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Simulations used in training attempt to portray reality for the units or individuals participating in training. Some of the benefits of simulation training include: cost efficient training, training units in tasks that are too dangerous to perform otherwise, and training units in complex tasks in a repetitive fashion. Also, training within simulations enables the senior trainer to control all of the environmental variables and give enhanced observation feedback to the training unit. The training outcomes are similar to those that would have resulted from a live exercise. There are several ways in which training simulations can emulate actual war or combat conditions. The Army has the capability to emulate or simulate tactical engagements through constructive, virtual and live simulations. Several simulation methods can be employed to meet overall training objectives for the training unit. Selection of the proper simulation or simulations ensures that all tasks are trained and the desired outcomes or training objectives are achieved.

Early simulation models date back to the era of Napoleon. Mange, a famous French mathematician created logistics models which enabled Napoleon to conduct his victorious campaigns in a manner similar to modern military operations. Although very primitive in nature, these early models were nevertheless simulations. Simulation, in addition to military applications, is now widely used by corporate strategists and financiers worldwide. Currently, simulation can probably be viewed as Mankind's attempt to predict the future by using an array of methodologies including those which implement advanced technologies (Dessoy, 1995).

One of the most widely-used techniques of computer-assisted learning in use today is simulation. In civilian applications, most large scale, computer assisted learning projects have set out to teach students or trainees by using more cost effective ways which simultaneously and ultimately reduces the cost of the instruction per student (O'Shea & Self, 1983). The military has learned from these applications and has developed various forms of training and learning system models. In computer-assisted simulations, a program which models some process or system is available to a student or trainee in the hope that by studying the performance of the program the training subject will gain positive insight into whatever process or system is being modeled. The

trainee role is typically more than that of a spectator; often he or she is responsible for providing inputs into the program after deciding on a particular strategy to use. This situation results in the ability of the student to experiment with the modeled system. The advantages of simulation as a viable approach to learning are well appreciated outside computer-assisted learning. The advantages a computer brings to a simulation are the attributes of a different, powerful, and flexible device for controlling programmed simulations. Development and use of mathematical models often create complexities beyond the capabilities of a trainee or student. Computer implementation of these models make them usable by enabling the student to gain an understanding of the principles underlying the process. Computers are often used in simulation to remove complications which could obscure the more important principles. A computer simulation may be the only method or avenue to provide a trainee or student with a safe, inexpensive view of certain phenomena and situations such as nuclear reactions, space travel, complex flight situations, and combat environments (Oshea, & Self, 1983).

Computer-assisted learning has faced peculiar difficulties in the attempt to provide evidence of its contribution to the learning process. The traditional method uses pre-test and post-test scores for a computer-assisted learning group of students and a control group. This method is encouraged by the fact that the computer is suited for collecting and analyzing statistics and tracking details of events (O'Shea & Self, 1983). When the military uses the computers for learning processes, the trainees' functions are stored for review at a later time by other students. This allows for reduced training time and cost.

The military applications as well as the civilian uses for training simulations have found many positive reasons to use the computer aided learning techniques. An evaluation of a college based training program concluded the following about the use of computers for learning: 1) they provided significant contributions toward achievement, 2) they produced positive effects on the attitudes toward instruction and the subject matter, and 3) they substantially reduced the time needed for instruction (Oshea & Self, 1983).

The military, like various academic institutions, are using distance learning within programs of instruction. Distance education occurs when the student is physically distant from teachers and an institution. Since computers can be linked into several networks and information transferred between them, they are well suited to support the distant learning concepts (O'Shea & Self, 1983). Simulation requires data for the processing and production of usable data. In simulation technology, this technique naturally lends itself to the re-creation of operational situations for training purposes. By the analysis of research simulations, doctrines can be established that when applied in training simulations yield additional data that may be useful to the trainer.

