INTRODUCTION

GOOD MORNING AND THANK YOU -- IT'S A GREAT PLEASURE FOR ME TO BE HERE TODAY. LEARNING, EXPANDING THE SCOPE AND DEPTH OF KNOWLEDGE -- CREATING HUMAN CAPITAL -- IS A TIME-HONORED SUBJECT OF DISCOURSE....AND CONTROVERSY.

WIDESPREAD ACCESS TO EDUCATION HAS BEEN A PRIORITY IN OUR COUNTRY SINCE ITS FOUNDING, AND THE DRIVE FOR THAT GOAL HAS GIVEN RISE TO DARING AND VISIONARY ACTION ON A NATIONAL AS WELL AS A LOCAL LEVEL. TWO EXAMPLES COME IMMEDIATELY TO MIND. THE MORRILL ACTS ARE OFTEN CITED AS HAVING MADE THE SINGLE GREATEST CONTRIBUTION TO HIGHER EDUCATION IN AMERICAN HISTORY. AND THE G.I. BILL MORE THAN ERASED THE EDUCATIONAL DEFICIT OUR COUNTRY FACED AFTER WORLD WAR II.

WITH SUCH INGRAINED CONCERN, AND WITH A HISTORY OF GREAT ACCOMPLISHMENT, IT'S ALL THE MORE IRONIC THAT THIS COUNTRY FACES A GROWING CRISIS. OUR ECONOMIC AND TECHNOLOGICAL
LEADERSHIP POSITION IN THE WORLD HAS BEEN RAPIDLY
DETERIORATING -- AND THE TIME HAS COME FOR NEW VISION....A TIME
TO RE-THINK SOME OF OUR FUNDAMENTAL ASSUMPTIONS ABOUT THE WAY
WE TEACH -- AND LEARN.

THE PROBLEMS

SO MUCH HAS BEEN SAID ABOUT THIS PROBLEM OF A DETERIORATING
TECHNOLOGICAL POSITION AND THE FAILURES OF EDUCATION IN THAT
REGARD THAT IT WILL SUFFICE TODAY FOR ME TO SIMPLY SUMMARIZE
THE SITUATION BEFORE MOVING ON TO THE PROMISE TECHNOLOGY HOLDS
FOR ALLEVIATING OUR CONDITION -- AND THE PITFALLS WE MUST AVOID
IF IT IS TO DO SO.

MILLIONS OF DISADVANTAGED PERSONS LACK EMPLOYABLE SKILLS.
MILLIONS OF DISABLED PEOPLE COULD BE TRAINED -- BUT AREN'T. WE
FACE THE SPECTRE OF A VERY LARGE UNDERCLASS WHICH IS
TECHNOLOGICALLY ILLITERATE. AND, AT THE OTHER END OF THE
SPECTRUM, WE'RE GRAPPLING WITH A SCARCITY OF THE TECHNICALLY
SKILLED PERSONS ESSENTIAL TO OUR ECONOMIC WELL-BEING AND
NATIONAL SECURITY.

UNDERLYING THIS LITANY OF WOES ARE A NUMBER OF PROBLEMS AT THE
PRE-COLLEGE LEVEL: THE CONTINUING DECLINE IN PERFORMANCE ON
SCHOLASTIC APTITUDE TESTS....THE HIGH PERCENTAGE OF COLLEGE
FRESHMEN WHO REQUIRE REMEDIATION....THE GROWING SHORTAGE OF MATH AND SCIENCE TEACHERS....AND THE FACT THAT ONLY ABOUT ONE IN EVERY SIX HIGH SCHOOL STUDENTS TAKES A JUNIOR OR SENIOR YEAR SCIENCE COURSE.

AT THE COLLEGE LEVEL, BUDGET CONSTRAINTS MAKE IT IMPOSSIBLE TO PAY THE SALARIES NEEDED TO RETAIN HIGH-QUALITY PROFESSIONALS -- ESPECIALLY IN THE ENGINEERING SCHOOLS -- OR TO PREVENT THE OBSOLESCENCE OF LABORATORY FACILITIES. AND THE RATE AT WHICH NEW KNOWLEDGE CAN BE PRODUCED HAS ALSO SLOWED BECAUSE THE FEDERAL GOVERNMENT -- THE MAJOR SOURCE OF SUPPORT -- HAS REDUCED ITS FUNDING FOR RESEARCH.

AT THE SAME TIME -- WHILE ENGINEERING SCHOOLS ARE FALTERING AND A HIGH PERCENTAGE OF STUDENTS ARE GRADUATING FROM HIGH SCHOOL AS TECHNOLOGICAL ILLITERATES -- HIGH TECH INDUSTRIES HAVE A GROWING NEED FOR SKILLED PEOPLE. IN MY INDUSTRY, FOR EXAMPLE, THE NUMBER OF JOBS AVAILABLE FOR COMPUTER MAINTENANCE TECHNICIANS WILL CLIMB BY 147% DURING THE '80S -- BY 107% FOR COMPUTER SYSTEMS ANALYSTS. THE PERCENTAGES ARE EVEN HIGHER IN ROBOTICS AND MICROELECTRONICS.

