AIR FORCE C2 TRAINING SOLUTIONS IN DISTRIBUTED MISSION TRAINING ENVIRONMENTS, A REPORT FROM THE SYNTHETIC BATTLESPACE

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Currently, Command and Control (C2) virtual simulations used in training are usually not designed to be interoperable with other distributed synthetic battlespace systems. This characteristic thus makes it difficult to integrate C2 training assets into a full synthetic battlespace. Current systems are designed such that they are not open and have proprietary software thus further complicating the interoperability problem. Scenario generation and control of the synthetic environment have proven to be tedious and cumbersome. Solutions such as strap-on systems to provide synthetic battlespace require significant resources in regard to contractor personnel and role players. A few stand-alone training systems have been developed for the general air defense task. This paper will discuss various advanced solutions including the application of realistic synthetic battlespaces to provide more effective C2 training in the developing distributed mission training environment. Also, the transition of these training concepts to next generation C2 of the 21st century will be considered.

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INTRODUCTION

Distributed Mission Training (DMT) is a shared training environment that includes live, virtual, and constructive simulations that allow warfighters to train individually or collectively at all levels of war. This combination of live, virtual, and constructive environments provides on-demand, realistic training opportunities for warfighters by overcoming many current constraints that limit training effectiveness.

The modeling and simulation (M&S) community has devoted considerable effort to the development of synthetic battlespaces (SB's) to effectively emulate an operational mission at multiple echelons and across services (e.g., Joint Simulation System (JSIMS), Synthetic Theater of War (STOW)). In the future, a Global Battle Space simulation is required that will incorporate every entity on the land, in the sea, in the air and in space. Although the push towards joint operations has added additional complexity to the development of corresponding Joint SB's (JSB), a more subtle M&S development difficulty has arisen due to the increasing reliance of all the services on more sophisticated command, control, communications, computers, and intelligence (C4I) systems. Development of effective JSB's can no longer rely primarily on simple doctrinal concepts (e.g., force ratios) or weapons system performance parameters (e.g., probability of kills (pKs) for a given missile). They must now also incorporate more sophisticated representations of the C2 information infrastructure as man-in-the-loop and constructive simulations. But this demands a significant increase in model sophistication far beyond a representation of merely the C2 sensor characteristics and communications infrastructure links. In fact for a full SB, it demands a faithful representation of the *nodes* of that C2 infrastructure: the human decision-maker, who, singly or as a member of a team, transforms that information into operationally effective actions, be they conventional force-oriented or, increasingly, information-oriented (e.g., Information Operations, or IO).

In actual combat situations, aircrews interact with various air weapons directors, link operators, and battle managers that comprise the Theater Air Control System (TACS). In the real world there is considerable coordination and communication between aircrews and the various C2 operators that must be represented in a synthetic battlespace. A computer-generated force (CGF) with a synthetic natural environment (SNE) is an effective tool to implement C2 training.

In anticipation of the increased role of C2 in DMT and the identification of significant training deficiencies, Air Force Research Laboratory (AFRL) has been working with the Iowa Air National Guard (ANG) in the development of current and future training options for C2 . This has included evaluation of the technologies required to integrate to the DMT environment and full SB of the future. This research has included a task analysis of the ground based C2 Modular Control Equipment (MCE), a proof-of-concept stimulation of actual MCE with STOW constructive synthetic force and training options for future C2 systems.

DISTRIBUTED MISSION TRAINING

In the past, warfighter training depended heavily on the weapon and operational systems as the only realistic media for providing mission training. Now, dramatic improvements in the capability and affordability of advanced distributed simulation (ADS) technologies, warfighter training can be significantly improved at the mission and team level using the concept of DMT.

Distributed training allows multiple players at the same or multiple sites to engage in training scenarios ranging from individual and team participation up to full theater-level battles. It allows participation, using almost any type of networkable training device, including C2, from each weapon system and mission area. Additionally, computer-generated, or constructive, forces can be used to substantially enhance the scenario. This combination of live, virtual, and constructive environments will allow nearly unlimited training opportunities for joint and combined forces from their own location or a deployed training site. This expanding capability will provide on-demand, realistic training opportunities for all warfighters unconstrained by the fiscal, geopolitical, legal, and scheduling problems associated with current real-world ranges and training exercises that limit training effectiveness and arbitrarily cap readiness levels today. DMT will dramatically improve the quality and quantity of warfighter training

The capability to conduct distributed mission training has existed at the AFRL for several years and has been demonstrated in the Multiservice Distributed Training Testbed (MDT2) effort. AFRL participated in the Warrior Flag exercise, which was comprised of over 2000 live and simulated entities. Additional exercise participation includes Road Runner 98 (a virtual Red Flag training event) , Combat ID, Joint Combat Search and Rescue (JCSAR), Joint Strike Fighter, Expeditionary Force Experiment (EFX) 98, and Joint Expeditionary Force Experiment 99 (JEFX '99).

