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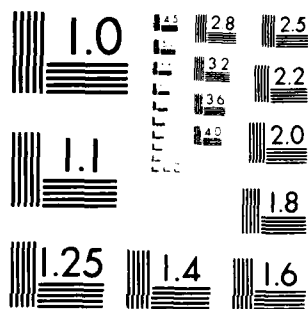
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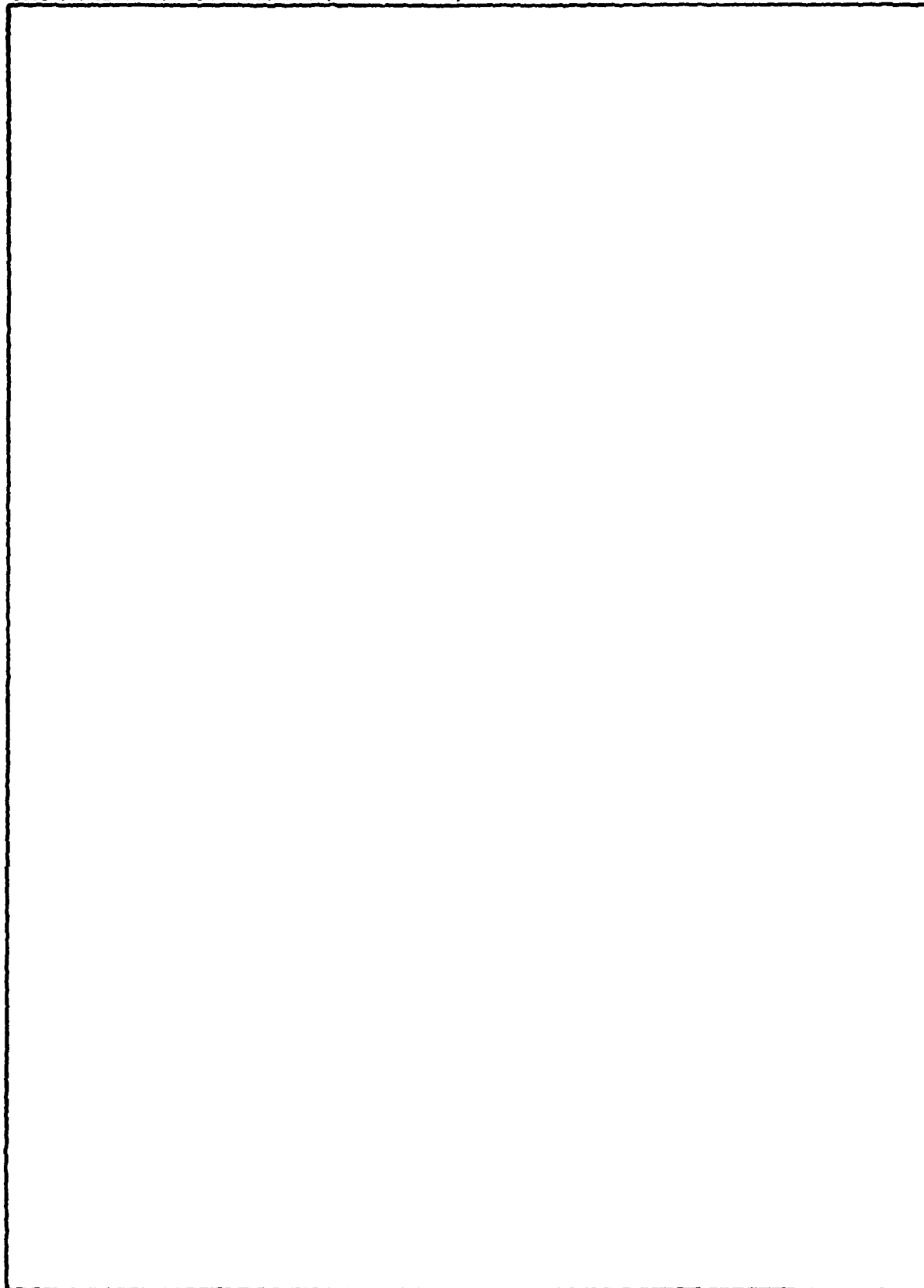


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USAWC MILITARY STUDIES PROGRAM

PERSONAL COMPUTERS AND THE ARMY

INDIVIDUAL ESSAY

by

Lieutenant Colonel Robert W. Zetterberg
Signal Corps

US Army War College
Carlisle Barracks, Pennsylvania 17013
5 May 1983



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ABSTRACT

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PERSONAL COMPUTERS AND THE ARMY

Once viewed in room-size splendor, computers are now appearing on desk tops and are even being carried home from the office or on TDY in a briefcase.