IN ADDITION TO THE ADVERSE IMPACT ON OUR IMMEDIATE ECONOMIC SITUATION, THESE PROBLEMS ARE ALSO A GRAVE THREAT TO OUR POSITION AS THE WORLD'S TECHNOLOGICAL LEADER. OUR ONCE-STRONG COMPETITIVE POSITION IN TECHNOLOGY HAS BEEN STEADILY ERODING AS
OTHER COUNTRIES HAVE TAKEN A NUMBER OF STEPS TO DEVELOP THEIR HUMAN CAPITAL. THE U.S. RANKS FOURTH IN SCIENCE LITERACY BEHIND THE USSR, WEST GERMANY AND JAPAN. THE SOVIET UNION GRADUATES THREE TIMES AS MANY ENGINEERS AS THE U.S., AND JAPAN, WITH HALF OUR POPULATION, PRODUCES 5,000 MORE ELECTRICAL ENGINEERS PER YEAR.

BUT OUR COMPETITORS HAVE GONE BEYOND JUST INCREASING THE NUMBER AND QUALITY OF AVAILABLE SCIENTISTS AND ENGINEERS. THEY HAVE EXPANDED RESEARCH AND DEVELOPMENT THROUGH INCREASED GOVERNMENT SUBSIDIES AND COOPERATION; HAVE REDUCED THE COST OF CAPITAL FOR INDUSTRY; AND HAVE FOSTERED GROWTH IN TARGETED INDUSTRY AREAS.

THE PROMISE OF TECHNOLOGY

SO -- WHERE DO WE TURN? HOW CAN THE DETERIORATION IN OUR ECONOMIC AND TECHNOLOGICAL CONDITION BE REVERSED? OBVIOUSLY, IT WILL NOT BE EASY. IT WILL REQUIRE A WIDE RANGE OF RESPONSES, MUCH MORE THAN SIMPLY RE-TOOLING OUR EDUCATIONAL SYSTEM. BUT NO SOLUTIONS WILL WORK WITHOUT DRAMATIC CHANGES IN THE WAYS WE TEACH, SO MY REMARKS TODAY WILL BE LIMITED TO THE RESPONSE IN EDUCATION AND TRAINING, AND MORE PARTICULARLY, TO THE ENHANCEMENT -- THE EXCITEMENT -- ELECTRONIC TECHNOLOGY CAN BRING TO THE PROCESS OF TEACHING.

BECAUSE CONTROL DATA'S PLATO COMPUTER-BASED EDUCATION SYSTEM IS THE MOST ADVANCED OF ITS KIND, AND THE ONE I KNOW BEST, I WILL USE IT AS AN EXAMPLE TO ILLUSTRATE THIS PROMISE OF TECHNOLOGY.

THE MAIN FEATURES INCLUDE:

- AN EDUCATIONALLY EFFECTIVE METHODOLOGY
- AN INTERACTIVE NATURE
- AN INDIVIDUALIZED, SELF-PACED APPROACH
- EASE OF USE
- THE ABILITY TO MOTIVATE
- PRIVACY
- AND A DEMAND FOR MASTERY OR COMPREHENSION BEFORE THE STUDENT CAN MOVE TO THE NEXT LESSON

LET ME TAKE THESE FEATURES ONE BY ONE.

A KEY INGREDIENT OF SUCCESSFUL LEARNING IS ACTIVE STUDENT INVOLVEMENT -- WITHOUT IT, NOT MUCH LEARNING TAKES PLACE. IT MATTERS VERY LITTLE HOW EFFECTIVE THE DELIVERY MAY BE IF THE STUDENT'S RECEIVER ISN'T IN THE "ON" POSITION -- AND THAT'S WHY THE MOST IMPORTANT CHARACTERISTIC OF COMPUTER-BASED EDUCATION IS ITS INTERACTIVE NATURE.

ONCE STUDENTS ARE TURNED ON, LEARNING EFFICIENCY IS GREATLY ENHANCED WHEN THEY ARE PERMITTED TO PROCEED THROUGH THE MATERIAL AT THEIR OWN RATE. WE'VE ALL BEEN INVOLVED IN CLASSES MOVING EITHER TOO RAPIDLY OR TOO SLOWLY, CAUSING ANXIETY IN THE FIRST CASE AND BOREDOM IN THE SECOND. STUDENTS WHO'VE
PREVIOUSLY EXPERIENCED DIFFICULTY IN GROUP LEARNING HAVE ACHIEVED REMARKABLE IMPROVEMENTS WITH CBE -- IN LARGE PART BECAUSE OF THE GROWTH IN CONFIDENCE THEY'VE EXPERIENCED WHEN LEARNING AT THEIR OWN PACE.

EASE OF USE. IN ORDER TO BE EFFECTIVE -- AND TO EASE THE LEARNER'S APPREHENSION ABOUT USING WHAT APPEARS TO BE VERY A COMPLICATED TECHNOLOGY -- A GOOD CBE TERMINAL ALSO MAKES THE INTERRELATIONSHIP AS SIMPLE AS POSSIBLE. NEITHER COMPUTER, TECHNICAL, NOR TYPING SKILLS ARE NECESSARY FOR THE TERMINAL TO FUNCTION SMOOTHLY. STUDENTS OF ALL AGES CAN OVERCOME ANY FEARS IN A VERY SHORT TIME.

AND SUCCESS IS THE GREATEST OF ALL MOTIVATORS. IT WHETS OUR APPETITE FOR MORE. IMMEDIATE POSITIVE FEEDBACK MOTIVATES STUDENTS TO PROCEED QUICKLY TO THEIR NEXT "REWARD." WE'VE USED CBE WITH STUDENTS WHO'VE NEVER EXPERIENCED LEARNING SUCCESS BEFORE -- WHEN THEY DO, THEY NOT ONLY LEARN THE MATERIAL BUT ALSO INCREASE THEIR SELF-CONFIDENCE AND SELF-ESTEEM.

