil/programs/projects/lftt/
This website also is the vehicle for electronic submission of project white papers and it includes guidance on submission of proposals. As noted in the BAA, proposed projects must demonstrate applicability and benefits to both training and live fire test and evaluation (LFT&E). It is desired that LFT&T projects contain the following characteristics:

- Evidence of direct collaboration between testing and training communities;
- Maximum advantage must be taken of existing government, university, and industry research and engineering programs and facilities.
- Applicability across services, joint, or other government activities.
- Timely transition within one to two years (three years in exceptional cases) and implementation of the technology into operational use.
- Return on investment (cost or savings, new capabilities achieved, or other benefits to the training and testing communities); and
- Application to one or more LFT&T focus areas; or as an alternative, high return on investment in LFT&T related research.

These desired characteristics are used by the SAG as evaluation criteria when considering new project proposals and when reviewing the status/progress of funded projects. Guidelines for project submission and the process/schedule for project selection will be discussed later in this paper.

PROGRAM FOCUS AREAS

Although all projects which fit within the broad program guidelines will be considered, the SAG also has published a list of program focus areas for consideration. These focus areas represent areas in which the SAG feels the highest payoffs in test and training will occur in the coming year. For FY 2002, these are:

- Modeling of human decision-making under fire;
- Distributed simulation support;
- Non line-of-sight tactical engagement;
- Aviation-related simulation enhancements;
- Crew safety and survivability;
- Embedded systems;
- Time-critical targeting/strike/battle damage assessment;
- Asymmetric warfare;
- Synthetic natural environment;
- Network centric warfare; and
- Weapons of mass destruction.

PROPOSED PROJECT SUBMISSION AND SELECTION PROCESS/SCHEDULE

As noted earlier, the annual project solicitation process begins with a Commerce Business Daily (CBD) announcement in the Spring (mid-April to mid-May). Following the NAWCTSD BAA process, ideas for proposed new projects are solicited and evaluated in a three-step process, including:

Mid-May to mid-July – Submission of a white paper via the LFT&T website;

Mid-October - Oral presentation of selected projects to the SAG; and

Mid-October to early December – SAG makes final selection and invites submission of proposals for selected projects.

Contracts for selected projects normally are awarded during the second quarter of the fiscal year (January to March). Funding for the LFT&T Program thus far has been accomplished via an annual appropriation from Congress. Individual projects are selected and (separately) reviewed for continuation, therefore, on a year-to-year basis.

Certainly, one of the primary considerations for the SAG in this selection and review process is how much money will be available for the program, overall, in the coming fiscal year. This means that there is some level of competition for funding between current (second year) projects and new starts. Where appropriate, the SAG will work towards funding second year projects first, before considering new starts. Thus, while continuation for a second year is not guaranteed, continuation is anticipated, assuming that expected progress is being made against project objectives. The good news here also is that overall LFT&T Program funding has continued to increase each year, so funding has been available to support both new and continuing projects.

Guidelines for Submission of Project Papers

The BAA solicitation also includes the following basic guidelines for submission of project papers:

- A maximum of 15 double-spaced pages;
- A discussion of known, related efforts;
- A description of specific products to be delivered;
- Government activities expected to participate;
- Contractor organizations proposed to participate;
- Milestones for product development and delivery within one or two years (or three years in exceptional cases);
- Estimated cost for the entire project, by fiscal year;

- Discussion of specific plans for transition to operational use;
- Statement of impact, if funding is not provided;
- Designation of Project Manager, if the project were to be approved; and
- Point(s) of contact for further information/questions.

CURRENT LFT&T PROJECTS

Fourteen projects currently are funded under the LFT&T Program. Brief summaries follow:

AUGMENTED REALITY FOR SHIP SURVIVABILITY/DAMAGE CONTROL

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The current generation of fire fighting training systems uses live, propane-based fires that are unsafe and impractical for use in a shipboard environment. In a training environment, the use of live propane-based fires presents safety, health, and environmental risks.

