

COMPUTER ASSISTED WARGAMING AT THE AIR UNIVERSITY

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ABSTRACT

With the recent advances in computer and display technology, we are convinced that the professional military education (PME) program within the Air Force is at a point where education and training of our warfighting leadership can be dramatically enhanced through the use of a computer-assisted wargaming system. This paper presents a brief background on the Air University (AU), surfaces the need for an improved wargaming capability, discusses five wargaming models, identifies shortfalls in our existing capability, reviews desired capabilities, and discusses programming action for obtaining a new wargaming system.

At the close of World War II, when plans were being made to establish the United States Air Force as a separate and coequal branch of the armed forces, officials recognized that continuing professional education would be as important to the new service as its inventory of weapons. As a result, in 1946, a group of Air Force educational pioneers was given the green light to begin developing a new professional military education (PME) system. They envisioned a centrally managed university complex with schools and colleges to meet varied Air Force needs. Today, Air University and its comprehensive educational facilities stand as visible evidence of the soundness and practicality of their planning.

The mission of AU is threefold. First, we provide professional and specialized education to prepare commissioned and noncommissioned officers for command, staff, leadership, and management responsibilities. Second, we conduct precommissioning programs at civilian educational institutions. And, finally, we assist in the development of Air Force doctrine, concepts and strategy. AU performs this mission through the operation of colleges, schools, institutes, centers, and various other supporting organizations. The hub of AU activities is located in Montgomery Alabama, at Maxwell Air Force Base and Gunter Air Force Station. AU's Air Force Institute of Technology (AFIT) is located at Wright-Patterson Air Force Base near Dayton, Ohio. In addition, AU detachments and operating locations can be found throughout the United States and numerous countries abroad. Thus, with our

resident and nonresident PME programs throughout the world, AU can affect nearly half of the total population of the Air Force each year.

In recent years the Air Force has put added emphasis on training and educating our combat aircrews in warfighting, and has made a lot of progress. Unfortunately, due to technological limitations, we have not been able to do as well in training and educating the more senior officers--the commanders and the staffs that will manage the business of employing forces in combat. The current state-of-the-art in computer and display technology will now, for the first time, allow the Air Force to fill that void with realistic training under simulated real-world conditions; and AU proposes to lead in the development of that capability. With new computer-assisted capabilities, AU can improve its current gaming posture and more effectively contribute to the Air Force's warfighting capability through a multi-level command and staff oriented wargame called the Command Readiness Exercise System, or CRES. So, just as the Air Force's Tactical Air Command's RED FLAG exercise enhances our aircrews' tactical combat skills, CRES will sharpen and strengthen the decision making abilities of our future air commanders and their staffs in a realistic exercise environment.

In developing the CRES proposal, AU planners had the following objectives in mind:

- o Prepare PME graduates to employ aerospace

forces in war;

- o Educate students in sizing force requirements;
- o Provide wargaming support to our major air commands and Hq USAF.

CRES' initial baseline capability is being designed to work the first objective. By using our courses as a development laboratory, PME students who, by and large, will be our future seniors will be the first to benefit from CRES. With CRES, AU will be able to simulate real-world forces in a combat environment in which we can exercise the decision-making skills of future senior officers before they are called upon to deploy, employ, and sustain forces in actual combat. Additionally, through wargaming with actual force levels, our students will be trained in the business of sizing and shaping future force requirements. Finally, development from the initial baseline capability will enable the Air Force to achieve the ultimate aim of the system, to provide wargaming support to the Major Air Commands and Air Staff when the system is fully matured. Senior commanders, for example, will be able to use CRES to test and refine their operations plans from pre-employment to commitment of those forces in a given theater of operation. This will be possible because CRES will include actual forces, both friendly and enemy, in the data base. Thus, in the future, we could look at the various aspects of force deployment or employment in a range of scenarios.

Several capabilities will accrue from CRES, initially to our PME students and eventually throughout the Air Force. First, CRES, like any good wargaming device, will be an aid to the effective translation of strategies, doctrines and concepts into operational requirements and applications. CRES can provide an environment in which realistic problems of airpower employment can be experienced. CRES will also enable us to practice the task of integrating the complex variables of force planning, operations, communication, logistics, survivability, intelligence--all of which will affect the outcome of the battle. Finally, the net result of providing these hands-on, decision-making experiences will be the broadening of warfighting knowledge throughout the officer corps.