THESE SAME FORMERLY UNSUCCESSFUL STUDENTS, SOME OF THEM IN VERY DIFFICULT LEARNING ENVIRONMENTS, REPORT THAT THE PRIVACY OF CBE IS EXTREMELY IMPORTANT. NOBODY BUT THEMSELVES AND THEIR INSTRUCTORS KNOW THEIR LEARNING SITUATION. THEY SAY THINGS SUCH AS: "WHEN I MAKE A MISTAKE, 29 OTHER PEOPLE DON'T LAUGH" -- OR: "THE COMPUTER NEVER RIDICULES ME OR PUTS ME DOWN." WE CAN ALL RELATE TO THAT FEELING.
FINALLY, MOST LESSONS ARE DESIGNED IN A MASTERY LEARNING CONTEXT, WHICH REQUIRES STUDENTS TO MASTER THE LESSON'S OBJECTIVES BEFORE THE PROGRAM PERMITS THEM TO PROCEED TO THE NEXT LESSON. MASTERY CRITERIA ARE ESTABLISHED BY THE LESSON AUTHOR AND ARE MEASURED BY A CAREFULLY DESIGNED TEST.

BUT NO MATTER HOW EFFECTIVE THE DELIVERY VEHICLE AND THE ENVIRONMENT CREATED, CBE IS ULTIMATELY ONLY AS VALUABLE AS THE QUALITY OF THE MATERIALS BEING DELIVERED. COURSEWARE IS THE HEART OF THE MATTER. THERE AREN'T ANY SHORTCUTS IN COURSEWARE DEVELOPMENT -- EVEN THE SMALLEST CONCESSION TO QUALITY DIMinishes THE LEARNING EXPERIENCE. AS A RESULT IN THE GROWING BODY OF COURSEWARE NOW BECOMING AVAILABLE YOU CAN FIND MATERIAL WHICH IS VERY POOR AS WELL AS THAT WHICH IS EXCELLENT.

AT CONTROL DATA, THE PROCESS OF COURSEWARE DEVELOPMENT BEGINS WITH THE SELECTION OF THE BEST AVAILABLE SUBJECT MATTER EXPERT AND A CONTRACT WITH THAT PERSON AS THE CENTRAL FIGURE IN THE "AUTHOR TEAM." THE MAJOR AUTHOR IS THEN JOINED IN THE TASK BY SUBJECT MATTER CONSULTANTS, TECHNICAL SPECIALISTS, MEDIA EXPERTS AND PROGRAMMERS. ONCE CREATED THE COURSEWARE MUST BE CAREFULLY CHECKED FOR ERRORS, FIELD TESTED AND EVALUATED. THEN IT MUST BE MAINTAINED, IMPROVED AND UPDATED. THE ENTIRE PROCESS CALLS FOR SIGNIFICANT RESOURCE, PROFESSIONAL EXPERTISE
AND GENUINE COMMITMENT. THE DIFFERENCE BETWEEN SUPERIOR AND INFERIOR COURSEWARE IS THE DIFFERENCE BETWEEN THE MAGIC THAT OCCURS IN A REAL TEACHER/STUDENT INTERACTION AND THE BOREDOM IN A DULL IMPERSONAL LECTURE. AND WE'VE ALL EXPERIENCED THAT DIFFERENCE. THE PROCESS FROM BLANK PAPER TO FINISHED, FIELD-TESTED, HIGH-QUALITY COURSEWARE TAKES ANYWHERE FROM 18 TO 24 MONTHS, DEPENDING, OF COURSE, ON THE RESOURCES UTILIZED AND THE DIFFICULTY OF DEVELOPMENT.

PITFALLS

AN ORAL DESCRIPTION OF COMPUTER-BASED EDUCATION CAN'T DO IT JUSTICE. BECAUSE OF ITS VERY NATURE, IT CAN'T BE TRULY UNDERSTOOD OR APPRECIATED UNTIL IT'S EXPERIENCED. I THINK THOSE WHO DO HAVE THE EXPERIENCE -- AND I INVITE YOU TO VISIT THE PLATO BOOTH HERE AT THE CONFERENCE -- WILL AGREE ABOUT ITS ENORMOUS POTENTIAL.

THE CHALLENGE, THEN, IS TO REALIZE THAT POTENTIAL. CAN WE? WILL WE? WHAT STANDS BETWEEN US AND THE PROMISE IT OFFERS? WHERE ARE WE MOST LIKELY TO STUMBLE?

WHEN COMPUTER-BASED EDUCATION FIRST APPEARED SEVERAL YEARS AGO, THE MAJOR BARRIERS TO ITS WIDESPREAD ADOPTION WERE COST, AVAILABILITY OF COURSEWARE, AND RESISTANCE TO CHANGE.
COST IS REALLY NO LONGER AN ISSUE -- AND THE AVAILABILITY OF QUALITY COURSEWARE IS RISING RAPIDLY. BUT THE MAJOR BARRIER WAS AND IS -- RESISTANCE TO CHANGE.

THE RESISTANCE COMES IN TWO FORMS. THE FIRST IS STRAIGHTFORWARD AND EASIER TO DEAL WITH: IT'S OUTRIGHT REJECTION. THE SECOND IS MORE SUBTLE AND POTENTIALLY FAR MORE DAMAGING. I CALL IT "CO-OPTING THE COMPUTER" -- OR "WHISTLING PAST THE GRAVEYARD!" IT'S AN ESPECIALLY PERNICIOUS FORM OF REJECTION BECAUSE IT APPEARS TO BE ACCEPTANCE. I'LL COME BACK TO THIS.