TASK ANALYSIS

Chubb (1997) performed an extensive analysis of MCE tasking at the initiation of this program to define C2 training requirements. He used Integrated Definition (IDEF) drawings (Marca & McGowen 1989) to illustrate the task analysis. IDEF is a technique that enables people to understand complex systems in a graphical manner. The diagrams are organized in a hierarchic and modular top-down manner, showing the component subtasks in ever-increasing detail.

In a typical deployed configuration the MCC supervises both the weapons and surveillance crews with two operations modules (OM). Each OM has four operator positions with similar functionality such that they can be tailored for operator tasking. The functionality described here is common to both the AWACS (Fahey, Rowe, Dunlap, & deBoom, 1997) and the MCE. Primarily how these functions are accomplished differs because the operator consoles are different. In a minimal configuration, a Mission Crew Commander (MCC) will supervise two Weapons Directors (WD). In the Control Reporting Element (CRE) configuration, there is an MCC and three WD's in one OM and in the other there is an Air Surveillance Officer (ASO)/ Air Surveillance Technician (AST) supervisor, two ASO's or AST's and an Interface Control Technician (ICT) that manages data links. In the Control Reporting Center (CRC) configuration, the MCC will supervise two Senior Directors (SD) who each oversee a WD and an ASO or AST, with one ICT for the CRC.

Figure 1 illustrates the highest level IDEF0 for the MCE. Further details of this analysis will be found in an upcoming AFRL technical report. It describes the operation of the MCE *perform assigned mission* from a systems / training analyst viewpoint. The box represents a process; the left side represents inputs; the right side outputs; the top the control and the bottom the mechanism. The following is a description of the high level functionality:

- *Assigned Responsibilities* determine what configuration of MCE Operational Modules (OM' s) will be put in place, how the operator console units in each OM will be configured and duties assigned to each workstation. This functionality also determines what communications links will be needed and what type of radar and other support elements will be connected with the MCE operation.

- *Communications* inputs include both voice and data-link messages. These may be encrypted and non-encrypted

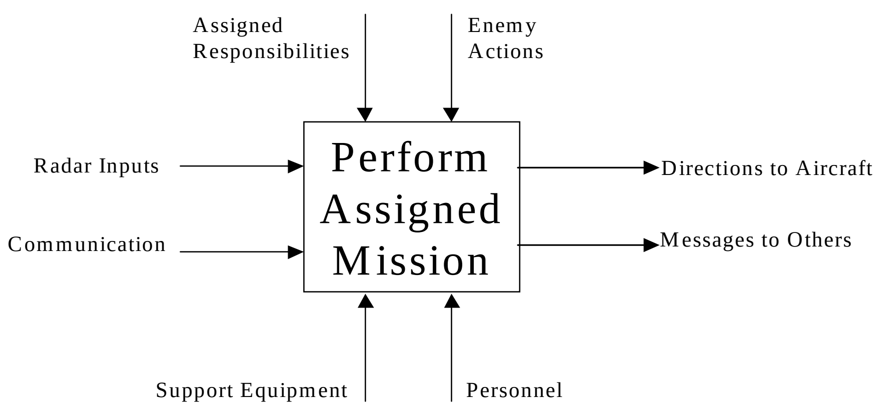

Figure 1 MCE Task Analysis IDEF0

- *Directions to Aircraft* exercise control over the airspace. The MCE provide ground control intercepts (GCI), vectoring fighters into a position where they can detect and attack hostile aircraft. Radar effectiveness is governed by antenna size and power, so that aircraft radar systems have a limited ability to see the overall air picture.

- *Enemy Actions* will dictate the response that is required. These are taken as controls rather than as inputs because it reflects enemy intent: the scenario drivers unknown to the MCE operators.