Historically computers were the protected domain of people who spoke a strange language dubbed "computerese." Computers and the personnel who operated them were often distrusted and viewed with a certain mystique. Thanks to easy to use desk top and portable computers that mystique is slowly disappearing. Today, enormous computing power is being placed directly into the hands of end-users by what industry calls the PC or Personal Computer.

The revolutionary character of the personal computer is having a significant impact on both civilian and Army ADP users and managers. ADP Management strategies are shifting as users recognize the potential of the PC and the role of these low cost computers is being analyzed and debated.

The private sector leads the Army in microcomputer use and the lessons learned by civilian counterparts can help as the Army develops its low-cost microcomputer requirements.

Just what do I mean by personal computers? By my definition, if a computer is used by an individual, it is a personal computer. I further define personal computers as having the following characteristics:

- The price of the PC is less than \$5,000.
- The system includes or can be linked to secondary memory in the form of cassette tapes or disks. In addition, the system has a monitor and can include a printer.

- The microprocessor can support a primary memory capacity of 64 kilobytes or more. A PC described later in this paper has 256 kilobytes of internal memory.

- The PC uses one or more high level language, such as BASIC, FORTRAN, COBOL or PASCAL.

- The PC operating system facilitates interactive dialogue; the computer responds almost immediately to the users action or request.

- Finally, although not a technical consideration, you can buy a PC in most PXs.

The technology behind the PC is the computer chip, first developed in the early 1960s, but perfected only in the last decade. Chips are tiny silicon wafers about the size of a fingernail. Each chip contains hundreds of circuits and are the brains behind today's computers. Refinements in chip technology has allowed the size and price of computers to shrink while their computational capacity has increased.

The merits of chip technology are more astounding when one realizes that the first electronic computer was built just a little over 35 years ago. The landmark machine, the Electronic Numerical Integrator and Calculator--commonly known as ENIAC--was developed at the University of Pennsylvania's Moore School of Engineering. The machine took two and one-half years to build. It solved its first problem, an equation involving atomic physics, in two hours. The huge computer filled a large room, required 18,000 vacuum tubes and needed 140,000 watts of electricity--enough power to drive a locomotive. Today a computer with ENIAC's capabilities would cost less than \$100.00, fit into a pants pocket and run on flashlight batteries.¹

Before I go any further, let me dispel the idea that PCs will replace mainframe computers. Mainframes will continue to play significant roles in the future. These roles include:

- Providing high volume batch data processing and number crunching services.

- Mass storage services to include file storage and information retrieval.

- Performing large scale electronic mail service.

- Serving as a hub for a large number of terminals operating in an interactive mode.

- Performing complicated modeling and simulation activities.

- Supporting large scale logistics and personnel services.

In actuality the proliferation of PCs could very well create a need to increase the number of existing mainframes as the demand to access mainframe databases increases.

If PCs will not replace mainframes, just what will they do? Let's look at a few general examples,--we'll get more specific later. Personal computers are ideal for:

- Writing and editing reports and letters using generalized text editors.

- Solving "what-if" problems using electronic spread sheets.

- Maintaining personal files, calendars and schedules.

- Developing graphic presentations from statistical reports.

For the minimally trained end-user PCs are advantageous because they:

- Have easy-to-use software.

- Provide excellent user response time.

- Are always available, and

- Workers can easily be taught to use computing tools and techniques as part of their jobs.

These are only a sample of the PC's utility. I have only scratched the surface. In the end, the ultimate power of the PC will be only limited by man's own imagination and creativity.

The potential growth of personal computer market is enormous. Last year 1,000,000 were sold to the American public. In 1985 industry forecasts slightly less than 5,000,000 will be in use. By 1990 over 18,000,000 will be in place and the face of automatic data processing will be forever changed.²

Originally the creators of the microcomputer saw the home as the primary market. The term microcomputer was thought too technical by the marketer--thus to make the micro more acceptable the term "Personal Computer" was coined. In 1982 the personal computer found its largest market, the home. By 1990 business will by far hold the largest market share and 70% of the decisions to purchase personal computers will be made by data processing managers.³

To say that industry projections for PCs look bright would be a gross understatement. But where does the Army fit into this picture? Before we examine specific Army PC initiatives and management implications let's take a look at our "ADP roots" to help us understand the present environment and assist us in exploring the future of the Personal Computer.