OUTRIGHT REJECTION IS PROMPTED MOSTLY BY FEARS THAT COMPUTERS WILL STEAL JOBS FROM TEACHERS -- BUT MORE AND MORE TEACHERS ARE DISCOVERING THAT THEIR ROLE IS EVEN MORE CRITICAL IN THE COMPUTER-BASED ENVIRONMENT THAN IT WAS BEFORE.

IT IS DIFFERENT, THOUGH. TO BEGIN WITH, COMPUTERS DON'T REPLACE TEACHERS, RATHER THEY REPLACE SOME OF THE MORE MUNDANE, REPETITIVE FUNCTIONS EVERY TEACHER PERFORMS. IN THE NORMAL TEACHING ENVIRONMENT TOO MUCH TIME IS WASTED ATTENDING TO CHORES WHICH DETRACT FROM STUDENT CONTACT. COMPUTERS CAN DO THEM BETTER -- SO WHY NOT LET THEM?
AT THE OTHER END OF THE SPECTRUM, COMPUTERS CAN PROVIDE REAL LIFE SIMULATIONS TO ENHANCE THE LEARNING EXPERIENCE -- SIMULATIONS WHICH CANNOT BE PRACTICALLY ACHIEVED IN ANY OTHER WAY.

SO TEACHERS WILL NOT BE PUSHED OUT THE BACK DOOR AS TECHNOLOGY COMES IN THE FRONT. HOWEVER, FEWER WILL NEED TO BE DIRECTLY INVOLVED IN THE MECHANICAL DELIVERY OF LEARNING -- AND MANY MORE WILL BE NEEDED TO CREATE LEARNING MATERIALS AND COURSES. WHEN YOU THINK ABOUT IT -- THAT'S SIMPLY UPGRADING THE JOB.

A VARIATION ON THE THEME OF OUTRIGHT REJECTION IS THE POSITION THAT COMPUTERS WILL DEHUMANIZE THE EDUCATIONAL PROCESS. CRITICS SAY COMPUTERS CAN NEVER REPLACE THE HUMAN DIMENSION OF WARM TEACHER/STUDENT RELATIONSHIPS.

I AGREE THAT STUDENTS -- AND TEACHERS -- NEED THOSE WARM HUMAN RELATIONSHIPS. WHERE THEY ARE HAPPENING, I HOPE THEY CONTINUE. WHERE THEY ARE NOT, I HOPE THEY BEGIN. STUDENTS SHOULDN'T SIT IN FRONT OF A TERMINAL SIX OR SEVEN HOURS A DAY -- THAT WOULD BE COUNTER-PRODUCTIVE AND SELF-DEFEATING....AND IT'S NOT EVEN A FEATURE OF A TRUE COMPUTER-BASED EDUCATION SYSTEM. IT WOULD APPEAR, UNFORTUNATELY, TO BE A DESIRE OF THE VIDEO GAME INDUSTRY -- BUT THAT'S ANOTHER STORY. AND ANY SKEPTICS WHO DOUBT THE HUMAN
ELEMENT COMPUTERS CAN BRING TO THE LEARNING PROCESS SHOULD SPEND A FEW MINUTES WATCHING A YOUNG CHILD ENCOUNTER A PLATO TERMINAL FOR THE FIRST TIME — OR MEET THE JUNIOR HIGH STUDENTS WHO BROKE INTO THEIR SCHOOL BUILDING IN THE MIDDLE OF THE NIGHT TO GET MORE TIME ON THE TERMINALS.

THE KIND OF RESISTANCE WHICH LEADS TO OUTRIGHT REJECTION CAN BE DEALT WITH — AND THE NUMBER OF RESISTERS IS STEADILY DIMINISHING. NEITHER THE FEARS OF TEACHERS LOSING THEIR JOBS OR COMPUTERS DEHUMANIZING THE EDUCATIONAL PROCESS WILL BE SERIOUS PROBLEMS IN THE YEARS TO COME.

BUT I DO FORESEE A FORMIDABLE PITFALL REPRESENTED BY THOSE WHO ARE "CO-OPTING THE COMPUTER." THESE ARE THE PEOPLE WHO SAY: "WE'RE ALREADY BRINGING COMPUTERS INTO OUR SCHOOLS — MORE OF THEM EVERY YEAR. WE KNOW THEY'RE HELPFUL. WE WANT MORE OF THEM. JUST GIVE US THE MONEY WE NEED AND WE'LL PUT MORE AND MORE OF THEM TO WORK."

THE FIRST PROBLEM WITH THE CLAIMS OF THOSE WHO SAY they're ALREADY BRINGING COMPUTERS INTO THE SCHOOLS IS THAT EVEN THOUGH THE TOTAL NUMBER HAS RISEN DRAMATICALLY AND IS SUPERFICIALLY IMPRESSIVE, CLOSER EXAMINATION REVEALS THAT THE RATIO OF STUDENTS TO COMPUTERS (OR TERMINALS) IS VERY, VERY HIGH. THE SECOND PROBLEM IS THAT COMPUTERS ARE BEING USED ALMOST
EXCLUSIVELY AS A SUPPLEMENTAL DEVICE, ALMOST AS IF THEY ARE
NOTHING MORE THAN ANOTHER FORM OF CALCULATOR. IN ELEMENTARY
AND SECONDARY SCHOOLS IT'S EVEN WORSE -- MORE LIKE AUDIO-VISUAL
DEVICES. COMPUTERS ARE SIMPLY BEING SUPERIMPOSED ON THE
TRADITIONAL LEARNING ENVIRONMENT. NO REAL CHANGES ARE BEING
MADE IN THE LABOR-INTENSIVE PROCESS ITSELF.