- *Messages to Others* include passing data to other agencies as well as to higher command levels about ongoing events or mission results.

- *Perform Assigned Mission* reflects the fact that the MCE can be used more than one way, and in more than one configuration. It is a general purpose element of the Theater Air Control System (TACS). As a single OM it can serve as an Air Operations Center (AOC) but cannot perform all of its normal functions. Normally, two OM's are a minimal operating system since it takes three computers and only two are in one OM.

- *Personnel* include the individuals performing specified duties at each of the supporting OM's.

- Radar inputs include not only raw radar video but also the processed tracking and Identify Friend or Foe (IFF) information. Up to three local radars can be coupled to the MCE and a fourth can be connected and "standing by".

- *Support Equipment* includes not only the radars and communications equipment, but also the power and environmental control equipment necessary to operate the complex.

MCE C2 TRAINING REQUIREMENTS

Chubb (1997) in his MCE training analysis reported that operators returning from the Kuwait theater indicated they were not adequately prepared to perform MCE tasks using existing training capabilities. They felt overwhelmed by the magnitude and intensity of the operations there, and many tasks that needed to be routinely performed were seldom (if ever) practiced in the continental US (CONUS) training operations or exercises. While the MCE came with an embedded mission simulation capability, it is difficult to use, fragmented in functionality and inadequate for preparing operators for theater duty. The existing simulation and portrayal of the synthetic battlespace is not scalable, does not provide realistic behaviors and is not totally autonomous. *First*, it requires operators to run the simulation, and they are not proficient or formally trained in console inputs, so they are not able to maintain the tempo required. *Second*, some training tasks require netted architectures of data links that are not included in the simulation. *Third*, kills and drop track commands do not occur as rapidly as their real-system counterparts, creating an unrealistic situation display. *Fourth*, full crew training is difficult to perform with the large number of role players required. *Finally*, the existing training systems are not easily or cost effectively interoperable with other distributed simulations that the DMT vision of the future requires.

From Chubb's analysis of tasking a C2 training system must be able to perform the following:

- *Training for all levels of C2 tasks*. This includes familiarization as well as sustainment and advanced training. Training for the individual, team and large numbers of multi-service teams in interoperable distributed simulation training exercises is required.
- *Theater certification.* Following satisfactory completion of training on the various aspects of the specific theater where they may have to deploy, operators receive certification. Training for the various geographical theaters requires geo-specific data.
- *Mission rehearsal*. The ability to actually practice a mission in a simulator where contingency plans can be developed prior to performing the real mission is extremely valuable. Again this requires geo-specific data, rapid scenario generation, and a large number of participants.
- In all cases training must stimulate the operational crews, the command element and maintenance crews to work as a team in a high fidelity, multi-task environment.

UNIQUE AIR NATIONAL GUARD (ANG) REQUIREMENTS

Due to the fact that many ANG members only get two days a month for training there are unique considerations that must be addressed in training systems. Full crew training is done twice a quarter. Surveillance and data link training is done on demand as time permits. Training for the MCE operators is impacted if aircraft or a netted link environment are not available on the scheduled MCE training days. With unpredictable weather conditions, sortie costs, and the current operations TEMPO (OPSTEMPO), it is difficult to guarantee that these aircraft or other battle management platforms will be available. Due to these constraints, the training system must provide a scenario generation capability that allows the instructor to quickly set up any number of scenarios of varying skill levels that can be used by students. These scenarios can be developed, tested, and archived for future use by instructors or students. These should emphasize specific training objectives from the novice through the highly experienced members of the MCE team. The execution of these scenarios should be expedient and easy for a user to perform. The scenarios must be in a format that can easily be interchanged among other units. Autonomous entities in the SB should allow the student to perform some training on his own as time permits after hours, prior to a simulator exercise or proficiency check, or on the weekend. A final requirement is the ability to use computer based training via web based interchange such that the crews can train at home where they have sufficient time to proceed at their own pace.

TRAINING SOLUTIONS

There are three basic approaches to provide a C2 training system to meet established training requirements:

- Stimulation of the actual equipment with a SB.
- Stand-alone simulator with SB as part of simulation system
- Embedded simulation with SB as part of the operational system

Stimulation requires the use of actual operational equipment and displays in the OM. In stimulation an external SB provides target state, behavior, and environmental effects that would normally be represented by the radar and detection algorithms. Ideally, the operator should not perceive any difference between the real and stimulated systems. Stimulation has the advantage of easily supporting upgrades to the operational hardware, training at site, and providing a training environment that the operator is accustomed to. The ASCOT and AFRL proof-of-concept system that will be described in the next section are both stimulation approaches.

