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A Technology Whose Time has Come:
CD-ROM and The U. S. Marine Corps

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Thesis: CD-ROM technology has developed to a point where the United
States Marine Corps must seriously consider adopting it as a primary
data storage and retrieval medium. This paper defines CD-ROM and
identifies it's current status in the Corps. Additionally, this
document examines the current and potential uses of CD-ROM and
offers recommendations on the most efficient way to migrate towards
this new technology.

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A TECHNOLOGY WHOSE TIME HAS COME
CD-ROM AND THE U.S. MARINE CORPS

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A TECHNOLOGY WHOSE TIME HAS COME

Outline

Thesis: CD-ROM technology has developed to point where the Marine Corps must seriously consider adopting it as a primary data storage and retrieval medium. We have defined CD-ROM and identified it's current status in the Corps. We examined the current and potential uses of CD-ROM and offer recommendations on the most efficient way to migrate to this new technology.

I. Introduction

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A TECHNOLOGY WHOSE TIME HAS COME

In his best selling work, MEGA-TRENDS, economist John Naisbett, asserts that, "The new source of power is not money in the hands of the few, but information in the hands of the many." (36:7) In today's world it it of ever-increasing importance to be able to handle larger volumes of information with greater speed and efficiency. The Marine Corps has historically handled storage and retrieval of large volumes of data through a combination of hard-copy filing, microfiche, and magnetic tape. Since 1988 the United States Marine Corps has explored the potential of Compact Disc Read Only Memory (CD-ROM) to store and retrieve information.

CD-ROM has been the subject of several Department of Defense (DoD) initiatives in recent years. These projects have met with varying degrees of success. Results in Marine Corps CD-ROM projects are mixed. Our research into CD-ROM and the Marine Corps' introduction of CD-ROM technologies indicates a need for the Marine Corps needs to introduce a centralized, standardized, and long-term plan for the development and production of CD-ROM discs.

This paper reaffirms the Marine Corps' need for CD-ROM technology and provides some basic recommendations regarding its introduction. We will justify our recommendations by exploring the following questions:

*What is CD-ROM?
*What are the strengths and weaknesses of CD-ROM?
*What is the Marine Corps doing with CD-ROM today?
*What should the Marine Corps be doing with CD-ROM?
*Why isn't the Marine Corps doing all it should?
*How can the CD-ROM be introduced more efficiently?

WHAT IS CD-ROM?

CD-ROM is a computer peripheral that provides a durable, high volume, low cost, near on-line, information storage and retrieval. Compact Disc, Read Only Memory (CD-ROM) is a "read only" or fixed optical medium. Once written to disk data cannot be changed. Information is recorded as "pits and lands" or dull and shiny spots that are read by shining a pinpoint of laser light less than one millionth of an inch wide on the surface of a 4¾ inch polycarbonate disc. (25:16) The computer reads the reflection as binary ones and zeros--the digital language of computers. (38:29) All information that can be digitized, whether text, audio, or graphics, can be stored on a CD-ROM disc. One CD-ROM disc can hold 680 MB of data. To better visualize this, imagine twelve mount-out boxes or 120 shelf-feet of paper condensed onto one CD. A single disc replaces 567 high-density, 5¼ inch floppy disks. This equates to 275,000 pages of text, 74 minutes of audio, thousands of images, or any combination of text, audio, and video. The .7-ounce discs can be mailed for the price of a first-class stamp (30:74). In essence, CD-ROM technology provides micro-computers the data storage/retrieval capacity of a mainframe computer, at a fraction of the cost.

CD-ROM development history is short; Phillips and Sony developed it in 1983. It is an extension of Compact-Disc music research, which Phillips and Sony pioneered in the late seventies as a durable medium for recorded music. Only in recent years has it achieved maturity as a viable information retrieval system. The establishment of an international standard in 1986 was the pivotal event that secured for CD-ROM technology a significant role in the future. The acceptance of an international standard is

critical as it ensures all makes and models of readers will be compatible with every CD-ROM disc produced in the future.

WHAT ARE THE STRENGTHS AND WEAKNESSES OF CD-ROM?