OBSERVING THIS GIVES ME A HORRIBLE SENSE OF DEJA VU. FOR THE
FIRST 20 YEARS OF THE INDUSTRY'S EXISTENCE, PEOPLE DID LITTLE
MORE THAN PLUG COMPUTERS INTO ROUTINE CLERICAL OR COMPUTATIONAL
TASKS. NOBODY THOUGHT VERY LONG OR VERY HARD ABOUT THE TOTAL
PROCESS AND HOW IT SHOULD CHANGE IN ORDER TO ACHIEVE TRUE
OPERATIONAL EFFECTIVENESS BY EFFECTIVELY INTEGRATING COMPUTERS
AND PEOPLE.

JUST SO IN EDUCATION -- THE MAJOR PITFALL WE FACE IS A
SITUATION OF COMPUTERS BEING USED AS A SUPPLEMENTAL TOOL AT AN
INCREMENTAL COST -- WHEN THE REAL CHALLENGE SHOULD BE TO
COMBINE THE USE OF THE TEACHER AND THE COMPUTER MORE
EFFECTIVELY AND PRODUCTIVELY IN ORDER TO CAPITALIZE FULLY ON
THEIR RESPECTIVE STRENGTHS. WE NEED TO FIND THE BEST MIXTURE
OF HUMAN SKILLS AND TECHNOLOGY -- AND THAT MEANS LOOKING AT THE
TOTAL LEARNING PROCESS. AS FRED DAVISON, PRESIDENT OF THE
UNIVERSITY OF GEORGIA, SAID IN THE NOVEMBER ISSUE OF YOUR AAHE
BULLETIN, "UNIVERSITIES HAVE BEEN PROVIDED A RARE, GENUINE
OPPORTUNITY TO RETHINK THE WAY THEY DO THINGS .. OUR WORST
FEAR," HE SAID, "MIGHT BE THAT EXPENSIVE MACHINERY WOULD BE
PURCHASED AND USED MERELY AS AN ELECTRONIC PAGE-TURNER."
RE-THINKING THE WAY WE DO THINGS IS HARD WORK -- NO DOUBT --
AND FOR MOST OF US IT'S CERTAINLY EASIER TO GO ON DAY AFTER DAY
WITHOUT QUESTIONING OUR ROUTINES. IT IS BY NO MEANS LIMITED TO
THE EDUCATION BUSINESS. A LITTLE MORE THAN A YEAR AGO, IN MY
OWN COMPANY, A PROPOSAL WAS MADE TO UPGRADE A MARKETING ORDER
ENTRY SYSTEM. THE SOFTWARE COST, WHICH INCLUDED PURCHASE OF
OUTSIDE CONSULTING SERVICES, CAME TO SEVERAL MILLION DOLLARS.
THE PROPOSAL WAS REJECTED -- AND WE MADE IT CLEAR THAT ALL
PROPOSALS WOULD BE REJECTED UNTIL IT COULD BE DEMONSTRATED THE
TOTAL PROCESS HAD BEEN EXAMINED AND PROBED. THE NET RESULT WAS
A SIMPLER, FASTER, NEW ORDER ENTRY PROCESS -- AND SYSTEM --
WHICH COST LESS THAN ONE-THIRD OF THE ORIGINAL PROPOSAL.

YES, IT'S HARD WORK, BUT ONCE WE START -- ONCE WE START ASKING
OURSSELVES WHY WE DO THINGS AND BEGIN LOOKING FOR BETTER
METHODS -- IT CAN BE STIMULATING, CHALLENGING....AND DOWNRIGHT
FUN. AND UNTIL THE MANAGEMENT CAPABILITIES OF THE COMPUTER ARE
UTILIZED TO INCREASE EFFICIENCY AND PRODUCTIVITY IN THE
EDUCATION PROCESS AS A WHOLE, TECHNOLOGY'S PROMISE CANNOT BE
REALIZED. THAT IS THE CHALLENGE YOU PEOPLE IN HIGHER EDUCATION
FACE TODAY: A CHALLENGE AND AN OPPORTUNITY.

THE REWARDS OF DOING IT RIGHT

LET ME GIVE YOU JUST A FEW EXAMPLES OF HOW THE CHALLENGE HAS
BEEN MET -- AND THE BENEFITS WHICH CAN BE GAINED BY APPLYING
THE TECHNOLOGY OF COMPUTER-BASED EDUCATION WELL.
CONTROL DATA'S FAIR BREAK PROGRAM USES PLATO TO PREPARE DISADVANTAGED PEOPLE FOR JOBS BY TRAINING THEM IN BASIC AND VOCATIONAL SKILLS. SINCE THE PROGRAM BEGAN IN 1978, MORE THAN 10,000 STUDENTS HAVE ENROLLED IN MORE THAN 250 LOCATIONS ACROSS THE U.S.

IN SAN ANTONIO, MORE THAN 95% OF THE PREVIOUS HIGH SCHOOL DROPOUTS ENROLLED IN THE PROGRAM PASSED THEIR HIGH SCHOOL EQUIVALENCY EXAMS.

IN ATLANTA, 645 OF THE 711 STUDENTS ENROLLED COMPLETED TRAINING SUCCESSFULLY -- AND SKILLS ARE NOW INCREASING BY AN AVERAGE OF 2.5 GRADE LEVELS IN READING AND 1.9 GRADE LEVELS IN MATH FOR EVERY 40 HOURS OF PLATO INSTRUCTION.

IN ST. PAUL, 94 OF THE 138 STUDENTS WHO STARTED A WORK READINESS PROGRAM OBTAINED UNSUBSIDIZED EMPLOYMENT WITH AN AVERAGE STARTING PAY OF $4.13 PER HOUR -- 25 OTHERS WENT ON TO FURTHER EDUCATION AND TRAINING.

