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THESIS

AN ANALYSIS OF THE POTENTIAL USE OF
CORPORATE TRADE PAYMENTS BY THE NAVY

by

Frederick Charles Alke

December 1984

Thesis Advisor:

James M. Fremgen

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An Analysis of the Potential Use
of Corporate Trade Payments by the Navy

by

Frederick Charles Alke
Major, United States Marine Corps
B.B.A., University of Georgia, 1979

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

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ABSTRACT

Corporate Trade Payments (CTP's) are a recent development in electronic funds transfer (EFT) technology. Essentially they are a commercial payment system that replaces paper checks with electronic data which are transmitted via the automated clearing house system. This thesis analyzed the potential use of CTP's by the Navy for making vendor payments. The thesis reviewed EFT in general and CTP's in particular. It performed a cost comparison between checks and CTP's, and predicted whether using CTP's would be cost beneficial to the Navy. A survey of private sector companies was conducted to solicit primary market data about using CTP's. The respondents' data were statistically tested to identify possible vendor concerns and needs.

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I. INTRODUCTION

A. PURPOSE

The purpose of this thesis is to develop information about the potential use of Corporate Trade Payments by the Navy. Corporate Trade Payments are a recently developed electronic payment mechanism that eliminates paper documents (checks) from bill paying procedures. Their use by the Navy for paying vendors could result in more efficient processing and timely disbursement of funds. Whether their use would be cost beneficial, or otherwise desirable, is examined in this thesis. The information it systematically develops is intended to give decision makers within the Financial Systems, Policy and Planning Operations Directorate, Navy Accounting and Finance Center, a basis for considering using Corporate Trade Payments in the Navy.

B. SCOPE

This thesis discusses the potential use of Corporate Trade Payments by the Navy. Its approach is conceptual in nature and does not address specific implementation procedures. It makes an analysis of Corporate Trade Payments costs and compares them to costs of checks. Additionally, it surveys the environment of private companies now using them.

The outline of this thesis is as follows. Chapter II is a review of electronic funds transfer's history, technology, environment and possible future. Chapter III specifically describes the Corporate Trade Payment and how it might be used by the Government and the Navy. Chapter IV discusses the methodology used in determining whether Corporate Trade Payments use would be cost beneficial for the Navy. Chapter V is an analysis of the data that were collected. Chapter VI is an analysis of the private sector environment in which Corporate Trade Payments are being used. Chapter VII summarizes the thesis and states its conclusions.

II. REVIEW OF ELECTRONIC FUNDS TRANSFER

A. PAYMENT SYSTEMS

The function of payment systems is to provide a means for conducting exchanges of values. These exchanges usually involve goods, services, or financial obligations on one side, and money on the other side. The money used in the exchange can include coin, paper money, checks, or credit instruments. Because they facilitate the exchange process, payment systems have become all-pervasive and essential to the operation of our modern society. This is very much in contrast to what nineteenth century classical economists would have thought.

Thus John Stuart Mill stated:

It must be evident, however, that the mere introduction of a particular mode of exchanging things for one another by first exchanging a thing for money, and then exchanging the money for something else, makes no difference in the essential character of transactions. . . . There cannot, in short, be intrinsically a more insignificant thing, in the economy of society, than money; except in the character of a contrivance for sparing time and labor. It is a machine for doing quickly and commodiously, what would be done, though less quickly and commodiously, without it: and like many kinds of machinery, it only exerts a distinct and independent influence of its own when it gets out of order. [1]

This idea was based on the fundamental concern of the classicists with the "long run." In today's world, where the sparing of time and labor is often of the utmost

essence and competition and technology run at breakneck speed, there must be a much greater focus on the short run. Whenever a significant need has been recognized for timely and cost effective payments, some form of payment mechanism has arisen to meet that need.

B. CHECKING ACCOUNT DEPOSITS

The major part of the monetary stock of the United States is in the form of demand deposits at commercial banks. Demand deposits are bank liabilities arising out of receipt of monies by a bank from its customers. These liabilities must be paid by the bank upon demand by the customers, who state their payment orders by means of checks. The check is the device that allows transfer of funds from one account to another to satisfy debts. This ability to transfer balances between accounts is what has made checks acceptable as the primary means of payment in the United States.

Checks became popular in the United States in the 1870's and 1880's because of stringent restrictions placed on the issuance of currency under the National Banking Acts of 1863 and 1865 [2]. They are today the most popular payment mechanism. Checks can be drawn on any of the 14,000 commercial banks in the 50 states and also upon thrift institutions that offer negotiable orders of withdrawal (NOW) accounts.

In order for checks to function as a payment mechanism there must exist a thorough network of communications, transportation, and computers to clear them from account to account. The clearing mechanism operating in the United States today is probably the most efficient paper-oriented communications system in the nation. The clearing process is operated as a partnership between the Federal Reserve and the larger commercial banks. The commercial banks prepare and presort the checks for entry into the system and the Federal Reserve maintains the arterial flow of checks between and within its districts.

Certain advantages have favored the widespread use of checking accounts as a means of payment. Checks can be drawn for the exact amount of payment, thereby eliminating the need for change. Checks can be transported easily, regardless of the distance involved. When endorsed by the payee, the check serves as a receipt of payment. The great majority of checks change hands only once, beginning with the payor and ending with the payee. The checks are, in effect, just a series of paper orders to the banks to adjust their books in accordance with the depositors' wishes.

Although checks are responsible for well over 90 percent of the total dollar value of payment transactions made, the typical check size is relatively small. More than half are written for amounts less than \$50. The 1 percent

of checks written for more than \$10,000 represent 80 percent of the dollar value of funds transferred by check. [3]

The check payment system is operated by commercial banks acting individually, through correspondent banks and other direct relationships, and through local clearinghouses. The Federal Reserve System assists this operation by establishing standards and procedures and by operating a national clearing system, the arterial flow for checks. This flow mechanism for checks has been necessary because of legal technicalities and banking custom which required the paper checks to follow the flow of financial information through the communications network. Therefore, even though the banking industry is highly automated, the payments system is still highly labor intensive because of the paper handling requirements.

Check handling in most banks in the United States was partially mechanized by 1940 [4]. The machines used were mechanical sorters and tabulators that provided a method of proving deposits by entering the amounts of the checks through a keyboard. The checks proved could then be mechanically conveyed to a selected bin. These machines represented a marked improvement over the earlier method of manually listing and sorting and could process between 1,000 and 1,200 checks per hour. At this minimal level of automation, further handling of the checks was still

required before they could be forwarded to the bookkeepers or bundled into clearing house packages.

Through the 1940's and 1950's, technological progress in the handling of checks and maintenance of accounts did not keep pace with the changes in the volume of check writing. In the early 1950's, 8 billion checks were written annually in the United States [5]. In the early 1960's, more than 12 billion checks were written annually in the United States. By 1974 the amount had risen to 28 billion and bank experts were predicting an escalation to 44 billion by the early 1980's [6]. There began to be serious concern that the check processing system would collapse during this decade due to limited clearing capacity. This potential collapse of the predominant payment system and the technological growth in computers then focused thinking on a "cashless society."

In 1971, technology gave the payment system a reprieve from the predicted collapse. The Federal Reserve System undertook a two stage program to restructure the nation's payments mechanism through the use of organizational change and recent technological developments.

The first stage of the restructuring was the establishment of a series of regional check processing centers (RCPC's). The RCPCs were concentrated in the East, West, and mid-West in basic alignment with the major

population centers of the United States. The Federal Reserve intended for these additional check clearing centers to result in faster, more convenient and more economical banking service to the public. These RCPC's were able to process a greater volume of checks in less time, due in part to a new development in checks--the magnetic character recognition code (MICR). The MICR was imprinted directly on the check and permitted a rapid electronic scanning and mechanical sorting to speed delivery of the checks to the RCPC concentration points. The MICR reader/sorters could process checks at a rate of 100,000 per hour. When operating in conjunction with a computer, it could also handle the related payments and bookkeeping necessary for the payment system to keep functioning. [7]

From about this point in time on, the commercial banking industry evolved into the largest single user of computers in the United States, except for the Government. The reason for this is that computers, along with MICR equipment, permitted the automated handling of checks. The increased speed of mathematical computation provided by computers was not a primary objective of their use because check clearing calculations are relatively simple and computationally short. Of far greater significance to the banking industry was the opportunity to handle the increasing volume of checks by electronic automation. An

American Bankers' Association report concerning the mechanization of check handling in 1956 stated a primary use for computers as the replacement "for the hands, eyes, and the more automatic phases of mental activity." [8]

Increasing check volume required increasing use of computers to keep up with the demands of the payment system. This increasing use of computers by the banking industry led to the Federal Reserve's second stage of payment system change.

C. AUTOMATED CLEARING HOUSES

In 1973, the Federal Reserve set in motion the second stage of its restructuring program by inviting comments regarding the fundamental structure of the nation's payments mechanism. It specifically raised the question of how an electronic funds transfer system (EFTS) could be implemented. An EFTS substitutes electronic transactions for paper documents. This potentially reduces the effective time and distance from point of initiation to point of posting to close to zero by eliminating the physical movement of paper. The Federal Reserve recognized that technological evolution would have a significant effect on the payment system.

David A. O'Connor, President, EFT Group, Inc.

summarized the effect of technology on the payment system:

The view from the future, however, is that we are in fact moving into an information-oriented society and the payment system which will function in that

environment will be an information-based system. The system will deal with information about money. In fact the difference between money and information about money takes some definition: Checks are no more than information about the ownership of money; electronic checks (transfers) are the same. [9]

The concept of the automated clearing house (ACH) was first formulated as a solution to the predicted crushing volume of paper checks. The concept was made possible by the advances of computer technology melded with the idea that checks are just information about the ownership of money. The idea was that an ACH could electronically transfer funds through a telecommunications network linking banks, savings and loan institutions, and credit unions. The voluminous paper flow could be eliminated.

An automated clearing house, then, is a processing and delivery facility that provides for the distribution and settlement of electronic debits and credits. Through a nationwide telecommunications network linking 11,000 commercial banks, 3,500 thrift institutions, and 22,000 companies, local ACHs can communicate with other ACHs to exchange information about money quickly, efficiently, and with no regard to the geographic distances involved. This nationwide telecommunications network evolved from the interconnecting of local ACHs.

In 1974, the National Automated Clearing House Association (NACHA) was organized to staff and monitor standards and regulations needed to facilitate the

interregional exchange of information. In 1975 there was significant growth in ACH development that has continued to the present time. Today there are 32 regional ACH associations serving the United States. Most of the regional ACH's use the clearing facilities, delivery methods, and settlement services operated by the Federal Reserve, although some use private processing facilities as well.

The function of the ACH is, therefore, one of information and funds transfer in that it performs the same basic function as a clearing house that handles checks. The difference is that the ACH passes information electronically from computer to computer rather than by paper check. Additionally, the ACH truncates the check process. Four separate check activities are eliminated: (1) preparing the check, (2) mailing the check, (3) cashing or depositing the check, and (4) clearing the check. The level of computer technology available permits handling large numbers of transactions in very short periods of time.

1. How the ACH Process Works

Payment data flow through the ACH system in electronic form and can represent many variations of settlement. The transaction information flows in a prescribed format according to a fixed processing/delivery

schedule which is governed by the predetermined settlement date for the payment.

The Federal Reserve system provides all computer processing and delivery support necessary for the ACH operation. There is one exception to this, and that is the New York regional ACH. It is operated by an association of commercial banks rather than the Federal Reserve. Net settlement is still made through the Federal Reserve.

On the settlement date, all parties to the transaction will settle simultaneously. These parties include the originating company or Government agency, the originating depository financial institution (ODFI), the originating ACH, the receiving ACH (if the transaction is interregional), the receiving depository financial institution (RDFI), and the receiving company.

The ODFI debits or credits the originating company's account. The originating ACH debits or credits the reserve account of the ODFI and, if the RDFI is a member of the local ACH, debits or credits its reserve account. If the RDFI is not local, the data are sent to the receiving financial institution's ACH where its account is debited or credited. The receiving ACH debits or credits the account of its RDFI. The RDFI then debits or credits its member's accounts.

The RDFI does not need electronic processing capabilities to be a member of an ACH association. The ACH will provide paper print-outs of transactions to it. Transactions listed on a print-out would then have to be manually posted and the account holder notified of the transaction by some means. If the RDFI has automated capabilities or subscribes to a computer service bureau, it receives a magnetic tape, diskette or direct transmission from the ACH. Federal Reserve policy allows the RDFI to select only one of the four media.

NACHA rules, along with local ACH rules, govern all ACH transactions. One of the governing rules requires that a ten-day notification transmission be sent before a live settlement transaction can be initiated. The ten-day notification sends a zero dollar amount including the routing and transit number of the receiving financial institution, its name, its customer's name, and an account number through the network. The notification transmission alerts the RDFI that live dollar transactions will follow and verifies the customer account information and authorization of future transactions. Errors must be reported to the ODFI within ten days so corrections can be made by the originating company before the actual payment transmission is made. [10]

2. A Navy Originated Transaction Example

A possible payment transaction between the Navy and a vendor would flow as follows:

- 1- The Navy creates a NACHA formatted data string of payment information.
- 2- Prior to the settlement date, the Navy delivers the payment data (by tape, data link, diskette or paper listing) to its originating financial institution. For the Navy, the ODFI would be the Federal Reserve Bank in that area. The timing of the delivery must conform to all local and interregional schedules.
- 3- The ODFI transmits the payment information to the local ACH.
- 4- The local ACH, or originating ACH, sorts the payment items by routing and transit numbers, delivers or transmits the local items to local receiving financial institutions for posting, and sends the remainder to the interregional ACH network via high-speed transmission.
- 5- The receiving ACH delivers or transmits the payment information to the local RDFIs for posting.
- 6- On settlement day, all parties to the transaction effect the appropriate settlement. The rules that govern the ACHs contain the interregional transmission schedules and include provisions that funds must be available and posted to the bank account at the RDFI no later than the settlement date. [11]

3. ACH Use

In the early 1960's, more than 12 billion checks were written annually in the United States. The current number is over 35 billion and rising at the rate of 6 to 7 percent per year [12]. The original fear that the payment system might collapse due to the increasing volume is not now considered a real threat, but the labor, material and overhead costs to process checks have become increasingly a

significant problem. To counter these costs, the movement toward an electronic payment mechanism is well underway. It would also appear that this movement is both desirable and irreversible.

One of the most significant factors in the movement toward EFT and the acceleration of ACH activity was the action by the Treasury Department in 1974 to implement direct deposit programs for Government payments. The greatest attention was given to the program for direct deposit of Social Security payments through the ACH's. In December of 1975, only 189,000 of the transactions processed through the ACH network were Government generated. One year later the number had grown to 4.7 million [13]. By 1984, the number was over 200 million [14]. The Treasury's goal is to make 65 percent of all Government payments by EFT methods by the end of fiscal 1990. Treasury data indicate that between 1972 and 1984 the number of payments issued annually by the Department of the Treasury on behalf of the various Government agencies increased by 40 percent, from approximately 500 million to approximately 700 million. The Direct Deposit Program (DD/EFT) alone has been successful in converting nearly all of this increase to electronic payments instead of paper checks. Treasury expects cost savings of more than \$100 million annually when the 65 percent goal is reached [15]. Direct deposit of Social

Security payments alone is now in excess of 13 million payments per month. [16]

The private sector has not accepted the ACH payment mechanism as quickly as has the Government. Until 1978, ACH growth occurred mainly within the local regions. Interregional exchanges of information were possible only by the exchange of magnetic tapes, which was considered a major impediment. In late 1978, electronic interregional exchange was implemented; the result was a truly nationwide ACH payment mechanism. Electronic exchange made it practical for corporations with nationwide operations to use the ACH to disburse and collect funds from all over the country. Electronic exchange also marked the point of greater acceptance by the private sector. In 1975, 228,000 transactions were generated by the private sector in local ACHs. After implementing interregional electronic exchange, the number increased to more than 11 million by 1982, a compounded growth rate of more than 74 percent. [17]

Despite this high growth rate in ACH use, estimates for private sector origination of ACH transactions for 1984 are but in the 190 million range. This amount may be over 800 times larger than the number transmitted in 1975, but it is less than 1.2 percent of the combined business generated check and ACH volume. Business

originated checks have not, therefore, been significantly displaced by ACH payment mechanisms. [18]

There are three specific ACH services that offer significant opportunity to private firms for eliminating check-based payments. One of these services is the direct deposit of payroll, the same service that has been very successful for the Government. Another is the ACH concentration transmission, where relatively low volume but high dollar amount checks are replaced. The last service is the corporate-to-corporate trade payment. Of these three, only the ACH concentration transmission is used to a significant degree by corporations. [19]

Figure II-1 shows the volume of checks handled by the Federal Reserve System. Figure II-2 shows the volume of electronic fund transfers handled by the ACH system. Figure II-3 shows the dollar amounts those volumes of checks and electronic fund transfers are carrying. The significant point to notice is the growth in EFT and the fact that this method moves most of the dollars in the system. (These figures do not include direct transfers between banks, internal bank transfers, clearing houses and transactions between correspondent banks.) [20]

4. Benefits of Using the ACH

There are readily identifiable benefits accruing to the originator of payments made through the ACHs. The