AU has, over the years, developed several computer-based exercises which focus on force employment, the most complex of which is the Theater War Exercise, or TWX. To better understand our desire for a new wargaming capability, it seems appropriate to review the capabilities/shortfalls of our current wargames.

The Theater War Exercise (TWX) was developed to apply the principles of air warfare in response to a hypothetical Warsaw Pact attack against NATO forces in Central Europe. NATO land and air forces oppose Warsaw Pact land and air forces in the exercise. Events outside the area may be introduced during the Theater War Exercise, but the primary focus is the air war within NATO's Central Region. Each group of students play the roles/functions of the headquarters of Allied Air Forces Central Europe (AAFCE), Second Allied Tactical Air Force (2 ATAF), and Fourth Allied Tactical Air Force (4 ATAF). Initially, each group of students develops

its air operations strategy and contingency air operations plans as a conventional response to a growing Warsaw Pact threat. Subsequently, the groups plan for the daily employment of their forces in a simulated combat situation. Employment of air forces as planned, directed, and controlled by each group is simulated by computer models. These models also simulate the actions of the NATO land forces and Warsaw Pact land and air forces. The models assess results of each day's operations and report those results to each group of students.

The modules used in the Theater War Exercise simulation are a modified RAND Corporation land battle named TOTEM, and the Air War College developed air battle model. The function of the computerized models is to simulate the interaction of the opposing forces in the air and land battles of the TWX. The quantitative assessment of the battle is highly aggregated and necessarily involves many simplifying assumptions. The models have been designed to support the objective of providing the student with insight into the employment of tactical air power in a theater war situation. Therefore, primary emphasis is placed on credibly reflecting the effect of strategy and employment decisions on the outcome of the battle. Attrition, damage expectancy, and most other model events are deterministic--the same inputs will always result in the same outputs. However, the input parameters determine the outcome; thus, the simulations consider both Red and Blue Force employment in the assessment programs. Certain aspects of the simulation will be based on the selection of random numbers; and as such, are unpredictable and random in nature just as they would be in an actual situation.

The data on NATO and Warsaw Pact forces are only approximations, while deployment, force dispositions, and Pact strategies are hypothetical and based only on conjecture and speculation. Internal computations of the computer program are based on highly aggregated interactions between the two forces who do not explicitly consider such things as timing and aircraft range limitations. Further, computer simulations cannot consider all possible factors which influence events in the real world. Problems such as unconventional warfare command relationships, communications, and the realities of political decisions are not modeled. Despite the shortcomings to the Theater War Exercise simulation, the student receives an opportunity to apply his understanding of theater air operations in a simulated combat situation. It is important to realize that the Theater War Exercise simulation system is a decision-making exercise which will require analysis of typical problems--it is not an analysis of the real world situation.

A political scenario is introduced which tracks milestones in a developing international crisis. The scenario continues to evolve and become synchronous with the start of the Theater War Exercise. Evolution of the political scenario continues during this phase and is reported to the appropriate student groups through daily intelligence briefings and/or message texts. Also, during this period, the students organize their staffs and distribute responsibilities, maps, and supplementary material required to conduct the exercise. As the political

situation deteriorates, CINCENT (the Control Group) issues a Priority Directive which requires Allied Air Forces Central Europe (AAFCE) to develop an air employment strategy and initial COMAAFCE Air Directive. This Directive is the guidance for the Second Allied Tactical Air Force (2 ATAF) and the Fourth Allied Tactical Air Force (4 ATAF) to develop their operations orders which are the mission allocations in the event hostilities should occur. (A warning time of attack is assumed to be approximately 72 hours.) COMAAFCE is the Theater Air Commander for the entire Central Region and 2 ATAF and 4 ATAF command the air resources assigned to their respective areas. The timing of the enemy's first strike cannot be accurately anticipated; therefore, hostilities may commence anytime after the initial operations orders are complete and entered in the computer.