IN LOS ANGELES, 58 OF 60 PARTICIPANTS WOUND UP WITH JOBS AS ENTRY-LEVEL COMPUTER TECHNICIANS IN 33 LOS ANGELES-AREA COMPANIES -- AT SALARIES RANGING FROM $11,336 TO $15,600 PER YEAR.
IN ANOTHER FORM OF ASSISTANCE FOR THE DISADVANTAGED, 44
PHILADELPHIA YOUTHS BETWEEN THE AGES OF 16 AND 21 COMPLETED A
SERIES OF PLATO COURSES IN A TRANSITIONAL ASSISTANCE PROGRAM
FOR THE MENTALLY AND PHYSICALLY HANDICAPPED. FORTY-TWO WERE
PLACED IN ON-THE-JOB TRAINING AND 37 ACQUIRED FULL-TIME,
NON-SUBSIDIZED JOBS.

PLATO HAS WORKED IN MORE TRADITIONAL ACADEMIC SETTINGS AS
WELL. FRANCIS FISHER, HENRY LUCE PROFESSOR AT HAVERFORD
COLLEGE, CITES ONE STUDY IN ANOTHER ARTICLE FROM YOUR AAHE
BULLETIN, AND I QUOTE: "THE INTRODUCTORY MECHANICS COURSE IN
PHYSICS AT THE UNIVERSITY OF ILLINOIS HAS BEEN TAUGHT FOR SEVEN
YEARS BOTH IN A STANDARD WAY AND WITH THE ADDITION OF A
COMPUTER-AIDED INSTRUCTION COMPONENT....A CAREFULLY CONTROLLED
EVALUATION SHOWS THAT STUDENTS INSTRUCTED IN THE PLATO MODE DID
BETTER ON A COMMON EXAMINATION THAN THOSE WHO RECEIVED ALL
INSTRUCTION IN A TRADITIONAL MANNER. PERHAPS MORE SIGNIFICANT
WAS THE REPORT THAT 86 PERCENT OF THE STUDENTS IN THE
EXPERIMENTAL GROUP SAID THAT THEY WOULD LIKE TO TAKE THEIR NEXT
PHYSICS COURSE IN A PLATO VERSION WERE IT AVAILABLE."

COLLEGES AND UNIVERSITIES USE PLATO FOR A WIDE RANGE OF
SUBJECTS. THE UNIVERSITY OF ILLINOIS HAS THE MOST
COMPREHENSIVE CATALOG, PRIMARILY BECAUSE THE DEVELOPMENT OF
PLATO BEGAN THERE SOME 20 YEARS AGO.
USE OF PLATO HAS ALSO BEEN ACCELERATING AT THE LOWER ACADEMIC LEVELS. FOR EXAMPLE, HUNDREDS OF STUDENTS AT BERENDO JUNIOR HIGH SCHOOL IN LOS ANGELES ARE IMPROVING THEIR ACADEMIC SKILLS AND THEIR MOTIVATION TO LEARN. THE SCHOOL ONCE EPITOMIZED MANY OF THE WORST ASPECTS OF INNER CITY EDUCATION. BUT, THROUGH THE HARD WORK AND INNOVATIVE THINKING OF ITS ADMINISTRATION AND FACULTY, IT'S NOW AN EXEMPLARY MODEL. PLATO HAS PLAYED A CENTRAL ROLE IN THAT TURNAROUND. AFTER THREE YEARS OF USE, STUDENTS WHO'VE WORKED WITH THE SYSTEM HAVE ACHIEVED ACCEPTABLE LEVELS OF ACADEMIC COMPETENCY, IMPROVED THEIR ATTENDANCE, AND DEMONSTRATED A WILLINGNESS TO APPLY THEMSELVES TO THE TASK OF LEARNING.

THE MOST EXTENSIVE USE OF PLATO TODAY, HOWEVER, IS IN BUSINESS AND INDUSTRY. CONTROL DATA PLACED A PRIORITY ON PENETRATING THIS SECTOR BECAUSE COMPETITIVE FACTORS AND STOCKHOLDER PRESSURES TO IMPROVE PERFORMANCE MAKE CORPORATIONS HIGHLY RECEPTIVE TO CHANGE. OUR DECISION PROVED TO BE SOUND: IN ITS MARCH 28 EDITION, BUSINESS WEEK SAID -- AND AGAIN I QUOTE -- "COMPUTERIZED TRAINING MAY FINALLY BE ABOUT TO TAKE OFF....CONTROL DATA'S PLATO SYSTEM COULD BE THE KEY TO SUCCESS."

MANY OTHER EXAMPLES AND STUDIES COULD BE CITED TO FURTHER DEMONSTRATE THE EFFECTIVENESS OF COMPUTER-BASED EDUCATION WHEN THE TECHNOLOGY IS APPROPRIATELY APPLIED, BUT A RECENT STATEMENT
WITH REGARD TO PLATO FROM THE U.S. GOVERNMENT OFFICE OF TECHNOLOGY ASSESSMENT IN ITS REPORT TO THE CONGRESSIONAL COMMITTEE ON EDUCATION AND LABOR SAYS IT BEST. SUMMARIZING THE STUDIES OF PLATO TO DATE, THE REPORT SAID MOST OF THEM "REGARD PLATO LEARNING AS BEING EXCEPTIONAL AND BELIEVE THAT ITS FULL POTENTIAL IS STILL UNREALIZED."