In the early days of ADP history the military services were "bell-wethers" of computer technology. Today our military organizations are burdened with aging computers and non-interactive software. Computer technology, in the late 1950s and early 1960s was characterized by the large sprawling mainframes. Punch cards ruled the 50s and 60s until magnetic mass storage devices were introduced. Automation growth was retarded by

cost. Only the largest corporations and the federal government could afford these huge machines. IBM dominated the market place. Large, expensive hardware and a small technical labor pool dictated a strategy of high control and centralization.

The high cost of automation and the continued market dominance by IBM led to enactment of the Brooks Act. This act and subsequent GSA policies set hardware competition as a goal in the federal government's computer systems acquisition and established rigid cost control criteria. The prime problem was that regulations stated that software conversion costs had to be absorbed separately. Competition was restricted to hardware only. Federal agencies were not permitted to use lowest total overall cost as a criterion to buy replacement computers.

Ten years of applying this rule made most information system managers reluctant to buy new automation systems through the competitive process. Piecemeal upgrading of old technology was the approach taken by most DP managers. By the end of the 1970s, DOD was no longer a front-runner. In analyzing that decline Mr. Vico E. Henriques, President of the Computer and Business Manufacturers Association adds further insight.⁴ He states, "Certainly the procurement problems, the maze of regulations, the beauraucratic tangle that exists, slow down the introduction of new technology in the federal government." He goes on to say,

I think the government's pioneering in many areas has equally left the government with a number of 'stranded' software, where moving to the next generation is almost impossible. But you can not afford to stop everything while you install a new system. There are thousands of people whose training and experience is tied to a current way of doing things. Getting them over the hump and retraining them while maintaining the old system is a difficult task.

Mr. Henriques further states,

The government procurement drag is only symptomatic, however of a larger problem of fiscal year mentality. They (the government) do not like to look farther ahead than one year, maybe two at the outside and they should be looking at ten year windows.

Partly because of the beauracracitic maze and deficiencies in long-range planning the Army has barely touched the power or recognized the potential that personal computing offers. A study on "Small Computing in the Army" done for the Computer Systems Command⁵ leads one to believe that there are probably less than 800 personal computers in use today in the entire Army. This figure will probably quadruple in the next year. Since the approval authority for small computers, by virtue of their development cost thresholds, rests with the MACOMs, Department of the Army lacks visibility over these resources and no one is absolutely sure how many PCs are being used.

What is known about the current use of low cost personal computers used in the Army today is that:⁶

- Most personal computers are managed by end-users versus Data Processing Organizations.
- Although there is a large number of vendors supplying PCs to the Army, only Apple has a sizeable portion of the Army's non-scientific micro market.
- There is no standard Army PC operating system. After Apple DOS, CP/M is the second largest operating system in use.
- Commercial software packages are used to some extent in all application areas, with heaviest emphasis in the administration and general purpose area.
- There is little long-term system planning and there is a general trend towards piecemeal aggregation of equipment and software.

- Most organizations feel overwhelmed with the task of selecting hardware and software. There is no single source of expertise within the Army where advice on PCs can be obtained.

Corporate users have moved towards end-user computing for the same reasons Army users are demanding improved Automatic Data Processing service. Let's examine some of these reasons.

- Information developed by centralized systems is often not timely, consistent, complete, relevant or in a useful format.

- Relatively few of the systems are interactive. Most applications are batch oriented.

- It takes too long to define, develop and field large scale automated systems.

- Existing mainframe query languages are difficult to use without extensive training.

- There are not enough systems analysts and programmers to meet individual user needs.

- ADP department's response to individual requests for small programs or "quick fixes" is normally unsatisfactory.

- The cost of developing software is prohibitive.

Notwithstanding the above complaints, the role of the central data processing department is further complicated by the fact that users are becoming more computer literate and the data processing mystique is waning. This situation is influenced, in part, by the following:

- Computer hardware costs are decreasing dramatically and commanders know PCs are available.

- Users know that there has been a tremendous growth in user-friendly applications software and data base management systems. Like systems would

cost thousands of dollars if developed on mainframes--only hundreds on micros.

Unquestionably end-user computers are inevitable because no data processing department can keep up with the wide variety of good application software that is already available, and is arriving every week.

Personal Computers were once looked upon as toys, but are now starting to become accepted by Data Processing Managers and Army policy makers. Data processors who in some cases have felt threatened by end-user computing are now beginning to see the utility and potential of personal computers. They see, on one hand, the potential the personal computer has on reducing their own overburdened staffs workload. On the other hand they feel ill-equipped to keep pace with user's personal computer demands and needs. Information compiled for the Computer Systems Command⁷ revealed that Data Processing Manager's main concern with the influx of personal computers deal with confusing acquisition policies, maintenance, standards and software procurement. The major complaint is that acquisition thresholds are too low. In addition, they complain that the paperwork is cumbersome and time-consuming with acquisition process costs exceeding purchase prices for low cost items.