Training aids such as some sort of mechanical device(s) used to educate personnel in the operation of a piece of equipment do not qualify as simulators. These upscaled mechanical devices are not capable of providing recorded data during or after use. The recorded data produced by simulators is necessary for the performance feedback desired from the system. For the same reason, some flight simulators developed with earlier technology do not technically qualify as simulators since these systems do nothing more than orient a pilot or student to the operational controls and characteristics of the aircraft to which the simulator emulates.

Simulation has been integrated within infantry training programs for quite some time now. Simulations used in the training of infantry units and personnel are based on three functional stages which fully integrate all aspects of the training program or process. These functional stages are the fundamental basis for systems currently employed in the U. S. Army and military organizations worldwide. The first functional stage is the individual/technical stage. This stage is normally described as weapons management and creates the appropriate relationship between man and device. Basic indoor simulation is typically incorporated into this stage; it teaches the trainee basic targetry and simulated engagement with a particular weapon system. This stage correlates to the psycho-motive portion of the human learning process to achieve skilled proficiency prior to advanced training requirements. The second functional stage places the trainee in a collective environment where he or she collectively interacts with fellow soldiers under a specific organizational structure such as squad or platoon under centralized control. This collective stage is designed to be tactical and enhances the trainee's marksmanship skills and typically involves indoor simulation utilizing video projection emulating a complex tactical situation. This stage corresponds to the socio-affective portion of the human learning process. The third and final functional stage involves maneuver or movement management. This stage is referred to as the operational stage of personnel training for a mission which uses a combat substitute to provide the indispensable cognitive component of the human learning process. This stage culminates all of the skills acquired from the two previous stages. Simulation of this operational stage can involve two separate ideologies. One aspect of simulation may involve actual live fire with a simulated enemy while another aspect might employ simulated fire with a live enemy force. The latter is typically more desirable based on the cost of ammunition versus simulation systems in the long-run and normally utilizes laser engagement systems (Dessoy, 1995).

The U. S. Government has a history of experimenting with technology. The Department of Defense Advanced Research Project Agency, the first and steadiest supporter of artificial intelligence and the Office of Naval research, has experimented extensively for the purpose of insurance against unwelcome technological surprises (Michie & Johnson, 1985).

With the advent of new technology comes a rapidly changing world. This volatile world requires the United States to maintain a fluid and combat-ready force. There are several key imperatives to sustaining this force which is ready for the challenge of tomorrow--doctrine, force mix, equipment, training, leader development, and quality personnel. Each of these imperatives are not static or fixed. They change at a pace which is even greater than the society in which we live.

Generally, when the Armed Forces can keep pace with the changing situations, it is usually very successful. One recent example of this is the Operation Desert Storm. Although known as the "hundred hour war," billions of man hours were invested in preparation and maintaining the trained force. One way the Army is looking to maintain its forces in the future is a concept called Force XXI. This concept will be the result of a rework of the conceptualization and redesign of the forces at all echelons, from the front line foxhole to the industrial base. It will tailor the

organized total force around information and information technologies (Directorate of Battle Lab Integration Technology and Concepts, 1995).

The Force XXI concept incorporates three complementary and interactive efforts: the first is the redesign of the Army's operational forces, the second is the redesign of the institutional forces, and finally, the efforts focused on the development and acquisition of information-age technologies. These technologies will include experimental methodology to produce a better trained force.

The experimental methodology developed in the Battlefield Laboratories Program will shape the Army of the 21st Century. The force will be designed and built based upon experimental data and information generated in the war-fighting experiments. This experimental technology provides the ways and means to conduct appraisals of critical operational and institutional requirements needed to meet the challenges posed by the constantly changing nature of war (Directorate of Battle Lab Integration Technology and Concepts, 1995).

The Battle Labs Program has formed teams of combat developers, material developers, and testers who conduct operations using the integrated concept. The program is a forum for holistic appraisals of joint and coalition war-fighting. The U. S. Marine Corps Combat Development Command, U. S. Air Combat Command, U.S. Navy Doctrine Command and others are active participants in war-fighting experiments. The British and German armies are establishing programs similar to the Battle Labs and have asked to coordinate the programs to ensure compatibility on future battlefields and avoid redundant development efforts. These joint and coalition linkages provide a "real world" context where the development of land combat forces can be developed for the 21st Century (Directorate of Battle Lab Integration Technology and Concepts, 1995).