The objective of this project is to research the feasibility of using Augmented Reality based technologies in shipboard testing and training environments. Investigations into various display and tracking technologies will be evaluated and developed to demonstrate the capability to overlay realistic artificial fire, smoke, and extinguishing images onto images of the real world environment - including facilities, equipment, and personnel.

DISMOUNTED INFANTRYMAN TESTBED

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Recent technological developments have allowed the small arms development and testing communities to successfully apply high fidelity modeling and simulation techniques to address many live fire testing and training needs from within a virtual testing environment. In particular, the Small Arms Simulator Testbed (SAST II) system developed by NAWCTSD has allowed the small arms community to examine new weapon concepts in a validated virtual operational environment, without having to commit time and resources to prototype development and LFT. However, while the SAST II system has proven successful as a stand-alone testbed, it does not provide the capability to examine the chaotic synergism between multiple weapons in a virtual team exercise environment.

The objective is to provide a validated multi-user SAST II infrastructure, allowing both the LFT and training communities to analyze and optimize the lethality and survivability of a fighting team. Simulated live fire exercises, supporting both LFT and training needs, are to be developed and conducted on virtual test ranges to examine the complex interrelationships between man and multiple weapon systems. Performance metrics and methods of analysis are to be developed to provide for data reduction to support both the LFT and training communities.

SYNERGISTIC EFFECTS OF ALMOST- LOSS OF CONSCIOUSNESS (A-LOC)/SITUATION AWARENESS

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Acceleration-induced loss of consciousness (GLOC) is possibly the main physiological threat to aircrew of high-performance aircraft. From 1983 to 1996, the Air Force experienced 24 Class A mishaps and 18 fatalities as a result of GLOC.

Much has been learned about the kinetics and mechanism of GLOC since the mid-1980's. In fighter aviation medicine, the GLOC syndrome is now recognized as a normal sequence of events in healthy aircrew, when their tolerance to +Gz-stress is exceeded. Nearly all of the previous work on GLOC has been aimed solely at preventing GLOC from occurring. Significant strides have been made in enhancing tolerance to +Gz-stress and thereby reducing the risk for GLOC occurrence. GLOC, however, still occurs and remains a continual threat for all tactical aircraft aircrews.

The overall objective of this task is to test several proposed technologies that may be able to reduce the period of incapacitation that occurs after a pilot experiences GLOC. The first task identifies acceleration induced aircrew problems in Navy and Air Force tactical aircraft. Four other tasks use Air Force centrifuges to test the efficacy of specific technological approaches to enhance recovery.

REALISTIC MUNITIONS-IMPACT FLASH EVENTS

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The objective of this project is to exploit live firings of anti-armor munitions against armor targets to collect impact signatures which shall be used to guide development of synthetic image generation for use in training. Inherent in the confusion of armor combat battles is the problem of determining whether a shot fired at enemy armor has done any damage. Gunners may not be prepared for the visual signature resulting from a KE round (or other munitions) impacting an enemy target - it can be quite spectacular - even when causing little damage.

INFRARED TARGETS FOR TEST AND TRAINING

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Training in the use of Forward Looking Infrared (FLIR) and other Infrared (IR) technology requires live fire targets that closely mimic the appearance of real targets in the IR. Initial explorations have proven a basic design for an IR projector based on Digital Light Processor (DLP) video projectors. The Infrared Targets for Test and Training (IRT3) project will adapt this technology to the live fire test and training arena.

The IRT3 project will develop an IR projection capability suitable for providing live fire targets for testing and training with IR systems in the 8-12 micron band. The targets would be projected using infrared projectors onto screens that would be unobtrusive in the absence of projector energy. Under computer control, the projected images could appear and disappear realistically, simulating actual targets. Computer-generated forces and stealth software will be adapted to provide control of computer generated imagery for the IR projector capability. The projection machinery would be hidden and protected behind berms, so that only the projection screens would be subject to damage by live fire. The digital light processor technology will produce the full range of military targets on reusable and renewable (water-based) projection screens. A production ready system will be available at the end of the second year and field verification and validation will be conducted in an optional third year.