Strengths

When considering the employment of CD-ROM Disc technology in possible information system projects, several critical factors need to be considered. Figure 1 provides a matrix based upon five criteria recommended for consideration when determining the applicability of CD-ROM technology. At least four of the five areas should be answered "yes" to warrant serious consideration for CD-ROM conversion. TheMarine Corps must view CD-ROM applications with its major advantages in mind.

When is CD-ROM the Right Medium?

CRITERIA	YES	NO
Goal is dissemination, not archival		
Data easily digitized		
At least 100MB of data		
Used by at least 50 people		
Needs updating less than once per month		

Figure 1

The greatest promise of CD-ROM is for the data storage demands of today and the next decade. Its strengths are massive data storage, compactness, a non-volatile memory, inexpensive production cost, and interoperability with current Marine Corps systems and technologies. It is the best form in which to maintain non-volatile information at a cost-effective price. CD-ROM allows the retrieval of data from large

8data bases without the associated connection costs of mainframe processing. Using CD-ROM for data storage can reduce printing, distribution, and storage costs.

CD-ROM eases information retrieval with unparalleled, speed, thoroughness, and efficiency. A researcher uses a cross-indexing system called hypertext to search for all references to a particular topic or keyword. The search encompasses an entire publications library (for instance, all FMFMs) on one disk. In a matter of minutes, a researcher can thoroughly complete a complex job that might ordinarily take a week-long search through hundreds of publications.

CD-ROM readers are available from multiple sources for about $599 on current GSA schedules. Written material can be converted to digital format either in-house, or contracted out for approximately $1.50 per page to a government agency without the requirement for competitive bidding. MCCDPA Quantico possesses the equipment to premaster and create a master CD-ROM, or gold disc. The staff at MCCDPA expanded on this point:

> A stand-alone CD-ROM disc mastering system can be procured for under $15,000, and the price is dropping monthly. Copiers cost far more than this. What about the price of the medium? The so-called "gold discs" that are used for local one-of-a-kind mastering have dropped from $30 per disc to under $20 in less than a year. Twenty high density 3½" "floppy disks cost more than a single "gold disc." The floppies will hold approximately 30 MB; the gold disc, 700 MB. Sounds pretty cost effective to me. (19)

CD-ROM conforms to established international standards. These standards ensure all makes and models of readers can access data on any CD-ROM disc. ISO 9660, introduced in 1986, provides for a standard data storage format. An emerging standard, CD-ROM Data exchange (CD-RDx), will allow a manufacturer to produce a single disc that may be used across multiple platforms and operating systems. For

instance, a single user with a personal computer running MS-DOS could use the same disc as a user with a mini computer running UNIX. This standard, sponsored by the Intelligence Information Handling Committee, will decrease unit costs for manufacturers and users alike.

The contents of CD-ROM discs cannot be altered. As the name implies, read-only allows a user to access data but not to change it. Data bases and references would therefore be standard at all levels.

The National Security Agency (NSA) recently approved a data encryption scheme for CD-ROM. The strength of the system is that classified information can be distributed on unclassified media. Navy Commander Bonnie M. Sargent, CD-ROM project manager for the Naval Intelligence Command, said, "In intelligence, the product is information, and one way to save money is inexpensive dissemination." The classified information could be used on any computer with the appropriate interface card. (43)

