BREAKING THE PAPER PARIDIGM
A Revolution in Professional Military Education

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ABSTRACT

It was during the fiscal year 1993 the Air Command and Staff College (ACSC) undertook the most significant change in its approach to military education since the school's inception. In a total departure from the military norm, the school moved from a traditional lecture-based, passive learning environment to a demanding state-of-the-art **computer-based curriculum**, supported by world-class **hyper-information systems.** This architecture allows the student to access the multitude of **information superhighway** products both internal to the Air University (AU) and national on-line systems.

Moving beyond the 600 student residence program, these systems are rapidly revolutionizing our "Distance Learning" effort supporting over 6,000 students. This exciting thrust includes three major prongs: multimedia hyperlinked curriculum on CD-ROMs, on-line "cyber" seminars, and video-teleconferencing to complete the student/faculty interaction.

ABOUT THE AUTHORS

Lt Col Pat Nutz is the architect behind the technology revolution at Air Command and Staff College and draws upon an extensive background in research and development within the USAF. He has a MS in Aeronautical Engineering from the AF Institute of Technology and a BS in Mechanical Engineering from the University of Pittsburgh. He has experience major defense efforts such as the high energy airborne lasers, airborne and space based radars, space sensors, and directed energy weapons in space, and space systems survivability.

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Lt Col (Select) Woody Wilson has been Chief of ACSC's Distance Learning Technologies since the inception of that office in 1994. His work includes development of the computer architecture for Cyber-Seminar and Electronic Campus, research and design of the Multimedia Course, and producing the college's first tele-seminar broadcasts. Major Wilson has served as the Commander of three different Air Force Office of Special Investigations' units and he is a 1994 Distinguished Graduate of ACSC.

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"Air Command and Staff College has created a curriculum that is both <u>dramatic</u> and <u>bold</u>, exactly what is needed in these changing times"
General Michael P. C. Carns
US Air Force Vice Chief of Staff
Academic Year '94

INTRODUCTION

The Air command and Staff College has spearheaded an amazing transformation in professional military education--a veritable "revolution" in the classroom, all in the past 24 months. Founded on the premise that we needed significant improvement to prepare our students to succeed in the future, and forged in the air plan that won the Gulf War, the college completely reworked nearly every aspect of its 10 month program and is now leading the revolution throughout the Department of Defense professional education system. With the goal of creating a curriculum that teaches serious critical thinking and analytical skills, the school used every possible high technology approach to establish an infrastructure of over 1,500 personal computers, 10 Mbps LAN, Internet access, and extensive software.

Based on the same premise, the college has "revolutionized" distance learning for the thousands of officers and civilians who participate in our educational program from afar. ACSC embarked on an aggressive effort to transform the distance learning program from a traditional, text based correspondence program to a multifaceted, technology based course of instruction. Our vision of distance learning involves a three prong approach to incorporating new and emerging technologies into distance learning. These are: a interactive, multimedia computer program on CD-ROM using on-line communications in 'cyber-space' facilitating interaction, and satellite video teleconferencing capabilities to deliver special instruction to our students. Each of these technology based initiatives have been integrated into our program to give ACSC a unique "multi-medium -- multimedia approach" to distance learning.

However, the single most successful enabling technology has been the new breed of multimedia authoring programs. Using one such package, ACSC has laid the conceptual base for its transformation, achieved a true paperless schedule and lesson plan environment, and much more. Within the first three months of use, faculty-led student research teams built over 50 multimedia "encyclopedias" on most of the key educational points in the curriculum. Building on that base over the past academic year, we produced nearly 100 new applications and significantly improved the initial group. These "encyclopedias" and other multimedia authoring manifestations have changed forever the way we do business.

This essay gives an overview of this rapid progress and introduces the principles and logic behind the ACSC's computer assisted curriculum. Although we are in the early stages of this very fast paced revolution, we eagerly look forward to an even more exciting future.