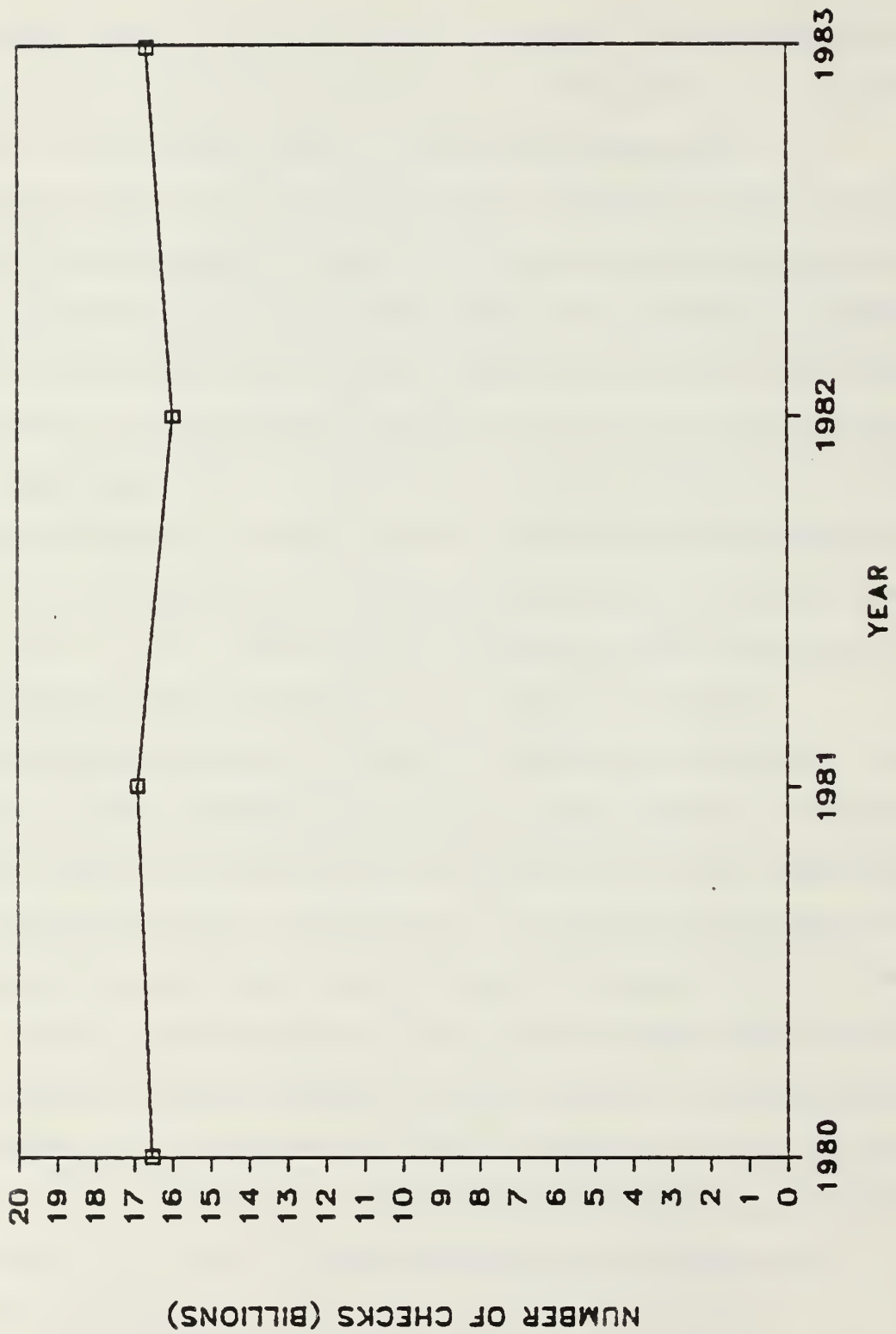


Figure II-1 Volume of Checks Handled by the Federal Reserve

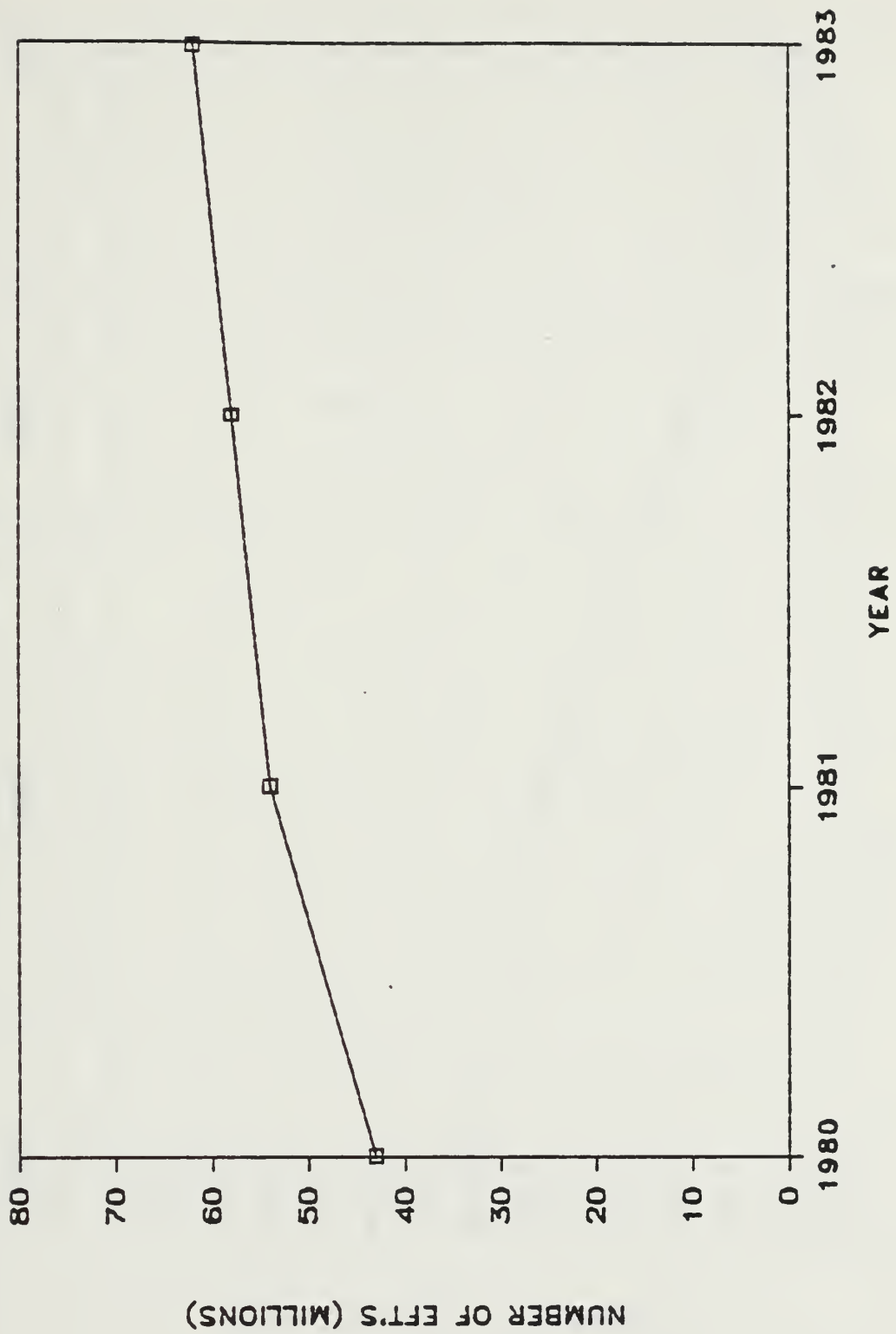


Figure II-2 Volume of Electronic Funds Transfers

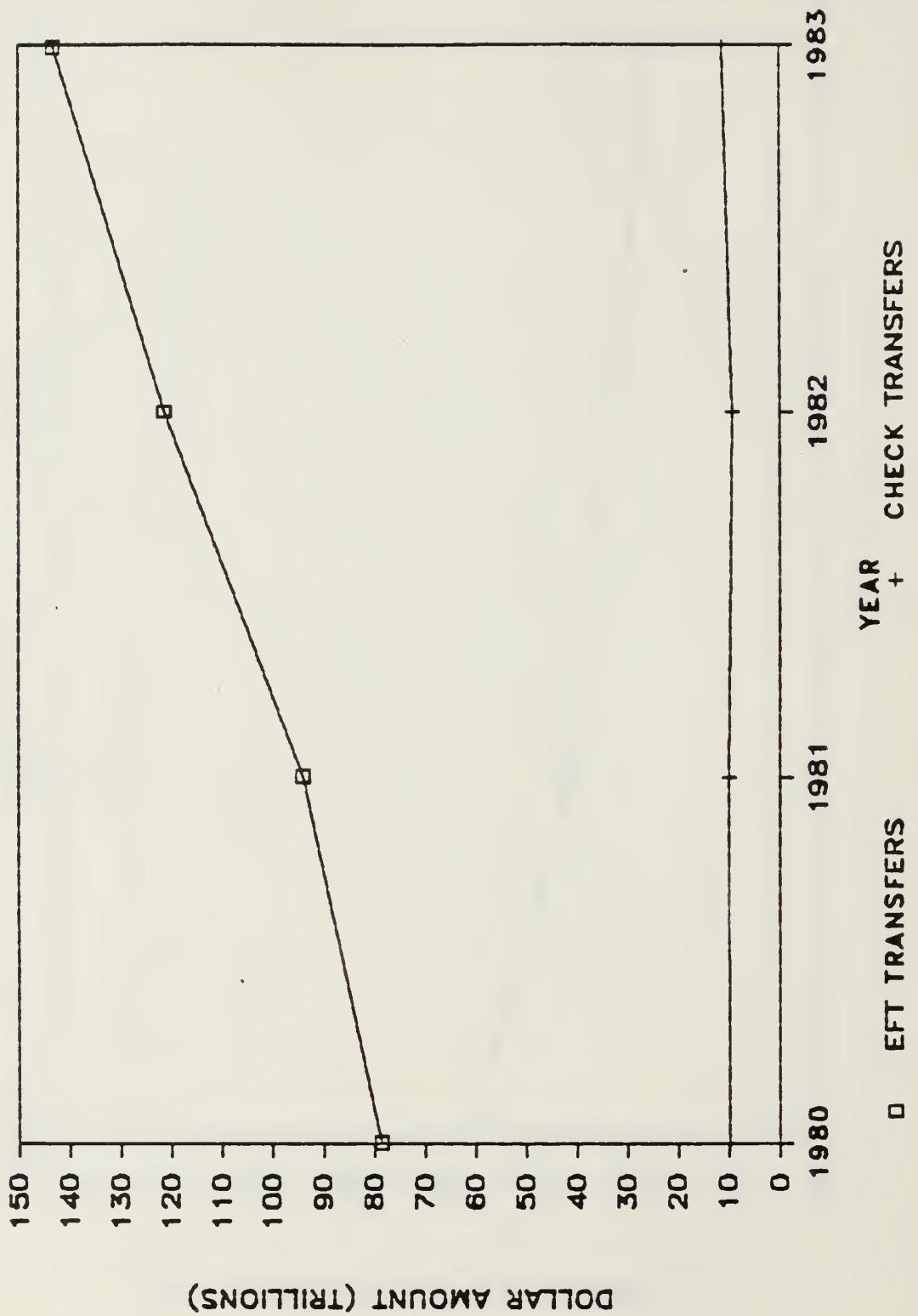


Figure II-3 Dollar Amounts Transferred by EFT and Checks

most easily identifiable are the reduction of paperwork per transaction, thereby eliminating labor costs. Postage and printing expenses are also reduced. EFT offers greater control over cash flow because payments can be made exactly when due, being neither early nor late. When payments can be made in such an exact manner, the potential for interest penalties due to late payment and opportunity costs for lost interest due to early payments is greatly reduced.

There are benefits accruing to vendors receiving payments through the ACHs as well. Receiving a credit to an account via the ACH is more convenient than receiving a check because the vendor is relieved of the necessity to deposit the check. This was found to be a potentially significant benefit among vendors receiving payment by check from the Navy Supply Center, Oakland, where over 1,000 vendors regularly picked up the checks in person or by bank courier rather than wait for postal delivery. Security is also improved because there is no check to be stolen from the mail or from the recipient.

The ACH, if pressed to its fullest potential, could possibly usher in the totally checkless society. If electronic payment mechanisms were commonplace, vendor invoices could stipulate that payment was due in good funds, that is, cleared funds on a certain date. The old expression that "the check is in the mail" might never be heard again.

A cash management consultant has stated that the technology required for a potentially checkless society is already in place. The ACH can indeed credit and debit without paper, but the fact remains that less than 1 percent of the nation's payments are now handled electronically. Corporations especially have yet to utilize the ACH extensively. [21]

5. Problems of the ACH System

Factors limiting the growth of the ACH system appear to be a lack of awareness, especially on the part of businesses and financial institutions, and a misunderstanding of the benefits and costs involved in utilizing EFT. [22]

The true cost relationship between paper-based and electronic transactions has been difficult to determine. Costing in a service industry, such as banking, is difficult at best. Additionally, the check payment mechanism in the United States helps obscure the true cost of the paper-based transaction due to the way in which banks and the Federal Reserve charge for their services. Increased ACH use, however, will require identifying the true costs. [23]

The check-collection system has, in the past, been subsidized by the banking industry. While the Federal Reserve spent over \$250 million on processing checks in 1980, this amount is relatively small compared to the

banking industry's cost of \$7.2 billion. The ratio of cost between Federal Reserve and the banking industry is 1:29. The cost per check for the banking industry was estimated at 18 to 23 cents. This cost was not passed on to customers, but this is changing. [24]

One cause for difficulty in banks determining the cost of EFT services is that, historically, banks have not been particularly precise in pricing their services. Customers often paid on the basis of the amounts of their balances kept at the bank. As excess balances have been driven down by more active cash management on the part of corporate treasurers, banks have been forced to look more closely at their pricing philosophy. There is now a clear trend toward fees, rather than balance-oriented pricing [25].

The trend toward fee pricing may make the use of the ACH mechanism more economically attractive. Both banks and customers may begin to realize that ACH debits and credits are substantially less expensive per transaction than processing a paper check. Additionally, as the corporate world begins to feel more comfortable with the surety and preciseness of ACH transactions compared to the imprecise nature of checks, use of the ACH will continue to expand. [26]

To compound the difficulty of all of this, there is a general lack of research information on corporate payment practices. Major banks that are involved in corporate-cash management have made studies of specific corporate payment practices, but these have remained generally proprietary and unpublished [27]. The reason for this is market competition.

The cash management market is already highly concentrated, with just a few big banks fighting intensely to recruit or retain the same corporate customers. This situation tends to make banks coy about costs. Bank's cash management fees have remained stable since the 1970's, with price increases being held in check, whether they cover costs or not, by competition [28]. The problem, then, in attempting to make net cost comparisons between ACH and paper-based services is that the true costs are difficult to arrive at.

D. GAO REVIEW OF GOVERNMENT PAYMENT PERFORMANCE

In 1978, the U.S. General Accounting Office reviewed the Federal Government's bill paying performance. The overall finding from this review was that payment performance was good, but should be better. [29]

It was found that, while the payment performance was nearly always good, long delays did occur and contractors often believed they were not being paid soon enough.

Additionally, it was found that in many cases there were early payments being made that not only were costing the Government opportunity costs in lost interest but were also causing some vendors to stop offering early payment discounts.

The cause of long payment delays was often problems in the different agencies' receiving and acceptance procedures. A contributing cause was that the vendors often submitted incorrect invoices. Correct invoices were often submitted to the wrong payment center, too. There was, however, an overall problem of a lack of Federal standards establishing when actual payment was due. In the Department of Defense, the Defense Acquisition Regulations did not specifically require standard contract payment clauses which specified payment due dates. Additionally, procurement and fiscal regulations did not direct absolutely whether advantage had to be taken of vendor payment terms. [30]

Since the time of this GAO review in 1978, there have been many changes. Payment due date standards have been developed. Whether or not acceptance of discounts on vendor invoices is made now depends upon the effective annual discount rate. The minimum acceptable effective annual discount rate is published each quarter by the Department of the Treasury and is known as the current value of funds rate (CVFR). For the Navy, regulations require that the discount

be taken should the vendor's rate equal or better the current CVFR. There is also a standard interest rate published for assessing interest penalties should payments not be made on time. Defense Acquisition Regulations now require payment due dates be written into Defense contracts. [31]

E. FEDERAL CASH MANAGEMENT

The Federal Government's cash flow is the largest and most complex of any single organization in the world. The major cash disbursements that are made include payments for goods and services, grants, payrolls, interest on the public debt, tax refunds, social security, welfare, unemployment insurance, and pensions. Improving the Government's financial management will necessarily require more efficient processing and more timely handling of these disbursements.

The Department of the Treasury, the Office of Management and Budget (OMB), the Federal Reserve System, and, specifically in this study, the Navy, play key roles in the Government's overall financial management. The Treasury's role is supervising and managing the Government's finances and overall control of the Government's cash. Specific duties include collecting and disbursing funds, borrowing cash, maintaining a central cash accounting and reporting system, and, perhaps most importantly to this

study, establishing cash management policies and procedures to be followed by individual agencies like the Navy.

OMB's role is to provide general oversight control of the cash management operations of all agencies, including Treasury. It also administers the Federal budget. In administering the budget, it provides guidance to Government agencies for estimating their cash outlays. The Treasury, in turn, uses these cash flow estimates to forecast the Government's overall cash flow.

It is the individual Government agency that then becomes the essential link in the management of the Government's cash, because it is expected both to carry out the Treasury's cash management policies and to estimate its cash outlays as required by OMB.

The Federal Reserve's role is primarily to formulate and implement monetary policy, and for this it is best known. It has other significant duties, however. The Federal Reserve is the Government's bank. In this role, it maintains the checking account on which all Government checks are drawn.

There is now a declared interest in improving Federal cash management. In the 1970's and 1980's, sustained high-interest rates meant that the opportunity cost became sufficiently high to justify the expense of managing cash. It was also in the 1970's that the rapid growth in computer

technology was coupled with telecommunications technology. This coupling has permitted major advances in monitoring and controlling cash flow just as it did in automating check handling.