Since the Army's role in Operations Other Than War (OOTW) is continuing to expand, the understanding of the requirements which are unique to OOTW is an important element of the readiness of the Army. The Battle Lab contacts with Federal Emergency Management Agency, Justice Department, and Coast Guard which will help in the development of the force which can meet the challenges of the next century.

War-fighting experiments are key to the successful development of our forces. These war-fighting experiments begin with formal hypotheses derived from normal operational issues or from projected Force XXI concepts. These experiments employ a progressive and iterative mix of constructive, virtual, and live simulations. These simulations involve field soldiers and units in relevant, tactically competitive scenarios.

There are a wide variety of war-fighting experiments ranging from a fairly narrow focused look at an issue to a comprehensive, detailed exploration of a complex issue. War-fighting experiments that have relevance to a single battlefield dynamic are called Battle Lab War Fighting Experiments (BLWE). More advanced experimentation called Advanced War-fighting Experiments (AWE) focus on the effects of major war-fighting capabilities within a theater (Directorate of Battle Lab Integration Technology and Concepts, 1995). AWEs impact most of the issues associated with the battlefield. The AWEs address all the domains of doctrine, training, leader development, organization, design, material, and soldier systems requirements.

The first AWE as the Atlantic Resolve REFORGER exercise in November 1994. This experiment provided insights into the linkage of disparate constructive, virtual, and live simulations in a "synthetic theater of war" (STOW). Other AWE include the Theater Missile Defense experiment, the Mobile Strike Force, and the Focused Dispatch experiment. The latest AWE is Desert Hammer VI which will evaluate the processes and functions of digital connectivity among fire support, intelligence, combat service support, and battle command in a mounted battalion task force. The final AWE is Warrior Focus which will establish a baseline for digitization of dismounted battalion task forces and continue to explore night fighting alternatives.

The experimental forces which will prelude the Force SSI will be organized around information and information technologies. While it will experiment with new technologies, it will focus on the organization using these technologies (Directorate of Battle Lab Integration Technology and Concepts, 1995).

The new forces require much greater training requirements than earlier forces. One method the Army has explored is to assist in the training requirements in the use of simulators. Simulations and simulators are the principle tools of the Battle Lab concept. The extreme simulations are the heart of the war-fighting experiments. Due to the fact that the simulation technology is evolving rapidly, the Battle Labs are devoting significant resources to more fully develop this capability.

Military simulation systems in continuous development by the Battle Labs and currently employed by the U. S. Army are divided into three categories--constructive simulation, virtual simulation, and live simulation. Constructive simulations are widely used within the Army and have proliferated greatly within the last ten years. They are complex, computer-driven war games and models most often associated with training battalions, brigades, divisions, and corps. The primary training audience for constructive simulations is commanders and their staffs. In the majority of the cases, these simulations are "exercise drivers" for the training exercises where the training audience is located in field command posts. The primary purpose of constructive simulation is to stimulate the command, control, communications, and intelligence functions of the command process. Within these systems, the roles of adjacent, higher and lower units are "played" in computer workstations transparent to the training audience. These workstations are typically networked to a mini-mainframe computer operating the entire exercise. Communication between the commander and workstation role-players may comprise organic communications to add realism. Outcomes from constructive simulations are typically based on models of attrition and algorithms within the simulation. Constructive systems currently utilized by the U. S. Army are Vector-in-Command, Combined Arms, and Support Task Force Evaluation Model (CASTFOREM), and Battlefield Engagement Weapons Simulation Systems (BEWSS). Most of these simulations require interactive free-play from the workstation participants whether friendly or enemy.