ABOUT AIR COMMAND AND STAFF COLLEGE

Air Command and Staff College is in a unique class among institutions of higher learning. Our mission is to "educate mid-career officers to lead in developing, advancing, and applying air and space power in peace and war." That gives us carte blanche to cover any and all subjects and also introduces a prioritization issue since we have only 10 months to complete our mission.

All of our approximately 600 resident students are selected through a rigorous process that results in each selectee being ranked in the top 15% of his or her peer group. Almost all have at least one master's degree and all have the maturity expected among a professional cadre. A

typical class consists of approximately 400 active duty Air Force, 20 Air National Guard/Reserve, 90 Army/Navy/Marine, 70 international officers from 50+ countries, and 10 Air Force civilian employees.

The faculty and staff are also uniquely constituted. Approximately 130 professional military are complemented by 35 career civilian educators. Most of the faculty are selected from the graduating class and then rotate out of the college after two or three years duty. This affords a constant stream of "non-traditional educators" - - young, dynamic, tireless, thinking individuals ready to tackle nearly any challenge posed. This includes writing and administering the distance learning program to over 6,000 students worldwide.

Given this mission and student/faculty make-up, one central premise is also key. The environment they will face for the next 20 - 30 years will be significantly different from the past. They are being educated during the greatest confluence of revolutions ever: the geo-political revolution, where we went from a bi-polar to a multi-polar world; the information revolution (or second industrial revolution) where we find almost unlimited access to information and communications; and the military technical revolution and it's attendant "Revolution in Military Affairs." We begin our teaching of air and space power upon the observation that revolutionary change looks likely and may even accelerate for the foreseeable future. We conclude by positing that mental agility and "top down" critical thinking will be the most important tools to impart to our students during their sojourn at Air Command and Staff College.

ABOUT AIR AND SPACE POWER

Before one can understand the introduction of advanced educational technologies a summary of the latest airpower concepts is needed. With less than a century of experience, airpower theory and concepts have developed rapidly and, in many ways, track with the explosive nature of the technology advances since the early 1900s. Without technology, man could not sustain himself in the air (or space) and so the intimate relationship between the two is no surprise.

While there are tomes of official airpower doctrine, we will highlight some of the latest concepts tested and found successful in the recent Gulf War. These are listed in Figure 1.

Key Concepts.

- ► **Operational/ strategic level of war**
- ► **Parallel war**
- ► **Effects of precision**
- ► **Information organization**
- ► **Pattern recognition**

Figure 1: Key Concepts

The traditional view of point #1 (Figure 1): "Strategic/Operational level of war" is one where the few decision makers develop strategy and the operational level infrastructure supplies the entire system. And these two rest securely on the purposely broad tactical level. This system is designed to degrade gracefully and, when attacked in the traditional linear attrition warfare mode, usually does.

The air and space power view is fundamentally different: one from a high vantage point. We teach that the system actually teeters on a precarious strategic point (see Figure 2.). Direct attacks on this point, flying over the tactical and operational levels, yield significantly different results.
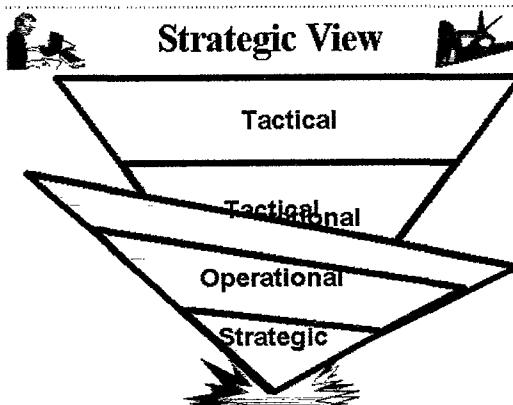

Figure 2. Strategic View

Point #2, Parallel War, can easily be understood from observing the Gulf War. Whereas many in the US government were proposing a serial, gradual escalation approach, the actual airpower campaign called for strikes on the most important strategic level targets almost simultaneously! This produced the effect of paralysis on the enemy, similar to the "death of a thousand cuts," which then allowed numerous options for the attacker.