Perhaps most important is the cost-effectiveness of CD-ROM. Low mailing costs, savings in storage expenses, reduction of on-line mainframe time, and reduced production costs over hard-copy printouts make CD-ROM a very economical storage and dissemination medium. Figure 2 shows the per unit cost of producing a 500 page
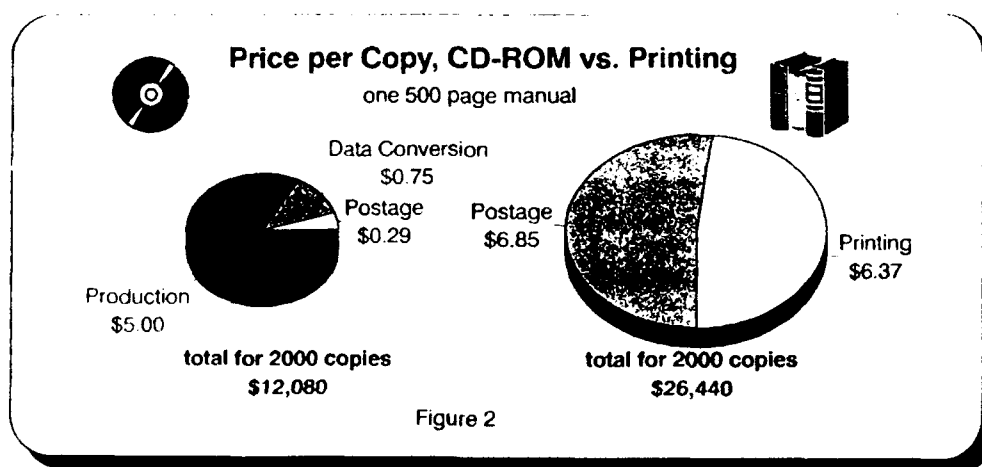

Price per Copy, CD-ROM vs. Printing
one 500 page manual

Data Conversion
$0.75
Postage
$0.29
Postage
$6.85
Printing
$6.37
Production
$5.00

total for 2000 copies
$12,080

total for 2000 copies
$26,440

Figure 2

manual. The difference is remarkable considering that one disc can hold 275,000 pages of text. At $6.04, the CD-ROM saves 37.18 *per copy* over the $13.22 printed version

Weaknesses

For all its advantages, CD-ROM has several shortcomings. The key in all of them is making sure that CD-ROM is the technology of choice for a particular application.

The CD-ROM reader's laser head scans data at a continuous rate. It requires a relatively time-consuming adjustment of the laser head to read the outer edges of the disc. CD-ROM readers have a relatively slow data transfer rate compared to other high-density magnetic media (hard disk drives and floppy disks). Slower transfer rates (150 kbps) result from CD-ROM's use of sequential access rather than random access, as employed by magnetic disk media. The CD-ROM reader must search the disc from the beginning until it locates the requested data. Most magnetic disk media allow accessing of data randomly at any point on the disk. Another consideration is that legal arrangements for the copying of some passages of literature, and the restrictions of copyright laws may pose difficulties in developing some CD-ROM projects.

Just as the "read-only" nature of CD-ROM is a strength, it is also a weakness. Data bases which are modified frequently are not appropriate for distribution on CD-ROM. Programs which require interaction with the data are not suitable to ROM based storage.

The pace at which technology changes or improves is an inherent weakness in any data processing application. There is well-founded concern that today's technology will be outstripped by advances before being totally fielded. The recent introduction of

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the NSA approved encryption device for CD-ROM is an example. The Marine Corps must be willing to invest in technology without waiting for the "perfect box."

The shortcomings of CD-ROM dictate that this technology may not be the perfect solution for every application. For example, the United States Air Force undertook an extensive program to automate its Judge Advocate Office's legal information files. During the planning of the automated on-line information file, the Air Force considered CD-ROM as a mass storage medium. The Air Force concluded that the slow data transfer rate of the CD-ROM reader and the high cost of data conversion made the program impractical. (45)

The weaknesses of CD-ROM lead to several pitfalls that must be avoided; the Marine Corps must use caution and foresight in developing new CD-ROM projects. For instance, the potential of lattice/cube storage devices that may allow up to three terabytes of data storage in a two-inch cube will one day come to fruition. It may supersede most CD-ROM applications with the establishment of international standards. These developments are in the distant future, however, and should not retard the adoption of sound CD-ROM programs. The key is to avoid commitment to unproven applications or applications that require the extensive augmentation of additional hardware. Such programs could offset the cost effectiveness of CD-ROM technology by binding it to expensive applications with a limited shelf-life.

WHAT IS THE MARINE CORPS DOING WITH CD-ROM TODAY?