A stand-alone system also incorporates a synthetic battlespace for target representation as well as an emulation of the display OM on a workstation or PC-based computer monitor. This requires development of software for the user system interface that is similar to the actual system symbology and operator characteristics. Advantages of this type of solution include a separate training device thus allowing the operational equipment for operational use only and the ability to train away from the operational site. Current stand-alone systems include the Raytheon Fighter Control Simulator, Southwest Research Institute Air Warning And Control Systems (AWACS) simulator, and AWACS simulators at Brooks AFB.

Embedded simulation is simulation software and hardware that is a part of the actual operational system. It is internal to the OM providing the synthetic battlespace. The advantage of embedded systems is the fact that training is available any place the OM is located, including the theater. The existing MCE SIM is an embedded system currently in use.

It is anticipated that for next-generation C2 training systems all three options may be employed to support more intense theater certification, training on demand, mission rehearsal and proficiency training.

MCE STIMULATION PROJECT

AFRL has been working with the Iowa Air National Guard in developing training options for C2 and the technologies required for integration to the DMT environment (George et. al. 1998, George et. al. 1999). This has included the proof-of-concept stimulation of actual AF C2 MCE with STOW constructive synthetic forces Air Synthetic Forces (AirSF) (Johnson et. al. 1994, 1995) in a distributed environment. A trade study showed that a stimulation approach was technically possible and could be done with less hardware and software development to demonstrate a proof-of-concept distributed interoperable training system. The goal was to provide simulation of the radar system including tracking algorithms using state information from AirSF. The simulation uses the classical radar equation, earth curvature model, and emulated tracker algorithms. This data is then used to generate tracks on the MCE OM displays.

The AN/TYQ-23 MCE (Janes 1993-1994) provides the Air Force with a transportable automated air command and control system for controlling and coordinating the employment of aircraft and air defense weapons (Figure 2). The Air Force version of the MCE uses the

Figure 2. MCE Operational Modules

AN/TPS-75, 3-dimensional, long-range, high-power, air defense radar.

The basic system element of the MCE is the OM. A single OM is comprised of a standard 6 m American National Standards/ Institute International Standards Organization (ANSI ISO) shelter and contains all the air C2 equipment. This includes a full range of tactical digital data-links to perform the air defense function. System sensors and all power supplies are external to the shelter.

Up to five OM's can be connected through the use of fiber optic cables. Lengths of up to 500 m allow a variable OM configuration at various locations for tactical or terrain reasons. The local radars can have locations up to 2 km from the OM and are connected using fiber optic cable. The distance for remote radars is only limited by the capability of the medium being used to transmit data to the OM.

Within the OM, the weapons control function provides the capability to exercise positive control of aircraft employed in tactical operations: air defense, counter-air, interdiction, close air support, reconnaissance, refueling, search and rescue, and missions other than war.

Inside each OM are four multicolor operator monitors for four C2 operators. These displays provide real-time information about the various tracks on the planned position indicator displays in regard to range and azimuth as well as IFF and jamming status. The display shows superimposed track symbols, map or overlay lines, and alphanumeric data. There is a monochrome auxiliary display presenting stored alphanumeric data to supplement the situational display. Touch sensitive screens allow the operator system control.

Currently AirSF has been integrated to the MCE system via the OM gateway providing tracks on the operator displays. The interface software in the Distributed Interactive Simulation (DIS)/MCE translator uses DIS 2.0.4 protocol to communicate with AirSF over an Ethernet connection. Much of the interface software was reused from the AFRL Network Interface Unit software developed for the DMT testbed. It is hosted on a Sun Sparc workstation. The radar system and tracking functions are simulated using entity state data from the AirSF. These tracks also have the simulated video. The raw video functionality is from the existing embedded simulation system. The ability to display AirSF tracks was demonstrated in the summer of '98. Initially the STOW system Command Talk was to be used for voice activation but evaluation of that system indicated it would not meet the MCE latency requirements.