The ability to attack many small strategic targets in a very short time is due in large part to the technology advances in precision weapons and detection-avoiding "stealth." However, this precision also drives the need for precision information and lightning fast timeliness. **Imagine the same technologies and methodologies applied to the professional education environment.** ACSC developed such a high tech classroom with its multimedia applications and we can now "educate the way we fight!" We could discuss many more airpower concepts but they all sum to the same conclusion. Air and space power promise ever increasing potential for the future, but the successful application will require seasoned critical thinking. This is the objective of ACSC's curriculum.

ABOUT THE ACSC CURRICULUM

Given the information explosion and the nature of our mission, we moved away from the traditional stovepipe (independent) courses and developed a "problem solving" curriculum. Figure 3. shows the overall flow where we start on a base of "command and leadership" lessons and then quickly enter the "campaign" approach. We study the reasons for warfare and the importance of establishing concise objectives, then relate past, present and emerging theories of airpower. Next, we develop prioritized target categories at the strategic and operational levels, paying close attention to their likely effect on meeting objectives. Then, we build a campaign plan, starting at the multi-service (Joint) level and concentrating on the airpower contribution with a constant eye on war termination criteria. Last, we move to a future emphasis and examine many possible scenarios, each with multiple permutations.

The Revolution in PME

|	
Command and Leadership	Geopolitical Revolution
War, Conflict and Objectives	
War Theory	
Strategic Structures	
Operational Structures	
Info Revolution	
Joint Campaign Concepts	
Revolution in Military Affairs	Theater Air Campaign
War Termination	
Campaign 2000+	
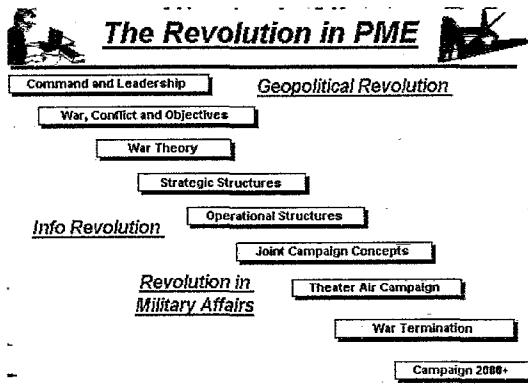
Figure 3. The Revolution in Professional Military Education

This is a five day a week 10 to 14 hour a day intensive program. Actual time in the seminar room averages approximately 3 hours/day with time for extensive reading (over 100 books in 10 months), class preparation, and team research. Each segment of the course builds on the previous ones and therefore each test, usually essay or oral, stresses the integration of all material. Again, we highlight critical thinking skills and information management.

The team research is of particular interest from an educational technology perspective because this is where we tap a vast reserve of student labor and experience. The research program is designed to challenge the students to think creatively, contribute to the body of airpower knowledge in a measurable way, and focus on the theater (operational) level of warfare. Most of the digital interactive hyperlinked "encyclopedias" are the direct result of challenging the students and giving them the tools to efficiently build the products. This student labor pool, constantly refreshed each year, also solves the problem of maintaining the currency of the products. We can assign "update" tasks as either research or, if the updates are relatively straightforward, as homework or classroom exercises.

Speaking of exercises, we have more than doubled the use of case studies, exercises, and educational and analytical wargaming in the past two years. These application, comparison, synthesis level experiences allow the student to integrate the entire curriculum and demonstrate mastery of the information. Using a combination of commercially available and internally developed exercises, we cover a broad spectrum of scenarios and derivatives to give the student a deep appreciation for the flexibility and advantages of applying airpower. True to our high tech emphasis, we developed most of our exercises internally, including decision aids and campaign planners, using the same authoring software as used for the encyclopedias. In fact, we can add simple exercises to each encyclopedia to enhance the learning and usability.

Efforts have already begun to expose the students to the use of virtual reality and the Synthetic Theater of War (STOW) in simulations and wargames. May '95 saw the college's first use of Distributed Interactive Simulation (DIS) as ACSC participated in a joint exercise, "Prairie Warrior" with the U.S. Army's Command and

General Staff College at Ft. Leavenworth, Kansas.