THE FUTURE

SO IT CAN AND DOES WORK. BUT THERE IS EVEN MORE TO COME. WE ARE AT THE POINT WHERE A COMPUTER-BASED SYSTEM CAN NOT ONLY DIAGNOSE A STUDENT'S KNOWLEDGE AND SKILL LEVELS....IT CAN ACTUALLY DETERMINE THE METHOD BY WHICH HE OR SHE LEARNS BEST -- BY ANALOGY, FOR EXAMPLE, OR BY ROTE MEMORY....IT CAN DETECT PROBLEMS ANYWHERE IN THE STUDENT'S LEARNING PROCESS....AND CAN THEN DELIVER AN INDIVIDUALIZED COURSE OF INSTRUCTION BASED ON THAT INFORMATION. WHAT THIS AMOUNTS TO IS SORT OF AN EDUCATIONAL EQUIVALENT OF A MEDICAL PRESCRIPTION -- UNDERSTAND THE NEEDS, DIAGNOSE THE PROBLEMS, THEN PROVIDE A SPECIFIC SCHEDULE OF LEARNING.

THE WHOLE LEARNING PROCESS IS FURTHER AUGMENTED BY THE ABILITY TO INCLUDE REAL WORLD PROBLEMS IN SIMULATED FORM. THIS IS PERHAPS THE MOST POWERFUL CAPABILITY OF COMPUTER-BASED LEARNING. IN A RECENT SPEECH, FRANCIS FISHER DESCRIBED A PROGRAM DESIGNED TO TEACH GASTROINTESTINAL DISEASE DIAGNOSIS. THE FOLLOWING IS HIS DESCRIPTION.
"THE SCENE OPENS (ON VIDEODISC) WITH THE PATIENT BEING WHEELED INTO THE HOSPITAL ROOM....HE DESCRIBED THE DIZZINESS HE EXPERIENCED AND OTHER SYMPTOMS. STOP. THE COMPUTER TAKES OVER, ASKING YOU, THE 'STUDENT' DOCTOR, WHAT IS WRONG WITH THE PATIENT? WHAT ADDITIONAL INFORMATION DO YOU WANT? WHAT TESTS WOULD YOU LIKE PERFORMED? THE COMPUTER PRINTS OUT A MENU OF A WIDE VARIETY OF TESTS. YOU SELECT SOME AND THE TEST RESULTS ARE DISPLAYED. DO YOU WANT TO ASK THE PATIENT SOME QUESTIONS? YOU CAN SELECT THOSE ALSO -- AND GET ANSWERS. IF A PICTURE OF THE PATIENT IS NECESSARY, AS IN ANSWER TO THE QUESTION, 'SHOW ME WHERE IT HURTS,' THE LASER PICKS UP A TV SEGMENT SHOWING THE PATIENT POINTING TO THE APPROPRIATE SPOT. IF YOU ASK FOR IT, THERE IS ALSO A SEGMENT SHOWING VIEWS THROUGH A SIGMOIDOSCOPE. AND YOU CAN STOP THE PICTURE AT ANY TIME FOR CLOSER EXAMINATION, OR GET 'INSTANT REPLAY.' YOU CAN ALSO OBTAIN EXPERT OPINION ON CERTAIN MATTERS.

WHEN YOU MAKE YOUR ULTIMATE DIAGNOSIS, THE COMPUTER CRITICIZES IT, AWARE OF THE CONTEXT OF KNOWLEDGE YOU HAD ABOUT THE PATIENT AT EACH POINT YOU MADE A PRELIMINARY DIAGNOSIS OR DECIDED WHAT QUESTION TO ASK. 'YES,' THE COMPUTER TELLS YOU, 'IT WAS AN ULCER, JUST AS YOU GUESSED AFTER THE FIRST TEST, BUT THE COMPUTER POINTS OUT AT THAT TIME IT WAS A POOR GUESS, FOR THERE WERE STRONG COUNTER-INDICATIONS THAT WERE NOT EXPLAINED AWAY UNTIL LATER.' WITH A SERIES OF SUCH CASES, IT IS GOING TO BE POSSIBLE TO GIVE A PHYSICIAN TEN YEARS OF GASTROINTESTINAL EXPERIENCE IN A FEW DOZEN HOURLY SESSIONS."
Similarly real-world design problems can be fashioned for mechanical and electrical engineers; process design problems including flow sheet simulators can be presented to the chemical engineer; and so forth.

But how are we actually to realize this effectivity that quality computer-based education can bring about? It's been said that 200 years went by after Gutenberg made it possible for books to become widely available before they were used by teachers. Relatively speaking, then, you'd have to say any use of computers in the education process at this point in their history is remarkable.

Unfortunately, the pressing need for budget relief and the call for higher quality, more responsive education and training to meet the pressures of competition from other countries, don't allow us much time. We need to vastly improve the quality and quantity of education and training within the next decade -- and do it efficiently.

Many and varied actions will be required to do what is necessary at all levels of education: primary, secondary, post-secondary, and continuing education. But one ingredient runs through every action at every level -- the need for an unprecedented level of cooperation among government, industry

TIME DOESN'T PERMIT ME TO COVER ALL OF THE WAYS IN WHICH COOPERATION IS NECESSARY TO ACHIEVE WIDESPREAD USE OF QUALITY COMPUTER-BASED EDUCATION, BUT I'D LIKE TO SPEND MY LAST FEW MOMENTS WITH YOU DISCUSSING THE IMPACT IT CAN HAVE IN THE MOST CRITICAL AREA -- COURSEWARE DEVELOPMENT. I WILL USE AS AN ILLUSTRATION A PROGRAM WITH WHICH SOME OF YOU MAY BE FAMILIAR. IT'S A COOPERATIVE EFFORT TO DEAL WITH THE URGENT NEED FOR MORE -- AND BETTER QUALIFIED -- ENGINEERING GRADUATES.