LIVE FIRE ADVANCED CONCEPTS

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Live team exercises are costly, complex, and inherently dangerous; and difficult to plan, resource and execute. Introducing new weapons into the scenario renders such exercises even more complex.

The LFAC project explores the concept of how existing technologies and efforts can be leveraged to create a test bed that can be used for both LFT&E, as well as collective and individual training. Although both a development and integration effort, this concept capitalizes on government, industry, and university investments. This project incorporates proven technologies to create a virtual world that simulates the dismounted battlespace. This virtual world is being created by the utilization of the RealGuy™ system, which allows the soldier to maneuver throughout the battlefield, using a head-mounted display to view terrain and both friendly and opposing forces. As the soldier traverses his area of operations, realism will be enhanced with the incorporation of 3-D audio and olfactory effects. This provides a complete suite of input (sight, sound, smell) to the soldier and allows a complete set of data to stimulate the human decision making process. Critical events and decisions will be recorded to facilitate after action review.

MISSILE WARNING SENSOR STIMULATOR

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Battlefield proliferation of light vehicle and man portable antiaircraft missiles is driving development and deployment of a number of electro-optical missile warning receivers and associated countermeasures. Headquarters AFOTEC initiated development of the MWSS to demonstrate that open-air testing of missile warning systems is possible without the expense of firing large numbers of threat missiles. The MWSS is a transportable test and training tool designed to support operational evaluations of the AN/AAR-47 missile warning system conducted with fully operational crews and aircraft performing realistic maneuvers and tactics. The MWSS has been successfully tested against helicopters and transport aircraft employing the AN/AAR-47. Results from these tests have proven that the concept of an ultraviolet laser stimulator is not only feasible, but also that the stimulator can highlight tactical considerations where the AN/AAR-47 is combined with other

defensive systems to counter, defeat and/or destroy infrared threats.

The objective of this project is to enhance capabilities of the MWSS and conduct a comprehensive V&V program. Studies will be conducted to determine requirements for integrating the MWSS into range operations, identify MWSS enhancements needed for stimulating the advanced AN/AAR-47 Missile Warning Sensor, and recommend improvements for stimulating the Directed Infrared Countermeasure (DIRCM) system. V&V will be conducted to construct a database for future users in validating and accrediting the MWSS in test and training operations.

VIRTUAL ENVIRONMENT SIMULATION FOR SHIPBOARD INCIDENT MANAGEMENT

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There is a requirement for both medical and non-medical personnel in the Navy to be trained and exercised in first response to major incidents involving damage to ship structures, systems, and personnel. There currently is no way to realistically train or evaluate individuals and teams in first response or recoverability tasks, both medical and non-medical.

Although ship interior spaces and systems have been modeled and represented in virtual environments in varying levels of detail, these have been in undamaged states. And, we are not aware of any efforts to accurately represent such damage in Virtual Environment (VE), including primary and secondary damage.

The objective of VESSIM is to use ship design and other off-the-shelf software, and the NAWCTSD Virtual Environment Technology Testbed (VETT) to develop a prototype shipboard virtual environment representing the USS SAN ANTONIO (LPD-17) to train "first responders" in management of major casualty incidents and support development of ship vulnerability, survivability, and recoverability metrics.

VIRTUAL TARGET AND RANGE

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Fleet Exercise Publications (FXPs) support the training of units in each of their warfare mission areas. FXP 3 for Strike Warfare (STW), Surface Warfare (SUW), Intelligence (INT), command and control Warfare (C2W), and Command, Control and Communications, and FXP 5 for Amphibious Warfare (AMW) Exercises are the focus of the VITAR program.

VITAR is a portable acoustic impact scoring system that is lightweight, compact, easily stored aboard ship and deployed at suitable locations throughout the world's oceans. The objective is to provide a prototype system for conducting cost-effective live fire surface fire support exercises and supplementary training to Navy units.