Currently, several organizations within the Marine Corps are going forward with CD-ROM programs. The Marine Corps Lessons Learned System (MCLLS) is currently transitioning from a floppy-based distribution to CD-ROM. MCLLS intends to fund

the development of a project that will provide the past ten years of Marine Corps Lessons Learned in a CD-ROM format. The disc also will include the Joint Universal Lessons Learned System (JULLS), the Joint Chiefs of Staff (JCS) version of MCLLS. MCLLS intends to fund the acquisition of CD-ROM readers for all Marine Corps installations and major commands to use these historical records. However, the project has been stalled awaiting research results on the new encryption standard for CD-ROM. MCLLS should soon join the ranks of military-produced CD-ROM applications.

The MCCDPA, Quantico, Virginia, under direction of C'I', Headquarters Marine Corps, has produced two CD-ROM demonstration discs. The first, "WarChest," has already been demonstrated to the Fleet Marine Force (FMF). The second, "FightSmart," contains all USMC doctrinal publications and thirty-one minutes of audio. Both have been well-received by FMF units. A third disc is under development and will contain more than seventy-five technical publications.

Headquarters, Marine Corps has a hands-off approach to the adoption of CD-ROM technology. They assume the position that CD-ROM use will grow naturally as the technology becomes more commonplace. CD-ROM should be considered a peripheral device and treated as any other peripheral. Forced introduction of CD-ROM is therefore not necessary and would actually restrict the natural growth of the technology by forcing it on users. The emphasis at HQMC is to convert current data to digital storage. Once that is accomplished, the medium it takes will be governed by the needs of the user. CD-ROM would then be naturally introduced into those areas where its strengths are emphasized and its weaknesses are minimized.

All independent commands with a budget are currently responsible for their own CD-ROM development. Conception and pursuit of each project in development mentioned in this paper have been on the initiative of one or two key individuals within their respective organizations. The organizations involved have received minimal guidance from HQMC. There is no centralized and standardized development and production plan for CD-ROM project managers. The only official HQMC guidance consists of a one page message. It briefly discusses hardware considerations and refers all other inquiries to telephone contact. (5)

Marine Corps acquisition programs focus on user requirements. Most potential users are unfamiliar with CD-ROM. Like the personal computer, it is an item that most users don't know they need until it is force-fed through the acquisition system. But once users see the power CD-ROM offers, they won't be able to get enough of it. C4I has not funded implementation of CD-ROM technology to specific functional areas. These funds must come from the functional areas not familiar with CD-ROM technology. This unfamiliarity has stagnated CD-ROM development.

Judging from the current lack of responsiveness, Information Systems Management Officers (ISMO) and the Commanding Officers of fleet units are only moderately aware of CD-ROM application possibilities. The Marine Corps gears its acquisition program toward user requirements. While this is the optimum approach in most acquisition situations, the question remains, What can be done if the user is unfamiliar with an assets' potential? While the lag in developing CD-ROM is not of the magnitude of the acceptance of the Lewis Gun in the early 1900s, the point is the same. User unfamiliarity is retarding CD-ROM development. This is primarily because few

CD-ROM discs are produced by the military and other government agencies. But as agencies convert their databases to a digital format, the production and popularity of CD-ROM discs will accelerate. An additional difficulty is the fact that personnel manning levels and training are often inadequate. As a result, functional area managers are often handicapped by having few proficient data processing personnel; and those they do have are overburdened. The Defense Technical Information Center (DTIC) noted that, "Many personnel were . . . unfamiliar with the system files themselves and needed to be led blindly through the modifications, not really understanding what the changes meant." (24:4)

WHAT SHOULD THE MARINE CORPS BE DOING WITH CD-ROM?

Rapid technological advancements make it difficult to forecast the best long-term use of currently available resources. Many alternative systems are, or soon will be, available including write-once, read-many (WORM) optical drives, magneto-optical (rewritable optical) drives, and very large-scale, three-dimensional storage systems. However, it must be noted, that unlike CD-ROM, these systems have no uniform set of standards. The Marine Corps faces hard choices in making acquisitions in the near future. During this period of dynamic change and restructuring, the moment is ripe for implementing new changes to the Automated Information Systems (AIS).