Virtual simulations are normally referred to as simulators because they are either a single component or complete replicas of individual or crew-served weapon systems and/or vehicle or crafts. Virtual simulations are found in flight simulators at the U. S. Army Aviation Center at

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Fort Rucker, tank simulation at Fort Knox, infantry fighting vehicle (IFV) simulation at Fort Benning, and engineer vehicle simulation at Fort Leonard Wood. Virtual simulators provide primary training to individuals and crews in collective training experiences and scenarios. Within the virtual environment, trainees interact with simulators through a prescribed number of tasks involving sight, sound, and motion payback (Farber, 1996). Graphical interface is heavily employed within some more sophisticated virtual simulation systems. Such systems as "magic glasses" interface with a simulator system through a headset worn like conventional spectacles containing a wide array of instrumentation characteristics (Moravec, 1988). These glasses, as they are often referred, possess high-resolution color displays, one for each eye, with optics that cover the entire field and make the image generated by the computer appear in focus at a comfortable distance. At least two high resolution television cameras with forward-looking wide-angle lenses are placed as close to the position of the eye as possible. This enables a person to see where one is going when the cameras are connected to the corresponding display screens on the lenses. A third camera could be and is normally utilized to observe the wearer's facial expressions and characteristics. These systems are also equipped with microphones and small earphones in the frame for sound and communication. Most of these virtual interface systems are equipped with a navigation system that accurately and continuously tracks the position and orientation of the glasses. These type systems are typically interfaced with a powerful computer that can generate realistic synthetic imagery, sound, and speech as well as understand spoken commands. One of the earliest successful models of virtual interface involving this technology was developed by Boeing in 1986 for a Boeing-Dikorsky experimental helicopter project. This early model remarkably projected data from the aircraft's instruments into the pilot's field of view. For example, radar blips are made to appear at the actual locations of the objects being tracked (Moravec, 1988). All branches of the military currently use some form of virtual simulation within flight, vehicle, or virtual combat training configurations. Within the Army, SIMNET and Mobile Conduct of Fire Trainers (MCOFT) are probably the most common virtual system that can be linked via high-speed data link to a worldwide network of computers involving other simulators or systems.

Within the live simulated training environment, the Army employs weapons simulator exercises that directly involve weapons simulation technology. Weapons simulator exercises employ training devices that do not require live ammunition or live-fire range facilities. Within the Army, the most utilized training devices employ eye-safe lasers integrated into weapon systems fire control. These training devices provide a relatively high degree of realism in training while allowing units a high degree of maneuver freedom not available in live-fire exercises. The absence of live ammunition in these simulator exercises enables units to overcome unrealistic, artificial range safety requirements associated with live-fire range operations. These requirements do not exist on a real battlefield and thus distract from the realism. Live weapons simulations are more focused on synchronization of fires, maneuver, and command and control in a controlled environment. Live training exercises are conducted in conjunction with, prior to, or after constructive and virtual simulation. Live training validates proficiencies gained in constructive and virtual simulated environments, builds fieldcraft, exercises combat deployment in the field, and adds stresses caused by the unpredictable environment of combat. Live exercises can be conducted at several levels varying from the MILES (Multiple-Integrated Laser Engagement System)

supported company level force-on-force exercises and tank weapons gunnery simulation system to full-scale battalion task force maneuver at a Combat Training Center. The desired training effect can be gained by using any combination of weapons simulators, subcaliber devices, and organic weapons (Dessoy, 1995).

Due to the cost of munitions, training budget constraints, and range availability issues, live simulation has proliferated to individual marksmanship training. Laser marksmanship training systems are typically the norm with regards to individual weapon training systems. These systems are advantageous to Army units in that they are low cost and enable personnel to safely train with their own assigned weapons with no special facilities required. These systems typically operate by mounting a laser transmitter in the barrel of any M-9 pistol or M16A2 rifle with no modification to the weapon at all. Beamhit™ Model 330-A is currently a system on the market implementing simulated laser engagement technology with systems for both the M-9 pistol and M16A2 rifle. System interface with a PC is fairly straight forward as well as the design for installation on the weapon. Cables supplied with the laser simulator unit run from the target to the control box. From the control box, cables attach to the PC via a COM port. Once the IBM-compatible software is loaded onto at least a 286 PC platform, the system is completely operational. Systems are currently available to operate up to ten targets from one computer (Belvoir Publications, Inc., 1995).

