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The future of aviation collective training in safe hands

The benefits of co-ordinating and rehearsing in simulation by Bruce Miller, Operation's Manager, Combat Aviation Simulation Facility (CAVSIM)

Combat aviation virtual simulation - the term conjures up visions of an approaching but still futuristic capability in which crews of multiple helicopters interact with each other to engage a common threat. Crews move and shoot, unrestrained by environmental and weapon range restrictions, in a battle space strikingly similar to combat mission training centres or real-world trouble spots. The mission preparation and the pressures of co-ordinated attacks of combined and joint operation are real. The mechanics of tactics, techniques and procedures are the same. There is everything to gain from collective simulation and little to lose.

Volumes have been written about this technology and the immeasurable benefits of co-ordinating and rehearsing in simulation, the variety of missions US army aviation is required to undertake. Simulated military operations merging the simultaneous capabilities of battlefield operating systems on a common terrain have been the focus of the military and industry since the early 1980s. Was this capability realised for the first time when *Boeing Frontiers Online* June 2002, Volume 01, Issue 02 stated delivery of "... the world's first multiple rotary wing training device" to the US Army? Are we awaiting the capability in aviation to join the combined and joint fight in simulation? The answers are no and no respectively.

These capabilities have been fully functional at the US Army Aviation Center (USAAVNC), Ft. Rucker, Alabama since 1989. Under three names, AIRNET or Aviation Networking (1989-1990), the Aviation Test Bed (1991-2001) and the Combat Aviation Simulation Facility (CAVSIM), the Research and Development Community, the Combat Developers, the Tactics, Techniques and Procedures Developers and the Active duty and National Guard Aviation Units have had a fully interactive combat virtual environment available to conduct their widely varied tasks.

The CAVSIM is a product of the Advanced Research Project Agency's (DARPA) Interactive Simulation Networking (SIMNET) experiment initiated in the early 1980s. The objectives of SIMNET were twofold. One was to investigate development of technologies to create a vast network of inexpensive computers that could be used to reduce engineering risks during the early stages of new

weapon system acquisition. The other was to enhance combined and joint war-fighting skills with interactive simulations. Phase I was the development of a ground force tactical trainer. By 1986 successes of this phase resulted in the creation of M1 Abrams and M2 Bradley SIMNET facilities at Ft. Knox, Kentucky; Ft. Benning and Stewart in Georgia; Camp McCain in Mississippi, and four additional sites in Europe.

Phase II was designed to integrate aviation with the ground force tactical training system to provide the army with a low-cost combined-arms tactical training system. In late 1988, four prototype rotary-wing devices were delivered to Ft. Rucker. The Directorate of Training and Doctrine used these immediately in a Preliminary Training Development Study to prepare for and to obtain certification and approval for the Aviation Combined Arms Tactical Trainer (AVCATT) Training Development Study (TDS).

Attack and Scout crews of the 2nd Battalion, 229th Aviation Regiment, participated in the Preliminary Training Development Study. They commented that the devices had significant potential as a collective training tool. Using the input of the 2/229 crews, the AVCATT - TDS was completed, submitted and approved by the Training And Doctrine Command (TRADOC).

The objective of AVCATT - TDS is to determine the most cost-effective alternative for conducting collective task training in attack and scout helicopter units. AVCATT - TDS findings indicated that the AVCATT, by default, represented by surrogate AIRNET devices, would meet requirements to train collective training tasks when used in conjunction with aircraft flight hours. Referred to as Fully Reconfigurable Experimental Devices (FREDs), the AIRNET cockpits were generic, low-fidelity devices enabling basic capabilities of combat rotary wing aircraft: move, shoot and communicate. The name was particularly descriptive of its utilitarian construction but the functionality of the FREDs, demonstrated in this first practical use of AIRNET, would change the aviation simulation industry's focus on incredibly expensive, single-purpose, high-fidelity, full-motion simulators.

The FREDs were proof of principle devices and not expected to have an extended lifespan. They did not parallel the relatively sophisticated construction of the ground component SIMNET fibreglass shells or the high-fidelity M1 Abrams and M2 Bradley crew stations. The FREDs replicate the side-by-side seating configuration for scout helicopters and the tandem configuration of attack helicopters. Constructed from plywood, eight 25-inch monitors (three over five) provided the out-the-window display for the pilot's station and offered an approximate 30x60^{o} field of view. Three 25-inch monitors provided the gunner's OTW display.