Independent research into CD-ROM feasibility is currently being conducted by every branch of service within the DoD. The Marine Corps must take proactive measures to execute a CD-ROM implementation plan. With the current emphasis on jointness, other DoD agencies will develop requirements that will dictate a plan to the Corps. The Marine Corps has several advantages over the other services in developing

AIS Programs. Although it is the smallest service, the Corps has its own data network (MCDN). The Corps has huge data bases that could be immeasurably improved by conversion to CD-ROM. The goal of DoD research is to stimulate discussion of CD-ROM issues and to generate interest in developing proactive plans for CD-ROM.

Before the Marine Corps can develop a wise policy on CD-ROM, it must determine the discs future role. Where will the Marine Corps' AIS be in ten years? Developments in the field of information systems over the last twenty years have been volatile. Where Marine Corps Automated Information Systems development will lead in the coming years is extremely difficult to gauge. However, experts in the field can make some general assumptions as to its nature. Figure 3 presents a matrix based on a list of assumptions presented to the Command and Control Systems Course. (31) It attempts to foresee the Marine Corps' AIS five years hence. These assumptions are subjective but

AIS Future
Assumptions
- Continue standard architecture, operating systems and hardware
- Centralized policy in procurement (PMC)
- Fewer development dollars readily available
- Centralized business case systems (finance, manpower, logistics)
- Centralized data management
- Decentralized processing (download data to micro)
- More software reuse (ADA language)
- Manpower cuts
- An increase in automated support requirements
- Resist potential growth in Class II Data Systems
- Loss of CDPAs to DoD (purple)

Figure 3

provide as credible an approximation of future events as is currently possible. Using

these assumptions as a guide. it is reasonable to assume that the future AIS will be characterized by three features: (1) The adoption of systems with increased cost effectiveness. (2) A centralized management system originating at HQMC. (3) A decentralization of mainframe-like data retrieval capabilities to the lowest level possible. Despite the possible introduction of presently unforeseen technology, CD-ROM supports every expected development of the future. Its impressive data storage capability will dramatically help microcomputers become less dependent upon on-line data systems.

The Marine Corps should focus on those applications that directly support the warfighting commander's needs. Reducing administrative work is fine, but the purpose of the Marine Corps is to win on the battlefield. CD-ROM has potential; The "War Chest" and "Fight Smart" are a good start. By providing FMFMs and other doctrinal publications complete with hypertext access, MCCDPA, Quantico has given the warfighter the ability to shorten the commander's decision cycle in combat as well as to reduce his logistical footprint.

The warfighter's requirement for adequate map coverage is a problem area that CD-ROM could partially solve. Due to its contingency nature, the average MEU carries twenty-six pallets of maps. DMA is currently producing a set of discs which cover the entire planet in both 1:250,000 and 1:50,000 scales. (20) These discs could replace the bulk of the map load, allowing selective loading. Maps could be printed from disc and copied as necessary. Of course, this would require appropriate hardware aboard ship.

Similarly, CD-ROM could provide the landscape, photographs, and floorplans of all embassies and ambassadorial residences within a MAGTFs area of responsibility as well as national intelligence summaries, geographical, and historical information.

These are only a few examples of how CD-ROM could be of use the warfighter. In each case, CD-ROM could provide a reduced load and allow more rapid access to critical information. CD-ROM is a force multiplier, for commanders as well as logisticians and administrators.

WHY ISN'T THE MARINE CORPS DOING ALL IT SHOULD?

CD-ROM is the best solution for many Marine Corps information access needs, but these needs have yet to be identified, and there is no comprehensive plan to find and fill them. The Marine Corps needs to quickly develop and introduce a centralized, long-term plan for implementing of CD-ROM technology. Out in the Fleet Marine Force, where savings in research time and shipping space are critical, there are no CD-ROM applications in development.

An attempt to question the functional manager of C^4I^2 on CD-ROM plans and policy resulted in a referral to CDPA. This reply seems to illustrate the problem with CD-ROM in the Marine Corps; there is no push from the top. HQMC has neither adequately informed the Corps on CD-ROM nor said "Make it happen." Only a few independent offices are working on the issue.