The increasing complexity of the modern battlefield demands extensive training in crew gunnery and tactics. Precision gunnery training enhances crew skills when restrictions on unit training time, ranges, and ammunition make live-fire gunnery difficult. Tanks and armored combat vehicles equipped with a Tank Weapons Gunnery Simulation System (TWGSS) can track maneuvering targets and fire on the move using the complete or partial fire control system just as they would in actual battlefield engagements. These simulators record data in the form of hits and misses with individual vehicle and ammunition codes to create accurate data for review and assessment. The current complexity of these systems integrate recorded weapon sounds, timed program obscuration, high fidelity tracer images in the sights with burst on target cues, multi-level damage assessments, and an accuracy ballistically matched to all ammunition and missile projectiles in the Army inventory. Engagement information is provided for review. Most of these systems store data on removable memory cards, transfer information to a portable computer in the field, and provide real-time displays of graphics and data (Saab Training System, 1996).

Complementing the Tank Weapons Gunnery Simulation System (TWGSS) and PC-based infra-red training programs like those currently under development for the U.S. Army by E-OIR Measurements, Inc. These systems comprise an array of Combat Vehicle Identification (CVI) thermal training software packages. These packaged systems provide a comprehensive training tool which enables students to recognize thermal imaging and visible cues of various tactical ground vehicles at several ranges through a wide variety of thermal sights. The program is user friendly, menu-driven, and provides test functions for evaluating trainee progress. Image digitization technology is also being implemented within the training and combat environments. Companies such as E-OIR Measurements, Inc. are currently developing a low-cost sensor suite coupled with commercial notebook computers containing PCMCIA digitizing cards. These systems

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are flexible and can serve a variety of needs. These systems basically operate by a high-resolution Pentium® notebook computer capturing and digitizing 8-bit still frames through the PCMCIA interface. Future technology will incorporate laser range-finding capabilities coupled with global positioning to enhance this feature (E-OIR Measurements, Inc., 1996).

There are pros and cons to the various types of systems of simulation. Experimental designs must be tailored to take advantage of the strengths of the individual systems. Ultimately, these simulation systems will be tied together seamlessly to form the Distributed Interactive Simulation (DIS) program. The near term use of this system is the application of the development of the Synthetic Theater of War (STOW). The STOW is being developed to demonstrate the dynamic, credible synthetic environment by linking the interactive simulations. The concept of the STOW will allow simulations (constructive, virtual and live) to work together in order to allow the forces to interact among simulations.

To implement the DIS and STOW systems, a combination of wide area communications networks must exist. These circuits will connect simulations and simulators to create a highly complex and realistic synthetic battlefield environment. The Battle Labs have taken the lead in developing this connectivity by installing the Defense Simulation Internet (DSI) (Directorate of Battle Lab Integration Technology and Concepts, 1995). The DSI will allow the Battle Labs to take advantage of advances in the wide area communications and to interconnect with geographically dispersed simulators.

Probably one of the most sophisticated and complex simulation networks involving live simulation are instrumentation systems employed by the U. S. military, particularly the U. S. Army, at U. S. Combat Training Centers worldwide. These systems integrate data communications and instrumentation subsystems to produce real-time data and information about current engagements in real-time. The basis of these systems is the data communications interface (DCI) which collects event data and global positioning system (GPS) location. This DCI interfaces with laser tactical engagement simulations such as the Multiple Integrated Laser Engagement System (MILES 2000). Advanced signaling technology allows communication through heavy foliage unlike previous systems. The ability to transmit under austere conditions is a breakthrough in technology due to the type of terrain maneuver forces typically manipulate during the course of an exercise. The information generated from the data communication interface (DCI) is transmitted from the field site through a relay tower to a core instrumentation subsystem. This subsystem records instrumented data and observer/controller observations in a database for rapid after-action review (AAR) retrieval and analysis. The core instrumentation subsystem supports scenario development, exercise control, and AAR preparation, generates paperless real-time data entry and retrieval, and possesses a fully redundant system which minimizes hardware/software downtime.