TWO YEARS AGO, CONTROL DATA ESTABLISHED A CONSORTIUM OF ENGINEERING SCHOOLS TO DEVELOP AN ENTIRE CURRICULUM FOR THE FIRST TWO YEARS OF A STUDENT'S ENGINEERING EDUCATION. MEMBERS OF THE CONSORTIUM INCLUDE THE ENGINEERING SCHOOLS AT THE UNIVERSITIES OF ARIZONA, DELAWARE, MINNESOTA, NEBRASKA, SOUTH FLORIDA, TEXAS A & M, AND THE CALIFORNIA STATE COLLEGE
SYSTEM. THE DEANS OF THE SEVEN ENGINEERING SCHOOLS COMPRISE A STEERING COMMITTEE FOR COURSEWARE DEVELOPMENT, AND EACH UNIVERSITY HAS DESIGNATED FACULTY MEMBERS TO SERVE ON REVIEW BOARDS FOR INDIVIDUAL SUBJECTS. THE BOARDS REVIEW COURSE DEVELOPMENT AT EACH STEP IN THE PROCESS. MANY OF THE MEMBERS ARE NATIONALLY RECOGNIZED SCIENCE AND MATH EDUCATORS.

A COMPLETE FRESHMAN AND SOPHOMORE CURRICULUM IS BEING DEVELOPED. IT'S CALLED THE LOWER DIVISION ENGINEERING CURRICULUM -- LDEC -- AND IT CONSISTS OF MATHEMATICS, CHEMISTRY, PHYSICS, AND COMPUTER SCIENCE, PLUS ADDITIONAL HUMANITIES, ENGLISH AND WRITING COURSES. THE FIRST COURSES IN THE SERIES WERE OFFERED LAST FALL. BY 1984, 12 COURSES REPRESENTING 39 SEMESTER CREDITS WILL BE AVAILABLE. OVER TIME, THE CURRICULUM WILL INCLUDE AT LEAST 64 SEMESTER CREDITS. LDEC ENABLES COLLEGES TO COMBINE CLASSROOM AND COMPUTER-BASED INSTRUCTION IN WHATEVER CONFIGURATIONS THEY DESIRE -- AND TO DELIVER INSTRUCTION AT REMOTE LOCATIONS, EVEN AT HOME.

THE LDEC PROJECT -- AND ANOTHER CONSORTIUM CURRENTLY BEING ESTABLISHED TO DEVELOP A FOUR-YEAR COLLEGE-LEVEL CURRICULUM IN AGRICULTURE -- IS A GOOD EXAMPLE OF THE KIND OF COOPERATION WE NEED TO GLEAN THE FULL BENEFITS OF COMPUTER TECHNOLOGY IN HIGHER EDUCATION. BUT IT IS JUST A BEGINNING. IF HIGHER EDUCATION IN AMERICA IS GOING TO BENEFIT FULLY FROM THE
COMPUTER REVOLUTION, MANY MORE CONSORTIA IN EVERY DISCIPLINE ARE REQUIRED. A GO IT ALONE APPROACH WILL INEVITABLY RESULT IN SQUANDERED RESOURCES -- MONEY AND PEOPLE -- AS WELL AS A LOT OF MEDIOCRE COURSEWARE AND POORLY EDUCATED STUDENTS.

THE SYSTEMATIC APPLICATION OF COMPUTER-BASED LEARNING TECHNOLOGY CAN HELP OFFSET THE RAPID OBsolescence OF SUBJECT MATTER; CAN HELP MEET THE NEED FOR CONTINUING EDUCATION IN FIELDS SUCH AS ENGINEERING WHERE NEW SKILLS ARE NEEDED EVERY DAY. THE PROPER INTEGRATION OF COMPUTER TECHNOLOGY CAN HELP ALleviate CONstricted BUDGETS AND INADEQUATE FACILITIES. BUT WITHOUT A REkindling OF THE VISION AND DARING WHICH LED TO SUCH NATIONAL PROGRAMS AS THE MORRILL ACTS AND THE GI BILL, WE WILL NEVER REAP THE FULL POTENTIAL OF THE NEW EDUCATIONAL TECHNOLOGY. AND THIS TIME IT WILL REQUIRE MORE THAN GOVERNMENTAL LARGESS -- IT WILL DEMAND UNPRECEdented COOPERATION WITHIN ACADEMIA AND BETWEEN ACADEMIA, GOVERNMENT AND INDUSTRY. THERE IS JUST NO OTHER WAY IN WHICH ADEQUATE RESOURCES CAN BE BOUGHT TO BEAR ON THE PROBLEM....AND WITHOUT IT THIS COUNTRY'S POSITION AS A LEADER IN THE WORLD'S TECHNOLOGICAL AND ECONOMIC ARENAS WILL CONTINUE TO DECLINE.

THAT WOULD BE SAD -- IT'S EQUALLy UNNECESSARY.
THE 1980S MAY NOT BE RECORDED AS THE HAPPIEST DECADE IN MAN'S HISTORY, BUT I SINCERELY HOPE IT WILL BE RECORDED AS THE DECADE IN WHICH HIGHER EDUCATION EMBARKED ON A JOURNEY INTO A NEW ERA OF PRODUCTIVITY. YOU HERE TODAY ARE BLESSED WITH THE OPPORTUNITY TO MAKE THAT HAPPEN.

THANK YOU.