1. The Use of EFT in the Government .

As stated earlier, the Treasury's duties are to supervise and manage the Government's finances and to provide overall control of the Government's cash. Specific initiatives directed toward these duties are being undertaken in the Treasury by the Bureau of Government Financial Operations (BGFO). These initiatives fall into four main areas: payments, collections, cash management, and Government-wide accounting. Both initiatives concerning payments and cash management are focusing on increased use of EFT in the Government. [32]

A top priority concern is to move away from paper payments and toward a much greater reliance on electronic payment mechanisms [33]. The Federal Reserve is the major provider of EFT facilities to Government agencies. The two major facilities are the Federal Reserve Communications System (FEDWIRE) and the automated clearing house network. The FEDWIRE system is similar to the ACH network in that it is a 40,000-mile, computer-based telecommunications network that interconnects Federal Reserve banks with several hundred commercial banks. Through FEDWIRE, funds can be

transferred in and out of Treasury accounts as disbursements or collections. These transactions are usually nonrecurring, large dollar amounts, that are handled individually. The Treasury has used the ACH network differently from FEDWIRE, in that transactions processed through it are recurring, batch processed, and of low dollar amounts. These characteristics describe the type of payments being made by the Direct Deposit Program (DD/EFT).

Since it was begun in 1976, the Direct Deposit Program for salaries, pensions and benefits has grown from 600 thousand to 235 million payments annually [34]. In conjunction with this program, major marketing efforts were successfully undertaken to encourage greater use of this payment mechanism. These efforts included information campaigns directed toward Government employees and a direct mail campaign to depository institutions not yet linked to the ACH network. A separate mailing campaign aimed toward corporations headquartered in the Southern states encouraged businesses to add pressure on banks to link up [35]. The Government is currently disbursing nearly 40 percent of its recurring payments through the ACH network by direct deposit. The savings attributed to the DD/EFT Program for 1982 were \$28 million. For 1983, the savings were estimated to be \$39 million. [36]

The BGFO is also working on a legislative proposal that would require Federal employees to be paid by direct deposit [37]. The primary purpose of this proposal is to increase the number of EFT payments and reduce the number of check payments. The Treasury expects this would not only improve its operating efficiency and increase productivity, but would reduce costs as well. The average savings the Treasury estimated for a direct deposit payment compared to a check is 21 cents per payment.

The Federal Reserve System provided free check-clearing services until the Depository Institutions Deregulation and Monetary Control Act of 1980 was made law. This Act required the Federal Reserve to price its once-free services [38]. Commercial banks that used that service had to factor in the new costs and pass them on to their customers. The Act also required pricing of ACH services. However, the Federal Reserve also has a stated goal to encourage the shift from paper-based to electronic payment mechanisms. To help achieve this goal, the Federal Reserve did not price ACH services based on the current rate of use, but rather upon expected mature system volumes. This resulted in a significantly lower price for ACH services than might have been the case. It is estimated that there is an effective subsidy of approximately 5 cents per ACH transaction, helping to keep the cost lower than a paper

transaction. This subsidy is scheduled to disappear in 1985, however. [39]

Another aspect of the Federal Reserve's pricing of its services is that it may eventually be levied on Government agencies as a reimbursable service. If this eventually occurs, and if ACH use can be kept less costly than check-based payment, there will be considerable incentive for the Government to move quickly to ACH use.

The BGFO's long-term goal is to make the greatest use possible of electronic payment mechanisms. This goal is being achieved in the Direct Deposit Program. However, the predominant method for paying Government vendors is still by check [40]. This method of payment is never expected to disappear completely, hence the BGFO is preparing to replace the currently used punch-card type checks with a more cost-effective paper check [41]. This new paper check will be printed only, rather than both punched and printed. Still, the current vendor payment system, whether punch card or paper check, exhibits a number of problems. The following problems are considered key problems by the BGFO: [42]

- 1- Check payment systems are paper and labor intensive.
- 2- The current system requires the U.S. Postal Service to deliver the checks to the vendors.
- 3- There is no control over the settlement date because the vendor can cash the check at his discretion.

-4- The current check payment system includes other processes such as claims processing, check issue verification, and payment reconciliation that are also paper and labor intensive.

-5- Costs associated with check payment systems are expected to continue to rise, even after the change to paper checks.

2. ACH Benefits to the Government

The benefits to the Government in using the ACH network to make vendor payments include those general benefits identified earlier in this study of using the ACH. The BGFO has identified specific benefits, as it has done with problems of the check payment system, to be obtained from an ACH vendor payment system: [43]

-1- The cost of an ACH vendor payment is expected to be less than either a check or a payment made through FEDWIRE.

-2- Settlement dates can be accurately predicted, thus cash outflows from the Treasury's accounts in the Federal Reserve Banks can also be accurately predicted.

-3- Productivity improvements will be obtained from elimination of the paper and labor intensive processing inherent in a check payment system.

-4- Consistently-defined third party information will be available for vendors receiving Government payments.

III. CORPORATE TRADE PAYMENTS (CTP'S)

A Corporate Trade Payment (CTP) is an electronic payment transmitted through the automated clearing house system. It is similar to a direct deposit payment but, where direct deposit is between a paying corporation or agency and an individual, the CTP is between corporations. Additionally, the CTP is standardized such that both the payment data and invoice data can be transmitted between corporations.

A. THE BEGINNING OF CTP'S

In 1978, the 32 local automated clearing houses were integrated into a national network. The system worked well for consumer transactions like direct deposit, so in 1980 the 'National' Automated Clearing House Association began to conduct research into the potential use of the system for corporation-to-corporation payments. The NACHA believed that efficiencies and cost advantages that had been achieved by the ACH's over certain costs, such as rising paper handling costs and postage rates, would encourage corporations to shift from checks to EFT.

An EFT system capable of supporting a corporation-to-corporation payment was envisioned to perform the following basic functions:

- 1- accept an order to pay a commercial obligation along with all the necessary invoice information,
- 2- convert this payment and invoice information into a standardized electronic form,
- 3- transmit the converted data to a vendor's financial institution and, once there, allow it to flow easily into the vendor's account, and
- 4- do all of this without the use of paper documents.

The EFT system designed to perform these functions was the CTP.

In 1983, a pilot program implementing CTP's was conducted. With CTP's, corporations can both credit and debit their corporate customers; but during the pilot only credits were originated. A total of 45 corporations took part in the program, eight of which were originators of CTP credits. The remainder were receivers of the payments. The eight originating corporations were Associates of America; Equitable Life Assurance Society; Exxon; Mabsco Audio Visual Services; Northern Trust; Xerox; Sears, Roebuck and Company; and Westinghouse Electric Corporation. The results of the pilot program were considered to be a success by the NACHA and the participating corporations. [44]

The pilot program lasted for six months, during which time 300 transactions were made for a total dollar value of approximately \$14.5 million. A single CTP transaction can pay a number of invoices. The 300 CTP transactions made during the pilot program each paid and transmitted invoice

information for 1 to 130 invoices, with the average being 10. The overall effect, then, was to eliminate 3,000 paper checks.

Upon completion of the pilot program, seven more corporations were attracted to using CTP's for making EFT payments. These corporations were International Telephone and Telegraph Corporation; Sony (USA) Corporation; American Hospital Supply Corporation; Black & Decker Manufacturing Company; United McGill Corporation; Emery Air Freight Corporation; and California First Bank [45]. Pilot participants have remained in the program.

A slightly reserved opinion of the pilot program's success was presented as an editorial in a cash management journal:

For the most part, the participating companies settled payables transactions through the pilot. This was, of course, relatively simple to accomplish for the large firms involved and indicated their awareness that such transactions were rather costly and could be handled more efficiently through this medium. However, 300 transactions are hardly a significant number to warrant optimism for wholesale acceptance of the system. [46]

The point that 300 successful transactions are an insufficient number to guarantee corporate acceptance of CTP's is well taken. But the pilot program was primarily a test of CTP feasibility. Acceptance may increase if additional concrete examples of benefits gained from using

CTP's are presented. As the old saying goes, nothing breeds success like success.

The operational success of the pilot program was, however, generally agreed upon. The eight corporations that originated the CTP payments identified 40 to 50 cents savings in banking, postage and administration costs on each check converted [47]. Trans Data Corporation, a consulting firm, reported that, while the value of transactions was low, the pilot generated favorable interest among other financial institutions and potential users. But like the editorial, a reserved opinion was given concerning the volume of check payments that would be displaced by conversion to CTP's. The judgement was that no measurable displacement was likely over the next three years. [48]

B. THE FUTURE FOR CTP'S

Many cash managers, corporate treasurers and bankers consider EFT as the payment mechanism of the future. This is a reasonable consideration because technological advancements in computers have automated many corporate financial functions such as payroll, accounts receivable and payable, and check preparation. But the transfer of funds and payment data is still subject to the problems associated with physical delivery of the paper check. And that delivery must rely heavily upon the postal service. That EFT technology will soon change the slow, labor intensive,

expensive paper-check payment system is indeed reasonable. But even the NACHA has stated it will not be an instantaneous occurrence [49]. Significant use of the clearing house system by corporations is expected to be at least several years off [50].

The past president of the NACHA stated, "Though conversion to CTP's will progress over a number of years, we can confidently predict that our volume will have quadrupled by yearend (1984) [51]." Even then, volume would still be low [52]. In numerical terms, CTP's averaged fewer than 140 per month during January through June 1984, peaking at 180 in May [53]. By year's end, volume will probably not average more than 200 per month. And two officers of the largest corporations using CTP's have also stated that full-scale use of the process will take time. The Director of Cash Administration at Westinghouse predicted that his corporation would need five years to implement the CTP process fully so that 65 to 70 percent of Westinghouse's transactions would be made by EFT [54]. The Assistant Treasurer for Sears, Roebuck and Company has stated that he expects a dual system with both checks and EFT to evolve. "An instant shift to this way of payment (CTP) will not occur," he reported [55].

A dual system of checks and EFT is highly likely. In instances where EFT and ACH services have been offered as

cash management services, they have been offered as "add-on" instead of replacement to the paper-based mechanisms that already exist [56]. Operating procedures and service features are still conceived in paper terms instead of electronically. The result is that a transition stage exists, with two payment mechanisms. Unfortunately, this stage is bearing the cost of each mechanism but taking only limited advantage of the capabilities of the superior system. It would, however, be unrealistic to believe that even a quick, much less instant, shift to CTP's could occur, since corporations are so accustomed to check payment systems.

It is realistic to believe that use of CTP's will continue to increase. The electronic transfer of funds has grown considerably at the consumer level, as evidenced by direct deposit. Intra-company transfer of funds by electronic means has been commonplace since the 1950's and is still the primary means of funds transfer within companies. Now, with CTP's, inter-company funds transfer by electronic means through the ACH network is possible. Research conducted by the Trans Data Corporation has shown that, from a list of over 20 cash management services offered by banks, ACH funds transfer services are rated as highest in potential demand growth by almost all banks and by almost a 2-to-1 ratio over the second highest rated

service, lockbox [57]. Corporations may move cautiously into this payment mechanism, but they will undoubtedly move. Slow acceptance possibly indicates satisfaction with, or at least a tolerance for, the current check payment mechanism. But the Federal Reserve continues to price fully its once free services. And banks are beginning to charge fees equal to their full costs. So as all of these costs are passed on to the corporate customer, the check payment mechanism will become increasingly more expensive. There will be increasing positive economic incentives for using an ACH payment mechanism like CTP's.

The benefits to be gained from using CTP's depend upon converting a large percentage of payments now made by check to EFT. Net positive benefits will probably not occur until significant check volume is converted. On a per item basis, CTP's variable costs are less costly than paper checks' and could provide a benefit for any number of transactions as the cost of processing paper documents continues to rise. But the greatest savings will occur in high volume situations. And with high volume there will be greater opportunity to recover the investment costs of computer software changes and any other necessary start-up costs required before CTP's can be used.

To encourage favorable response to EFT systems such as CTP's, the institutions concerned will have to launch

major promotional efforts [58]. Similar efforts were necessary in establishing direct deposit as a successful consumer payment mechanism. But the vice president (treasurer's sector) of the Equitable Life Assurance Society of America stated, "there is a lack of selling going on in electronic.payments [59]." The Equitable Life Assurance Society is a major user of EFT services, having made 6.1 million electronic transactions in 1983, and is also a user of CTP's. A greater selling, or marketing, effort may be needed to increase CTP's use.

C. USING CTP'S IN THE GOVERNMENT

Government agencies could use CTP's for making vendor payments through the ACH network. This would be one more step towards making EFT the predominant payment mechanism for the Government. Because the CTP is an existing and tested ACH transaction mechanism, even though not yet widely used, quick advantage could be taken of its benefits if it is capable of satisfying the Government's requirements for information transfer capacity. There may even be benefits in using this payment mechanism while volume is small; the inevitable problems of implementation would be much easier to solve while the using population is limited.

1. CTP's Ability to Meet the Government's Requirements

A BGFO study has determined that CTP's could potentially be used by the Government for making vendor

payments [60]. The major qualifying factor is its format for electronic payment data transmission. That format contains the necessary data fields to carry comprehensive information to vendors regarding the purpose of the payments they receive from the Government. Because the CTP was designed specifically for inter-company ACH payments, its format is standardized to accept comprehensive payment data and other information from various industry groups. This is significant because various industry groups often have different standards and requirements for paper payment documents. To overcome the need to support a number of potentially incompatible electronic interchange standards, the CTP was designed to enable all those groups to use its single standard for interchanging data.

The CTP format can also transmit multiple invoice payment data using a single payment transaction. This capability is important to agencies who make many small payments to individual vendors. Up to 4,990 individual invoice payments to a single vendor can be consolidated into one CTP transaction [61].

Pause should be taken here because checks can also pay multiple invoices. During the CTP pilot program, published statistics mentioned earlier stated that 300 CTP transactions eliminated 3,000 checks because of the multiple invoice paying capability. In a similar, although

hypothetical situation, 300 checks might have been paying 10 invoices each. If those checks were converted to CTP's, 300 electronic transactions would then replace the 300 checks. This point is significant when analyzing the volume of checks that might be displaced by CTP's. In a Navy example, payment data collected at Navy Supply Center, Oakland, California, showed multiple checks being prepared and sent on any given day to individual vendors, with many of those checks paying multiple invoices. In this situation, check conversion to CTP could eliminate some multiple of checks greater than one.

The BGFO's report states not only that the CTP could be used by the Government for vendor payments but also that its format best meets the Government's requirements at this time [62]. Because of this, there would not appear to be a requirement to develop a new format for Government vendor payments. The report specifically states that the benefits that could be gained from a new format would not outweigh the problems involved in designing that format and writing the processing software [63].

2. CTP's Problems

The biggest problem facing the use of CTP's for vendor payments by the Government is the number of receiving depository financial institutions (RDFI's), or vendors' banks, that can receive CTP's via automated media. To

review, the RDFI is a commercial bank, mutual savings bank, savings and loan association, or credit union which captures ACH transactions for the receiver of a payment, the vendor. There is no problem at the ACH processing facilities, but the Federal Reserve's ACH policy is to provide payment data to the RDFIs in only one form of output medium. And the Federal Reserve operates 31 of the 32 ACH networks. This medium can be magnetic tape, diskette, automated telecommunication, or paper printout; but, again, only one may be selected. This means that RDFI's that are currently receiving EFT transactions through the ACH by automated media must receive CTP's the same way. But if they do not possess the necessary software to handle the automated CTP's, then their only alternative is to change to a paper listing for all transactions. Receiving ACH transactions by paper listing is labor intensive and counter-productive to the general concept of EFT, so there is a strong hesitancy to change to that medium. Hence, there is a strong hesitancy to process CTP's if the necessary software is lacking.

To explain this problem further, part of the linkage between individual financial institutions that makes EFT possible is the software that permits computer-to-computer information exchange. Within the back offices of most banks today there are 10-20 year old large mainframe

batch oriented computer systems [64]. The institutions' software must instruct these systems in handling electronic transactions. Because of the computers' ages and the existing software, there is still much manual labor involved in these systems. As the volume of EFT transactions increases, the number of transfers requiring exception processing or manual handling increases. This type of processing is, as stated earlier, labor intensive, time consuming, and costly.

These problems occur not only because the volume of EFT is increasing, but also because the existing software that links the computers does not share a common "language" for all types of transactions. This is one of the problems that affects CTP's. Because of their newness, CTP's are information that cannot be accommodated by some financial institutions' software. The electronic link that connects the computers is there, but the computers can not talk the CTP language over it to each other. Banks in this situation, then, have to translate the CTP information into different sets of terms from those that travel via automated media if they want to process CTP's. Paper listing is the major alternative. And here is the rub.

If a bank wants a paper listing of CTP's from the Federal Reserve's ACH, it must accept all other ACH transfers in the same media--paper. This situation could

lead to awkward and costly operating conditions for banks. It could also result in increased exception processing, delays, and possible losses. The realistic effect of this is that acceptance of the CTP mechanism may have to wait for updated or new banking software.

RDFIs can obtain software that will enable them to receive CTP's by an automated media. This software enables their computers to "straight-through" process CTP's with no human intervention required [65]. In many cases, it is available as an update to existing software provided by the major software suppliers who produce banking application programs. In some instances, there would be no charge, but several RDFI's have estimated the cost of the software changes to be in the range of \$10,000 to \$25,000, if it could not be obtained free of charge. These costs may not be accepted by some as justified on the basis of the current volume of CTP transactions.