The MCE stimulation program was further extended to the Road Runner 98 exercise that was conducted by AFRL in the summer of 1998. Road Runner was envisioned to be an annual distributed training exercise; however, funding constraints and OPSTEMPO may limit the frequency of the exercise as well as the number of participants. AirSF, a key synthetic forces component, is hosted at AFRL at Mesa, AZ. and provided CGF state information for the two remote sites. The remote hookups of AirSF were to the 107th Air Control Squadron (ACS) at Phoenix, AZ, and the 133rd ACS at Fort Dodge, IA. Although hardware reliability and unexpected problems with the satellite link did not allow a full integration to the exercise, it was the first demonstration of sending DMT exercise data to a C2 computer generated graphics display in another part of the county. Personnel at the 133 ACS in Fort Dodge, IA were able to observe the exercise real-time, as it was conducted at the following distributed locations: Mesa, AZ, Kirtland AFB TX, Tinker AFB, OK, and Randolph AFB, TX.

At this time, engineering documentation is being developed as well as two technical papers. Further development is on hold pending further funding. If funding is located and an industry partner is identified, training research and development would include full integration of AirSF CGF functionality to the MCE and an investigation of stand-alone solutions to C2 training.

FUTURE C2 TRAINING SYSTEMS

The 133d ACS, Ft Dodge, Iowa is currently involved in developing the future ACS C2 systems. This transitions from the CRC/CRE to the Battle Control Center (BCC) and Radar Communications Center (RCC). The BCC houses operations functions. The RCC is comprised of sensor and communications equipment to forward and receive data. The RCC's are forward deployed near the Forward Line of Own Troops (FLOT) and are self-sustained with their own security forces. The ACS core competencies include theater missile defense, time critical targeting, battle management, data link management, surveillance & identification, air space management and weapon control. The first evaluation of the BCC will be done during JEFX '99. These devices rely on open systems, commercial off the shelf (COTS) and commercial standards. Rather than depending on highly compartmental systems like the MCE, these new systems consists of COTS workstations and PC's that are compatible and interoperable with the Theater Battle Management Control System (TBMCS) workstations. This workstation uses flat screens and laptops, provides a smaller "footprint", is highly mobile, requires minimal airlift requirements and easily reconfigured. There is considerable sensor fusion from other assets including Marine, Navy, Army, Link 16, UAV, E-3, AWACS and Situational Awareness Data Link (SADL).

These future systems with standard Ethernet connections and workstation-based processors will promote effective stand-alone, stimulated and embedded training solutions. A lesson learned from the proof-of-concept stimulation system involved a gateway to the OM that proved to be a problem due to the internal software being proprietary. Since this is a key interface to transmit synthetic battlespace state data, an understanding of the gateway is really necessary. Due to the unavailability of data, a tedious reverse engineering effort was required to create this interface and generate the control commands. The BCC workstations interface to a server that correlates data from radar data fusion to define tracks to be displayed. The stimulation option is to put a CGF on the net providing simulation of the radar, data fusion and synthetic battlespace entities. The embedded component would include these simulations in the actual operational system on the net. The stand-alone approach would be a "mirror" of the actual C2 system without the radar or data fusion. This system would be dedicated to training normally but could be used for actual operations with actual radar connected. Since the future C2 systems are open and highly distributed the application of a synthetic battlespace such as that demonstrated in the proof-of-concept system with AirSF is immediately applicable. Figure 3 illustrates the concept of adding a synthetic battlespace as well as an interface to virtual man-in-the loop and other live systems seamlessly to the future system.

Research is needed to determine optimum training strategies, techniques, and tools to accompany the new training systems. Research should include a front end analysis of the BCC to determine training requirements, development of performance measurement, development and evaluation of computer generated forces to support C2 training, distance pre-brief and debrief techniques and tools, battlespace visualization, deployable training, and team training.

C2 SYSTEMS OF 21st CENTURY

Next century C2 systems should provide a multi-dimensional representation of the battlespace. This will include virtual reality (VR) techniques that immerse the operator in a visualization of the battlespace. The controller will have a three dimensional view of the airspace including weather and natural environment visualization. Target information can be depicted by numerous color, graphics and symbology representations. Such data is called high-dimensional or multivariate. Many approaches have been used to visualize this type of data.