At the start of hostilities, the students assume the wartime responsibilities of AAFCE and the two ATAFs. Each simulated Theater War Exercise war day consists, as a minimum, of the following activities: Analysis of the previous day's results; planning for the next war day to include development of a COMAAFCE Air Directive; and translating the Air Directive into Operations Orders by the two ATAFs. The AAFCE and two ATAFs wartime responsibilities are broken out into the following categories: Apportionment; allotment; allocation; tasking; aircraft augmentation, movement and recovery; logistics support and movement.

Apportionment is the determination and assignment of the total expected effort by percentage and/or by priority that should be devoted to the various tactical air functions. AAFCE will direct the total efforts of the ATAFs that should be devoted to the various tactical air missions by percentage and priority. The ATAF staffs may request changes or support from the other ATAF if, in their assessment of the situation, they determine that they should deviate from the air operations plan.

Allotment is the temporary transfer of tactical air resources from one ATAF to the other ATAF. COMAAFCE will direct allotment in his Air Directive. In the Theater War Exercise program, allotment is accomplished through the aircraft movement program.

Allocation is the translation of the apportionment into total numbers of sorties by aircraft type by functions. Therefore, once AAFCE makes the apportionment decision, the ATAFs must allocate the available sorties to the various missions. Aircraft assets of each ATAF, along with the number of available sorties by each aircraft type, will be provided to the ATAFs each day. Sorties availability is a function of aircraft inventory, air base status and load factors, and POL, munitions and spare parts availability. During the initial period of hostilities, there is a surge capability which allows a maximum number of sorties to be flown: This surge capability is available for the entire Theater War Exercise. Sorties assigned to the various missions must be flown by aircraft capable of that role. The Theater War Exercise system limits aircraft to seven distinct roles: Attack; defense; strike; electronic countermeasures; WILD WEASEL; reconnaissance; and tactical airlift. One decision is the assignment of multi-role aircraft to specific roles. The Theater War Exercise

has specific tasking missions designed generally to accomplish the traditional missions of tactical air forces. Every conceivable way of accomplishing each mission is not programmed into the Theater War Exercise system; however, the tasking missions included are considered a reasonable representation of the most common methods of accomplishing the functions of tactical air forces.

Tasking is the process of translating sortie allocations into orders and passing these orders to the lower units. Munitions loads, units orders, time-on-target, tactics, and routes will be simulated by the computer model. Some detailed tasking will be required by the student. The tasking decisions are limited to the following:

- o Sorties must be allocated to the various missions and designated as day or night missions. Aircraft capabilities are the determining factor.
- o Offensive counter air, interdiction, and reconnaissance missions must be tasked by target, number and type of aircraft, and number, type and role of escorting aircraft.
- o Close air support must be tasked by corps.
- o Defense suppression, defensive counter air, and combat air patrol missions require only weight of effort. Electronic countermeasures missions may be flown either over friendly territory or into enemy territory as escorts and require weight of effort allocation.

Aircraft augmentation and movement is a list of numbers and types of aircraft provided by the Control Group to COMAAFCE who will then designate the ATAF which will be augmented. Augmentation aircraft may be moved directly into the combat theater on their availability date or on any subsequent date. Aircraft may be relocated or allotted in theater within or between the ATAFs. Consideration of aircraft moves and augmentation should take into account existing in-place logistics support and protective measures such as aircraft shelters or revetments. Movement may be required to prevent aircraft loss due to the danger of a base being overrun by enemy ground forces.

Logistics support and movement is a national responsibility within NATO; however, within the Theater War Exercise, some logistics control is accomplished at the ATAF level with AAFCE approval.

Regardless of how the students organize their staffs and assign the game functions, the basic game play is designed to exercise each student at two levels of command, the AAFCE staff level and the ATAF staff level. In actual combat, it is often difficult to identify where planning ceases and implementation begins; however, in the Theater War Exercise play such a clear separation is necessary. All of the decisions concerning the quantity and availability of resources to be released to each ATAF are solely an AAFCE function and must be completed prior to any ATAF operational decisions being made. Also, the Theater War Exercise computer program is batch process which requires all of the AAFCE inputs prior to processing any of the ATAF mission inputs.