Data indicate that EFT systems are characterized by large economies of scale [66]. For example, the average cost per transaction declines continually over very large ranges of output. The largest benefit, then, is realized when the level of output is extremely high. CTP's may have incremental costs that are less than those of checks. And CTP's may be significantly more cost efficient than checks when used in economies of scale. But because of the

potentially high start-up fixed costs for CTP software and the low level of CTP usage (not at an economy of scale level), the cost of implementing CTP capability may not be warranted. Benefits can not be achieved under these circumstances. For those corporations that participated in the pilot program, some reprogramming of their own internal software was required. During the time of that program, no commercial software programs to originate CTP's were available. The start-up costs for those companies ranged from \$2,000 to \$100,000 [67]. Companies may apply the same economic efficiency test to using CTP's that the RDFI's are. Without the potential for a high level of use, CTP's may be incapable of yielding net cash benefits.

The environment in which CTP transactions can take place, then, is limited to the relatively few RDFI's that can receive them by automated media. How large is the current environment? The NACHA estimates that approximately 100 RDFIs have the necessary software. Of these 100, only 50 are actively receiving CTP transactions by automated media. This would at first appear to be a severe restriction on the use of CTP's for vendor payments, because only a small percentage of vendors could be expected to hold accounts at one of the 100 banks capable of automated receipt.

The CTP environment may not be as bleak as it has just been painted. The CTP is a very new payment mechanism. The NACHA expects that, as more private sector companies begin to use them (or to approach their banks about their use), the RDFI's will obtain the software necessary to process automated CTP transactions. This would be a consequence of the sharp competition in the cash management services market described earlier. EFT systems can be expensive and some institutions may resist assuming the costs of participating. There are, however, some competitive financial institutions betting that such services will have an impact on market share, and that those institutions that wait too long may be left out in the cold [68]. Banks that desire to satisfy their customer's demands or hope to gain customers will actively seek to employ the necessary software.

Another aspect of the environment is seen by considering under what circumstances CTP's will provide the maximum benefits. As stated in the section concerning the future of CTP's, the greatest savings in lieu of the use of paper checks will occur in high volume situations. A high volume situation could be expected to occur where the vendor was both very large and a regular customer who received many individual payments. And very large vendors; such as Sears, Roebuck and Company; Westinghouse Electric; and Exxon (who

all are already CTP users) tend to use the largest of the commercial banks. An analysis of commercial banks by Trans Data Corporation determined that over 80 percent of the largest banks (based upon net assets) can currently offer full CTP services. By 1985, the percentage is expected to increase to over 90 percent [69]. The inference, then, is that probably there are some high volume situations that could currently be exploited by the using CTP's. Use of CTP transactions is likely to increase as more banks, large and small, gain the processing capability; but there appears to be no hard impediment to using them now in such beneficial situations as making multiple payments to large vendors.

If the Government adopts the CTP, private sector use of it may increase also. This is what occurred with direct deposit. Extensive use of this form of EFT by the Government for making Social Security payments soon led to ACH consumer payment acceptance by the private sector. The BGFO report states that representatives of NACHA, RDFI's, the vendor community, ACH processing facilities, and other Federal agencies believe that this could occur with CTP use also [70]. And as the CTP capable environment grows, so also will the potential net benefits of CTP use. In essence, the Government's use of these payment mechanisms creates a de facto standard of acceptability and stability.

It helps to strip away what might be considered just faddism and establishes legitimacy for the CTP payment mechanism. This may be what is required to prompt wider use of state-of-the-art technology that may be unfamiliar to some private companies. The Treasury initiated a CTP pilot program in 1984 with a limited number of vendors participating [71]. Results of that pilot program were not available to this analysis.

And finally, the CTP has been described as overdesigned and complex [72]. So few companies and banks are able to process its data format that even its acceptance and use by the Government may not increase its popularity. Because of this possible format problem, CTP's may not become an acceptable economic alternative to check payments for companies and banks. Large scale acceptance of CTP's may not depend so much upon its use by the Government or marketing efforts as it does upon a data format more compatible with the private sector.

IV. METHODOLOGY

The question this thesis research attempts to answer is whether there is a potential use for Corporate Trade Payments by the Navy. If there were, then this commercially available EFT payment mechanism that is operationally successful in the private sector and that uses current technology could be used Navy wide to support a more effective and efficient vendor payment system. The analysis used in formulating an answer to whether this should be done is divided into two steps, one quantitative and the other qualitative. The first step, the quantitative one, is comparing the costs of check use and CTP use to determine if it is cost beneficial to make payments by this medium. The second step, the qualitative one, is analyzing information about CTP's provided by companies now using them. This step is described in Chapter VI.

One major obstacle to potential use of CTP's was overcome when a study commissioned by the Bureau of Government Financial Operations determined the CTP format for data transmission was the best currently available for the Government's use [73]. This was a major, and probably most significant, obstacle to CTP use overcome. The report was published on 10 October 1984, several months after this thesis research was started. Originally, this thesis

research was to have included a similar analysis of data formats. Because of the more rigorous research conducted in the BGFO study, however, the premise that the CTP format best meets the Government's needs was accepted. Further analysis was not conducted here.

A. COMPARATIVE COSTING

The first step in the analysis of potential CTP use is comparing the cost of the Navy's check payment method with a CTP method. The check payment method is paper-based and labor intensive, and operating costs to maintain it are increasing. The critical question is whether these costs are more than those of implementing and operating the CTP alternative. If electronic payment by CTP costs less than a comparable payment made by check, as evidenced by actual cost data obtained from research, then net cash benefits could result from using CTP's.

A major assumption in comparing costs is that there will not be 100 percent conversion to EFT from the check payment method. This assumption is founded upon the current volume of commercial CTP use, the opinions regarding CTP's expressed by people knowledgeable about ACH transactions, and an analysis of the Navy's vendor environment. This assumption means the Navy will probably have to maintain simultaneously both a punch card (or paper) check system and

an EFT system if CTP's are adopted. The costs of both systems, then, will be borne by the Navy at the same time.

The cost analysis will focus on the relevant costs of implementing and using CTP's. These relevant costs are those expected future costs of the combined check and CTP system that will differ from the costs of the check system alone. The historical costs of the check system are used in predicting some of these relevant costs. But the historical costs themselves are not relevant to the analysis.

The comparative cost analysis first determines the variable costs per transaction for both checks and CTP's. This is the starting point for determining the relevant costs. Variable costs have a predictable relationship with volume. This relationship is such that total variable costs will vary in direct proportion with the volume of transactions. Therefore, any difference between variable costs for checks and CTP's will have a similar relationship with payment volume. This variable cost difference between payment methods is a relevant cost. The variable cost of a check is not relevant in itself, because it is the same under either alternative. The variable cost of a CTP is relevant only inasmuch as it differs from the variable cost of the check(s) it replaces.

Fixed costs are then brought into the analysis. The addition of the EFT system will convert some number of check

payments to CTP's, but the fixed costs of the check payment mechanism will not be affected to any extent. They are thus irrelevant. But there will be additional out-of-pocket fixed costs attributable to the EFT system. For a CTP payment system, these additional fixed costs would essentially be the Navy's one-time start-up costs, or investment costs, to modify its vendor payment and accounting software. These costs would be relevant. There would be no new equipment purchased or additional manpower requirements. Neither would there be any disposal of old equipment. Therefore, there would be no other relevant investment costs.

Some recurring fixed costs that are relevant to the analysis might be expected. Such costs, over time, might be found to be partially variable but, at this early stage of CTP analysis, are arbitrarily predicted to be fixed only. They include CTP-peculiar administrative, training, telephone, legal and printing expenses. No rational basis for estimating a dollar cost for them has been attempted. Their affect would be to reduce the annual savings. Because no cost has been estimated, no reduction in savings will be made. What these costs, and any other unknown costs, could amount to so that a Navy decision maker would be indifferent to using CTP's will be addressed in Chapter V.

Economy of scale must be achieved with CTP's in order for there to be a net cash benefit from their use. By definition, an economy of scale refers to the fact that the average costs of an activity tend to decline with increases in output volume. The reason for the declining average costs is that the average fixed costs, or the costs that must be incurred regardless of the volume of the output, will decrease as volume is increased. The Navy's one-time start-up costs for CTP's will have to be offset by some savings in order for there to be a net cash benefit.

Two factors will affect how the investment costs can be recouped. One factor is the difference between incremental variable costs of checks and CTP's. The other is the ratio of conversion from checks to CTP's: If a CTP transaction is less expensive than a check is, then the needed savings can be generated by some volume of checks being converted to CTP's. If the ratio of conversion is one-to-one, each conversion will contribute a cash benefit equal to the difference in the incremental variable costs. But the net cash benefit is dependent not only upon the incremental cost differences but upon the ratio of conversion. If that ratio were greater than one-to-one, then the first of however many checks converted would contribute an amount equal to the difference in the incremental costs. Each successive check converted to that same CTP would then

contribute an amount equal to the full incremental cost of a check. A CTP could conceivably be more expensive, or have a greater incremental variable cost, than a single check. If the conversion ratio of check to CTP is greater than one-to-one, however, a net cash benefit could still result.

B. THE COST-BENEFIT MODEL

A cost-benefit model was constructed to support a decision analysis. The model focused on the relevant costs of the Navy's check payment method and a CTP method. The focus on relevant costs produced a model that primarily predicted the economic efficiency of potential CTP use by the Navy. In other words, the model was intended to be a reliable guide for the Navy in determining whether CTP's are less expensive than check payments. The model does not consider nonfinancial implications of using CTP's.

Relevant costs are the basis of the model. There are, however, factors discussed in connection with the model for which no relevant costs were identified. The reason for including them is that originally it was not known which factors would generate relevant costs and which would not. Presenting more factors than a "bare bones" model would require helps show how the essential relationship between costs was eventually arrived at and what factors were considered in determining it.

To operate the model, vendor payment data were collected at the Navy Supply Center (NSC), Oakland, California. NSC, Oakland, serves as a Navy payment center located in the 12th Naval District, but it pays vendors across the nation. Using data collected there was considered both labor saving and economical. The predictions of the model could be applicable Navy wide and not just at NSC, Oakland, if it may be assumed that NSC, Oakland, does not differ significantly from other Navy payment centers.

C. PREDICTION

The purpose of the model was to predict whether it is cost beneficial for the Navy to pay some vendors by CTP's. The ultimate prediction is based upon inferences from vendor environment information and forecasts made on the basis of facts concerning costs. Absolutely accurate measurements of every effect were not possible, but that fact should not detract from the model's ability to provide useful information to Navy decision makers. It would be inefficient and unrealistic to refine all the measurements, in view of much of the uncertainty that still surrounds the inchoate CTP.

1. Incremental Cost Differences

The model first predicted the difference between incremental variable costs for checks and CTP's.

Let D = this difference.

$$D = \text{incremental cost of check} - \text{incremental cost of CTP}$$

It is possible, as stated earlier, to achieve a net cash benefit from using CTP's whether D is positive or negative, depending upon the ratio of conversion from checks to CTP's. To explain the methodology of analysis from a basic starting point, D will be considered positive (as was in actuality later determined by data analysis).

2. Conversion of Checks to CTP's

The absolute amount of the net cash benefit is dependent upon the percentage of checks that can be converted to CTP's. Assuming, for now, that the ratio of check to CTP conversion is one-to-one, let B = the percentage of the total number of checks issued per year that could be converted to CTP's. Let T = the total number of checks issued per year.

$$B = \# \text{ of checks that can be converted to CTP's} / T$$

B is dependent upon the CTP processing capabilities of the vendor environment and the number of checks issued annually at NSC, Oakland.

3. Net Cash Benefit

From this basic starting point, the model could now predict the annual incremental cash savings from

converting to CTP's B percent of the checks issued annually. Let S = the annual savings. Then

$$S = (T) (B) (D) .$$

The net cash benefit is obtained by comparing the annual savings with the investment costs of implementing CTP's.

It could be expected that all the savings and costs from implementing CTP's would not accrue immediately, but over time. Expecting this, the model had to compare effects occurring immediately, such as the investment costs, with those occurring some time in the future, such as possible savings. Since a dollar in the present is worth more than a dollar in the future, the future effects had to be translated into present value equivalents. The model discounted future effects to their present values so there could be a ready and justifiable comparison.

The model's discounting procedure is straightforward. Let I = the investment costs and NCB = the net cash benefit. Therefore, the net cash benefit for the first year will be equal to

$$NCB = \left[\frac{S}{(1 + i)} \right] - I ,$$

where i = the standard Navy-directed 10 percent discount rate.⁷⁴/ This net cash benefit is in real terms: that is

to say, it is calculated by using costs existing in the initial year. The directed discount rate is considered representative of private sector investment opportunities foregone. That rate, because it is standardized, does not vary with inflation as do money interest rates. Although the discount rate will not vary in proportion to inflation, there will not be any adverse effects on the model's predictions because of that.

The model's criterion for accepting or rejecting CTP use is based upon the net cash benefit, the difference between the present value of the savings and the present value of the investment costs. The decision rule is to accept CTP use as cost beneficial if the the net cash benefit is greater than zero, or to reject CTP use as cost beneficial if the net cash benefit is less than zero. The rule may be stated as follows:

DECISION RULE

Accept if $NCB > 0$;

Reject if $NCB < 0$.

If the investment costs are totally recouped the first year, a positive net cash benefit would result. From analysis by the basic model, then, the decision rule would accept CTP use as cost beneficial to the Navy. The net cash benefit will be negative after the first year of using CTP's

if the amount of discounted savings are not greater than the investment costs. CTP's may still prove cost beneficial in this situation. Investment cost recovery just will take longer. Using the model to find how long it will take is done by setting the discounted savings cash flow equal to the investment costs and solving for the number of years necessary to establish the equality. Thus

$$\sum_{n=1}^N \frac{S}{(1+i)^n} = I ,$$

where n = the number of years. The decision rule remains unchanged.

All models operate at some level of uncertainty when predicting some future results. The level of uncertainty often depends upon the assumptions the models make. A major assumption made in the basic model above was that the annual savings remain constant. In making this assumption, another must be made that the number of checks converted annually to CTP's does not change. The basic model assumes that 100 percent conversion of payments from checks to CTP's is possible in order to determine an absolute value for the potential annual savings. Recognizing that 100 percent conversion is considered impossible in the short-run, a more realistic model is then used to predict annual savings with a check-to-CTP conversion factor of something

other than 100 percent. The conversion factor used in the realistic model is speculated from an analysis of a sample of Navy vendors and payments made to them.

The use of the word "uncertainty" in describing the prediction ability of the models should not convey a negative image or one of undue risk. It just means that the models have no information about the probability of an outcome, or of a predicted result. Uncertainty is an inherent aspect of evaluating new projects. Decisions still have to be made with the best information available. Both the basic model and the realistic model focus on economic efficiency as the basis for their decision rules. Economic efficiency is not the only thing of importance to Navy decision makers considering using CTP's, but it is important. And it does provide a good starting point for comparing trade-offs in other areas.

In this research, the decision rule for determining whether CTP use is cost beneficial was applied to the criteria of both the basic and the realistic models. The reason for both predictions and decision analyses was to provide consideration of both an ideal and a more realistic CTP scenario. If both analyses reveal that the net cash benefits from using CTP's are relatively insensitive to changes in the predicted annual savings, the matter essentially ends there. However, if the models are

sensitive to the treatment of annual savings so that the decision rule decides one way for the basic model and the opposite way for the realistic, more caution should be used in judging the results. Other criteria may then have to be evaluated concerning the potential of using CTP's in the Navy. These other criteria could include a policy decision to adopt some cut-off (or pay-back) period. The use of CTP's might be considered only if they were capable of generating (discounted) cash benefits prior to the cut-off sufficient to more than cover (discounted) investment costs. Providing both basic and more realistic estimates of the net cash benefits gives Navy decision makers a basis for making their own judgements about the rationality of the predicted results..

V. ACCUMULATION AND ANALYSIS OF DATA

A. INCREMENTAL CHECK COSTS

Predicting the incremental cost differences between a check and a CTP first requires that the incremental costs of each be known. The outline listing below shows the cost factors that were considered in determining the incremental variable costs for a check.

-1- Internal Costs

Creating a Check and Mailing It

Check Stock Cost

Envelope Cost

Labor (Handling) Cost

Postage Cost

Administrative and Overhead Cost

Check Storage and Retrieval

-2- External Costs

Bank Fees

-3- Other Costs

Loss of Disbursement Float

For some of the factors shown there were no relevant costs identified. How the costs were calculated and their amounts are explained in the following paragraphs.

1. Internal Costs

The internal costs are the incremental variable costs generated within the Navy when a check is issued for payment to a vendor. Two major areas of potentially relevant costs were considered -- creating and mailing the check and storing and retrieving it.

a. Creating a Check and Mailing It

(1) Check Stock Cost. NSC, Oakland, uses standard punch-card Treasury checks for vendor payments. The cost per check is \$.02062, based upon the average cost of check stock purchased in late 1984.

(2) Envelopes Cost. Vendor checks at NSC, Oakland, are mailed in franked, windowed envelopes sized 3 1/2 inches X 8 inches and costing \$.0011 per check. A larger sized envelope that is more expensive than the one costed is used when several invoices must be included with the check. Its cost is not factored into the calculation because it is not frequently used and the proportion of its use compared to the smaller envelope is unknown.