The system will have the capability to determine the position of an impact and transmit data over the horizon to a system controller. The shipboard system controller will display the impacts on real maps over any virtual terrain or target. The controller will have the capability to operate as a stand-alone system, or interfaced with shipboard systems to provide real time feed back to the crew.

VULNERABILITY/LETHALITY METRICS

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As the field of ballistic vulnerability/lethality (V/L) developed, various practices and metrics emerged. In some cases, metrics were developed that were abstractly useful, but which bore no direct relationship to field observables. As a result of the LFT program, increased attention was focused on V/L to bring greater rigor and clarity to the discipline. As a result, a realistic decomposition of the V/L process was developed (V/L taxonomy). Using the V/L taxonomy, the traditional vulnerability metrics were shown to misrepresent vulnerability by directly assessing the impact of component damage impact on a typical mission accomplishment without determining its impact on a system capability V/L estimates are misused as probabilities of complete loss of function, not permitting degraded capabilities or degraded states of a weapon system to be evaluated in the context of a scenario. This project will leverage existing degraded states and V/L taxonomy efforts to develop and implement a new set of V/L metrics for potential integration into future analytical and training combat simulations.

MANPADS T&T RESULTS

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The Man Portable Air Defense Systems (MANPADS) shoulder fired missiles, is a threat of significant importance to National and World Security. Both the military and commercial aviation communities are greatly concerned due to the wide

proliferation of these systems. MANPADS are easily and cheaply procured by third world countries. The Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS), Joint Live Fire (JLF), Justice Dept., and the National MANPADS Workshop have all highlighted the need for more comprehensive data on the effects of MANPADS on tactical and transport aircraft. Future vulnerability analysis and vulnerability reduction designs require and understanding and database of damage effects (blast, fragments, kinetic energy and traveling charge effect) from documented test events. At present, there is a significant shortfall in all these areas.

The objectives of MANPADS are the following: 1) Team with live fire test planners to facilitate the collection and presentation of test results directly supporting training needs. 2) Document live fire test results in a format or formats that facilitate its use as training materials for the various agencies affected by the MANPADS threat.

Using the results of live fire tests with MANPADS, this data will train warfighters, design and test engineers, analysts, anti-terrorism specialists and battle damage repair specialists involved in aircraft survivability and anti-terrorism enterprises. This training project is necessary to act as a conduit of information transfer to DoD and other Government agencies that are not directly involved in Live Fire Test programs such as Justice Dept., Airport Security Committee, and the National Security Council.

MOVING WEAPONS PLATFORM SIMULATOR

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Most small caliber weapon systems fielded today are of a crew-served nature, i.e. an operator stands behind the weapon and manually trains and elevates the weapon to control his firing. The methods used to analyze effectiveness and lethality are complicated, costly, and often provide only subjective results from the operators. Platform costs, availability of ranges, data collection time, and ammunition all drive the cost of hardware testing. Efforts are now being made to mount these weapons on stabilized platforms and operate them remotely from fire control stations. In some cases these stabilized mounts may become more effective through the use of electro-optic tracking devices. Many approaches are used to develop the most economical solution for effective fire control. With limited objective data on the crew-served weapons they replace and limited test opportunities, the operational requirements can be hard to define. Development projects then become iterative. The resulting products too often become systems that are too heavy and/or costly to effectively satisfy the original intent.

The purpose of this project is to develop a platform-based, small arms training and weapon mount test system that can be used for testing and training. The project's initial focus will be the MK 98 25MM gun. This project leverages on an existing training system known as the Moving Weapons Platform Simulator (MWEPS) to create a simulated-fire test capability for small arm (30mm and smaller) weapon mounts. The engineering data collected will serve to 1) quantitatively measure the performance of a unit under test to create baseline information and 2) construct a simulation model for use in future development efforts. Improvements to the baseline unit may then be made based upon quantitative, rather than subjective, data.