Generic instruments and a very basic combination navigation and radar warning display were presented at the pilot and gunner station. An additional display for an OH-58D Mast Mounted Sight Thermal Imaging System was located in front of the co-pilot/observer's seat. A small display representative of the AH-64A Target Acquisition System's Optical Relay Tube was positioned at the co-pilot/gunner's location. A Lockheed Martin GT 111 image generator provided the OTW, instrument, navigation and thermal/FLIR displays.

Citizens-band radios provided basic but effective communications. One set of controls, control loaded with a simple multi-axis trunnion and spring assembly, allowed the pilot to manoeuvre the helicopter over the battlefield. The most

sophisticated component in the FRED cockpit was the co-pilot/observer's cyclic grip. Mounted on an immobile cyclic stick, the grip was an exact copy of that found in the OH-58D Kiowa Warrior. Comments by crews that took part in the AVCATT preliminary and final Training Development Study provided design and operational improvements of the FREDs. These were invaluable to the development of the AVCATT Operational Requirements Document but few were incorporated into the FREDs.

The system's fidelity was increased dramatically when the AIRNET moved into a permanent facility in 1990. Four FREDs, two generic fixed wing, an M1, and a generic air defence (GAD) vehicle were added to the inventory. The integration of Tactical Operation Centres, Combat Service Support stations and Artillery Fire Direction Centres into the exercise network further widened the utility of this new technology. Aviation staff training - the decision-making process, information flow and manoeuvre co-ordination - became an indispensable part of the simulation. Control stations were added to allow evaluators or senior trainers to observe the entire battlefield or move freely to observe any single event as it evolved. A digital logger permitted an entire exercise to be recorded and played back for detailed after-action review discussions and statistical analysis.

The CAVSIM was developed as an R&D facility. It was invaluable at every stage of the development of criteria for the Army's AVCATT programme. The CAVSIM participated in Synthetic Theater of War exercises as Army Aviation's piece of the Battlefield Distributed Simulation - Developmental's (BDS-D) programme to expand the role of large virtual and constructive simulations. CAVSIM assets were instrumental in predevelopment exercises of Directed Energy Weapon (DEW) countermeasure systems in the Counter Target Evaluation System Concept Evaluation Program. As the system matured, the CAVSIM created the environment for evaluating Bradley fighting vehicle crew training requirements for DEW in the Stingray Phase II Simulation Evaluation. Experiments sponsored by the Communications and Electronic Command (CECOM) evaluated cockpit enhancements to assist attack helicopters in identifying more accurately the threat and reduce instances of fratricide. Other CECOM experiments focused on situational awareness and targeting enhancements in the form of exceptionally dynamic threat overlays on colour moving maps supplemented with 3-D audio threat orientation cueing.

The CAVSIM hosted Army investigation in use of unmanned aerial vehicles. The Ferret, a sensor-equipped missile, and a small tactical UAV were evaluated in separate experiments from which tactics, techniques and procedures were developed. Helicopter crews were given operational control of the UAV to recon the helicopter's flight route, battle position, anticipated engagement areas and to perform area security while the crews were focused on the attack.

Other experiments at the CAVSIM focused exclusively on the development of TTPs. In 1992, Air-To-Air Combat II was conducted to develop air combat battle drills and TTPs that would enable attack helicopters to perform their primary mission in an environment in which an air threat was present. The product was a standard set of procedures that would be incorporated into the individual mission type aircraft aircrew training manuals. The CAVSIM was the only facility in the world available to conduct such an experiment. Exorbitant costs, safety and environmental considerations, effective control and timely observation of meeting engagements prohibited the development of air-to-air TTP using real aircraft.

In an effort to develop joint doctrine and enhance joint training, the Office of the Secretary of Defense chartered the Joint Combat Search and Rescue (JCSAR) Joint Test and Evaluation (JT&E) programme to examine the Department of Defense's end-to-end capabilities to respond successfully to the report of a downed aircrew and culminate in the successful recovery of isolated personnel. Two JCSAR JT&E exercises were conducted in distributed interactive virtual simulation involving F-15s, F-16s and MiG 29s from the Theater Air Command and Control Simulation Facility at Kirtland AFB, New Mexico; A-10s from the Air Force Research Lab in Mesa, Arizona; E-2Cs from the Marine Corp Air Station in San Diego, California; F-18s from the Naval Air Warfare Center in Patuxent, Maryland and Air Force, Army, Marine, Coast Guard and Naval helicopters and two A-10s from the CAVSIM, participated in a daily mix of service assets in a high air defense and air threat, red-flag environment. Daily mission briefings and pre-mission planning and dynamic and revealing after-action reviews were conducted using video teleconferencing between the five participating sites.