(3) Labor (Handling) Cost. There are several steps at which the checks must be physically handled during the payment process. It is after they are printed by the computer that handling then becomes a relevant cost. First, they must have an authorizing signature marked on them after they have been printed by the computer. At NSC,

Oakland, this is done by a Cummins Tallyprinter. The Tallyprinter can mark signatures on 1,000 checks per minute. The average number of checks issued per day (based upon a 22 working day month) is 2,104 checks. The Tallyprinter must be tended by an operator while it is running, so labor time is equal to

$$(2,104 \text{ checks}) (1 \text{ minute}/1,000 \text{ checks}) = 2.1 \text{ minutes.}$$

Second, the checks must be inserted into envelopes. This is done by a Pitney Bowes Insertamax II at the rate of 125 checks per minute. The operator's labor time is equal to

$$(2,104 \text{ checks}) (1 \text{ minute}/125 \text{ checks}) = 16.8 \text{ minutes.}$$

Third, the envelopes are sealed on a Pitney Bowes sealing machine at the rate of 1,000 envelopes per minute. Operator labor time is equal to

$$(2,104 \text{ envelopes}) (1 \text{ minute}/1,000 \text{ envelopes}) = 2.1 \text{ minutes.}$$

The three machines used in these procedures are owned by NSC, Oakland. No costs attributable to them are considered relevant because they are sunk costs. Operator labor time is relevant. The machines are operated by a GS-5 Federal employee and his labor is relevant because

it is an opportunity cost. The incremental handling cost for a check is therefore equal to

$$\begin{aligned} & (2.1 \text{ min} + 16.8 \text{ min} + 2.1 \text{ min}) \text{ (GS-5 pay rate)} \\ & / 2,104 \text{ checks} \\ & = (21 \text{ min}) (\$7.33/\text{hour}) / 2,104 \text{ checks} \\ & = \$.00122/\text{check} \end{aligned}$$

The three of the machines were prone to malfunction while operating. The inserting machine failed more often than the others and clearing the jams was time consuming for the operator. No data were collected on the rates of failure or length of down times; so, the total labor time used in labor cost calculations assumes perfect machine operation.

(4) Postage Cost. Checks are mailed to the vendors. The rate of \$.1914 per check includes the average discount received for the volume mailed.

(5) Administrative and Overhead Cost. Administrative and overhead costs are not relevant in this analysis because they will not differ between the alternatives.

b. Check Storage and Retrieval

Storing and retrieving checks is not a relevant cost. This is because there are no checks being

stored and retrieved by the Navy. This fact needs mentioning because it could become relevant in the future.

Whether check storage and retrieval costs become relevant depends upon policy changes. When the Navy pays a vendor by Treasury check, the check is consolidated with other Treasury checks and forwarded by the vendor's bank to a Federal Reserve Bank. In this manner, Treasury checks can be cleared for quick use of funds. The Federal Reserve Bank truncates the clearing process by microfilming the checks and preparing transaction listings, both of which are then sent to the Check Claims Group at the Treasury. The Check Claims Group maintains the microfilm records for six months, after which time the records are transferred to the Treasury's Federal Records Center. The records are kept there for an additional six years and seven months. There is substantial cost in this record keeping procedure. There is, too, a Treasury study underway which is looking into placing the check-record keeping requirements on the individual check-writing agencies -- in this particular case, the Navy. The potentially relevant cost of maintaining the Navy's check records and the likelihood of a policy change requiring the Navy to maintain its own records is beyond the scope of this research.

2. External Costs

External costs are expenses attributable to checks but generated outside of the Navy. The only external expense considered in this research was bank fees. There were no relevant costs identified in this area.

The Federal Reserve System is the Government's bank. The Treasury accounts upon which Navy vendor-payment checks are drawn are held there. In conventional banking, check writers pay a clearing fee whenever they write a check on their account. When the Navy issues a check drawn on a Treasury account, there is no clearing fee charged to the Navy or the Treasury. The Federal Reserve is required by the Monetary Control Act of 1980 to price its check clearing services in such a manner that fee revenues will cover all costs of the clearing service. A Treasury official explained that the Federal Reserve should charge the Treasury for clearing its checks as a reimbursable expense, but that it is not being done. If it were, the Treasury would pass the cost along to the Navy. A Federal Reserve official agreed with that statement. He added that charges are mandatory for financial institutions clearing checks through the Federal Reserve System but that the Navy and the Treasury were not considered in the same category as member banks and other institutions. He foresaw no change in this policy in the immediate future.

3. Other Costs

Disbursement float represented neither relevant costs nor benefits for the Navy, although disbursement float does normally result in financial benefits for private companies as well as for the Department of the Treasury. This situation needs explaining.

Payment by check allows private companies to earn interest on funds that have not yet cleared the bank and been credited to payees' accounts. It is a different situation for the Navy, though. The Navy neither earns interest on funds in the Treasury accounts nor does it experience any float from an accounting standpoint. When the Navy issues a check, its obligational authority is simultaneously decreased by a like amount. There is no extra use of funds for the Navy while it waits for checks to clear. The check sent to the vendor may take some time to clear, but no interest is earned for the Navy on those funds while they wait in the Federal Reserve Bank. Disregarding the Treasury's possible concerns at this time and considering only Navy concerns, there are no tangible relevant costs or cash benefits.

4. Total Incremental Check Costs

The incremental variable cost of a check is \$.21434 calculated by summing the identified relevant

costs. These costs are all internal costs and pertain to creating the check and mailing it to the vendor.

Incremental variable cost of a check =

Check stock cost (\$.02062)

+ Envelopes cost (\$.0011)

+ Labor (Handling) cost (\$.00122)

+ Postage cost (\$.1914)

Incremental variable cost of a check = \$.21434

B. INCREMENTAL CTP COSTS

The incremental variable cost for a check has been estimated. To perform the cost comparison, the incremental variable cost of a CTP must be estimated, too. The outline listing below shows the cost factors that were considered in determining that value.

-1- Internal Costs

Authorization Agreement Cost

Input Preparation Cost

Prenotification Creation Cost

CTP Creation Cost

Tape Cost

-2- External Costs

Bank Fees

How the costs were calculated and their amounts are explained in the following paragraphs.

1. Internal Costs

a. Authorization Agreement Cost

The Navy's decision to pay vendors by CTP's will not be a unilateral one. Vendors must agree to be paid by that method. The NACHA CTP Notebook suggests legal contracts between originators and receivers of CTP's be established to define the agreement [75]. If this advice were followed, the Navy would need to develop a "form contract" to bind itself and its vendors in a CTP agreement. There would be a development expense for that included in the start-up cost. Once developed and written into a basic form, there would be no further significant cost. However, the question has been raised by consultants whether contracts of that type are required at all [76]. Financial institutions have specific responsibilities in their own contracts with their customers and their local ACH associations. A Navy originated CTP would be handled by those institutions according to those established contracts. All that may be required, then, between the Navy and a vendor is a simple agreement that the Navy will pay by CTP and the vendor will accept it. The costs associated with formal contracting could be eliminated. Thus, there would be no significant incremental costs.

b. Input Preparation Cost

The organization of Navy payment centers is not standardized. But the centers are similar in respect to the process flow and procedures employed in paying bills. Whether a bill will eventually be paid by check or CTP, preparing the input basically involves assembling the necessary documents and preparing a payment voucher. These data are entered into the automated payment system with a check or CTP the resultant output. Thus, there are no relevant costs because the expense does not vary between alternatives.

c. Prenotification Creation Cost

The prenotification is a zero dollar entry that must be sent through the ACH at least ten days prior to a live CTP that would affect an account at a receiving institution. Its purpose is to allow the receiving institution to validate the information and insure that the CTP that follows will be postable. Creating the prenotification will be a function of the CTP software used by the payment center. There are no relevant costs in creating the prenotification because it would be a standard computer output. And computer time is treated as a sunk cost in this analysis.

d. CTP Creation Cost

Creating the CTP involves the same lack of incremental expense as creating the prenotification--here is no relevant cost. The CTP is an electronic data string of vendor payment information. It is output from the payment center's computer and can be recorded on magnetic tape for delivery to a Federal Reserve Bank or sent there directly by data link.

e. Tape Cost

The prenotifications and the CTP's must be sent from the Navy payment centers to a Federal Reserve bank to be entered into the ACH network. These data may be sent by magnetic tape or electronic data link. Both of these capabilities exist at NSC, Oakland. The more expensive method of delivery is by tape and is considered here. NSC, Oakland, already has daily courier runs to the Federal Reserve Bank in San Francisco. Giving extra tapes to the courier to deliver entails no additional costs for the run. Tapes from the NSC are held at the Federal Reserve Bank for three days and then returned and may be reused. Magnetic tapes are stock in trade for computer using organizations and no measurably significant increase in tape usage would be expected if CTP's are employed at NSC, Oakland. There are, therefore, no relevant costs.

2. External Costs

Bank fees for handling Navy CTP's were the major external cost factor considered potentially relevant. The situation is similar to that of bank fees for Navy originated checks. The Federal Reserve does not charge the Treasury or any Government agency, such as the Navy, for making electronic fund transfers through the Federal Reserve's ACH network. This situation is not expected to change in the immediate future and was confirmed at both the Pricing Operations Section and the ACH Section at the San Francisco Federal Reserve Bank. Thus, there are no relevant costs.

3. Total Incremental CTP Costs

Simply stated, there were no relevant incremental variable costs identified by this research for the use of CTP's by the Navy.

C. INCREMENTAL COST DIFFERENCE

The incremental cost difference, D, between a check and a CTP is \$.21434. Because there were no relevant variable costs identified for a CTP, the difference is equal to the full incremental variable cost of a check.

$D = \text{incremental cost of a check} - \text{incremental cost of a CTP}$

$$D = \$.21434 - 0$$

$$D = \$.21434$$

That D is positive means a net cash benefit can be obtained from converting checks to CTP's if the volume of conversion generates sufficient savings to recoup the investment costs.

D. CHECK-TO-CTP CONVERSION

The extent to which annual savings can be generated is dependent upon the number of checks converted to CTP's. Before an estimate of the number of checks the Navy could expect to convert is made, two points concerning CTP use should be reviewed. First, how widespread the use of CTP's becomes depends primarily--and this is the precondition--on the number of banks that can process the CTP format "straight through." Second, once the precondition is met, how widespread CTP use becomes depends upon the willingness of vendors to accept the new means of payment. This second point will ultimately determine the growth of CTP's. Both points must be considered in estimating the potential number of check-to-CTP conversions in the Navy. Vendor acceptance will be addressed further in Chapter VI.

1. Vendor Payments

The estimate of check-to-CTP conversion is based upon a sample of vendor payment data. A single day's sample of vendor payments was randomly selected to represent the population of vendor payments during a year. It was not

possible to draw efficiently a random sample of all-payments made to individual vendors from an entire year's payments population. There was no evidence to suggest that any particular payment day was any different from the rest, so it was speculated that one day's payments did represent the whole population. From this one day sample of 2,705 payments, a random sample of payments to 143 vendors was picked. This sample represented approximately 15 percent of the total number of vendors issued checks during that day. Appendix A lists this vendor payment sample.

An analysis of the sample data reveals that, on average, each vendor received 2.95 checks for an average amount of \$1,252. Each check paid an average of 1.66 invoices. A CTP can pay up to 4,990 invoices to one vendor for a total dollar amount of \$99,999,999.99. The average number of invoices paid and dollar amount of the sample were well within this limit of capability. So, too, were the sample's largest elements, a dollar amount of \$105,726.00 and 88 invoices, each received by individual vendors.

E. ABSOLUTE LIMIT ON ANNUAL SAVINGS

An absolute limit on annual savings can be predicted by the basic model. That model assumes every vendor is able to receive CTP's and is willing to do so. The annual savings (S) are calculated by multiplying the total number of checks issued per year (T) by the check-to-CTP conversion factor

(B) and by the incremental cost difference between a check and a CTP (D). Thus

$$S = (T) (B) (D)$$

$$S = (555,456 \text{ checks}) (100\%) ($.21434/\text{check})$$

$$S = \$119,056.$$

This amount is the absolute, or high limit, value of annual savings estimated by this analysis of using CTP's at NSC, Oakland.

F. THE ABSOLUTE NET CASH BENEFIT

Estimating the net cash benefit from using CTP's requires comparing the discounted annual savings to the initial investment costs. Determining what the investment costs would be was somewhat arbitrary. In Chapter III it was stated that start-up costs for the private companies using CTP's varied from \$2,000 to \$100,000. Considering the Navy's size and its level of vendor payment automation, \$100,000 is not an unrealistic amount to estimate as the fixed investment cost. In this analysis, the entire investment cost is hypothetically recovered at a single location, specifically, NSC, Oakland. The CTP program is treated as a pilot program being tested and evaluated in a single organization. If it were deemed successful, it could be passed on to other vendor-paying organizations for

virtually no cost. Were the pilot program tested at more locations than just NSC, Oakland, the investment cost would be divided up among the different organizations based upon the proportion of the total vendor payments each made.

The basic model's net cash benefit after the first year of using CTP's is calculated as follows:

$$NCB = \left[\frac{S}{(1 + i)} \right] - I$$

$$NCB = \left(\frac{\$119,056}{1.1} \right) - \$100,000$$

$$NCB = \$8,323.$$

The discount rate (i) is the directed 10 percent rate, which will be used for all calculations in this thesis. The net cash benefit is greater than zero, thus the decision rule accepts CTP use as cost beneficial to the Navy.

G. THE REALISTIC NET CASH BENEFIT

The realistic model addresses an assumption stated in Chapter IV. The assumption was that there will not be 100 percent conversion by the Navy to EFT from the check payment method. This assumption is valid, at least in the short-run. Its implication is that the absolute (or high limit)

annual savings are too uncertain to consider attainable in the first years of using CTP's. What, then, is the realistic alternative?

The realistic model calculates a net cash benefit and uses the decision rule in the same way as does the basic model. What it does differently is realize that not all vendors can accept or may be willing to accept CTP's. Accepting this restriction, it attempts to predict a net cash benefit based upon speculating which vendors could probably utilize CTP's and in so doing would provide the greatest possible benefit to the Navy.

The realistic model's approach began with an analysis of the randomly selected vendor payment data taken from the single day's payment sample. Appendix A lists the vendor payment sample in descending order of the number of checks received by individual vendors. To illustrate, the first line of data indicates a vendor was paid 88 checks for a total of \$31,857 on that day. The second line indicates that another vendor received the second largest number of checks, 35 in all, totaling \$37,782. Table V-1 shows the cumulative percentage data for the first seven vendors listed in Appendix A. The fact that seven were chosen was arbitrary.

Listing cumulative data for the first seven vendors was arbitrary in that more or fewer could have been

TABLE V-1

CUMULATIVE DATA FOR VENDOR PAYMENTS
IN DESCENDING ORDER OF NUMBER OF CHECKS RECEIVED

<u>This Percent</u> <u>of Vendors</u>	<u>Received This Percent</u> <u>of Total Checks</u>
.7	21
1.4	29
2.1	36
2.8	42
3.5	45
4.2	47
4.9	49

included. Seven were included because that number amounted to approximately 5 percent of the sample vendor population. The important point indicated by the data shown in Table V-1 is that approximately 5 percent of the sample vendor population received 49 percent of the checks paid by the Navy on that day. If it can be assumed that this is representative of the entire vendor population, then it may follow that if a select 4.9 percent of Navy vendors can be paid by CTP's instead of checks, then 49 percent of the checks issued annually by the Navy can be eliminated. It would be more efficient for the Navy to concentrate initially on those vendors that make up that specific 4.9

percent of the population than to try to convert the entire vendor population to receiving CTP's. However, this begs the question which vendors are included in the 4.9 percent target.

Chapter III stated that high check-volume situations could be expected to occur where the vendor was both very large and a regular customer receiving many individual payments. Additionally, very large vendors tend to use the largest commercial banks. To speculate who the largest vendors are, Appendix B lists the same sample data shown in Appendix A, but it is listed in descending order of the absolute amount of the payment received by the vendors. To illustrate, the first line of data indicates taht a vendor was paid a total of \$105,726 by 29 checks. The second line shows a vendor received the second largest amount of \$49,377 paid by 26 checks. Table V-2 shows the cummulative results of payments to the seven vendors receiving the largest payments. As in Table V-1, selecting seven vendors was arbitrary and done only because that number represents approximately 5 percent of the vendor sample. The important point indicated by the data shown in Table V-2 is that approximately 5 percent of the vendors received 63 percent of the total payment amount.

There is a similarity in the data shown in Table V-2 to the data shown in Table V-1. The similarity is that a

 TABLE V-2

CUMMULATIVE DATA FOR VENDOR PAYMENTS
 IN DESCENDING ORDER OF PAYMENT AMOUNT RECEIVED

<u>This Percent</u> <u>of Vendors</u>	<u>Received This Percent</u> <u>of the Total Payment</u>
.7	20
1.4	29
2.1	38
2.8	45
3.5	52
4.2	58
4.9	63

few vendors receive the most, whether it is the number of checks or the amount of money. And of the seven vendors receiving the largest number of checks, five of them were included among the seven vendors receiving the largest dollar payments. These five vendors (representing 3.5 percent of the vendor sample) received 190 of the total 422 (45 percent) checks issued by the Navy, and \$260,971 of the the \$528,471 (49 percent) total payment.

The five vendors receiving both the greatest number of checks and payment amounts are speculated to be representative of those large vendors that are regular customers receiving many individual payments. If this can

be assumed, then it follows that they can probably utilize CTP's. This, then, is the vendor population target the Navy should focus on initially to realize the greatest benefit from using CTP's.

The realistic model predicts annual savings the same way as the basic model does. It multiplies the total number of checks issued annually by the Navy (T) by the check-to-CTP conversion factor (B) and by the incremental cost difference between a check and a CTP (D). Its prediction differs because a different conversion factor is used. The basic model predicted with a conversion factor of 100 percent. The realistic model predicts with a conversion factor of 45 percent, the same percentage of checks received by the 3.5 percent vendor target. Thus, for the realistic model,

$$S = (T) (B) (D)$$

$$S = (555,456 \text{ checks}) (45\%) ($.21434/\text{check})$$

$$S = \$53,575.$$

The realistic model's net cash benefit calculated after the first year of using CTP's would be negative. This is fairly obvious because its annual savings equate to approximately only 53 percent of the investment costs. The decision rule would reject using CTP's as cost beneficial to

the Navy if a cut-off (or pay-back) period of one year was required. For this model's annual savings, the pay-back period is calculated by setting the discounted annual savings equal to the investment costs and solving for the number of years necessary to establish equality. For the realistic model, the pay-back period is 2.2 years. Thus, use of CTP's would be cost beneficial as long as the economic life of the original investment (\$1,000,000 in this analysis) is longer than 2.2 years. The decision rule would accept using CTP's as cost beneficial after three years of using them. The pay-back period could be shortened if the investment costs were amortized among more than one vendor-paying organization or if the investment costs were found to be less than the amount estimated in this analysis.