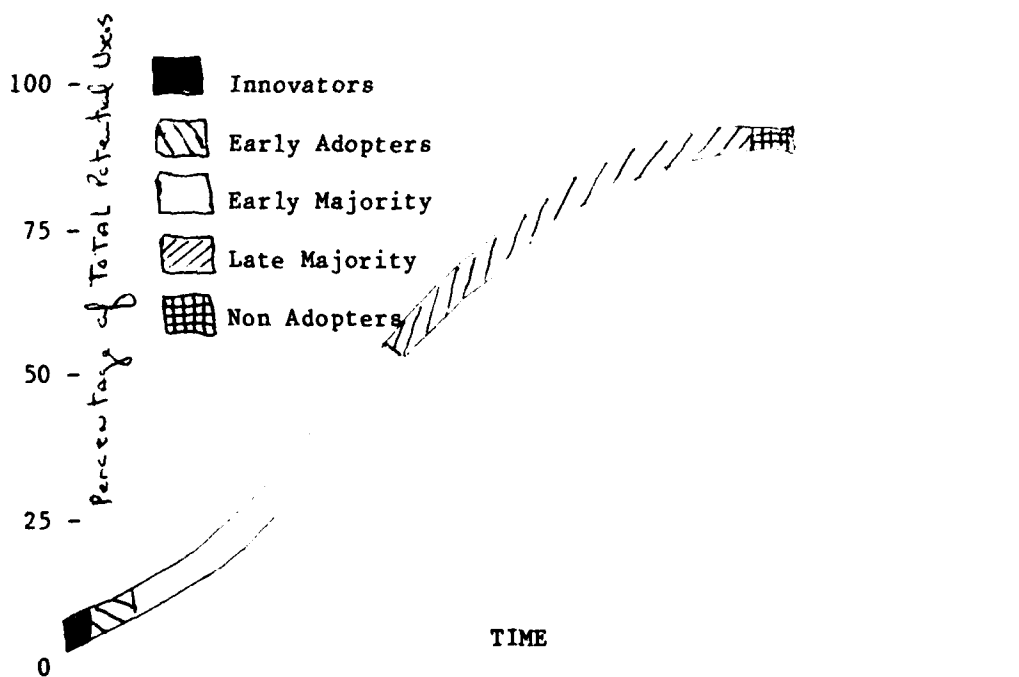
Maintenance is also a concern. It is not uncommon to find installations served by four or five different vendors. End-users often buy hardware and software and fail to adequately plan maintenance support. Those data processors who have influenced the procurement of standardized equipment and have negotiated responsive maintenance support appear to be better off.

For years data processors have been inculcated and absorbed with mainframe technology. Centralized management philosophies have often

created professional tunnel vision and many data processing departments are not equipped, staffed or trained to offer the best advice on personal computer hardware and software acquisition.

The plight that DP managers find themselves in today is in part related to the Department of the Army's low cost computer strategy. This strategy is called by some the "Let the Thousand Flowers Bloom" strategy. Basically the strategy is one that encourages grass roots experimentation with low cost computers. It's a sort of "wait and see" strategy, with no immediate effort to develop controls or standards.

One way to look at the personal computer problem that confronts Army management is by examining the "Adopters Curve,"⁸ (Figure 1) a standard tool for predicting the penetration rate of a new technology.



The lazy s-shaped curve can be used to chart the development and predicted growth of PCs. It also can give insight into when Army ADP management will need to shift and refine policies. The toe of the curve--the initial, almost flat section before the line begins to sweep upward, consists of the "innovators," the first five percent or so of those potential users who try personal computers, then adopt, the new tool. Next come the "early adopters." Noticing the use of new machines by innovators, early adopters try the new tools, make a tougher analysis of their usefulness and help wring the major problems out of them. They form the next five to fifteen percent of the users. The "early majority" of users swells the market for producers, and moves the product from a curiosity to a reality. The early majority looks to the early adopters for advice. Adoption by the "late majority" signals the maturity of the market and standardization of the technology. The Adopter Curve finally flattens out to include the last group--the "non adopters."

The Army is still in the innovative phase. Early experiments were initiated by commanders who hoped PC might provide the answer to getting a handle on the increased flow of information. Many early experiments involved automating manual tasks. The majority of applications involve battlefield command and control processes. In addition, there are a number of interesting applications using PCs to enhance the learning process in the TRADOC school system. As reports of the successful use of PCs are made known and a number of solid PC applications are demonstrated, Army automation will move rapidly into the early adopter phase. The "early majority" phase will begin by 1986 and by the mid-90s the PC will be commonplace

both on the battlefield and in the office.