The Theater War Exercise game play scenario initially has the Blue Forces defending against a Red attack in Central Europe and will involve the first five days of battle. The Blue Ground Concept of Operations assumes that all NATO ground units use tactical concepts consistent with the forward defense strategy for that area. The defensive battle will be characterized by a covering force operation, forces deployed along the forward edge of the main battle area. The counterattack will use primary indirect fire, Air Force close air support and Army attack helicopters. The Red Ground Concept of Operation calls for massing of up to six divisions echeloned in depth across a 10-12 kilometer front to breakthrough, cutoff and destroy Blue Forces. All of the force artillery is massed forward; 600 tanks will be in the forward echelon with a like amount to follow shortly after the initial breakthrough. The initial objective will be a 15-20 kilometer penetration with daily advances of 35-40 kilometers. The initial attack will be preceded by massive preparatory fires from tactical air and artillery. The objective is to overpower the Blue Forces and capture the central region. Despite shortcomings common to any emulation, the Theater War Exercise gives the student an opportunity to apply his understanding of theater air operations in a simulated combat situation. Given the information and resources they would typically have at their disposal, the students will be confronted with many of the problems a theater commander and his staff must solve.

Crisis Decision Exercise (CRIDEX) is designed to demonstrate which changes in national power sources and policy consensus building affect crisis decision making within the United States Government. The exercise play involves United States aid to a small and distant ally which is experiencing stability problems--insurgents being supported by a neighboring country backed by the Soviet Union.

The students are divided into teams of active and passive participants. The active team will simulate the National Security Council and will consist of five students. One student will assume the position of President and the other four students will be selected to serve in the capacities of Secretary of State, Secretary of Defense, White House Assistant for Economic Affairs, and White House Assistant for Domestic Affairs. The selectees are responsible for presenting and persuasively advocating those policy operations which they believe best solve the crisis at hand and protect the particular source of national power for which they are officially responsible. The passive team will be assigned as staff advisors to support each of the Council members. These staff advisors will meet with their Council member to provide arguments to support their positions when the Council member meets with the President. Members of these teams will then listen to the Council's deliberations with the President until called upon to express confidence in the President's decisions, or to replace one or more of the active Secretaries or Assistants on the Council. During actual play, Council members may be discharged by the computer as a result of poor strategy selection that reflected on that particular Council member. Replacements are selected from the passive team members, thus assuring their immediate interest in the status of the exercise at all times.

The question before the Council is how to respond to a request for direct military intervention. This constitutes a crisis because decisions will have to be made and executed under severe time constraints (ten minutes), and because some of the policy options available risk war between the United States and the Soviet Union. A Presidential Review Memorandum (PRM) covering staff estimates of the situation is provided. This memorandum contains a background paper on the insurgency, together with relevant policy analysis from each cabinet department and White House Staff group represented on the Exercise Council. Also included are the Central Intelligence Agency's current estimates of the relative political, military, economic, and domestic power postures of the United States and the Soviet Union; public opinion data; and seven recommended policy options and possible Soviet responses.

Actual play is limited to approximately 60 minutes to force time compression and generate decision making under pressures. Only the seven policy options are available for input at each decision point. During the game play, each group of students operating as the President and his Council are tied through the computer to another group of students operating in the same capacity. Neither group of students knows the existence of the other. The computer takes the U.S. input from one group of students, reformats this input as if it were a Soviet response, and transmits it to the other group of students. The CRIDEX supports the objectives of the core curriculum, but is considered a very basic simulation and game.

Big Stick War Exercise affords the opportunity to examine and test new ideas on modern national defense strategy. The exercise allows major inputs to policy, strategy, and doctrine, and then to select and deploy forces required to carry out the plan. In the execution of that plan, players implement the command functions by employing those forces to achieve the objectives.