H. RECURRING FIXED COSTS

It was stated earlier that some recurring fixed costs that are relevant to the analysis could be expected. They would be relevant because only the fixed costs that remain the same under each alternative are irrelevant. Using CTP's might incur fixed expenses for administrative, training, telephone, legal and printing requirements that would not have occurred if only checks were used to pay vendors. What these costs could amount to was not estimated. What these costs could amount to so as to make decision makers

indifferent between accepting or rejecting using CTP's is known.

The decision rule will accept using CTP's as cost beneficial if the net cash benefit is greater than zero. The basis for that decision is simple economic efficiency. The effect of recurrent fixed costs in the analysis would be to reduce the amount of the annual savings cash flow. As the costs increase, the savings will equally decrease. The decision makers will be indifferent to accepting or rejecting using CTP's when the present value of the reduced annual savings is equal to the initial investment costs. If the fixed costs increase beyond this point, the decision makers are no longer indifferent and will reject using CTP's as cost beneficial.

1. Indifference and the Basic Model

Relevant fixed costs and the basic model are considered first. The basic model's net cash benefit was predicted on the basis of 100 percent conversion from checks to CTP's. The predicted annual savings were the absolute amount that could be expected from that 100 percent conversion. In order for a Navy decision maker to be indifferent between accepting or rejecting that conversion as cost beneficial, the relevant fixed costs would have to be such that the net cash benefit over the economic life of the investment was equal to zero. But now another

assumption is in order. In this type of analysis, an assumption must be made about the length of the economic life of the investment. There is no reason to assume that economic life will be equal to the payback period. Neither can it be assumed the economic life would increase because annual savings decreased and a longer pay-back period was required. The assumption of economic life is one of the decisions mentioned in Chapter IV that Navy decision makers may have to make. Essentially, assuming an economic life for using CTP's establishes a cut-off period within which the cash benefits (discounted) must cover the investment costs. This thesis makes no specific assumption about the economic life of using CTP's, but rather, for the purpose of analysis assumes it might be one through five years.

To calculate the relevant annual fixed costs that would make a decision maker indifferent to using CTP's, let the fixed costs = C. Let the economic life of using CTP's = N. The following equality is then solved for C over economic lives of one through five years. The results are shown in Table V-3.

$$\sum_{n=1}^N \frac{S - C}{(1 + i)^n} = I$$

TABLE V-3

BASIC MODEL RELEVANT FIXED COSTS FOR INDIFFERENCE

<u>ECONOMIC LIFE</u> <u>IN YEARS</u>	<u>RELEVANT ANNUAL</u> <u>FIXED COSTS</u>
1	\$9,056
2	61,437
3	78,844
4	87,509
5	92,676

The data show that if an economic life were determined to be one year, relevant fixed costs could equal \$9,056 and the decision maker would be indifferent to using CTP's. If the economic life were two years, then indifference would occur when the fixed costs reached \$61,437. Extending the economic life to only five years was arbitrary.

2. Indifference and the Realistic Model

Determining economic indifference to using CTP's in the realistic model is done in the same manner as in the basic model. In the basic model, the net cash benefit from using CTP's was greater than zero in the first year. Relevant fixed costs could equal the amount of the net cash benefit before a decision maker would be indifferent towards using CTP's if a one year economic life had been assumed.

In the realistic model, however, the net cash benefit was not greater than zero in the first year. A period a little over two years of using CTP's (under the realistic model's assumptions) was required before a positive net cash benefit was obtained. If a three year pay-back period were acceptable to Navy decision makers, then the decision rule would accept using CTP's as cost beneficial in that third year. The affect, then, of any relevant fixed costs introduced into the calculations is to lengthen the pay-back period because they reduce the annual savings. The decision rule to accept or reject using CTP's as cost beneficial may always be applied at any point in time; the first, second, third or any following year. But if relevant fixed costs are so great so as to extend the pay-back period beyond the estimated economic life of the investment, use of CTP's would never be cost beneficial.

To calculate the relevant fixed costs that would make a decision maker indifferent to using CTP's under the assumptions of the realistic model, the same equality that the basic model used was solved. The results are shown in Table V-4. The data show that if an economic life were determined to be less than two years, using CTP's could not be cost beneficial under the assumptions of the realistic model. If any relevant fixed costs were experienced, the net cash benefit would be even more

negative. Relevant fixed costs could be sustained for assumed economic lives equal to or greater than three years. Assuming a maximum economic life of five years was, as in the basic model, arbitrary.

TABLE V-4

REALISTIC MODEL RELEVANT FIXED COSTS FOR INDIFFERENCE

<u>ECONOMIC LIFE</u> <u>IN YEARS</u>	<u>RELEVANT ANNUAL</u> <u>FIXED COSTS</u>
1	N/A
2	N/A
3	\$13,364
4	22,028
5	27,195

Determining the relevant fixed costs which would cause a decision maker to be indifferent about using CTP's is an important decision-making aid. Economic efficiency speaks convincingly when considering a new project such as using CTP's. Considering the relevant fixed costs that would indicate indifference over five different economic lives of the investment permits some relative comparison of those efficiencies. But a significant point is that there may be some pivotal cut-off date representing an economic life of the investment before which economic efficiency must

be met. Cut-off dates will not be plumbed further. They are potentially affected by a myriad of factors and are left to the Navy decision makers.

I. THE TREASURY'S POSSIBLE CONCERN ABOUT NAVY CTP'S

It was stated in Chapter V that there were no relevant costs or benefits accruing to the Navy from disbursement float. That is because the Navy, from a practical standpoint, does not experience disbursement float. When the Navy pays a vendor by check, Navy obligational authority is simultaneously decreased as the check is issued (if not earlier). The delay in time between issuing the check to disbursing the funds because of mail-handling and check-clearing serves only to delay the reconciliation of the Navy's accounts. For the Treasury, however, there are relevant benefits and costs.

The Treasury's cash management goals are to (1) accelerate the collection of cash receivables, (2) make timely disbursements--neither early nor late, and (3) prepare reliable cash forecasts. The Navy will be assisting in achieving timely disbursements and making reliable cash forecasts if it pays a vendor by CTP. The assistance, though, is mainly in timely disbursement. Vendor payments are non-recurring in nature and cannot be as accurately forecasted as can wages. The Treasury needs such large amounts of cash that it must arrange its borrowing needs

months in advance. CTP's cannot assist much in that. The forecasting advantage of CTP's is that they afford more certainty about the timing of disbursements than checks. But payment by CTP virtually eliminates disbursement float. The effect of eliminating float is that funds are withdrawn earlier from Treasury accounts. This early withdrawal will, in effect, constitute an opportunity cost for the Treasury.

This opportunity cost comes in two forms. The first is interest earnings foregone from the Federal Reserve that are known as interest on Federal Reserve notes. The Treasury's Federal Reserve accounts function as checking accounts; all Treasury payments are drawn on them. At the end of the day, after all the disbursements that are going to be made from Treasury accounts have been made, the Federal Reserve draws down the excess funds in those accounts and invests them in ways that earn interest. They can be lent as over-night loans to banks or used to purchase securities. This is quite profitable for the Federal Reserve and the net earnings from all Federal Reserve security holdings and loan interest is paid to the Treasury. Thus, the earnings are called interest on Federal Reserve notes. The opportunity cost, then, occurs when a disbursement occurs earlier than it could have. The amount disbursed will not be contributing to the amount of excess funds available for

draw down investment, and interest on Federal Reserve notes will be foregone.

The second form of opportunity cost occurs when the Treasury transfers funds into its Federal Reserve disbursement accounts to cover the payouts. The Treasury keeps its operating cash in accounts both at the Federal Reserve Banks and in tax and loan accounts held at commercial banks. The majority of funds paid to the Government go into tax and loan accounts. When disbursements are made from the Federal Reserve accounts, such as when vendor's checks are presented for payment, cash is transferred into them from the tax and loan accounts to replenish the balance. But the funds held in the commercial bank accounts earn interest for the Treasury at the rate of one-fourth of one percent less than the Federal funds rate. The Federal funds rate is the rate banks charge each other for lending or borrowing excess reserves. If funds are withdrawn early from the Federal Reserve accounts, early transfers from the commercially held accounts must occur, too. Opportunity costs of foregone interest earnings are then experienced.

What could the magnitude of opportunity cost be for the Treasury if the Navy initiated vendor payment by CTP's? To estimate this amount, an assumption is made that mail-handling and check-clearing float is equal to six days.

Six-day float was cited in private sector float analyses [77,78]. It is additionally assumed that the interest on Federal Reserve notes paid by the Federal Reserve is equal to the Federal funds rate and the Federal funds rate is equal to 8.75 percent (the rate on 17 December 1984). The loss of interest on Federal Reserve notes and interest on the commercial tax and loan accounts are alternative opportunity costs. Interest on Federal Reserve notes is the larger of the two and considered relevant.

The basic model assumed 100 percent conversion from check-to-CTP. For the randomly selected day whose payment data were used in this analysis, 2,705 checks were issued for a total amount of \$3,387,474. The opportunity cost to the Treasury would be the foregone interest from the interest on Federal Reserve notes. The opportunity cost for that day is calculated by the following method:

$$\text{Opportunity Cost} = (\$3,387,474) (6 \text{ days}) (.0875/365 \text{ days})$$

$$\text{Opportunity Cost} = \$4,872.$$

For the entire year of 264 check issuing days, the basic model's predicted opportunity cost to the Treasury would equal

$$(\$4,872) 264 = \$1,286,312.$$

The realistic model speculated that the conversion from checks-to-CTP's should be limited to 45 percent. Additionally, that model speculated that the 45 percent conversion would account for 49 percent of the total payment amount being paid by EFT. That means 49 percent of a day's payments will not be subject to disbursement float. Thus, calculating the opportunity cost of foregone interest for the realistic model is done in the same manner as for the basic model, except for one difference. The difference is that the amount paid is multiplied by a factor of .49. Thus

$$\begin{aligned}\text{Opportunity Cost} &= (\$3,387,474)(.49)(6 \text{ days}) \\ &\quad (.0875/365 \text{ days})(264 \text{ days})\end{aligned}$$

$$\text{Opportunity Cost} = \$630,293.$$

Whether calculated by the basic or the realistic model, the Treasury will suffer a significant float loss if the Navy begins paying vendors by CTP's. Some of this opportunity cost will be offset by the savings obtained from eliminating checks and their attendant costs. Another way that the opportunity cost could be offset is by altering payment terms with Navy vendors. Such modifications would take a long time to implement with all vendors, but it need only be done with those vendors the Navy wanted to pay with CTP's. Modified trade terms could actually benefit both the vendors and the Treasury.

An example would best explain how payment terms could be modified. A common payment arrangement with Navy vendors is 2/10, net 30. This means the Navy can take a 2 percent discount from the invoice amount if payment is made within ten days of the invoice date. If payment is not made within that time, the full amount is due within 30 days. It is the Navy's intent to take advantage of discounts, thereby necessitating a timely disbursement, neither early nor late, on the tenth day. If the payment is made by CTP, the Treasury account is immediately reduced by the payment amount. The vendor has good funds credited to his account no more than one working day later. If it were paid by check on the tenth day, funds would not actually be debited from the Treasury's account until six days later because of mail-handling and check-clearing delays. That is the effect of disbursement float working for the Treasury. The Navy's vendor does not get good funds until the sixteenth day while the Treasury is at the same time earning interest on Federal Reserve notes.

A trade term modification beneficial to both the Treasury and the Navy's vendor might be 2/13, net 30 for CTP's. This would allow the Treasury three more days use of funds before they are disbursed from its accounts. It would give the vendor good funds on the thirteenth day instead of the sixteenth day if it had been a check payment. Even the

Navy would benefit because it would have three more days in which to process the invoices and vouchers and still take advantage of purchase discounts.

The Treasury has stated one of its goals as applying EFT technology to Government payment systems. The ultimate intent is that EFT will become the predominant payment mechanism for the Government. Increases in efficiency and effectiveness are the outcomes predicted by the Treasury for this change. But making this change from checks to EFT could result in significant loss of float benefits accruing to the Government. The float losses would have to be offset by other operating savings in order for economic efficiency to be obtained. Using CTP's could result in cost benefits accruing to the Navy, while simultaneously resulting in large opportunity costs for the Treasury.

What is the overall financial effect on the Government, then, of the Navy paying some of its vendors by CTP's? Under the assumptions of the basic model, annual savings amounted to \$119,056, and the opportunity cost of lost interest on Federal Reserve notes equalled \$1,286,312. The net effect is a Government-wide cash loss of \$1,167,256. Under the assumptions of the realistic model, annual savings amounted to \$53,575, and the opportunity cost of lost interest on Federal Reserve notes equalled \$630,293. The net effect estimated by this model is a cash loss of

\$576,718. Neither of these predicted net losses take into consideration any savings the Treasury might realize through the elimination of the checks the Navy converted to CTP's.

The Navy may not need to modify trade terms to reduce float losses for the Government. The reason for this is the level of cash management sophistication of the companies that will be receiving CTP's from the Navy. The realistic model identified a market segment target of 3.5 percent of the vendor population that should be capable of receiving CTP's. In all probability, this target segment represents large vendors who both receive large amounts of payments and numbers of checks from the Navy and use large commercial banks. This type of company's cash management procedures will usually instruct their customers to address checks in settlement of accounts to a postal box number located in a big city. This box number is not the company itself, but its bank. Checks are thus received directly and entered into the clearing system with minimum delay. Major companies can operate "lock-boxes" anywhere, taking advantage of the geographic concentration of their business. The Navy's vendor payment checks, which are drawn on Treasury accounts, need only to be delivered to a Federal Reserve bank for nearly immediate disbursement of cash. This lock-box processing has become a sophisticated operation. Where large payment amounts are expected by

vendors (as, presumably, in the case of the 3.5 percent of the vendors used in this analysis), couriers may be used to pick up and deliver the checks to the bank. At NSC, Oakland, for example, over 1,000 vendors are authorized to pick up checks on the day they are issued. With the prime rate at 10.75 percent (26 December 1984), and not long ago over 20 percent, it becomes clear that where checks for large amounts are involved it is well worth a company's effort to avoid unnecessary delay.

The target companies are probably not experiencing the six day float delay used in the opportunity cost calculations because they use couriers and lock-boxes. If that can be assumed, then it follows that the Treasury is not, in reality, realizing any interest on Federal Reserve notes on those payments. If it were, it would not be six days interest, but perhaps only one, at most. Couriers and lock-boxes may be an expensive financial service for these companies to maintain, but the more checks they receive and the larger the payments, the cheaper the service becomes.

The result of all this is that the target segment companies would probably accept CTP's from the Navy if the cost of doing so were not greater than the cost of their lock-box service. They probably would not agree to any extension of trade discount terms. There would be no need for this, though, because for these vendor payments the

opportunity cost of foregone interest on Federal Reserve notes would not be relevant to using CTP's in the Navy.

VI. VENDOR FACTORS

A. REASON FOR SURVEY

How successfully the Navy could use CTP's will be determined to a great extent by the Navy's vendors. The decision to pay by an EFT system, such as CTP's, will not be a unilateral one made by the Navy alone but will depend upon whether vendors will agree to accept electronic payments. For as long as they do not agree, check payments will continue to predominate. To obtain agreement, the Navy will have to encourage vendors to accept EFT payments by convincing them of the potential benefits that could be realized. This encouragement, or marketing effort, should be vendor oriented rather than Navy oriented. In other words, to sell the idea of CTP's to vendors, the Navy must stress those positive reasons for using CTP's that will provide the vendors, not the Navy, with the most satisfaction. To cite the fact that CTP's may save the Navy money or may be a desired governmental payment mechanism may elicit only a "so what's in it for me" response. The Navy should also know what factors would cause the most difficulty after a vendor agrees to accept EFT payments in order to anticipate vendor reluctance.

The vendor's reasons for use of and difficulties in implementing CTP's are qualitative factors. They have

intangible effects on the comparisons performed in this research because they cannot easily, if at all, be valued in dollar terms. They are, however, relevant factors. Certainly they are relevant in formulating a marketing plan, but they could be more important than the quantified financial effects predicted for using CTP's in the Navy. For example, while it could be cost beneficial for the Navy to pay some vendors by CTP's, significant problems encountered by vendors now using them might induce Navy decision makers to hold back from adopting that payment method. Of course, such a decision would depend upon the magnitude of the difficulty. This research takes the position that vendor factors should not be overlooked by the Navy, much less declared unimportant when compared to the cost analysis.

Benefits and difficulties of using CTP's can be identified by survey methods. Secondary data concerning these factors exist, but much of it is promotional in nature, having been postulated and published before the CTP pilot program was conducted. Other secondary data from the pilot program period are available, but much of it is based upon the experiences of only a couple of the larger participating companies. Some of this is relevant because the Navy's size makes it similar to these large companies. But primary data concerning benefits and difficulties of

using CTP's from firsthand information would be of the most use to the Navy. And primary data that are current are more in touch with the actual environment.