One more aspect about our curriculum. It also has to service our nearly 7,000 non-resident student population. These folk do not have the dedicated time afforded those chosen to attend in residence but have many of the same needs and growth potential. In the past we would develop quite separate curricula for this group and, over the years, the two programs drifted very far apart. No longer. Consistent with our vision of exporting professional military education, we use technology to make the non-residence experience a type of "in-depth executive summary" of what is taught in the residence program.

COMPUTER BASED CURRICULUM

Choosing a problem solving approach to our curriculum was fundamental. Greatly increasing the emphasis on application through exercises and wargames was next. Coupling these with the recent advances in personal computers gave us the near perfect opportunity to go digital, interactive, and multimedia. The first "product" was a combination problem solving tool with an "on demand" hyperlinked curriculum fully integrated. We also used this application to demonstrate the ease of using the authoring software and to gain outside support and additional funding to fuel the revolution.

Following the initial proof of concept, we immediately tackled the "paperless" curriculum and scheduling task. Figure 4. shows the initial screen presented to every new student at ACSC as they start to play with their individual notebook computer.
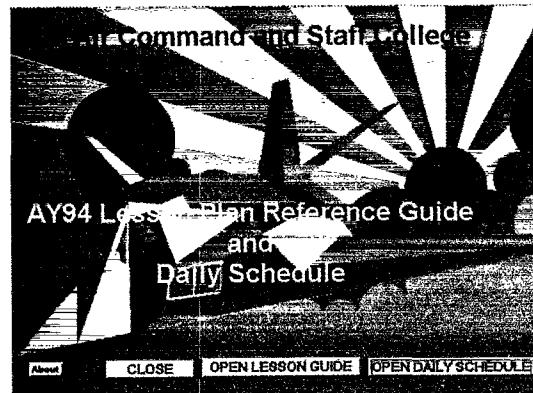
Figure 4. ACSC Lesson Plan Reference Guide

This application was immensely successful for it contained absolutely vital information each

student needed: schedule of classes, lesson plans, reading assignments, and a plethora of administrative information such as organizational charts, mission statements, faculty bios, and the like.

The student simply starts at the top level and then explores each day and each lesson plan to learn what he or she needs (Figures 5-7). Authoring the application ourselves has several very tangible benefits: we can design it to fit our exact needs, we can update and re-design it as necessary, and we can be immediately responsive to the users' feedback.
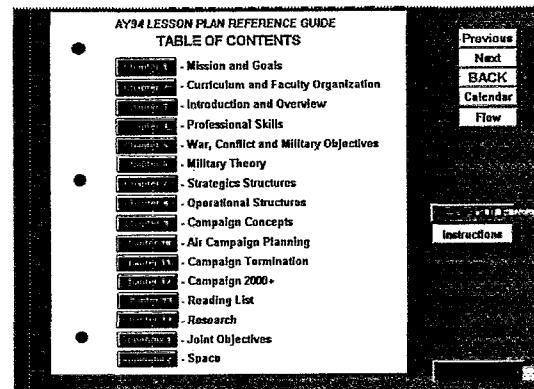
Figure 5. Lesson Plan Table of Contents
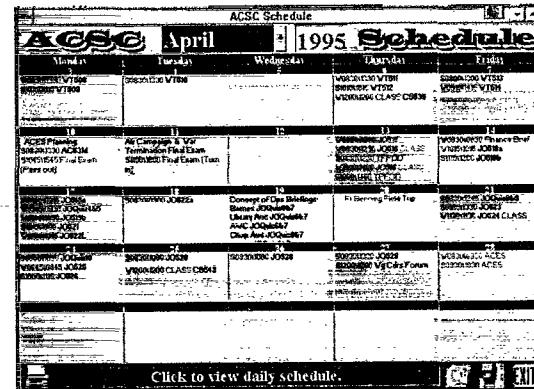
Figure 6. Monthly Schedule

And feedback they did. This total immersion approach produced a hue and cry at first which quickly died down as its usefulness became apparent. A subset of the students did complain that they could no longer make notes on the schedules and so, overnight, we modified the application to include a "personal notes" section, and also added the ability for the students to customize the material by adding their thoughts directly to the lesson plans (see Figure 7). We were so encouraged by this initial success we decided to push far more aggressively into many of our other planned applications.