This technology also has significant benefits to training efforts. MWEPS is already a successful and well-received training system for basic skill acquisition. An enhanced simulator will provide additional capabilities. Weapons operators have very few opportunities to engage targets in a 360-degree "weapons-free" environment. Also, there is limited ability to train in varying conditions, such as a high sea state, night operations, etc. A weapons simulator platform can be constructed which provides training (and data collection) on mission level scenarios in several types of environmental conditions. Improvements to the baseline unit may then be made based upon quantitative, rather than subjective, data.

VIRTUAL TARGET GUNNERY SYSTEM

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The objective of the VTAGS is to significantly enhance the current state-of-the-art in live domain target technology. The program will demonstrate an enhanced live domain target technology by presenting intelligent, virtual targets to trainees learning to use the Mark 38 25 mm machine gun. These targets will be presented to the trainee in a real world setting, with the targets integrated in real time, into the trainee's real worldview. We anticipate that the program will support Mark 38 training in both the live fire and dry fire modes. Secondly, we will show that the use of virtual targets can provide more realistic and challenging training as well as support more thorough analyses

of weapon systems, munitions and platforms that can be obtained using current target technology. We intend that the resulting VTAGS system will serve as a baseline design for a whole family of direct-fire weapon system trainers that use virtual targets, providing a set of common software and hardware components.

Benefits: It is anticipated that the use of virtual targets in the live domain will reduce training and test costs as well as achieve the following benefits for the training and test communities:

- Provide realistic signatures (visual, thermal, infrared, acoustic signatures, etc.)
- Stimulate Battlefield Combat Identification (BCID) capabilities
- Represent a wide range of sea, air and land based platforms
- Simulate friendly, hostile and non-combatant personnel and platforms
- Accommodate non-line-of-sight, beyond-line-of-sight activities and engagements
- Replicate buildings, bunkers and other infrastructure
- Realistically represent threat, friendly, non-combatant and neutral behaviors
- Realistically simulate target vulnerability across a wide range of effects (electronic, non-lethal, lethal, etc.)

WEAPONS AIMPOINT ANALYSIS AND TRAINING TOOL

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This project will develop an infrared live fire tracking and data collection system for small arms weapons systems that will allow the small arms community to essentially measure the gunners aimpoint in real time during live fire target engagements. This will allow the testing and training community to easily separate out the true sources of error during testing and training scenarios. The proposed system will have the capability to provide: ballistics validation; fire control system validation; error budget validation; aimpoint validation; and weapon tracking data to support both live fire testing and training needs. The proposed system will further provide a means to examine the real-time aim point position of a gunner/weapon system during both testing and training exercises. Currently this data is unavailable to the weapons testing and training communities forcing them to rely on limited and expensive indirect methods of measurement, such as the projectile terminal impact position, to measure gunner/weapon performance.

The Live Fire Testing community will benefit from new capabilities to:

- Provide real-time gunner/weapon aimpoint position data relative to stationary/moving targets.
- Provide a method to validate ballistic models for complex fire control systems.
- Provide a method to validate fire control system error budgets.
- Provide after action review of tracking data to examine weapon wobble and tracking.
- Provide a method to correlate aimpoint position with terminal/air- bursting ballistics.
- Provide a method to examine atmospheric effects on terminal/air-bursting ballistics.
- The Training community will benefit from new capabilities to:
- Provide a method to separate gunner errors from weapon system errors.
- Provide a means to rapidly identify problems with engagement rules, decision-making and aiming techniques during live fire training exercises.
- Provide enhanced weapon aimpoint and tracking feedback.
- Provide for reduced use of live fire terminal/air-bursting ammunition.

A REPRESENTATIVE EXAMPLE OF HOW THE LFT&T PROGRAM CAN BENEFIT BOTH TESTING AND TRAINING COMMUNITIES

In just a short time since its inception, the LFT&T Program has had some very positive impacts. One of these success stories is summarized in the following paragraphs.