A number of significant DA low cost computer initiatives have begun that will stimulate the use of personal computers throughout the Army. First, the Department of the Army has delegated to MACOMs and ARSTAF authority to approve up to \$300,000 (not to exceed 10 computers per requirement) and competitively purchase ADPE for administrative systems without higher headquarters approval. MACOMs have also been delegated authority to non-competitively acquire ADP support services whose annual cost per requirement does not exceed \$50,000. Up to \$70,000 of the authority vested in the MACOM for competitive purchases can be redelegated to subordinate commanders of general officer rank or Senior Executive Service Heads of subordinate agencies. Not all MACOMs have redelegated their authority.⁹

Although there is considerable discussion in some quarters as to the need to establish standards to insure hardware compatibility, software portability and to facilitate computer networking, there has been little or no Department of the Army effort taken to lay down hardline standardization criteria. I support this totally. It is much too early in the PC development cycle to pin down absolute technologies for adoption. At best the Army should be stressing commonality vice standardization.

In a more subtle manner, DA is encouraging defacto standardization by establishing an indefinite quantity, indefinite delivery contract for a family of microcomputers worldwide.

This contract will provide four ranges of microcomputers. Range A is single user, stand alone desk type configuration, 64k RAM, dual floppy discs, printer, keyboard maintenance, and communications interface. Range B is a portable personal computer just like the computer described in Range

A. The third configuration is a single user workstation with 128K RAM, 5 million bytes of hard disc storage, a letter quality printer, two floppy disc drives and communication interfaces. The last computer to be afforded is a very powerful multi-user, multi-programmable configuration that includes 256K bytes of memory, four keyboard/visual displays, dual floppy discs, 30 million bytes of hard disc, a LPM line printer, a letter quality printer, communications interface and systems software. The obvious advantage of the strategy will be to ensure the most economical buy possible. It is not intended that this contract will force commands to buy a standardized piece of hardware--but it is intended to offer a deal "buyers just can't resist."

In an era of rising software costs and decreasing hardware costs this initiative is a conservative strategy designed to minimize software costs through the use of standard hardware. It is DA's hope that this strategy will encourage sharing software by users.

In order to meet battlefield automation needs Department of the Army is spearheading the acquisition and fielding of a Military Computer Family (MCF). The three member family contains a super minicomputer, a microcomputer and single module (card) computer. These devices will have standard interfaces, a standardized 32-bit instruction set architecture and use a standard higher-order language (ADA oriented). The MCF far exceeds the \$5,000 PC price tag that I described at the outset of this paper. Although this microcomputer incorporates state-of-the-art technology and will be built to withstand the rigors of combat, its high cost may well limit the growth of microcomputers on the battlefield. There are many PC advocates who argue for less costly, throw away or replace and repair microcomputers as a better alternative to the MCF.

The majority Army-user-initiated PC applications appear to be in the

Command/Control area. Every active duty corps and division is exploring the use of PCs to satisfy C² requirements. Recognizing the diversity of these efforts the Combined Arms Command at Ft. Leavenworth has been tasked by DCSOPS to develop a management approach that will ensure that all C² initiatives are focused on a common goal. To implement this management approach the Army Command and Control Initiative Program (TACIP) was established. The TACIP's primary objective is to support the development and fielding of objective C² systems by aligning the Army Command and Control System (ACCS) Architecture. TACIP is helping fund approved user initiatives. The best initiatives will be selected for fielding as interim systems and will augment objective systems.

At the grass roots level there are a considerable number of innovations being undertaken using personal computers. A look at a few of these efforts will give insight as to the potential of the PC.

One of the more interesting automation experiments using microcomputer technology is being considered by the 9th Infantry Division and High Technology Test Bed (HTTB). Using off-the-shelf hardware the HTTB intends to test a rugged, software available, user-friendly microcomputer. The system revolves around the portable GRID COMPASS microcomputer system. Technology includes:

- 16 bit processor and 80 bit floating bit co-processor, and
- 256K RAM and a 384K non-volatile bubble memory.

The proposed test will be conducted in two phases. Phase I will provide automation support to the battalion command and control process. Phase II will take the lowest from Phase I and add a "communications server" for a TOC area local area network.