The events in Big Stick take place in the late-1990s between the Blue and Red alliances. On the Blue side are the Continental United States and Blue Europe. The Red alliance consists of Red Socialist States United and its Eastern European satellites, commonly referred to as the USSR. While not part of the Big Stick action, two other sections of the world are involved in this scenario. Several Western Hemisphere nations are friendly to the Red side. These non-belligerent nationals are referred to as Separated Socialist States (SSS). In addition, there is a Third Country nuclear power called Yellow. In the event that the nuclear arsenal of either Blue or Red is reduced below that of Yellow, then Yellow will become a dominant world power. Both Red and Blue have completed SALT V negotiations and are essentially equivalent in strength. All targets, costs, and weapons systems capabilities are fictitious; thus the exercise is conducted at an unclassified level. The focus of the game, however, is on the same principles that apply in a real world situation. Scoring is accomplished by algorithms established in the computer and a detailed description is not germane. The scenario starts with a European tactical air battle that escalates to the use of tactical nuclear systems. After this battle, each leg of the strategic

TRIAD (ICBM, SLBM, Bomber) is exercised individually as the war expands to global proportions.

The Fast Stick Exercise is a tactical air employment wargame that presents the many factors associated with combat operations. It permits students to apply previously learned tactical employment concepts of counter air, interdiction, close air support, and reconnaissance in a two-sided tactical war. The tactical air wargame simulates two fictitious countries which both have offensive and defensive capabilities. The computer is programmed with those capabilities and becomes the opponent. Each team starts with a limited number of strike and reconnaissance forces.

Higher command directives guide each team in the formulation of operational plans to meet the stated objectives. The preparation phase involves developing reconnaissance and strike force requirements and employment plans. The teams create an effective fighting force through a combination of sorties for reconnaissance, attack, air defense, air refueling, airborne warning and control, air superiority and support. Points are awarded for targets destroyed and aircraft remaining in a manner consistent with the priority such an actual situation might dictate.

The Fast Stick scenario incorporates the current plans and current operations branches of a Tactical Air Control Center (TACC). Individual team members function as staff members of each of the TACC branches. In order to effectively simulate the TACC functions, all planning and flying is based on two cycles: morning and afternoon; all computer activity is keyed to these cycles. In order to simulate the two cycles, the computer is programmed to stop the simulation at 1200 game time. At this time the teams receive the results on all sorties that have returned prior to 1200. Approximately 30 minutes is allowed to permit review of the results report and, based on the assessment, to initiate changes or additions to the afternoon sorties. When the last afternoon flight has returned, a summary of the day's missions results is provided to each team. The next day's missions are then planned.

The first game day is devoted to reconnaissance flights to obtain more target information. Game days two and three are mixes of reconnaissance and attack sorties. During each day's planning, the team must decide which targets to recce and which to attack. To accomplish this planning activity, the team leader determines the priority of targets and assigns a desired damage expectancy for each. The computer, acting as the opponent, randomly generates both counter attacks and tactical air requests. Both of these requirements demand an appropriate and immediate response. To meet those situations various support and reaction options are available to the team, such as preplanned ground or airborne alert, diversion of sorties, or launching for survival. After the third day, the computer compiles a score based on targets hit and resources remaining. Comparison of totals with those possible under conditions of perfect performance offers an indication of planning effectiveness and forms the basis for the review and critique.

The Rapid Deployment Exercise (RADEX) is not a computer assisted wargame but certainly a candidate for development. RADEX is a planning exercise which focuses exclusively on the activities of the JCS Crisis Action Team and the RDJTF planning staff. Other participating or coordinating agencies and commands are treated constructively. The procedural framework for the exercise is the JCS Crisis Action System. The geographical area of concern is the Middle East. The military forces are to be deployed as a Rapid Deployment Joint Task Force (RDJTF). RADEX begins with a hypothetical crisis and terminates with a decision by the National Command Authorities (NCA) to execute a specific force deployment option developed during the course of the exercise. In the body of the exercise, the seminar performs as a planning staff at HQ RDJTF and as a Crisis Action Team (CAT) at the JCS. During this exercise, each seminar will develop specific military courses of action to respond to a hypothetical crisis situation and will plan the deployment of selected United States forces to implement a Presidential decision.