The next use of this high technology came as we pondered the dilemma of too much classroom time devoted to basic knowledge level learning. Why not digitize it and make it graphically interesting in the process? Our first such product was the Carrier Battle Group Joint Knowledge Primer (CVBG).

April 3, 1995		
3 Apr 95	Monday	(MIC Handlers Sem 17 & 39)
AM Seminars		
0830-1000 WT508 Wood	International Law Issues Mr. Hays Parks, Special Assistant to the Army Judge Advocate for Law of War	
1015-1145 WT509 Seminar	Humanitarian Issues	
1200-1245 IT505 Seminar	Internet: Search Tools (Archie, Gopher, etc.) and Exercise, (Seminars 29, 30, 31, 40, 41 and 42)	
PM Seminars		
1230-1315 IT505 Seminar	Internet: Search Tools (Archie, Gopher, etc.) and Exercise, (Seminars 7, 8, 9, 18, 19 and 20)	
1330-1500 WT508	International Law Issues	

Type your personnel notes in blue area.

Figure 7. Daily Schedule

United States Navy

The Carrier Battle Group

A Basic Knowledge Primer

Figure 8. CVBG Battle Group

We wanted to reduce classroom time learning basic facts about sea-based airpower and begin the seminar discussing sea and land based airpower and their contributions to national defense. Therefore, we designed the CVBG Primer to easily access history, employment, sea assets, and air assets, and hyperlinked between various screens to encourage the student to explore relationships. In this case, we chose the weapon systems carried aboard each craft to achieve such linking. See Figures 9 through 11 to see one possible flow of discovery.

Bolstered by this success, several faculty members and students tackled the US Army and developed one of our premier products: the Army Operations primer. This application refined the "top down" approach to accessing vast amounts of data and reached new levels of visual

attractiveness. Its table of contents appears in Figure 12.
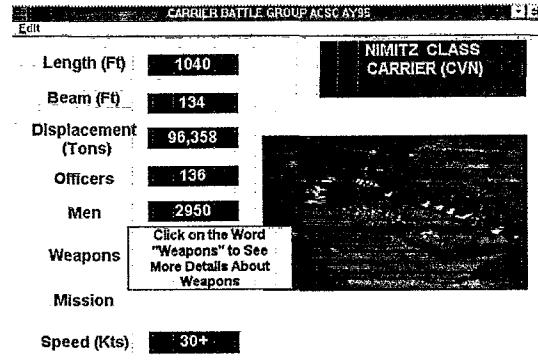
Figure 9. Hyperlink of Weapon Systems on Nimitz Class CVN
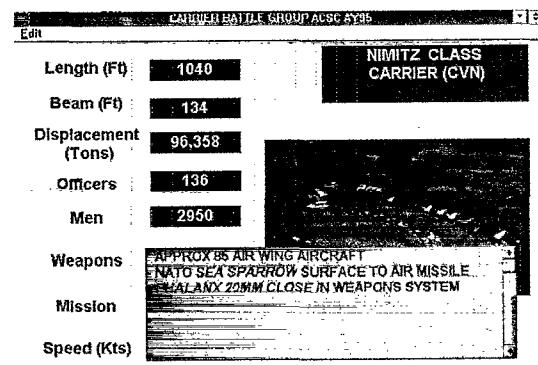
Figure 10. Second-level Hyperlink to "Type" Weapon Systems
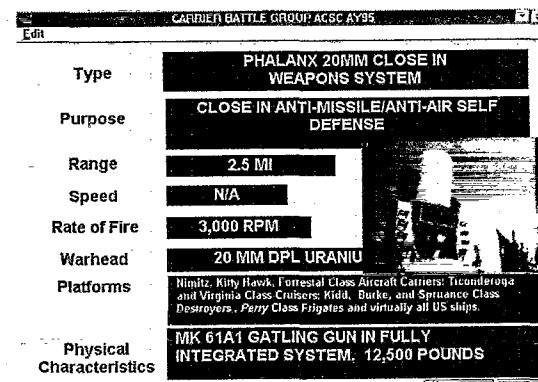
Figure 11. Third-level Hyperlink to "Specific" Weapon Systems.