The system will include a set of integrated software packages that

includes an electronic spread sheet, a data base management system, a text editor, graphics package and a communications package. In addition to the aforementioned functional software, applications software will be written in PASCAL (to be translated to ADA upon ADA approval). Applications include:

- Estimate of the situation
- Combat power available
- Plans and orders (warning, OP order, frag order, overlay)
- Logistics purchases
- Administrative functions (SIDPERS, PDS, casualty reports)
- Specialized applications (movement support, engineer applications, fire support, Army Tactical Frequency Engineering System)

The system is being designed to operate in vehicles or helicopters and data will be transmitted over single channel (secure) radio or telephone (multi-channel or landline).

Currently the Command and General Staff College at Ft. Leavenworth is buying 119 CP/M based personal computers to be used to support the college's computer student learning to program. These personal computers will be used to establish 17 local network subsystems. Each network will be supported by a common hard disc direct access storage device and will allow each computer within a given network to communicate with other computers in that network. Each work station in the local network will consist of a single user, stand alone, desktop computer. The stand alone will include a keyboard input device, one monochrome and one high resolution color monitor, a digitalizing input device, a printer and two floppy disk drives. This training system will have the capability of generating application software in BASIC, FORTRAN, COBOL and PASCAL. The system will also include a data base management system and an electronic spread sheet.

V Corps in Europe is using microcomputer video disc technology to develop a distributed processing network that will allow for the accelerated development of a mobile, low profile, distributed C³ system. Command posts will be split into modules and separated 10 to 20 kilometers from each other. Distances between command posts could be as far as 50 kilometers. The system is supported with all off-the-shelf equipment that includes Apple II personal computers, both floppy and hard disc systems, video disc player, a high resolutions graphics capability, printers and modems. Each cell will be a local network on the CORVUS OMNI system. Cells will have one or more work stations, a communications gateway for electronic mail and automated message delivery, printer/plotter access, hard disk access and one or more video disc players. The CORVUS OMNI net system will be used to join the Apples into a distributed processing network. Maps on the video disc will be overlayed with graphics information to show boundaries and flat unit positions. Only the graphics overlay information will need to be transmitted between modules. This will significantly reduce the electronic signature of the TOC and enhance its survivability.

Any one who has ever been associated with an Army Motor Pool has experienced the frustration of working with the labor intensive unit PLL system. Studies and work are being done to streamline this process using off-the-shelf microcomputers and video disc technology. It has been estimated that for under \$6,000 an effective electronic PLL work station consisting of a microcomputer, two disc drives, a printer and a video disc player can be developed. Without question such a system could pay for

itself in a very short time. This is only one of thousands of labor

intensive activities that could reap the benefits from increased efficiency and productivity offered by microcomputer technology.

Numerous commands are now purchasing personal computer systems for under \$3,000 to improve the productivity and efficiency of middle managers and action officers. Rather than developing costly software they are using commercially available, off-the-shelf software and adapting it to meet their needs. Popular software includes, text editors, speller and grammar checkers, data base management systems, graphics systems and electronic spread sheets.

Whereas PC use in the Army has been slowed by acquisition policies, management attitudes and user initiatives the use of PCs in industry is experiencing phenomenal growth. In a 1982 analysis of low cost computing strategies of selected private corporations the Arthur Young Company¹⁰ found several key points that may influence the way the Army integrates the management of microcomputers. First of all ADP policymakers need to take an active role in managing microcomputers. Private sector management has determined that there is a need to achieve an effective balance between user enthusiasm and the benefits to be derived from experimentation on the one level, and the potential for inappropriate and uninformed acquisition and use on the other. Management has further recognized that existing automation policies and programs do not address all the issues raised by microcomputers.

Many corporations are establishing a central microcomputer group to help introduce microcomputers into the organization. These groups provide invaluable technical services that include monitoring technological trends,

evaluating hardware and software, training users, troubleshooting defective software and hardware and demonstrating new computer products. These groups most often influence rather than direct user activity and corporate policy.

There a number of microcomputer user groups springing up within the Army. At the Army Command and General Staff College the Automated Command and Training System User Group (ACTSUG) has been established. The ACTSUG goal is to become a software clearinghouse for microprocessor users throughout the Army. Their primary interest is to develop and exchange software designed to support decision makers and maneuver unit staff officers.

Also at Ft. Leavenworth, the Command and Control Microcomputer Users Group (C²MUG) has been established to support the previously-mentioned TACIP effort. The C²MUG user group is chartered to serve as a focal point for C² microcomputer users.

Private industry has recognized that where exchange of information is desirable compatibility is necessary. Data base access control and policies are being developed and implemented. Differentiation as to compatibility criteria is being made between stand-alone micros and communicating systems. The central issue in managing the acquisition of stand-alone system is to determine if in the future the stand-alone might need a communications capability.

Firms are recognizing that low cost computers can enhance productivity and efficiency but to date little work has been done to quantify improvement results.

