Rapid Force Projection Initiative Advanced Concept Technology Demonstration (RFPI ACTD) – The Experimental Path

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Advanced Concept Technology Programs

The formal acquisition process, as directed by DoD Instructions 5000.1 and 5000.2, is the primary mechanism for the procurement of new systems and the introduction of new capabilities via new or upgraded systems. The Advanced Concept Technology Development (ACTD) Programs process is a pre-acquisition stage providing an important mechanism for the warfighter to evaluate proposed solutions to important military needs. ACTDs exploit mature advanced technologies to solve important military problems, to rapidly transition technology from the developer to the user. ACTDs are structured to address the needs of the warfighter, to provide needed capabilities, address deficiencies, and reduce costs and manpower requirements Each ACTD is aimed at one or more warfighting objectives, and is reviewed by the Services, Defense Agencies, and the Joint Staff. The focus of the ACTD is to react in response to critical military needs. This requires intense user involvement through the specification of the identified military needs. The ACTD program reacts to these stated needs and, through a process that exploits mature technologies places new equipment into the hands of the user, the warfighter. The warfighter may then conduct realistic and extensive exercises to evaluate systems utility and gain operational experience. The user is then the basis for evaluating and refining operational capabilities of these advanced technology systems, understanding their utility, before an acquisition decision is made based upon the systems potential or projected effectiveness.

When the user/warfighter conducts demonstrations of the capability of the advanced concept systems, the user defines measures of effectiveness and measures of performance (MOEs/MOPs) for the systems. He provides or approves the planned operational exercises, demonstrates and develops concepts, to include the new concepts of operation, tactics, and doctrine. The ACTD provides the means to develop, refine, and optimize new warfighting concepts, and to prepare the systems and the units for the transition into acquisition. To facilitate the refinement of requirements, the ACTD must provide a residual capability to the user to further refine the concept of operations and permit continued use, to include combat, or define additional needed capability prior to formal acquisition. The purchase of additional capability beyond the residuals provided by the ACTD, where appropriate, is accomplished through a formal acquisition program.

Each ACTD is managed by a lead Service or Agency developer, driven by the principal user sponsor, usually a Unified Commander. User and development organizations are represented on an oversight panel chaired by the Deputy Under Secretary of Defense (Advanced Technology) (DUSD (AT)), who defines guidelines and provides oversight, support, and evaluation. Final review is provided by Deputy Under Secretary of Defense (Acquisition and Technology) (DUSD (A&T)) and the Vice-Chairman, Joint Chiefs of Staff. The Office of the Army Deputy Chief of Staff for Research, Development, and Acquisition (DCSRDA) has been restructured to support ACTDs. Funding for the ACTD is typically provided from participating technology programs supplemented as needed from the DUSD (AT) ACTD funding line. Funding provides for systems integration, for multiple copies of system elements if needed by the user in his evaluation process, and for technical support of the residual capability for two years beyond the completion of the ACTD.

The following agencies make up the Rapid Force Projection Initiative (RFPI) ACTD User/Developer Integration community. These groups are responsible to the Secretary of Defense and to Congress for the oversight of the program, and for the contributions in the systems design, systems integration, systems assessment and evaluation. The Joint ACTD Management Group provides the operational level management interface between the oversight at the DoD and DA level and the materiel developers, the warfighters, and the analysts. This management group is comprised of the RFPI Technical Program Management Office, Redstone Arsenal, AL, representing the Army Materiel Command; the Commander's Office, XVIII Airborne Corps, Ft. Bragg, NC representing FORSCOM, and the Dismounted Battlespace Battle Laboratory, Ft. Benning, GA representing TRADOC. For the purpose of analysis, evaluation and assessment, the Army Test and Evaluation agencies AMSAA, OPTEC, TECOM, joined the TRADOC representative TRAC-WSMR, and make up an Analysis Steering Committee

Rapid Force Projection Initiative (RFPI)

The RFPI ACTD is the largest ACTD yet, with an operating budget approaching $800M. The RFPI ACTD provides a new capability for the Army and a model for future Early Entry Forces. RFPI is a sensor-weapons-C4I concept that allows light forces to fight the majority of the battle out of contact using non-line-of-sight killers. The use of U.S. forces in Contingency Operations requires the ability to respond quickly to unanticipated challenges to our interests around the globe.