From this point of departure, the learner can easily develop an understanding of almost every aspect of Army operations and start to appreciate the complexities of deployment, supply, and even field medical issues. Again, the "top down" approach yields great dividends. For

example, the learner may be interested in fuel use. He need only to move the pointer to the "Logistics" button and click to see the information (see Figure 13). Likewise, he can explore the time it takes to use this fuel, the alternatives of air and sea transport of the units (see table of contents) and then return to the basic fighting configuration to gain appreciation for the movement parameters.
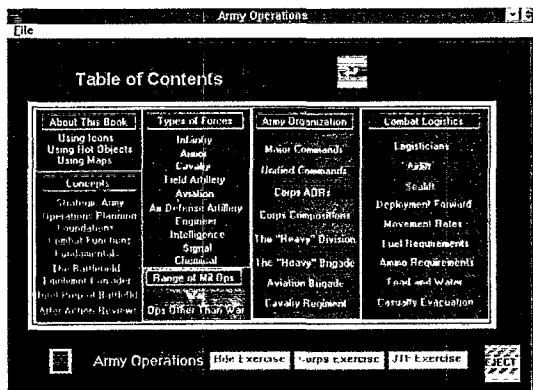

Figure 12. Army Operations Table of Contents
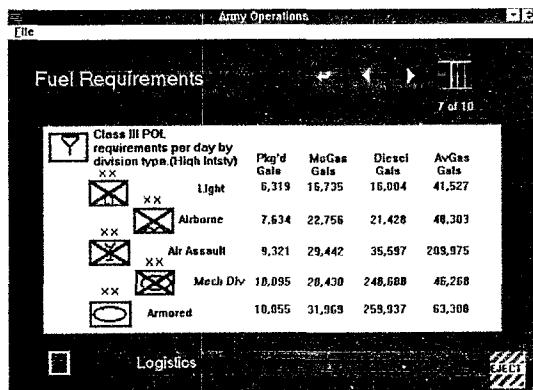
Figure 13. Fuel Requirements Hyperlinked from Logistics button.

For example, clicking on "Armor" from the table of contents gives first order differential information on the Armor basic--and M1A1 Abrams tank. Clicking on the tank icon yields second order differential information on the tank and offers the learner a digitized video of tank maneuvers over rough terrain or the loading, firing, and lethality of this fighting machine (see Figure 14).
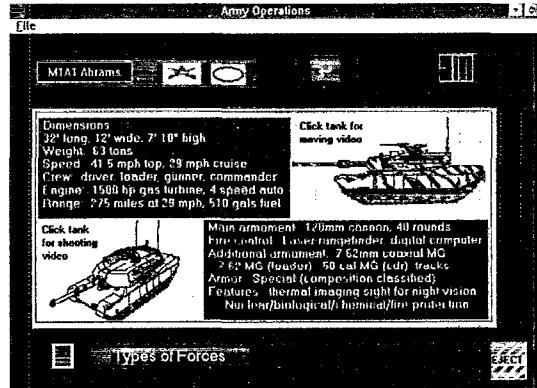

Figure 14. Hyperlink to Armor from Type of Forces button.