For example, the project officer for MCLLS has spent several months researching the conversion of floppy-based MCLLS files to CD-ROM. In particular, he spent many man-hours studying which brands of hardware and software were best suited for the task, and wrote reports on the subject. Meanwhile, MCCDPA Quantico simply did it and even produced a working model. Duplication of effort is often only lack of communication. Central coordination would have helped all concerned.

Similarly, the Administration and Resources Division (AR) at HQMC spent large sums of money researching the feasibility of basing the new Marine Corps Publications Distribution System (MCPDS) on CD-ROM. After more than a year of studying the problem, little headway had been made for the money and man-hours invested. Since then, AR has apparently backed off their plans for CD-ROM distribution. The current MCPDS position on CD-ROM is that it's just one distribution method that AR may consider in the future. For now they are concentrating on the local area network (LAN) for the offices at Headquarters. Meanwhile, in the space of a couple of months, personnel at MCCDPA Quantico developed and published a disc that contained all of the Marine Corps' FMFMs. It was complete with hypertext cross- referencing--exactly the sort of product that AR was striving for with MCPDS. If AR had requested the technical support and guidance as it should have from MCCDPA Quantico, there is a good chance that it would already be producing publications on CD-ROM.

Although MCCDPA Quantico possesses the expertise to produce the required information and guidance, it has not been required to publish it. More importantly, no one at Headquarters, Marine Corps has "taken charge" or been placed in charge of integrating CD-ROM project development Corps-wide. These deficiencies have led to a waste of the Marine Corps' time, effort, and money.

The Marine Corps' current lack of central guidance is not yet causing severe problems in project development. In fact, it may be the best position possible at the present time. However, as CD-ROM use increases, this position may become untenable. Someone will have to provide definitive guidance, coordinate and prioritize the use of mastering equipment, and enforce software standards for developers.

HOW CAN CD-ROM BE INTRODUCED MORE EFFICIENTLY?

Given the strengths and weaknesses of CD-ROM technology, what are the most practical applications for CD-ROM? The answer is the storage of large volumes of reference material. For example, the United States Navy has invested heavily in a project entitled "Paperless Ship." Using CD-ROM and related technologies, the goal was to enable the U.S.S. Ranger to function maximizing the use of Automated Information Systems (AIS). If successful, this prototype would serve as a baseline for other ships in the fleet. This Navy project is currently on hold. The Defense Mapping Agency (DMA) is currently publishing a series of CD-ROM discs containing maps of the world using the digital terrain mapping technology. Civilian publishers are producing encyclopedias and reference books on CD-ROM discs. The United States Army and the Joint Chiefs of Staff are developing a CD-ROM Disc that will contain all standard forms used throughout the DoD. Initial orientation to the subject of CD-ROM implementation shows many planning problems abound. Using the matrix in Figure 1 we can see that all of the current projects barely meet the minimum criteria for a successful CD-ROM Program. In all cases, the number of users in the program is extremely limited. The number of users barely reaches the goal number of fifty. To maximize the cost effectiveness of a CD-ROM program, more users are recommended.

How can the Marine Corps best introduce CD-ROM into their AIS? Central management is required to promote efficiency and prevent problems such as those experienced by AR. The central authority needs to take charge and resolve the following issues:

1. How will the Marine Corps get the hardware to use CD-ROM? Currently there are approximately 25,000 microcomputers in use in the Marine Corps. Obviously the few CD-ROM readers planned to be delivered under the MCLLS project will be insufficient to provide for all the Marine Corps' needs. There is no requirement for each of the 25,000 microcomputers to have a CD-ROM reader. A reasonable number seems 5,000 (about ten times the number to be provided in the MCLLS program). In other words, 25% of the microcomputers on hand should be equipped with the CD-ROM reader (total cost of $2,995,000 at $599 apiece). CD-ROM drives are an installed option on many microcomputers.