Interest in end-user computer literacy is widespread. Microcomputer training is prevalent across organizational lines in those companies who have opted to use micros. Both the Army Command and General Staff College and the Army War College have recognized the need to train officers using

microcomputer technology. Both institutions are integrating microcomputer technology into the curriculum and computer literacy classes are being offered.

The Army War College has been using 8-bit ALTOS microcomputers to support war gaming and simulation efforts, provide administrative support and conduct computer learning labs. One third of the current student body are enrolled in either the Fundamentals class or Advanced ADP study. Student interest in ADP possibly encouraged by Time Magazine's naming the computer the "Man of the Year," has doubled since last year.

Industry is moving towards a single management structure to control and coordinate office automation, data processing and telecommunications. This blending of advanced technology under single management is enabling industry to comprehensively address the implications which are drawing data processing, office automation and telecommunications closer together.

A number of Army and civilian studies have pointed out the need to merge these activities in order to provide focused and coordinated management over mutually supporting technologies. To date, these recommendations have been basically ignored by Army leaders.

Personal computing clearly holds tremendous potential for enhancing the way the Army conducts business, stores information and makes decisions.

I predict that within three years the Army will have determined the exceptional cost-benefit ratios that can be achieved by using PCs. Experiments by innovators and "seed money" planted by DA will bear fruit and successful projects will be emulated. The Army will be well into the "early majority" segment of the "Adopter Curve" described earlier.

The cost of hardware will continue to fall but at a decreasing rate.

Software costs will continue to rise. Many commercially available software packages will be directly adaptable to the military, especially staff applications.

PC storage capacity will no longer be a liability. Mass storage devices capable of handling over 100 million bytes in hard disc configurations will be available.

Hi-level graphics for micros will far exceed current user demands or expectations.

The Army will look to adopting the 16 bit micro as the standard system.

The major role of large computers will be in support of general administration (personnel, payroll and accounting) and logistics functions. Personal computers will primarily support command and control, training, project management, planning and modeling, graphics, decision support, word processing, local networks, electronic filing and mail, scheduling and teleconferencing.

A large number of action officers, planners and operators will be served by desk top PCs. In addition they will have access to a portable PC to support TDY and at home requirements. They will use text editor software to draft letters, memos, plans and messages before electronically forwarding them to a word processing center for final preparation. Spelling and grammar will be automatically checked and corrected. Unquestionably, the action officer who types, understands and uses the power of the PC will significantly increase his or her productivity and efficiency.

Requests for information will be readily retrieved from personal or office electronic files using data base management software. This information will be quickly edited updated and dispatched.

The electronic spread sheet will replace yellow legal paper and age-old stubby pencil drills.

Budget data will be effortlessly rolled up. The impact of cuts and modifications will be easily handled by demonstrating "what if" type questions.

Local networks will carry the decisions made at morning meetings and executive sessions. These same networks will facilitate the movement of paperwork throughout staff sections.

Analysis will be readily supported by high-resolution graphics packages. The butcher paper briefing charts will be replaced by microcomputer-driven video disc technology.

Thousands of labor intensive tasks will be automated. The widespread acceptance of PCs might be a key to reducing our "tooth to tail" ratio.

By the late 1980s the overhaul of the CONUS Base Opns ADP System (Project VIABLE) will be completed and it will be within the realm of possibility that stand-alone personal computers will be able to access central data bases and take advantage of the computational capacity of this modernized system.

There are a number of factors that could slow the growth of PCs in the Army. Congress might view the "Thousand Flowers" strategy as wasteful if it appears to be getting out of control and they may demand a more precise approach.

Security and privacy are additional considerations. Off-the-shelf low cost personal computers are "electronically dirty." They cannot be used to process classified information unless protected by other security measures. There are few software guards and those that provide file access security are easily broken. The entire area of privacy is a real concern when using

PC's and is beyond this paper's scope.

One of the real advantages of personal computers is their networking potential but the reluctance of "data owners" to share data with end-users could limit the PCs potential.

Of major concern is the shortage of trained microcomputer specialists who can help end-users usher the PC entrance into the potential myriad of applications. The Army is critically short technically qualified micro-computer specialists. As PC hardware use expands exponentially there may not be enough trained software specialists available to harness the full potential of the PC.

Ft. Bragg has taken an innovative approach to advancing microcomputer use by having the Post Education Center conduct PASCAL language courses using eleven Apple computers to train twenty-two programmers every six weeks.

Although I have extolled the virtue of PC's, users and policymakers must recognize the impact that the proliferation of PC's may have on future ADP policies.