Well, as one might imagine, this approach caught on like wildfire. Far faster than we expected, students were devoting the 100 to 200 hours necessary to master the authoring software and producing very credible applications. After only 3 months of hardware and software availability, introduced during the final third of the initial year (AY 94), we had over 50 hyperlinked multimedia applications available to all the students. Titles included: campaign planning, total quality management, DOD's budgeting system, Marine Air Ground Task Force (MAGTF), principles of war, military terminology dictionaries (in several languages to serve our international students), multiple historical battles (Cannae, Schlieffen, SW Pacific, Gettysburg, etc.), primers on night warfare, joint campaigns, space systems, and so on. We also had a number of interactive wargame applications that allowed the learners to prioritize target selections, develop out year budgets for DOD, and employ forces against a wide variety of scenarios.

We coupled these exciting graphical products with our curriculum and our research, threw in some nifty clipart and classical military documents, and produced the first CD-ROM ever in professional military education. We then highlighted this group achievement by handing out the CDs, *in lieu of diplomas*, at the graduation ceremony (see Figure 15). Times had clearly changed and there was no turning back.

That was last year. This graduating class also exceeded our expectations and we now have 175 multimedia applications and well over 100 research products. Our curriculum also improved and almost 50% has been rewritten and digitized. This year's class (AY95) received a double set of CDs that are integrated and updated with the

latest computer based curriculum information that they helped to produce!

AIR COMMAND AND STAFF COLLEGE
"Educating Tomorrow's Leaders"
AY 94 ACSC CURRICULUM
Multimedia CD-ROM
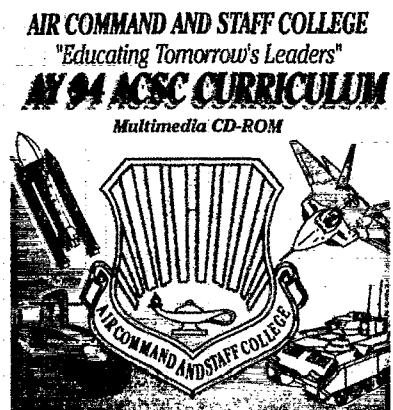
Figure 15. ACSC AY 94 CD

DISTANCE LEARNING TRANSFORMATION

This aggressive progress and increasing sophistication enabled two other related "new starts." We developed an Internet Home Page for the ACSC "Knowledge Warrior" and are producing a CD-ROM based non-residence, or distance learning, curriculum. We also experimented with great success in a "CYBER Seminar" over America On-Line and two way video teleconferencing to complete the spectrum of non-residence high technology (see Figures 16 and 17).
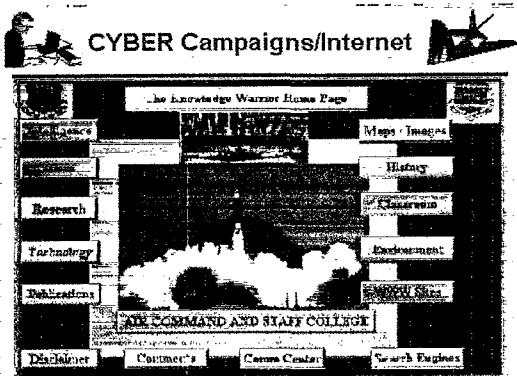
Figure 16. ACSC Knowledge Warrior Home Page

Figure 17. ACSC Distance Learning Program

The ACSC Distance Learning Course, Multimedia Edition, or "Multimedia Course" for short, is designed to significantly improve the educational value of ACSC's distance learning curriculum while updating our educational delivery system to take advantage of new technologies. Figure 18 provides a graphic depiction of the "hub and spoke" interactive design of this program. Interactive self-testing will help the student ensure comprehension and assimilation of the course content. The move away from a text-based delivery system to CD-ROM will reduce the costs of production and delivery of the course by an estimated $232,000 annually.

To our knowledge, ACSC is the first and only Department of Defense (DoD) institution to aggressively pursue the development of a complete course of instruction using CD-ROM technology with a multimedia based, interactive format. This ground breaking initiative will certainly have a significant impact on the future of distance learning programs throughout the DoD.

In an effort to improve the non-resident course of study and bring distant learners and school faculty closer together, ACSC's 'Cyber-Seminar' was born. The Cyber-Seminar went *on-line* in September 1994 and quickly evolved into a model for computer assisted, real-time education, allowing ACSC to study an alternative to the traditional correspondence format for isolated students.