B. SURVEY ANALYSIS

A survey, therefore, was conducted to determine the benefits of using CTP's and the difficulties experienced in implementing them. A letter was mailed to 56 companies identified as users of CTP's as of 5 July 1984 to request their participation in the survey. Appendix C shows a copy of this letter. The identification of these companies and points of contact within them were provided by the National Automated Clearing House Association, Washington, DC. The points of contact, or respondents, were people in positions of authority, predominantly involved in comptroller (7%), treasurer (23%), cash management (11%), financial services (23%), or other (36%) functions. The letter requested them to answer and return a questionnaire, which included two questions. Appendix D shows a copy of the questionnaire.

The overall response rate was 30 percent, or 45 questionnaires returned by respondents. However, for various reasons, usable data were limited to 35 responses to Question 1, a 63 percent response rate, and 32 responses to Question 2, a 57 percent response rate.

Survey Question 1 asked the respondents to rank order the following reasons for using CTP's:

- a- CTP's permit better cash management forecasting.
- b- CTP's permit more streamlined transaction processing.
- c- CTP's permit reduced operating costs.
- d- CTP's permit improved business relationships.
- e- CTP's permit participation in the trend toward the use of electronic funds transfer.

Respondents were given the opportunity to list and rank any "other" reason that was not included in the list. The opportunity to add another reason was necessary to collect current primary data that otherwise might be omitted. These other reasons that were submitted, however, were not included in the correlation calculations. This was necessary to maintain a constant base of five reasons to be ranked, for the majority of respondents did not add other reasons. Had the majority responded with six reasons ranked, the calculations would have included the data. The responses to Question 1 are tabulated in Table VI-1.

The results of Question 1 were analyzed to determine whether the sample of respondents believed some of the reasons for using CTP's were more important than others. The hypothesis that there was no agreement among these respondents as to which reasons were more important was tested using Kendall's Coefficient of Concordance, W. [79]

The Coefficient of Concordance is designed to test a null hypothesis of "no agreement among respondents" by

TABLE VI-1

OBSERVED RANKINGS FROM QUESTION 1

<u>REASONS FOR USE</u>	<u>RANKING OF RESPONSES</u>				
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
a.	5	7	8	11	4
b.	9	9	10	5	2
c.	10	12	7	4	2
d.	2	4	6	11	12
e.	9	3	4	4	15

comparing two sets of rankings for a collection of variables, or reasons for using CTP's as in this example. Appendix E describes the procedure in more detail. The observed rankings assigned to the reasons by the respondents are compared to an expected assignment of rankings made as if there were no agreement. In other words, the observed rankings are compared to a random set of rankings. The variance between these two sets of rankings is used to calculate the Coefficient of Concordance, W , which is then converted to a statistic that is distributed approximately as Chi squared. It was this statistic, with its known distribution, that was then used to test the hypothesis.

Five respondents added reasons for use to those listed in Question 1 and ranked them. Those additional reasons are listed below. The order in which they are listed is not intended to imply any significance in degree of importance or consensus.

- 1- CTP's reduce the effect of "float" on incoming payments [four responses, ranked 1, 2, 3 and 6].
- 2- CTP's were accepted to satisfy a customer who desired to pay by that method [one response, ranked 1].

For Question 1, the hypothesis of no agreement was rejected at a significance level of .005. Thus, there is agreement as to which reasons for using CTP's were more important than the others.

Survey Question 2 asked the respondents to rank order the following difficulties experienced in implementing CTP's:

- a- Accurately forecasting the cost/benefit trade-offs of using CTP's was difficult.
- b- Establishing the terms of agreement for utilizing CTP's was difficult.
- c- Making the necessary software changes for utilizing CTP's was difficult.
- d- Changing internal corporate procedures for utilizing CTP's was difficult.
- e- Generating interest of our financial institutions in utilizing CTP's was difficult.

As in Question 1, the respondents were given the opportunity to include an additional difficulty that they encountered.

And as in Question 1, these additional data were not included in the correlation calculations. The responses to Question 2 are tabulated in Table VI-2.

TABLE VI-2

OBSERVED RANKINGS FROM QUESTION 2

<u>DIFFICULTIES</u>	<u>IN</u>	<u>RANKING OF RESPONSES</u>			
<u>IMPLEMENTING</u>					
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
a.	6	10	7	5	4
b.	6	5	4	14	3
c.	11	5	8	4	4
d.	4	9	8	6	5
e.	5	3	4	4	16

The statistical procedure used to analyze Question 2 data was identical to that used on Question 1 data. The result of the analysis was that the hypothesis of no agreement could not be rejected at an acceptable level of significance. Thus, there was no agreement by the respondents as to which difficulties experienced were more serious than others.

Twelve respondents added difficulties to those listed in Question 2 that they experienced in implementing CTP's and

ranked them. Those additional difficulties are listed below. The order in which they are listed is not intended to imply any significance in degree of difficulty or consensus.

- 1- Generating vendors' interest in CTP's was difficult [four responses, ranked 1, 1, 1 and 2].
- 2- Generating vendors banks' interest in CTP's was difficult [two responses, ranked 2 and 6].
- 3- Using CTP's caused a loss of "float" benefits [two responses, ranked 1 and 2].
- 4- Respondent's own banks had difficulty reporting CTP information [two responses, ranked 1 and 1].
- 5- Respondents' companies' high level management was hesitant to implement CTP's [one response, ranked 1].
- 6- Respondent's company had problems with the CTP data format [one response, ranked 2].

C. SURVEY CONCLUSIONS

The hypothesis of no agreement among the respondents was rejected for reasons for use of CTP's, but could not be rejected for difficulties experienced in implementing them. Respondents consensually agreed upon the importance of the reasons for use in the following rank order:

CONSENSUAL RANK

REASON FOR USE

- 1- c. CTP's permit reduced operating costs.
- 2- b. CTP's permit more streamlined transaction processing.
- 3- a. CTP's permit better cash management forecasting.

-4- e. CTP's permit participation in the trend toward use of electronic funds transfer.

-5- d. CTP's permit improved business relationships.

The primary consensual reason for use was reduced operating costs. This is one of the primary promotional claims made for using CTP's and it appears to stand up under test by actual users. Two respondents commented with caveats, however, on the potential savings. "CTP's should permit this [reduced operating costs] eventually, but it will take a long time until many more corporations begin participating." Similarly, "[reduced operating costs will result] with sufficient volume [of CTP use]." These statements reflect the general opinion concerning savings given in current literature and the need for economies of scale.

Three respondents listed reducing opportunity costs attributable to mail float as an important reason for using CTP's. This is from a receivers point of view. Related to mail float, another commented that CTP's would eliminate the opportunity costs of "crediting for discounts based upon postmark date," while the actual funds were not available until several days later. This point was repeated when another user stated, "CTP's lock in float and make the payment date a negotiated item. We have no control over the actual clearing time on checks." These points were summed by a respondent who generalized, "any reluctance in this

program is on the sending side rather than the receiving side." This comment has particular relevance for the Navy. As a potential user of CTP's, the Navy would only be on the sending side. Navy vendors would be on the receiving side.

Respondents did not consensually agree upon the rank order of difficulties in implementing CTP's. This does not invalidate the collected data or refute the existence of any difficulties in implementing CTP's. The respondents, in actuality, may have agreed upon a rank order, but that order can not be statistically proved (with a significant degree of confidence) as any different from a random order ranking. Thus, there is no best estimate of which difficulties are the most serious.

There were a few comments that addressed float losses from a CTP originating perspective. The relative slowness of the check clearing system, or float, is widely exploited by companies to prolong the use of their funds. A company that draws its checks on small banks in remote areas, such as Montana or West Texas, can generate a few more days of interest bearing use of funds. But electronic funds transfer can reduce this type of float to nearly zero. Hence, "assuring management of the ability to maintain present float experience," as one user stated, was a comment similarly made by four respondents. This seems to back up the earlier statement about the benefits being with the

receiver, not the sender. It bears repeating at this point that the Navy will only be a sender of CTP's.

Four respondents listed as their primary difficulty "generating interest in other companies." One stated it as, "finding vendors willing to accept CTP's." These statements reflect the hesitant acceptance of CTP's described in current literature. Closely associated with finding vendors who will accept CTP's is finding vendors' banks that can process CTP's. "Generating interest, not in our bank, but in our vendors' banks," and "RDFI's were our greatest obstacle," were comments made. Two other respondents did, however, comment that there were problems with their own banks' information reporting capabilities. Both referred to their banks inability to report the status of accounts in a timely manner after CTP transactions had taken place. "[CTP] program is of little value if good funds remain idle in the bank over night," described both their concerns. These comments support similar statements made in current literature.

There was an interesting contrast presented in the comments by two respondents. One, who elected not to rank the listed difficulties, stated, "None of the selections can be classified as difficult." Opposite this, the other stated, "Currently, the problems listed far outweigh the advantages." This contrast in opinions helps bring out an

important point concerning rank order statistics. That point is that determining a rank order of variables through the use of Kendall's Coefficient of Concordance, W , does not mean that the ordering is correct. The ordering is consensual only, even when there is a high degree of agreement. Whether the ordering was truly objective and reflected rational analysis may not be known until there has been much more experience with and analysis of CTP's.

Earlier in this chapter these vendor factors were declared to have an intangible effect upon the analysis of potentially using CTP's in the Navy. But in Chapter IV it was stated that the predictions of the models were based upon inferences from vendor environment information. These nonquantifiable reasons and difficulties constitute a substantial segment of vendor environment information. This research attempted to incorporate this information into the analysis by asking the following question: Does it appear likely for any particular reason or difficulty that values in the prediction models would have been substantially affected by the intangible effects of that particular reason or difficulty (if it could have been quantified) so that the decision rule would have directed the opposite finding? The answer to this question, for both reasons and difficulties, was "no."

VII. CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

This thesis analyzed the potential use of Corporate Trade Payments (CTP's) by the Navy. CTP's are a recent development in electronic funds transfer (EFT) technology that could be used to eliminate checks from the vendor payment process. Replacing checks with CTP's could be cost beneficial to the Navy.

CTP's are electronic payments transmitted between a payor and a payee (potentially the Navy and a vendor) via the automated clearing house (ACH) system. The ACH system uses computers and telecommunications to link together a network of financial institutions across the United States. That network of 32 regional ACH associations includes 11,000 commercial banks and 3,500 savings and loan associations and credit unions.

Direct deposit is one of the most widely used ACH services. Direct Deposit/Electronic Funds Transfer (DD/EFT) is a voluntary program which has enabled the Government to pay its civilian employees and military service members by electronic means. Nearly 40 percent of the Government's recurring payments are made through the ACH network. Significant savings have been achieved in making recurring

payments this way. Savings have been so great, in fact, that the Treasury is proposing legislation that would require all Federal employees to be paid by direct deposit.

The Navy's interest in CTP's stems from the fact that CTP's technology is similar to, though more complex than, direct deposit's. That similarity may be sufficient to generate the same kind of savings as direct deposit has from eliminating the cost of printing, mailing and processing checks. Another similarity is CTP's voluntary nature--vendors cannot be forced to accept them. Just as was necessary with DD/EFT, major marketing efforts to promote using CTP's may be required if a decision is made to implement them for Navy use.

CTP's are not without potential problems. Their acceptance in the private sector is not yet guaranteed and there are few banks that are able to process its electronic format. Even so, its format is capable of transmitting the necessary Government payment information to some commercial companies. It is important to determine if it would be cost beneficial for the Navy to make some vendor payments by using CTP's because establishing EFT as the dominant payment system within the Government is a stated goal. CTP's are an already established, if not widely used, step in that direction.

The banking environment is becoming more competitive.

A major implication of this competition is that banks need services to attract and keep their corporate customers. The result of this is the banking industry is moving away from paper and labor intensive check processing toward using EFT's, such as CTP's. ACH services have the highest potential demand growth of any cash management service. If CTP's can continue to show lower processing costs than checks, their value as a cash management service may prompt their greater use among corporations. Additionally, the potential use of CTP's by the Government may have the same effect on their broader use as Government usage did in establishing the acceptability of direct deposits.

This thesis made the assumption that it is feasible for the Navy to use CTP's for making vendor payments. Accepting this, it then asked whether it would be cost beneficial to do so. Another assumption it made was that there could not be 100 percent conversion of checks to CTP's, at least in the short run. Relevant costs of checks and CTP's were identified, compared and projected under conditions that would identify maximum potential benefits and more realistic benefits. Speculation about which Navy vendors could probably receive CTP's and the percentage of checks that could be converted was made on the basis of sample payment data.

The speculation about which vendors could probably receive CTP's was made to enable the Navy to target high-potential market segments. The idea of being able to pay all vendors by CTP's was recognized as unrealistic because of the currently limited CTP-capable environment.

This thesis took the position that CTP's would have to meet the needs of the marketplace to be successful as a Navy payment system. If its design does not meet customer needs, some other EFT system might better serve the Navy's purposes. Market research in the private sector was used to identify the important reasons for using CTP's and the most difficult problems in implementing them. The primary market data received were tested with Kendall's Coefficient of Concordance to determine whether there was consensus among the respondents providing the data. Testing revealed there was a rank order consensus about the reasons for using CTP's. No consensus could be statistically proved for which difficulties in implementing CTP's were more important than others. The intent of obtaining this information was to provide the Navy with market research in identifying vendor needs. If it were decided to implement CTP's in the Navy, it would be essential to market their benefits, to emphasize why vendors should accept CTP's and why it would be good for them (not why it is good for the Navy). The Navy's

potential use of CTP's must be market driven in addition to cost beneficial.

B. CONCLUSIONS

The conclusions reached in this thesis about the potential use of CTP's in the Navy are drawn from the predictions of the models and the survey results. If it can be assumed that those models were correct and the data they operated on were representative of their populations, then it may follow that the conclusions based upon them have merit. Conclusions drawn from the survey are based upon the statistically tested market data.

1. First Conclusion

This thesis concludes that the incremental cost difference between a check and a CTP is equal to \$.21434.

The check has the higher incremental cost. This incremental cost difference means that a potential net cash benefit can be obtained from converting checks to CTP's if the volume of the conversions generates sufficient savings to recoup the investment costs.

2. Second Conclusion

This thesis concludes that a realistic annual savings of \$53,575 at NSC, Oakland, could be obtained by using CTP's. This conclusion is predicated upon strong speculations. Analysis determined that for a sample of payment data, 3.5 percent of the vendors represented

received 45 percent of the checks issued and 49 percent of the total payment amount. If these percentages were representative of the Navy's vendor population in toto, then the Navy could initially target that small, specific vendor segment for making payments by CTP's. Paying only that specific 3.5 percent of the vendors by CTP's could result in achieving nearly half of the maximum possible savings if 100 percent conversion from checks to CTP's were made. The maximum, or absolute, savings predicted in the analysis for 100 percent conversion was \$119,056. The analysis, additionally, speculated that the targeted 3.5 percent of the vendors would be capable of receiving CTP's by virtue of the size of the payments they received. The reasoning was that large payments go to large Navy vendors, and large Navy vendors use large commercial banks. Data indicate that the largest commercial banks can probably "straight through" process CTP's. Most banks do not have this capability, and this fact severely limits the widespread use of CTP's.

3. Third Conclusion

This thesis concludes that relevant fixed costs from using CTP's could be expected and that they would affect the pay-back period. Using CTP's in the Navy would probably involve recurring fixed costs for administrative, training, telephone, legal and printing requirements that would not otherwise have occurred if only checks were used

to pay vendors. The analysis did not estimate what those costs would amount to. It did calculate what the fixed costs could be so that a Navy decision maker would be indifferent to using CTP's. For a decision maker to be indifferent, the Navy would experience no economic gain or loss from using CTP's. The greater the fixed costs, the longer the pay-back period required to recoup the investment costs. A more important criterion than the length of the pay-back period is the expected economic life of the investment. A cut-off date, equal to the estimated economic life, before which the savings generated would have to equal the investment costs must be decided upon. The recurring fixed costs that would cause indifference to using CTP's were calculated over estimated economic lives of one through five years. Savings generated by using CTP's beyond five years are too uncertain to be brought into the analysis.

4. Fourth Conclusion

This thesis concludes that using CTP's in the Navy could incur a net cash loss to the Government because of opportunity costs from the loss of float benefits. For the time that it takes from when the Navy issues a check to pay a vendor until the time the funds are disbursed from the Treasury's account, float benefits accrue to the Government. Funds in the Treasury's disbursement accounts, which are held at Federal Reserve banks, can potentially earn interest

on Federal Reserve notes. This interest is earned when the Federal Reserve loans excess funds in the Treasury's accounts overnight to banks or uses them to buy securities. The interest earned, net of the Federal Reserve's costs, is paid to the Treasury. CTP's will effectively eliminate disbursement float because net settlement for the Navy, the Treasury, the vendors and their banks will occur simultaneously. But the opportunity cost of lost interest to the Treasury may be reduced by other expected benefits of using CTP's that are unknown or could not be measured. The analysis speculated that the Treasury may already be experiencing that opportunity cost for the payments made by check to the targeted 3.5 percent of Navy vendors because of their cash management procedures. If this were the case, then it follows that the opportunity cost of lost float benefits for those payments would not be a relevant consideration.

5. Fifth Conclusion

This thesis concludes that companies are in consensus about how important some reasons for using CTP's are compared to other reasons. If the Navy were to decide to use CTP's, marketing that payment method to vendors would be important. CTP's success for the Navy would depend upon its capability to meet Navy vendor's needs, not its capability to meet the Navy's requirements. The Navy would

have to emphasize to its vendors why they should accept CTP's, and why it would be good for them to be paid that way. This thesis can help identify vendor needs. It statistically tested primary market research data and determined the following order of importance of reasons for using CTP's:

- 1- CTP's permit reduced operating costs.
- 2- CTP's permit more streamlined transaction processing.
- 3- CTP's permit better cash management forecasting.
- 4- CTP's permit participation in the trend toward use of electronic funds transfer.
- 5- CTP' permit improved business relationships.