From the core instrumentation system, data is generated and transmitted via communications link, i.e. microwave or fiber optic, to either a mobile or fixed after-action review. The after-action review utilizing the mobile system can take place anywhere at the training center and has a full range of audio/video recording and editing capabilities. The mobile system can be set up in

approximately thirty minutes. Unlike the mobile system, the fixed AAR site is highly automated for rapid user feedback. The fixed system has user definable reports and the project slides onto any one of three large video screen displays which automatically update themselves with current real-time information. Both the mobile and fixed AAR sites utilize expert system software which minimizes manpower in analyzing and generating desired after-action review output. The sub-systems linked to the data communications interface and either the mobile and/or fixed AAR sites can synchronize data collection for up to four thousand soldiers, vehicles, and rotary-winged aircraft. The flexible architecture employed in these training center instrumentation systems supports integration of constructive, virtual, and/or live simulation. Instrumentation systems are currently in use by the U. S. Army at Combat Training Centers at both Fort Irwin and Fort Polk. The systems at these centers are designed so that future growth and complexities can be incorporated and implemented into the system to accommodate training needs for units engaged in tough realistic scenarios involving both actual war and operations other than war (Cubic Defense Systems, Inc., 1996).

The Army is relying more on simulations to experiment with the war-fighting impacts of advanced concepts and technologies. The current generations of simulations do not possess the capability to provide the results required for the future. The Battle Labs are currently involved in modifying the existing simulations to accommodate the growing requirement for experimentation. The Battle Labs have developed a new generation of simulators called reconfigurable simulators. This is a modular, reconfigurable software and hardware architecture to which future simulators can be designed and built. These reconfigurable simulators will expand the combined arms representation of the synthetic environment and allow Battle Labs to address a wide range of issues. These reconfigurable simulators will link to larger simulations to allow interactive experiments on the combined arms synthetic battlefields.

The Battle Labs Program is organized to address the battlefield dynamic concepts. Each of the concepts--early entry lethality and survivability, battle space, depth and simultaneous attack, CSS and Battle Command--has a dedicated Battle Lab. Separate labs address mounted and dismounted battle space issues of the Army and related military services. In an effort to achieve online data-link capability, the Battle Labs are connected to the Army Interoperability Network (AIN). The AIN is a nationwide network of distributed communications and services to support more cost effective software and interoperability experimentation and development (Directorate of Battle Lab Integration Technology and Concepts, 1995).

Each Battle Lab has its own area of expertise and experimentation with each one being uniquely formulated to achieve its desired mission objectives. The Battle Command Battle Lab has elements in three separate, linked locations. Fort Leavenworth provides overall direction for the laboratory and works on issues concerning the "Art" or principles of command. The laboratory at Fort Gordon works on issues concerning the technical methods and means of command. Concurrently, the laboratory at Fort Huachuca works on issues concerning intelligence collection and dissemination and electronic warfare. The Battle Command Lab issues start with tasks relative to how commanders lead and decide, how information impacts decision making, and how information flows in a high performance organization. Special projects under this laboratory

include experiments addressing battle command, Combat Training Center rotations, interactive training tools, Tactics, Techniques, and Procedures Manuals, Digitized Battle Staff concepts, prototype battle command decision support systems, (i.e., Phoenix), and Mission Planning Rehearsal System utilizing 3-D virtual reality. Other research conducted by this battle laboratory communications technology field study include sensors, data processing, and revolutionizing the Information Operations in the Army.

The Combat Service Support Battle Laboratory concentrates its efforts on improving logistical support systems for the Army. This laboratory focuses on the concept that the future threats will not allow for the build-up of logistics and resources. It also supports the mission requirement by developing and implementing programs and training packages which will get the right equipment to the battlefield at the right place at the right time. This focus has come to be known as the Battlefield Distribution and includes a vast network of wireless communications. The objective of the battlefield distribution is to enhance the movement of material by passing routine storage functions to the soldier. The intent of the Battlefield Distribution concept is to substitute enhanced reliability and velocity in lieu of material stockpiles. The use of source data automation enhances the speed and reliability of processing almost real-time information through the asset visibility. This battle laboratory is tasked with developing systems that give us the ability to track requisitions from the industrial base to the depots, and ultimately to the soldiers. This laboratory will work through networks closely with the Defense Logistics Agency, U. S. Transportation Command, Air Mobility Command, and the Military Sealift Command.