This issue is particularly divisive between parties in the Marine Corps when who should pay for CD-ROM equipment is debated. Where would this money come from? The CD-ROM reader should be treated as any peripheral device and purchased at the unit organizational level with unit funds. The more expensive mastering equipment and software licenses should be paid for by Headquarters. However, if funding has to come from the functional managers, it should be spread evenly to all seven functional areas. Each functional area will eventually benefit from the savings generated by CD-ROM through efficiency and publication costs. A fielding plan over two or three years would spread the cost over several fiscal years and still provide a significant capability to the FMF.

2. What should be published? The CD-ROM advantage of hypertext searches of large data bases makes conversion of manuals and reference publications desirable. Program managers must insure the user-friendliness and productivity of an application through standardized software tools such as menus and hypertext; we don't want simply

to throw information on disc. The establishment of a controlling authority seems critical to ensure the most efficient use of CD-ROM publication procedures. CD-ROM discs have such a huge information storage capacity that few discs currently produced use more than a fraction of their storage capacity. A central coordinating authority (C^4I^2) is required to ensure different Functional Area Managers producing CD-ROM discs will compile their data and eliminate unnecessary mastering costs.

3. Who will bear the nominal cost of producing a disc? This cost would normally remain a responsibility of the functional manager who wants the product. Converting data in house will cost probably no more than $10,000, and less than that if two functional mangers combine their data onto one disc.

The need for clear guidance with central sponsorship of Corps-wide applications is clear. The central authority needs to provide prioritization for delivery of centrally sponsored equipment. Access to limited mastering equipment will be managed by this central authority.

The CD-ROM strategy should break down to some simple fundamentals. CD-ROM has a long, but not unlimited, lifespan; the sooner we convert to CD-ROM storage and retrieval applications, the more cost effective it will be. The Marine Corps should strive to:

1. Encourage CD-ROM reader procurement for all units battalion and squadron size and larger immediately.

2. Digitize current databases and documents to ease all data manipulation and speed the production of CD-ROM discs.

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3. Get the ISMOs and Functional Area Directors involved in promoting CD-ROM programs.

CONCLUSION

Our research has resulted in the following conclusions:

1. The Marine Corps needs the benefits of CD-ROM technology.

2. The Marine Corps needs more definitive guidance to ensure rapid and efficient introduction of CD-ROM technology.

Based on our conclusions and the factors we believe are essential for success, we have identified several actions which would benefit the Marine Corps. Accordingly, we make the following recommendation:

Place someone (agency) in charge of CD-ROM development and implementation. The main mission would be to inform the FMF, demand input and produce a long-term, comprehensive plan. The plan would cover 1-7 below.

1. Keep the two major advantages of CD-ROM applications. It is the best form to maintain nonvolatile information at a cost-effective price. CD-ROM has established and proposed standards, (ISO 9660 and CD-RDx) and is unlikely to be supplanted in the near future.

2. Proceed quickly to maximize the benefits of the technology.

3. Proceed cautiously to introduce only programs that have long term gains.

4. Avoid unproven applications or applications that require the extensive augmentation of additional hardware investment.

5. Take steps to digitize current data bases and convert them to CD-ROM. Once users see the benefit, they will want invest in readers.

6. Encourage CD-ROM reader immediate procurement for all battalions/squadrons.

7. Get the ISMOs and Functional Area Directors involved in promoting CD-ROM programs.

CD-ROM technology will provide tremendous benefits to the Marine Corps. It can achieve substantial savings in man-hours, particularly important during this time of personnel cuts. It provides more efficient storage for applications in every functional area. It allows for great savings in storage space, shipping costs, and paper usage. CD-ROM allows the Marine Air-Ground Task Force (MAGTF) to carry more warfighting equipment in place of paper. Given the tremendous potential benefits of CD-ROM, it borders on negligence to merely, "let it happen." According to Naisbett, "change is occurring so rapidly that there is no time to *react*; instead we must *anticipate* the future." (Italics added) (36:9) There is no doubt that the Marine Corps needs CD-ROM technology; we must now move forward by quickly taking charge and implementing from the top down.

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