America OnLine (AOL) and Military City On-line (MCO) provide the on-line services and "virtual" classroom space for the. Faculty or guest experts, and guest speakers, guide students through thought-provoking discussion, allowing students to interact and provide differing

perspectives. On-line bulletin board and library areas allow for uploading and downloading of the most current information on subjects the college feels are important for the student, or on issues the students wish to share with each other.
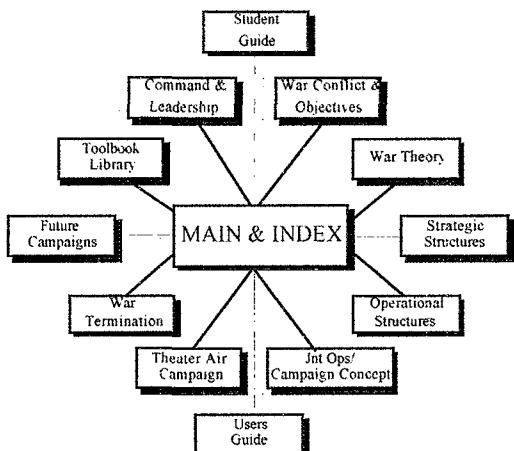

Figure 18. Interactive "Hub and Spoke" Design of the Multimedia Course

The new "ACSC Electronic Campus" will open its "cyber-doors" in September 1995 to serve the 300 students participating in the initial test of the Multimedia Course. Student's will have real-time, on-line access to faculty and subject mater experts at various times each month during "office hours." Faculty will assist in clarification of issues and lesson enhancement. On-line guest speakers, current literature and programming in the cyber-library, and direct e-mail to the college will round out our "Electronic Campus" and further enhance the learning process. Educators from sister services and other federal departments have benchmarked against ACSC's on-line initiatives for designing similar programs.

The final medium in ACSC's three-pronged approach is tele-seminar broadcasts. We have already successfully broadcast ACSC classes to remote seminar locations using the Air Force Reserve's Teletraining Network (TNET) and, our primary broadcast system, the Air Technology Network (ATN). Initially, we are offering course overviews and lesson enhancement broadcasts to compliment the current distance learning curriculum. Eventually, we plan to broadcast presentations being made to the college's resident students so the distance learner can fully participate with faculty, guest speakers, and resident students in "face-to-face" discussions.

ABOUT THE FUTURE

We see no limit to the path we have embarked upon. We want to greatly expand our residence team research program using the latest Internet technologies. We envision collaboration between our resident and non-resident programs, between ourselves and graduate universities and laboratories, between ourselves and public grade school classrooms, and finally, international forums. We want to immerse ourselves in the latest information technologies and graduate critical thinking students with a life-long yearning to learn. And, we want our graduates to "pull" their future organizations into the information age and demand the same or better technologies they had routine access to while at Air Command and Staff College.

SUMMARY

Total immersion. Advanced information technologies. Authoring software and cheap personal computers. Unlimited potential among professional level students and aggressive faculty. We developed a clear vision for the future of professional military education and achieved amazing success in the first 24 months. We did move into a largely "paperless" environment with our computer-based curriculum and hyperinformation applications. And, we developed a methodology to continuously improve and update an exploding digital data base using student labor and faculty guidance. We experimented in the residence classroom with all the digital applications and communicated locally over our 10 Mbps LAN and internationally over the Internet. We then applied the same approach to our distance learning program and added on-line "cyber" sessions and video teleconferencing. We documented our success on CD-ROMs and distributed this capability world wide through our graduating students. And, the future is even brighter.

Thanks to visionary leadership within Air University and at the highest levels of the Air Force we were empowered with equipment and challenged to "aim high." We think we have succeeded and will continue to climb. The most difficult challenge is changing the culture to accept the technology, master it, and use it to improve education and airpower. Yes, we have broken the paper paradigm but we must continue to improve the technologies and the change methodologies to break the cultural paradigm.

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