The Early Entry Lethality and Survivability (EELS) Battle Lab is located at Fort Monroe, Virginia and is tasked with improving the deployability, operational capability, survivability and sustainability for deploying initial and follow-on forces to a theater of operations. The EELS Battle Lab is actively pursuing ever-changing simulation technologies to enhance early entry operations. This exploration will include mission planning and rehearsal technologies that are consistent with the Army's Simulation Master Plan.

The Depth and Simultaneous Attack Battle Lab is located at Fort Sill. This particular laboratory defines the requirements to detect and identify enemy forces throughout the battlefield, convey that information in real-time from sensors to engagement systems. This laboratory is extensively involved in the development of artificial intelligence and robotics to support the efforts on the battlefield. This laboratory is currently involved in a program which uses live, virtual, and constructive simulations to demonstrate current and future technologies to defeat a high threat in a theater operation. This laboratory is also working on ways to reduce the time a robotics sensor identifies a threat until the threat is engaged.

The Mounted Battle Space Battle Lab is located at Fort Knox. The term mounted battle space has come to be since man first thought of fighting on a moving platform. The success of the fight is measured by the range and speed of the platform, the distance a soldier can visibly see, and the range of the weapons system. The revolutionary advances of Information Age technologies have rapidly advanced the concept of expanding the mounted battle space. This laboratory has assisted in the development of a variety of systems such as sensors that provide real-time

images of the battlefield, global positioning system to pinpoint friendly forces, digital information links to other forces, and the well-known "smart systems." The laboratory's primary focus involves providing systems which optimize situational awareness to reduce fratricide and maximize the assets available on the battlefield, maximize the survivability of the force with systems that use countermeasures, reduce signature technologies and use of new materials and leadership training, expand the capabilities to engage an armored threat in all types of weather and terrain.

The Dismounted Battle Space Battle Lab is located at Fort Benning. This laboratory is tasked by the Department of Defense with providing systems which support the soldier operating in the dismounted battle space on the modern battlefield. The information age technologies has significantly increased the distance dismounted soldiers can see, along with the range and accuracy of their weapons. This laboratory is actively involved in the management of the program to ensure user night fighting requirements are met. This laboratory is the center of development for the Distributed Interactive Simulations facility. Within its mission, this laboratory is developing and refining the capability to place a soldier onto a virtual simulated battlefield. The soldier will be able to interact with other simulators, i.e., vehicular or aircraft in real-time. The first dismounted weapons simulator is being developed for the Javelin weapon system (Directorate of Battle Lab Integration Technology and Concepts, 1995).

The overall concept of Battle Labs was initially formed to streamline the mission of identifying concepts and requirements for future threats. The Battle Labs are dynamic and innovative organizations. The use of these labs contributes directly to the ability of the Army to fight and win both in the near and long term.

In the future, demand for virtual and constructive simulators will proliferate at a growing rate. This premise is derived from the basis of expected operational frequency and intensity, normally referred to as operations tempo and ammunition costs. The premise coupled with a gradual decline in training land and areas, will continue the expansion and integration of virtual and constructive simulations into the training base relative to individual units and the Army as a whole. The basis for simulations in training is the attempt to portray reality for the units or individuals participating in training. Simulators have many benefits over live training scenarios involving the same tasks. Some of the beneficial attributes of simulation training include: cost efficient training, training units in tasks that are too dangerous to perform otherwise, and training units in complex tasks in a repetitive fashion. With declining budgets and training resources, simulators will inevitably play an inseparable role in training our forces to confront many different threats on future battlefields (Faber, 1996).

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