Virtual reality approaches have proven effective in visualizing data using a helmet mounted display and full immersion in the virtual environment. At the 50th Anniversary of the Air Force, AFRL demonstrated a VR helmet and virtual gloves that displayed the DMT environment and allowed the user to interact with the

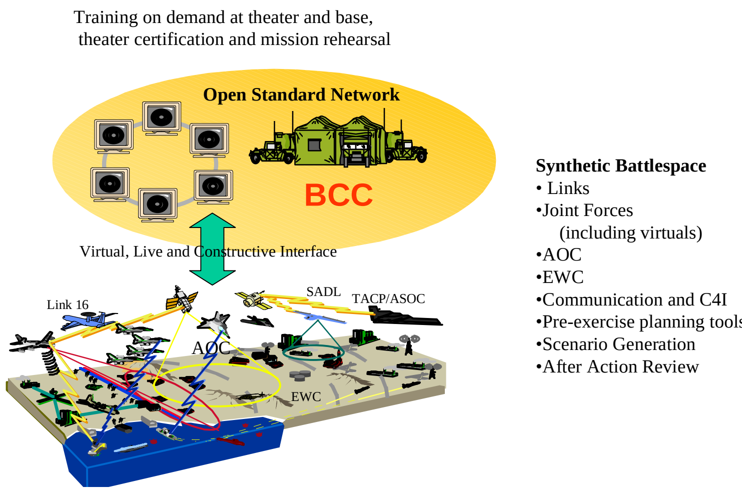

Figure 3. Future C2 Training System

environment. The scenario consisted of 4 F-16 cockpits, 2 A-10 cockpits, a C-130, an AWACS, and CGFs. All entities were displayed real time in the VR helmet. The user could literally reach out and touch one to get bearing, range, and altitude. The terrain (Alaska database) was depicted, and the user could "fly" around the database by using the gloves (up, down, etc.). Rings appeared in the database at intervals to represent altitude. CGFs indicating Red Air appeared in the scenario.

The 133d ACS is exploring the use of the virtual reality system The CAVE for C2 applications. This system is being developed at Iowa State University. The CAVE is a surround-screen, surround-sound, projection-based virtual reality (VR) system. Projecting 3D computer graphics into a 10'x10'x9' cube composed of display screens that completely surround the viewer creates the illusion of immersion. It is coupled with head and hand tracking systems to produce the correct stereo perspective and to isolate the position and orientation of a 3D input device. A sound system provides audio feedback. The viewer explores the virtual world by moving around inside the cube and grabbing objects with a three-button, wand-like device. Unlike users of the video-arcade type of VR system, CAVE dwellers do not wear helmets to experience VR. Instead, they put on lightweight stereo glasses and walk around inside the CAVE as they interact with virtual objects.

Multiple viewers often share virtual experiences and easily carry on discussions inside the CAVE, enabling C2 operators to exchange data and work as a combined team. One user is the active viewer, controlling the stereo projection reference point; while the rest of the users are passive viewers. The CAVE was designed from the beginning to be a useful tool for scientific visualization. The goal was to help scientists achieve discoveries faster, while matching the resolution, color and flicker-free qualities of high-end workstations.

Most importantly, the CAVE can be coupled to remote data sources, synthetic battlespaces and remote sensors via high-speed networks. These characteristics allow C2 operators to visualize very complex battlespaces in a natural manner. By reaching out and touching the entities, various data sources can be displayed in several formats: histograms, barcharts, boxplots, audio, color-coded and scatterplots. Figure 4 illustrates the general concept.

The 133d ACS is considering the integration of The CAVE to a synthetic battlespace such as AirSF. This will provide a proof-of-concept of a next generation C2 system as well as a training system. A key goal will be the reduction of personnel required to do the C2 task as resources continue to decline. The CAVE concept should allow C2 operators to evaluate the battlespace data more effectively. As we move from pure symbology in two dimensions to full visualization, a number of issues emerge:

- Simulator sickness must be considered. Full immersion into the battlespace must provide the necessary cues to minimize discomfort or sickness. This includes both the training systems as well as the actual system. Lessons from flight simulation can be applied here in regard to visual resolution and acuity, and the requirement for simulated motion.