While the exercises and experiments discussed have resulted in positive training benefit to the participating crews, the events were not designed specifically for that purpose. Training has increased over the past three to four years and the USAAVNC, Army National Guard units and Bosnia and Kosovo Aviation Task Forces training represent the majority of the training events now conducted at the CAVSIM.

In 1991, four classes of the Aviation Officer's Advanced Course conducted training exercises to evaluate the concept of collective simulation training to perform scout and attack helicopter operations and aviation battalion staff training. The response was overwhelmingly positive. As a result, the AVOAC (now the Aviation Captain's Career Course - AVC3), the Aviation Officer's Basic Course and the Warrant Officer's Basic Course have incorporated CAVSIM training exercises into their training curriculums.

The Army National Guard has capitalised on the CAVSIM availability to maximise very limited home station collective training periods. The full spectrum of attack, cavalry and assault National Guard units from Maryland, Pennsylvania, Ohio, Mississippi, Missouri, Arkansas, Tennessee, Louisiana, Minnesota, Iowa, Michigan, New Jersey and Colorado have travelled to the CAVSIM to take advantage of the training opportunity available nowhere else in the world. The exercises these units have conducted at the CAVSIM have increased their readiness for real-world deployment contingencies.

Aviation Training Exercises (ATX), organised and hosted by the Exercise Branch of the Directorate of Training, Doctrine and Simulation at Ft. Rucker, have prepared 16 aviation task forces for Bosnia and Kosovo peacekeeping operations. Exceptionally detailed exercises scripted from a mosaic of real-world events in both of these theatres re-align staff and crew thought processes from traditional aviation missions to those required in delicate peacekeeping operations.

The missions can be modified infinitely to alter the exercise tempo to match the Task Force's learning curve and can change almost instantly to reflect significant events occurring that day in theatre. As a by product of the exercise, crews fly daily missions on Bosnia and Kosovo terrain databases built from the most current National Imagery and Mapping Agency terrain data and develop an important sense of familiarity with the terrain prior to deploying.

The FREDs, recently renamed as Combat Aviation Virtual Trainers (CAV-T), have undergone several upgrades, including replacing the ageing SIMNET GT-111 image generator (IG) with a PC-based system,

improving the OTW display, adding digital communications and installing touchscreen flat-panel displays in the cockpits. The modifications have done much to enhance the overall utility of the training device. The PC IGs in conjunction with a larger 40x140^{o} OTW field of view, present a visually dynamic operating environment. The digital communications are more flexible, more reliable and can be logged for inclusion in the after-action review playback.

The cockpits, however, remain low fidelity or generic in nature. While this may appear as a significant deficiency at first glance, the customers who use the CAVSIM understand that the cockpits are not critical elements in the overall mission execution. The heated and emotional discussions on cockpit fidelity aside, the CAVSIM's customers are satisfied that they received excellent value for their dollar at the end of the day. They see the cockpits as tools that permit crews to perform the essential tasks that Army Aviation must execute on the battlefield. The CAVSIM is a tool that has honed the fighting skills of countless Army Aviation organisations, served as an evaluation tool for emerging aviation war-fighting doctrine and reduced significantly the risks of new equipment acquisition programmes.

The CAVSIM is the legacy aviation collective simulation that has established the standard by which all emerging collective training systems will be measured. CAVSIM employees have performed an exceptionally diverse variety of work in response to hundreds of delivery orders under three contracts to the Simulation, Training and Instrumentation Command. Their experience and dedication to the customer's tasks are critical elements in the success of technology and the operation of the CAVSIM.

Exciting new collective training systems such as the Longbow Collective Training System at Ft. Hood, Texas have just been introduced and other systems such as the AVCATT are immediately around the corner. Hopefully, they will service their customers as well as their only predecessor has done. They have a tough act to follow because their future was yesterday. They will provide Army Aviation commanders with a tool to conduct dynamic training and mission rehearsals and scrutinise mission performance in incredible detail.

For more information visit Fort Rucker website.