The RFPI ACTD demonstrates a highly lethal, survivable, and airlift constrained enhanced power projection capability through the development and evaluation of new technologies and tactics for early entry forces. The lift-constrained environment requires the new forces to be as deployable as current forces. The Rapid Force Projection Initiative also demonstrates real time targeting from forward sensors to standoff killer weapon systems with the capability to engage high value targets, including heavy armor, beyond traditional direct fire range. Target transfer is facilitated by tactical digital data transfer systems being developed as part of the U.S. Army Battle Command System (ABCS). This synchronization of dispersed forces results in increased force lethality and survivability. This ACTD also provides a tool for further exploration of emerging warfighting concepts and doctrine.

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An integral element of the RFPI ACTD is the provision of developmental ACTD items to the participating warfighting unit as a residual operating capability, with suitable technical support for at least two years. The unit which participated in the RFPI Field Experiment, conducted in summer, 1998 was the 2nd Brigade/101st Airborne Division (Air Assault), which is in turn a part of the XVIII Airborne Corps. This unit is still designated as the recipient unit of the RFPI equipment for the two-year residual period, although the possibility exists for the transference of the equipment to another unit of the XVIII Corps.

The RFPI System of Systems is designed to supplement or replace systems currently in the inventory of the Experimental Brigade (the Brigade Modified Table of Organization and Equipment. (MTOE)) See Table 1 for a listing of the brigade's weapon systems, as well as a listing of the RFPI ACTD program systems. The systems, designated the Residual or Leave-behind systems, are comprised of a variety of near-acquisition and brass-board systems that can be used today by the warfighter. Scheduled for initial unit production in the 2001-2003 timeframe, they are at a level of development sufficient for them to be retained by the experimental unit for the two-year residual period following the August 1998 Ft. Benning Field Experiment. The unit will train with them, and deploy with them in case of a warfighting need. The unit also can specify which of the Residual systems it chooses to retain, which needs further work and development to meet the units operational tempo and parameters adequately, and which systems it chooses not to retain at all. The advanced concept systems are more conceptual, with an expected initial

production in the 2006-2007 timeframe. These could only be evaluated through the means of interactive and constructive simulation, and were not ready to go into the hands of the warfighter. As shown below, these Technology Demonstration and Advanced Technology Demonstration (TD and ATD) systems are designed to supplement or replace systems currently in the unit's MTOE, or replace the residual systems. Again, the key is to improve the lethality, improve the survivability of the light unit while maintaining the same logistics burden.

Utility and the further exploration of emerging warfighting doctrine is being accomplished through a series of TRADOC sponsored Battle Lab Warfighting Demonstrations and Experiments. The RFPI ACTD builds on ongoing activities of the RFPI Technology Program (TP) and its supporting ATDs and TDs. Refer to Figure 1, which shows the process of taking the predictive performance of the systems from the TD and ATD program managers, and the developers, from limited field tests and limited system of system examinations. These are then focused through the lens of simulation in preparation for the delivery of the residual systems to the experimental unit for retention, and as the process continues on through the acquisition process.

RFPI ACTD System of Systems

	Hunters	**Battle Command (C4I)**	**Standoff Killers**
Current Systems	OH-58D, GBS, IREMBASS, AH-64D/LB, JTUAV, Predator,TPQ36/37 COLT, TACP, LRSD, RECON, FO/FIST, GBSC, etc.	ATTCS, other BOS C2 systems, SINCGARS	AH-64C/D, TOW-ITAS, Javelin, 105 HOW, 155 HOW, 60mm & 81mm Mortar, MANPADS, Avenger, 155 SADARM, ER MLRS
Residuals/Leave behind	Hunter Sensor Suite, Remote Sentry, FO/FAC, IAS (HE & ADAS)	Light Digital TOC, Distributed Automated C2, Digital Commo	HIMARS, EFOGM, 155mm AutoHOW
Advanced Concepts/ Systems Programs	Tech Demos: LOSAT, PGMM, RAPTOR IMF, Guided AIS, ASSI Tech Programs: Smart 105mm TGP, LCCM, LOCAAS Acquisition Programs: MSTAR, AVTOC, ER 155mm Comanche, UGV, PI SADARM, FOTT, 155mm LW LRAS3, ATACMS II (not used)		