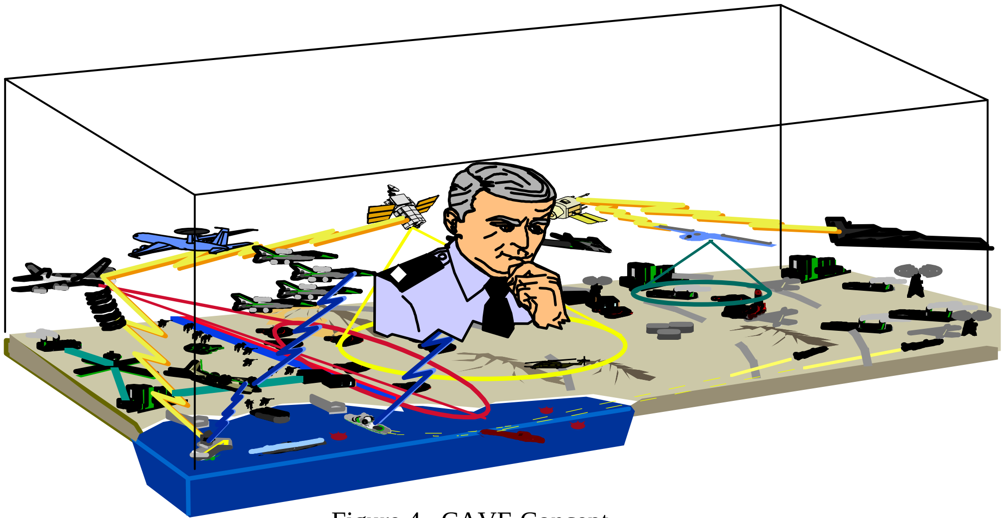

Figure 4. CAVE Concept

- Since the total battlespace is highly visualized, computer generated forces and synthetic environment must be high fidelity models. This impacts computer resources – particularly for large exercises or Global Battlespace applications.
- Latencies must be minimized such that tracks are smooth. This will require update rates as high as 60 Hz.. Again this is a computer resource problem.
- Determination of the optimum mix of visual and audio cues to allow the C2 controller to handle large amounts of data to effectively control the airspace is required

CONCLUSIONS

The addition of C2 assets to the DMT vision is a necessary part of the synthetic battlespace expansion. C2 is necessary to support both man-in-the loop and constructive simulations.

The proof-of-concept stimulation of existing C2 equipment proved that a reusable synthetic battlespace can be used to provide expanded C2 training in a distributed environment. The extension of this concept will apply almost directly to future Air Control Squadron C2 training systems that are being prototyped now. These systems promote open standards and interoperability that will enhance training system development for stand-alone as well as stimulated systems. The vision of the 21st century is total immersion in the synthetic battlespace allowing the C2 operator to handle massive amounts of information to manage the battlespace.

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APPENDIX A Acronyms

ACS Air Control Squadron
ADS Air Defense System
AFRL Air Force Research Laboratory
AirSF Air Synthetic Forces
ANG Air National Guard
ANSI American National Standards Institute
AOC Air Operation Center
ASO Air Surveillance Officer
AST Air Surveillance Technician
ATO Air Tasking Order
AWACS Air Warning And Control Systems
BCC Battle Control Center
C2 Command and Control
C4I Command, Control, Communication, Computers and Intelligence
CGF Computer Generated Forces
CONUS Continental US
COTS Commercial Off-The-Shelf
CRE Control and Reporting Element
CRC Control and Reporting Center
DIS Distributed Interactive Simulation
DMT Distributed Mission Training
EFX Expeditionary Force Exercise
FLOT Forward Line of Troops
GCI Ground Control Intercept
ICT Interface Control Technician
IDEF Integrated Definition
IFF Identify Friend or Foe
IO Information Operations
ISO International Standardization Organization
JEFX Joint Expeditionary Force Exercise
JSB Joint Synthetic Battlespace
JCSAR Joint Combat Search and Rescue
JSIMS Joint Simulation System
MCC Mission Crew Commander
M&S Modeling and Simulation
MCE Modular Control Equipment
MDT2 Multi-Service Distributed Training Testbed
OM Operations Module
OPSTEMPO Operations TEMPO
PDU Protocol Data Units
RCC Radar Communications Center
SADL Situational Awareness Data Link
SB Synthetic Battlespace
SD Senior Director
SNE Synthetic Natural Environment
Soar taking a State, applying an Operator, And generating a Result
STOW Synthetic Theater of War
TACS Theater Air Control System
TBMCS Theater Battle Management & Control System
OM Operations Module
UAV Unmanned Aerial Vehicle
WD Weapon Director
VR Virtual Reality