There is a real danger that users will develop their own fragmented and possibly inconsistent data bases. This situation will hinder the formation of integrated information systems. Likewise machines that lack essential commonality will not be able to meet the potential that networking offers.

With everybody doing their own experimenting, users will more than likely duplicate one another's efforts, at least in part. Redundancy is inevitable as users build their own applications and create their own data bases.

Current data processing organizations must consider reorganizing and restaffing to meet the challenge that end-user computing offers. Data processing managers will have to take on a "brokers" role in helping users define requirements and select hardware and software systems.

New users will require considerable assistance. Although hardware and software are becoming more and more user-friendly, they are not totally friendly.

Although the Army is developing an indefinite quantity contract that will encourage end-user participation, users will still be given latitude to go their own way. Clearly, uncoordinated buying could cause users to miss out on quantity discount agreements.

There is another real danger and that is that unskilled users may construct faulty models. These models, because they are "computer generated" may gain credibility and acceptance.

There are a number of initiatives that I believe the Army could take to promote the rapid and cost effective exploitation of small computer technology in support of the Army mission.

Acquisition authority within broad general guidelines needs to be placed in the hands of the end-user. Department of the Army/MACOMs and Post DPI's is needed to retain oversight to curb or prevent abuses, but the authority to acquire low cost computers should rest with the organization that has to budget, pay for and reap its benefits. There exists a need for the Army to streamline the acquisition process and eliminate burdensome, time consuming paperwork.

There is also a need to conduct a thorough review of all associated ADP regulations, directives and technical bulletins with an objective of

eliminating redundancies and making them more readable.

The Army would be well served by the creation of a highly visible Microcomputer User Support Group. Although there are several small informal user groups springing up in the Army they have low profiles and they do not serve a broad enough base. An Army Microcomputer User Group would be useful in:

- Monitoring technological trends.
- Providing information and assistance in selecting and using personal computer hardware, software and software tools.
- Keeping abreast of joint service end-user initiatives.
- Making policy and standards recommendations to Department of the Army.
- Testing and evaluating commercial software for possible Army-made adoptions.
- Sponsoring specialized training.
- Demonstrating applications.
- Evaluating user generated programs and applications.
- Assisting in developing long-range planning for the use of personal computers in the Army.

The Army should convene a Blue Ribbon Panel to examine and prioritize those battlefield and non-battlefield applications that can best be satisfied by the use of PC's. Applications that appear to have the most favorable cost-benefit ratios should be developed and tested. If successful they should be quickly adopted for Army use. The goal should be high-payoff, quick return. We cannot afford nor do we want any more TACFIRES.

The Army must face TEMPEST certification more realistically. There is no question that the threat of compromising emanations from PC's is real. However, current security policies reflect worst-case situations. Realistic

threat analysis must be made with enemy collection costs and the perishability of information given due consideration. It makes little sense to place high-cost shields around low-cost computers when a more reasonable security measure is available. Zones of protection should be developed and commanders should be given the prerogative to assess their own risks in light of reasonable assessments. Unrealistic and ill-advised security restrictions will needlessly thwart the effective use of low cost personal computers.

There is a pressing need to upgrade or include computer literacy training throughout the Army Education System--limit theory. Place emphasis on hands-on use of PCs using job or task related software.

Lastly, the Army must take a long-range view of the impact that the personal computer will have on information resource management, office automation, data processing and telecommunications. These emerging technologies are interdependent, and a closer planning and execution requirement is evident. The impact that the personal computer will have on all of these areas is significant, and the Army needs to look at the personal computer's management implications. There are many tough issues at stake, but in the future we will see a melding of these functions, and the impetus for solving these issues might well be the personal computer.

In conclusion--the future of personal computer use in the Army is promising. It offers tremendous opportunities to increase productivity and efficiency and to improve decisionmaking.

I predict that personal computers will have the same revolutionary impact on the Army as the wheel, typewriter, radio, machine gun, tank, helicopter, etc. Today we have only scratched the surface. Thousands of labor-intensive applications are waiting to be automated. Hundreds of

information needs are waiting to be filled.

The Army is on the right track. It is too early in the life cycle of this emerging technology to set in concrete standards, plans and policies. Current experiments and innovative uses will provide necessary data and experience that will allow the Army to optimize the potential of PC technology when it matures.

The next great ADP challenge the Army faces is one of timing policy shifts. The "Let the Thousand Flowers Bloom" strategy will help stimulate interest and innovation, but a time will come when decentralization policies produce data incompatibility, unwanted redundancy and security problems. Hopefully, prior to that point policies will be developed to help smooth the integration of the personal computer into the Army.

ENDNOTES

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