Table 1. The RFPI ACTD System of Systems

The following is a list of the RFPI Residual/Leave Behind Systems:

Hunters (Advanced Sensors):
Hunter Sensor Suite, Remote Sentry, Forward Observer/Forward Aerial Controller, Integrated Acoustic System
Battle Command C4I:
Light Digital Tactical Operating Center (LDTOC)
Standoff Killers/ Munitions:
High Mobility Agility Rocket System (HIMARS), Extended Fiber Optic Guided Munition (EFOGM), 155mm Howitzer Automatic Fire Control System (AFCS)

The following is a list of the RFPI Advanced Concepts Systems:

ATDs and TDs
Hunters (Advanced Sensors):
Aerial Scout Sensor Integration
Standoff Killers/Munitions:
120mm Mortar Fire Control System (MFCS) & Precision Guided Mortar Munition (PGMM), Improved Mine Field (IMF), Line-of-Sight Anti-tank (LOSAT), Autonomous Intelligent Submunition (Multiple Launch Rocket System (MLRS) Smart Tactical Rocket (MSTAR) Candidate)

Other Science and Technology Programs
Standoff Killers/Munitions:
Smart 105mm Munition (Terminally Guided Projectile; TGP), Low Cost Competent Munition (LCCM), Low Cost Autonomous Attack System (LOCAAS) (MSTAR candidate)

Advanced Concepts – Acquisition Programs (These are materiel programs which were advanced in the acquisition process independently of the ACTD program, but were included because of the potential for accelerating the systems acquisition timelines, thereby producing the systems for the warfighter much sooner.)
Hunters (Advanced Sensors):
Unmanned Ground Vehicle (UGV), Comanche helicopter
Battle Command C4I:
Aviation Tactical Operations Center (AVTOC)
Standoff Killers/Munitions:
Follow-on to TOW (FOTT), 155mm Lightweight Automatic Howitzer (ATCAS); 155mm Extended Range munition, Search and Destroy Armor Pre-planned Product Improvement (SADARM P3I), Guided MLRS, BAT P3I (MSTAR candidate) ATACMs Blk III

RFPI Milestones

What follows is a listing of the early RFPI events and milestones which served to define what was to be expected in the relationship of the selected TD and ATD systems, particularly keying on showcasing the EFOGM system and the digital communications and advanced sensors which would provide targeting information. The EFOGM system, along with the additional artillery systems, the HIMARS and 155mm ATCAS Howitzer answers the warfighter's interest in the RFPI ACTD to provide precision armor defeating capability beyond the infantry systems' direct fire range, extending the infantry brigade's area of influence to 60km to 100km, or into the divisional area of responsibility. This is due to findings from Desert Storm regarding the vulnerability of the airborne and air assault units defending against an armored attack. The exercise JRTC 94-02 (OOTW) (Operations Other than War) Nov 93 (before the initiation of the ACTD) showed the potential of the application of EFOGM and digital communications technology to the light force. The Infantry Commanders Conference, May 94 was a showcase to the collective Army leadership of the potential of the RFPI Hunter Standoff Killer concept. The Redstone Arsenal Early Version Demonstration, Sep/Oct 94 was the first opportunity to show the Army leadership the potential of the live/virtual representation of the battlefield in the Distributed Interactive Simulation (DIS) environment. This was done using the Battlefield Environment Weapons Systems Simulation (BEWSS) and other simulations and display systems in Redstone Arsenal Building 5400. Warrior Focus JRTC 96-02 November 95 offered another experiment regarding the potential of digital communications and targeting for the Army. The RFPI Initial Systems Mix approved by the U.S. Army Senior Advisory Group in December 94. The final U.S. Army approval of the RFPI Management Plan in occurred in March 95. The 101st ABN (AASLT) was designated by FORSCOM as the ACTD Experiment Force in July 95 for the purpose of pre-field experiment preparation. As far as experimentation is concerned, as differentiated from demonstrations were the April 94 Anti-armor Advanced Technology Demonstration (A2ATD) Battlefield Distributed Simulation -Developmental (BDS-D), which used the BEWSS constructive simulation to first