We know from experience and student critiques that these operationally-oriented exercises are the best learning tools Air University has to teach force requirements and strategic and general purpose force employment. However, our current exercises are constrained by existing capabilities which result in significant limitations to our computerized wargaming activities. The current hardware (Honeywell 6060) and associated software are time-shared in an unclassified environment at Gunter Air Force Station. The links between the gaming areas and the computer location are over non-secure lines. Therefore, all current and near-term games cannot incorporate real world planning data and forces.

Until the recent planning and programming for a new computer-assisted wargaming capability, our wargaming and simulation capability was best described as individual exercises designed to support separate courses of instruction within each of the institutions. Currently, our exercises are isolated in each school because existing equipment constraints have prevented us from establishing integrated linkages between the schools and achieving the multi-level player interactions that exist in the real world, such as between the theater commander and his operational units. The current system is very rigid, has little flexibility, and we are unable to shift to different scenarios. For example, the TWX, our NATO Central Region exercise, has limited air-land integration, limited flexibility, and has taken over four years to develop. We wanted to examine potential U.S. military responses to the Soviet invasion of Afghanistan--but this was prohibited by the limited flexibility in hardware and software architecture and the notional forces used in the data base. Finally, because of technological obsolescence, students spend about 30% of the wargaming curriculum time in wrestling with data entry and information feedback. The current technology available for CRES will eliminate these existing operating limitations.

CRES will create a secure wargaming environment in which actual warning and intelligence systems and joint forces can be arrayed. A real world data

base will be the heart of the CRES system which will allow us to maximize student learning relevant to current and future plans, strategies, and requirements--and, when the system is fully matured, enable us to meet the operational needs of the Air Force Major Commands and the Air Staff. The software will include a series of functionally-oriented modules and submodules tailored to specific operational needs. The execution of each module will be independent--such as a strategic airlift problem or tactical force deployment--or may be linked to other modules to game a more comprehensive problem--such as a full Rapid Deployment Joint Task Force movement and employment. At Air University, we will also be able to link and integrate the gaming efforts of the various AU institutions. CRES will be designed for maximum flexibility in order to accommodate varied scenarios, forces, and systems. With CRES, we would be able to wargame potential responses to a range of crises on a worldwide basis. Finally, CRES will incorporate all of the lessons we have learned from the Theater War Exercise and other Air University wargames, and will exploit state-of-the-art technology to reduce administrative time and optimize wargaming activities.

The initial target audience for CRES is the PME students who will be our future senior commanders and key staff officers. By introducing CRES into Air Force PME programs, we can educate a broad cross section of the officer corps in the decision-making processes underlying force deployment and employment. For example, over a 15-year period, 50,000 of our best Lieutenants and Captains, 6,500 of our best Majors and 2,500 hand-picked Lieutenant Colonels and Colonels would receive extensive exposure to the real business of the Air Force, employment of forces in combat.

Joint exercises with the Army and Navy schools will also become a reality through CRES linkages in the FY 86-88 time frame. We are ahead of the other services in most areas of quality, leadership, and management--but not here. Both the Army and Naval War Colleges are far ahead of the Air Force in developing and implementing wargaming systems with capabilities similar to CRES, both for PME and operational purposes. CRES will enable us to join with the other services in a more in-depth examination of the problems of joint employment.

As the system matures in 1988 and beyond, senior commanders and their staffs will be able to tie into CRES via existing communications systems or use the Maxwell facility to preplay major exercises or examine, in a macro sense, the strengths and weaknesses of operations plans. Moreover, before going to a new command or assignment, senior officers could quickly obtain a graphic overview of the command's wartime plans, forces and employment strategies, thereby significantly reducing theater orientation time.

Although CRES is included in the Air Training Command (ATC) and Air University budget submission, we do not feel it is just an ATC or an AU program--it is, in the truest sense, an Air Force program. To date, support for CRES expressed by the commands has been good. The program is, of course, in a highly competitive funding environment. However, when fielded, we believe CRES can fill a major

training and education shortfall and better prepare our future leadership to outplan, outthink, and outfight the enemy. With CRES, we would be in a position to take a major step toward the long-term enhancement of Air Force readiness that some day might spell the difference between winning or losing on the battlefield.