COMBAT TRAUMA PATIENT SIMULATION PROGRAM

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The purpose of CTPS is to more realistically assess the impact of battlefield casualties. CTPS goals include more realistic representations of casualty occurrences, enhanced initial, refresher, and sustainment training for medical personnel; improved analysis and test and evaluation of issues in casualty medical treatment; and

increased readiness by having better prepared military medical personnel and ultimately decreasing fatalities due to combat conditions.

Figure 1. Combat Trauma Patient Simulator

The CTPS system provides a simulation suite that can be tailored with its components to replicate any military medical setting from initial entry level or refresher training in a fixed-base simulation laboratory to sustainment training in a field location or forward deployment. It can be used as an integrated system or with each of its components operating in a stand-alone mode. It allows a combat casualty to be tracked from incidence of wound to final outcome by electronically monitoring the patient at each level in real time. It replicates combat trauma, chemical injury, and limited biological injury. The CTPS system and its components can be used to evaluate doctrine, force organization, training, leadership, and material at any level and for any service. It can be tailored for active or reserve components. CTPS can measure MSQ, ARTEP or credential training at the initial entry, basic, or advanced skill level. From an Army combat field suite, to a school-based simulation lab setting, to a hospital ship or aircraft level, the CTPS system will enhance medical readiness.

VULNERABILITY/LETHALITY SIMULATION ENHANCEMENTS

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This project focused on developing a methodology and tools for improving damage assessments in tank-on-tank gunnery simulations used in both the training and test and analysis communities. The Probability of Kill (P_k) methodology currently employed in these simulations does not provide for a detailed assessment of likely damage and resulting loss of mission capability in simulated engagements. The goal of Vulnerability/Lethality Simulation Enhancements (VLSE) was to find a way to replace the P_k methodology that would be acceptable in both communities and to demonstrate the approach in one or more training system applications. The result was development of a Degraded States Vulnerability Methodology (DSVM). The concept for DSVM was developed and demonstrated, including demonstrations with two current tank gunnery training simulations. Tank gunnery was selected as a starting point, but the methodology can be expanded to include other weapon systems, targets, and platforms.

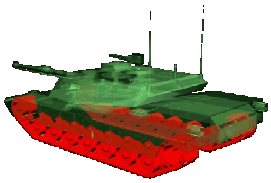

Figure 2. VLSE

Additional work under this project was accomplished in developing a methodology for new approaches to behavioral modeling of computer generated forces - an important step for successful application of the degraded states methodology. The primary objective has been significant qualitative improvements in training and in analysis of simulations - so that we can avoid negative training (i.e., "train as we fight") and better evaluate system designs, tactics. The VLSE Project has generated great interest in improving vulnerability and lethality simulations used in training and testing. The VLSE Project has directly resulted in a new initiative within the Army test/analysis community to further develop this methodology and expand its applications. This work is being accomplished at the Army Materiel Systems Analysis Activity (AMSAA) at Aberdeen Test Center. The initial VLSE Project provided a platform and testbed for AMSAA's continued degraded states development efforts, and also supports the next generation of computer generated forces (OneSAF) and other simulation developments. The Operational Requirements Document for OneSAF includes a requirement for this type of improved damage assessment. Similarly, the Marine Corps' planned acquisition of the Combat Vehicle Appended Training System also includes a requirement for a degraded states type of detailed damage assessment.

PROGRAM VISION

The LFT&T Program has demonstrated substantial value to the warfighters by reducing cost and improving the effectiveness of training and test/analysis activities. In addition, the program has promoted a stronger dialogue between trainers and testers; promoting understanding and a movement toward a higher level of standardization.

As program managers, our goal is to build on these successes and expand the program, while continuing our strong applications and product orientation. Our emphasis has been, and will continue to be, on quick returns on the federal investment and rapid transitions to operational use.

Part of our expanding view of this program is to work towards including an emphasis on operational testing, as well as on live fire testing. If we are successful in this program, one indication will be that trainers and testers at all levels will have a high level of interaction and collaboration, across organizational lines. This can only result in increasing the quality of both testing and training practices within the Department of Defense.