investigate the RFPI system of systems concept in a modified version of the Caribbean TRADOC scenario HRS 33.7. A major BDS-D demonstration was the RFPI Experiment 6, scheduled for June 95 and finally finished in Jan 96.TRAC-WSMR was asked for a CASTFOREM scenario to derive the ModSAF scenario, which matched the BEWSS 33.7 scenario being used by RFPI. Due to new BEWSS DIS capability, BEWSS was linked to ModSAF and the CASTFOREM scenario was not necessary except for the purpose of beginning the process of implementing RFPI representations into CASTFOREM for use in what-if analyses. The scenario in CASTFOREM was dropped in Apr. 96. The need for TRAC-WSMR's involvement in the RFPI assessment process increased dramatically in 1996, with DUSA (OR) blessing. This was to investigate the performance of combinations of the RFPI residual and advanced concept systems in CASTFOREM and Janus, and to present to DUSA (OR) using the 1999 operational capabilities of a Division Ready Brigade (DRB) of the 82nd Airborne, and a DRB of the 101st Air Assault operating in approved TRADOC scenarios in Southwest Asia and Northeast Asia. The purpose was to indicate which of the residual and advanced concept systems have potential in adding capability to the warfighter, and so therefore should be continued in acquisition consideration. These results were presented in October 97.

Finally, as the climax to the RFPI experimentation was a large scale, free play live/virtual field experiment conducted July-August 1998 at Ft. Benning, GA to support the evaluation of the value added by inserting these new technologies into the force structure of an existing unit. This was also to examine the unit as it developed tactics, techniques, and procedures (TTPs) based on the Ft. Benning-developed operational techniques as to how they would train and fight the RFPI system of systems as they entered into their MTOE as residuals. The developmental equipment was delivered to the artillery units of the XVIII Corps and the 2nd Brigade/ 101st AASLT for training starting in November 1997, and will be retained for two years after the field experiment. This is dependent on the ability of the developers to deliver and maintain the systems, and the unit's interest in retaining the equipment in their go-to-war inventories.

Leading up to this climax live-virtual field experiment were a large number of battle lab warfighting experiments (BLWE), 2nd/101st command post exercises (CPX) and field training exercises (FTX). These alternated with constructive simulation and interactive simulation experiments. These simulation experiments had the results of refining the TTPs and operational concepts for Ft. Benning DBBL and the experimental unit, to investigate the placement of data collection instrumentation and battle flow by representing the field experiment on a digital representation of Ft. Benning. Also, the constructive and interactive simulations were used to prepare the interactive simulation scenarios used to drive the live/virtual DIS field experiment. This back-and-forth between simulations and experiments is portrayed in Figure 2 representing the Model Experiment Model process. The final analytic products of the RFPI ACTD will be a set of five assessments: the OPTEC Assessment; the FORSCOM User Assessment; the TRADOC User Assessment; the Engineering Assessment comprised of the reports from the TD and ATDs, accumulated by the RFPI PMO; and the TRAC-WSMR Performance Assessment based on operational analysis events and constructive simulation. These analytic products, which are due in 4Q FY00, will provide the final and definitive measure of the RFPI Hunter Standoff Killer (HSOK) effectiveness.

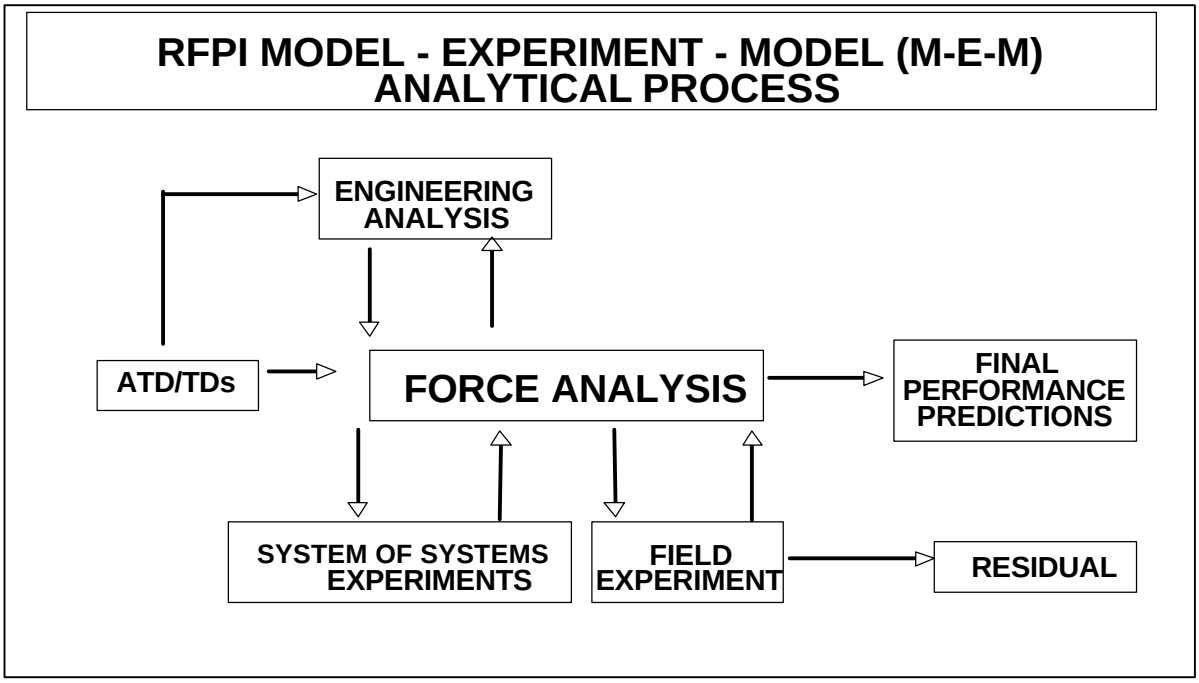

Figure 1 the Model Experiment Model Process

RFPI Model-Experiment-Model (M-E-M) Iterations

FY	Analysis	Experiment
94	Interim Report HRS 33.5	Early Version Demonstration (EVD) (Initial Live/Virtual Concept Demonstration)
95	Quick Look HRS 33.7	Integrated Virtual Environment Test
96	OP Concept HRS 33.8	Anti-Armor Advanced Technology Demonstration (A2ATD)
97	Trade-out Analysis	EFOGM BLWE (I) and LDTOC BLWE (II) (Verify C4I and EFOGM Simulation)
	Pre-FieldEx (BEWSS)	Virtual Rehearsal BLWE (III) (Verify Entity Quantity and Capability)
98	Post BLWE III (BEWSS)	Virtual Record Runs (Dress rehearsals)
	Pre-FieldEx (TRAC)	Ft. Benning Field Experiment
99	Post-FieldEx (TRAC)	
00	Final Analysis (TRAC)	

Figure 2 Model Experiment Model Iterations

The two principle components for the definition of success were the proof of the success of the live virtual DIS experiment. Secondly, success was in the completeness and applicability of the analysis and assessment of the equipment comprising the residual and advanced systems. This is in preparation for the accelerated fielding to the warfighter of the RFPI system of systems.

The Live/Virtual Field Experiment and the Distributed Interactive Simulation

The purpose of the live/virtual field experiment is to expand the live fight to the full Blue experimental force, a Division Ready Brigade versus the experimental operational force representing a Red division, and to represent the entire compliment of live and virtual entities in virtual domain. This will enable interaction of live and virtual entities, represent all munitions firing, detonations, and casualties in virtual domain; Inform live entities of their damage status; reflect direct-fire miles casualties in virtual domain; synchronize live and virtual target acquisitions and battlefield damage assessment. In addition, the technology created for the Ft. Benning Field Experiment allows the transition one virtual battalion of Opposition Forces (OPFOR) to live OPFOR at the Ft. Benning range boundary, and interface with live OPFOR voice networks.

In the process of simulating/stimulating the brigade command, control, communication, computers, and intelligence (C4I), critical virtual operational facilities are represented so that they can participate on tactical voice networks and tactical VMF networks. The Army Tactical Command and Control System (ATTCS) is stimulated to the degree supported by existing stimulation tools. Additionally, the C4I network was used to support exercise control, data collection, and analysis, to interface the virtual environment observer/controllers to the live Ocs through a simulated live/virtual voice network. The digital communications network also facilitated the accumulation and display of battle views and statistics, and the integration with experimental control and instrumentation control via voice and digital nets. All of this coordination and communication was accomplished during the field experiment in real time!

Simulation capabilities were developed enabling the Rapid Force Projection Initiative (RFPI) live / virtual experiments, which interfaced live instrumentation to the distributed interactive simulation (DIS) backbone, allowing the DIS integration of over 1500 entities, both live and virtual. The “shadow server” concept was developed to allow live/virtual interactions, with the shadow server allowing virtual to live transitions in real-time across the Ft. Benning range boundaries (the live ground vehicles could not operate beyond the bounds of the military reservation.) The virtual C4I systems stimulated digital networks modeled after the Task Force XXI (TFXXI) communications system. The field experiment demonstrated the first and only DIS air assault scenario, and demonstrated portability to provide the DIS battle to remote facilities. In order to facilitate the many types of systems represented in the live/virtual simulation, multiple models (ModSAF, TAFSM, IDEEAS, FireStorm, ITEMS) were made interoperable, sharing information about firings, impacts, unit location and status over a common shared information backbone. This information was communicated between the field units, the simulators at Ft. Benning, and the ModSAF and IDEEAS suites at Redstone Arsenal over a high-speed data network. At the same time, monitoring the status of the experiment in real-time were analysis tools collecting information pertaining to the status of the experiment, and collecting data in order to answer the pre-assigned Measures of Effectiveness (MOEs). These answers were then made available for discussion at an After Action Review, conducted directly following the end of each exercise portion.

Field Experiment Accomplishment

RFPI has just executed the most highly interactive live/virtual/constructive simulation exercise ever achieved or attempted. In this Blue brigade versus Red division fight, all combinations of live or virtual system interactions were allowed. Blue C4I systems had completely seamless stimulation of digital and voice traffic for Air Defense Artillery, maneuver, intelligence, and fire support. Virtual entities translated to live elements automatically, with contiguous translation and

correlation. No aggregation was used in this 1500+-entity fight, including the first ever live/virtual air assault mission. Finally, RFPI has shown that Distributed Interactive Simulation works for experimentation.

Constructive Simulation - Less than Successful

The intent of the constructive simulation was to specify that the items selected for the Residual Systems fielding to the 2nd BDE/101st AA Division were contributory on the combined arms battlefield, and that even in a brassboard state they could contribute to the performance of the warfighter. Performance data that had been provided by project managers and developers had been used in simulation studies for years. The reality of the situation from the viewpoint of the field experiment was how unprepared some of the systems were when put into the hands of the warfighter. Pretesting of several systems was not possible due to developer delivery slippage. No amount of political posturing or wishful thinking would allow several of the key Residual Systems to perform to the expected level. Even several systems already on the fast track to Army acquisition were not as well prepared as had been expected. However, the systems which were ready and were selected for continuation in the residual period of the ACTD will benefit from the experience, especially as they transition to acquisition.
So, the conundrum is that simulation is valuable in analysis and assessment. But, limitations due to using data that may be inadequate, less than objective, or fanciful may serve to compound problems, especially as doctrinal and systems' integration issues are being planned in the system of systems concept of operations. However this performance expectation sandcastle can readily come apart when actual performance falls far short of predicted data, and the expectations to the warfighter experimental unit are not realized. A case in point is the performance of the acoustic sensor making up the Integrated Acoustic System (IAS) and the Air Delivered Acoustic System. In simulation, this system was key for early warning of approaching enemy, for direction and classification as to type and number of approaching vehicles, and to pinpoint artillery, all at extended ranges. This information was to be used to cue attack helicopter launch and interception, artillery and EFOGM fire, and maneuvering of reserve elements if a strong enemy thrust was detected. This sensor was also an integral element in the Improved Minefield System, or RAPTOR. Simulation showed the many and various benefits of this system. In actuality, the system did not perform to the level of expectation, and so was eventually dropped from consideration as a residual system. There is a place for speculative data of a system's performance – much of the combat simulation work speculates on performances of systems 10 to 15 years out. But when an actual delivery date was at hand, and actual performance information was required to feed simulation, there is no tolerance for wishful thinking.

So, the results of the constructive simulation experiments, in light of the real performances of the systems in the hands of the experimental force cannot be considered a successful representation to date. The results of the constructive CASTFOREM and Janus simulations were useful for preparation of the field experiment, and have use in investigating the individual RFPI systems as they progress toward acquisition, through Analysis of Alternatives and Cost and Operational Effectiveness Analyses. However, several systems which proved very valuable to the force in simulation, and while the performance of these systems was taken from the input from engineering analysis and data from the proponents, they in reality were not ready for delivery as residual systems. Nor were the performances in the hands of troops that which was anticipated.