6. Sixth Conclusion

This thesis concludes that companies are not in consensus about which difficulties in implementing CTP's were more difficult than others. Market research should provide the information needed to offer a product or service to a specific market segment. The information can be about benefits or difficulties, as in the survey conducted. This thesis attempted to determine if some difficulties in implementing CTP's were more serious or important than some were. The results could not be proved statistically different from a random ordering of the difficulties.

C. RECOMMENDATIONS

The cost comparisons analyzed in this thesis between using checks and CTP's to pay Navy vendors are speculative. It follows that the conclusions derived from those comparisons are of a speculative nature, too. The following recommendations about using CTP's to pay Navy vendors are made with an understanding of the amount of uncertainty involved in the analysis and the conclusions.

1. First Recommendation

The methodology of analysis used in this thesis should be reviewed and, if found acceptable, tested with more data. CTP's are relatively new to the commercial marketplace. Existing evidence from their limited use may not constitute an adequate basis for making long-term policy conclusions about the Navy using them. Speculation was made that it could be cost beneficial to use CTP's in the Navy,, but further research is necessary to confirm this. Assumptions made about the capability of banks to process CTP's and the willingness of vendors to accept payment by that method should be confirmed before cost beneficial use is accepted. Specific costs needing more analysis are the marginal costs of checks and CTP's, the investment costs of necessary software (and an estimate of its economic life), and CTP peculiar recurring fixed costs that could be expected.

2. Second Recommendation

CTP studies done by others should be reviewed by the Navy. The National Automated Clearing House Association has more data about CTP's than was analyzed in this thesis. It would be to their advantage to share these data with the Navy. Widespread growth of CTP use could be greatly accelerated if the Navy (and other Government agencies) were to implement them as a major payment mechanism. The Treasury began a pilot program in 1984 using CTP's. Results of that program should be reviewed. Additionally, the Treasury has commissioned studies pertaining to the implementation of EFT payment systems in Government agencies.

3. Third Recommendation

The Navy should continue to monitor both the commercial environment and its vendors for acceptance and growing use of CTP's. CTP's may be similar to direct deposit in that a substantial investment will be required to establish them and ensure their success. Limiting studies to only the operating costs of CTP's may lead to underestimating the cost of developing them as a major payment system for the Navy, at least in the short run. CTP's may prove to be an economically efficient method for the Navy to pay its vendors if enough of them will accept

payment by EFT. Vendors will accept them only if there is a benefit to them in doing so.

APPENDIX A

VENDOR PAYMENT SAMPLE SORTED ON NUMBER OF CHECKS PAID

<u>Number of Checks Paid</u>	<u>Total Dollar Payment</u>	<u>Paid</u>
	<u>Number of Invoices Paid</u>	
88	31857	135
35	37782	57
29	105726	29
26	49377	43
12	36229	35
10	1631	17
8	2572	9
7	1345	8
7	16223	13
6	1678	11
5	8377	5
5	1616	5
5	1029	7
4	211	6
4	2143	5
4	149	6
4	447	5
3	364	3
3	293	4
3	6852	3
3	6832	3
3	522	17
3	1108	6
2	1784	2
2	10192	4
2	401	2
2	45349	7
2	463	9
2	462	3
2	17306	2
2	137	2
2	1813	2
2	566	2
2	445	2
2	1288	2
2	471	2
2	25	2
2	1024	2
2	178	3

<u>Number of Checks Paid</u>	<u>Total Dollar Payment</u>	<u>Number of Invoices Paid</u>
2	107	2
2	1293	2
2	117	4
2	61	2
2	495	2
2	147	3
2	519	4
2	2600	2
2	512	4
1	2815	1
1	1124	1
1	3354	2
1	2070	1
1	1368	2
1	1163	11
1	892	1
1	879	1
1	830	1
1	3539	3
1	20688	1
1	640	2
1	1198	1
1	633	1
1	596	3
1	1153	1
1	554	2
1	1687	2
1	25917	1
1	6778	1
1	634	2
1	3593	1
1	930	1
1	1495	17
1	1457	1
1	451	1
1	784	1
1	738	1
1	441	3
1	440	2
1	418	1
1	409	7
1	12000	1
1	11343	1
1	364	2
1	318	1
1	313	3

<u>Number of Checks Paid</u>	<u>Total Dollar Payment</u>	<u>Paid</u>
	<u>Number of Invoices Paid</u>	

1	4461	1
1	937	20
1	465	1
1	286	1
1	257	1
1	246	1
1	226	2
1	213	1
1	2784	2
1	208	1
1	208	1
1	207	3
1	194	2
1	1793	2
1	167	1
1	161	1
1	161	1
1	312	1
1	294	2
1	5963	14
1	140	1
1	1555	1
1	132	2
1	122	1
1	120	1
1	1349	1
1	111	1
1	1328	1
1	104	1
1	100	1
1	95	2
1	87	1
1	82	2
1	79	1
1	74	1
1	74	1
1	146	1
1	942	1
1	57	1
1	55	2
1	50	1
1	49	2
1	48	1
1	47	1
1	44	1
1	42	1

<u>Number of Checks Paid</u>	<u>Total Dollar</u>	<u>Payment Paid</u>	<u>Number of Invoices Paid</u>
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1	42	1
1	40	2
1	37	1
1	31	7
1	31	1
1	28	1
1	26	1
1	68	1
1	22	2
1	19	1
1	15	1
1	14	1

TOTALS:	422	528471	700
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APPENDIX B

VENDOR PAYMENT SAMPLE SORTED ON AMOUNT OF PAYMENT

<u>Number</u>	<u>of</u>	<u>Checks Paid</u>	<u>Total</u>	<u>Dollar</u>	<u>Payment</u>	<u>Paid</u>
					<u>Number</u>	<u>of Invoices</u>
						<u>Paid</u>
29			105726		29	
26			49377		43	
2			45349		7	
35			37782		57	
12			36229		35	
88			31857		135	
1			25917		1	
1			20688		1	
2			17306		2	
1			12000		1	
1			11343		1	
2			10192		4	
5			8377		5	
3			6852		3	
3			6832		3	
1			6778		1	
1			5963		14	
1			4461		1	
1			3593		1	
1			3539		3	
1			3354		2	
1			2815		1	
1			2784		2	
2			2600		2	
8			2572		9	
4			2143		5	
1			2070		1	
2			1813		2	
1			1793		2	
2			1784		2	
1			1687		2	
6			1678		11	
10			1631		17	
7			1623		13	
5			1616		5	
1			1555		1	
1			1495		17	
1			1457		1	
1			1368		2	

Number of Checks PaidTotal Dollar Payment PaidNumber of Invoices Paid

1	1349	1
7	1345	8
1	1328	1
2	1293	2
2	1288	2
1	1198	1
1	1163	11
1	1153	1
1	1124	1
3	1108	6
5	1029	7
2	1024	2
1	942	1
1	937	20
1	930	1
1	892	1
1	879	1
1	830	1
1	784	1
1	738	1
1	640	2
1	634	2
1	633	1
1	596	3
2	566	2.
1	554	2
3	522	17
2	519	4
2	512	4
2	495	2
2	471	2
1	465	1
2	463	9
2	462	3
1	451	1
4	447	5
2	445	2
1	441	3
1	440	2
1	418	1
1	409	7
2	401	2
3	364	3
1	364	1
1	318	1
1	313	3

<u>Number of Checks Paid</u>	<u>Total Dollar Payment Paid</u>	<u>Number of Invoices Paid</u>
1	312	1
1	294	2
3	293	4
1	286	1
1	257	1
1	246	1
1	226	2
1	213	1
4	211	6
1	208	1
1	208	1
1	207	3
1	194	2
2	173	3
1	167	1
1	161	1
1	161	1
4	149	6
2	147	3
1	146	1
1	140	1
2	137	2
1	132	2
1	122	1
1	120	1
2	117	4
1	111	1
2	107	2
1	104	1
1	100	1
1	95	2
1	87	1
1	82	2
1	79	1
1	74	1
1	74	1
1	68	1
2	61	2
1	57	1
1	55	2
1	50	1
1	49	2
1	48	1
1	47	1
1	44	1
1	42	1

<u>Number of Checks Paid</u>	<u>Total Dollar Payment</u>	<u>Paid</u>
	<u>Number of Invoices Paid</u>	

1	41	1
1	40	2
1	37	1
1	31	7
1	31	1
1	28	1
1	26	1
2	25	2
1	22	2
1	19	1
1	15	1
1	14	1

TOTALS:	422	528471	700
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DATA SUMMARY

Number of vendors: 143

Number of checks issued: 422

Total payment amount: \$528,471

Total number of invoices paid: 700

Average number of checks received per vendor: 2.95

Average number of invoices paid per check: 1.66

Average dollar payment per check: \$1,252 (rounded)

Average dollar payment per vendor: \$3,696 (rounded)

NOTE: This data summary pertains to both Appendix A and Appendix B.

APPENDIX C

EXAMPLE OF SURVEY COVER LETTER

[INSIDE ADDRESS: Tailored to recipient]

Dear Mr./Ms. _____

There is considerable interest within the Department of the Navy in making vendor payments through the increased use of electronics funds transfer. More specifically, the Corporate Trade Payment is being considered as a possible means of making electronic payment to Navy vendors.

It is the Navy's interest in this subject that prompts this letter to you. I am a graduate student at the Naval Postgraduate School conducting thesis research into the potential use of Corporate Trade Payments by the Navy. In pursuing this study, I am trying to identify the relevant benefits and difficulties that were, or are now, experienced by actual users of this method of electronic funds transfer. I identified your company as a user of Corporate Trade Payments from information supplied to the Navy by the National Automated Clearing House Association.

The brief questionnaire that I have enclosed will, I hope, require no more than a minute or two for you to fill out. Would you please answer the two questions and return the questionnaire to me in the envelope supplied.

Through analysis of the data I hope you will provide, along with other aspects of my work, I hope to give the Navy an objective assessment of the possible use of Corporate Trade Payments.

Thank you!

Yours very sincerely,

Frederick C. Alke
Captain, United States Marines

Encls.

APPENDIX D

EXAMPLE OF SURVEY QUESTIONNAIRE

CORPORATE TRADE PAYMENT QUESTIONNAIRE

(for companies receiving CTP's, sending CTP's, or both)

QUESTION 1: Why did you choose to use Corporate Trade Payments in your company? Please rank (1, most important, through 6, least important) in order of importance to you.

RANK

- a. ___ CTP's permit better cash management forecasting.
- b. ___ CTP's permit more streamlined transaction processing.
- c. ___ CTP's permit reduced operating costs.
- d. ___ CTP's permit improved business relationships.
- e. ___ CTP's permit participation in the trend toward use of electronic funds transfer.
- f. ___ Other: _____.

QUESTION 2: What difficulties did you experience in implementing Corporate Trade Payments in your company? Please rank (1, most difficult, through 6, least difficult) in order of difficulty for you.

RANK

- a. _____ Accurately forecasting the cost/benefit trade-offs of utilizing CTP's was difficult.
- b. _____ Establishing the terms of agreement for utilizing CTPs was difficult.
- c. _____ Making necessary software changes for utilizing CTP's was difficult.
- d. _____ Changing internal corporate procedures for utilizing CTP's was difficult.
- e. _____ Generating interest of our financial institutions in utilizing CTP's was difficult.
- f. _____ Other: _____.

Thank you again for your participation.

APPENDIX E

KENDALL'S COEFFICIENT OF CONCORDANCE PROCEDURE

The Kendall Coefficient of Concordance expresses the degree of association among several variables measured in, or transformed to, ranks. More specifically, it is a measure of the degree of variance among the rankings assigned to some number of variables by survey respondents from rankings that could be considered randomly assigned. The statistic tests the hypothesis that there is no agreement among the respondents. The null and alternative hypotheses are then:

H_0 : There is no agreement on the observed rankings,
otherwise

H_1 : there is agreement on rankings among
the survey respondents.

The test, then, is one of comparing a measure of the association between the observed rankings to a measure that would represent absolutely no agreement. The procedure is described as follows:

Let N = the number of variables to be ranked, and let k = the number of respondents assigning ranks. The observed rankings are then arranged in a $k \times N$ table. For Survey Question 1, the table would appear as shown in Table E-1.

TABLE E-1

OBSERVED RANKINGS FROM QUESTION 1

<u>REASONS FOR USE</u>	<u>RANKINGS OF RESPONSES</u>				
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
a.	5	7	8	11	4
B.	9	9	10	5	2
c.	10	12	7	4	2
d.	2	4	6	11	12
e.	9	3	4	4	15

The rank sum for each reason for use is then computed by adding the observed ranks shown in Table E-1 as follows:

$$\begin{aligned}
 a &= 5(1) + 7(2) + 8(3) + 11(4) + 4(5) &= 107 \\
 b &= 9(1) + 9(2) + 10(3) + 5(4) + 2(5) &= 87 \\
 c &= 10(1) + 12(2) + 7(3) + 4(4) + 2(5) &= 81 \\
 d &= 2(1) + 4(2) + 6(3) + 11(4) + 12(5) &= 132 \\
 e &= 9(1) + 3(2) + 4(3) + 4(4) + 15(5) &= 118
 \end{aligned}$$

If there were only random assignment of rankings to the reasons for use, then each reason would be expected to receive each rank approximately the same number of times. For a random assignment of rankings, the expected rank sum for each reason would be

$$\left(\frac{1+2+3+4+\dots+N}{N} \right) (k) = \left[\frac{N(N+1)}{2} \right] \frac{(k)}{(N)} .$$

For this sample of $k = 35$, and $N = 5$, the expected rank sum is

$$\left[\frac{5}{2} \frac{(6)}{2} \right] \left[\frac{(35)}{(5)} \right] = 105 .$$

The observed rank sum for each reason is then compared to the expected rank sum, the difference between the two is squared, and then the squared differences are summed. The resultant quantity is called the sum of the squares, s .

$$\begin{aligned} s = & (107 - 105)^2 + (87 - 105)^2 \\ & + (81 - 105)^2 + (132 - 105)^2 \\ & + (118 - 105)^2 \end{aligned}$$

$$s = (2)^2 + (-18)^2 + (-24)^2 + (27)^2 + (13)^2$$

$$s = 4 + 324 + 576 + 729 + 169$$

$$s = 1,802 .$$

The statistic s , the sum of the squares, is then used to calculate a statistic whose distribution is known.

For small samples (k less than 20) where the number of entities ranked, N , are less than 7, the Coefficient of Concordance, W , may be computed from

$$W = \frac{12 s}{k^2 (N^3 - N)} .$$

For larger samples (k) or a larger number of entities (N) the following expression is approximately distributed as Chi squared with N - 1 degrees of freedom:

$$\chi^2 = \frac{12 s}{k N (N + 1)} .$$

This expression is equivalent to

$$\left[\frac{12 s}{k^2 (N^3 - N)} \right] (k) (N - 1) ,$$

and therefore:

$$\chi^2 = k (N - 1) W .$$

Thus, the probability of the occurrence of any value as large as an observed W under the null hypothesis can be calculated.

If the value of the Chi squared statistic that is calculated equals or exceeds the table value for a particular level of significance and particular number of

degrees of freedom, then the null hypothesis that the k rankings are unrelated may be rejected at that level of significance.

For Question 1 of the survey, the computed value of the Chi squared statistic is 20.59 with 4 degrees of freedom. This is significant beyond the .005 level, therefore, the null hypothesis is rejected for Question 1.

Table E-2 lists the observed rankings from Survey Question 2. These data are tested in the same manner as were Question 1's.

TABLE E-2

OBSERVED RANKINGS FROM QUESTION 2

<u>DIFFICULTIES IN</u> <u>IMPLEMENTING</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
a.	6	10	7	5	4
b.	6	5	4	14	3
c.	11	5	8	4	4
d.	4	9	8	6	5
e.	5	3	4	4	16

The rank sums for the difficulties in implementing CTP's are as follows:

$$\begin{aligned}
a &= 6(1) + 10(2) + 7(3) + 5(4) + 4(5) &= 87 \\
b &= 6(1) + 5(2) + 4(3) + 14(4) + 3(5) &= 99 \\
c &= 11(1) + 5(2) + 8(3) + 4(4) + 4(5) &= 81 \\
d &= 4(1) + 9(2) + 8(3) + 6(4) + 5(5) &= 95 \\
e &= 5(1) + 3(2) + 4(3) + 4(4) + 16(5) &= 109
\end{aligned}$$

For Question 2, the sample, k , was 32, and the number of variables to be ranked, N , remained 5. The expected rank sum, then, is 96, and the sum of squares, s , is 460. The calculated Chi squared statistic is 5.75 with 4 degrees of freedom. This is significant only at the .25 level, therefore, the null hypothesis is not rejected for Question 2.

The significant value of the Chi squared test statistic for question 1's data may be interpreted as meaning that the respondents are applying similar standards in ranking the reasons. The similar standards are what causes them to be in agreement. This fact is valuable for the Navy to know if it desires to conduct a vendor oriented marketing campaign to encourage use of CTP's. The value comes from the ability to focus the marketing effort on the most important factors. There is no independent standard that the Navy could correctly use to determine what factors are most important from the vendors' points of view. It is the respondents' pooled ordering, collected as current primary data, that establishes a "consensual" standard.

The best estimate of the consensual rank order of the reasons and difficulties is provided by the rank sums only when the test statistics are significant. This is because the analysis procedure is based upon a least squares calculation, hence the most important and most difficult entities will have the lowest rank sums. The least important and least difficult entities will have the highest rank sums. The test statistic for Question 1 was the only significant one of the two calculated. The reasons for using CTP's can then be given a best estimate of rank order importance. This cannot be done for the difficulties experienced in implementing CTP's.

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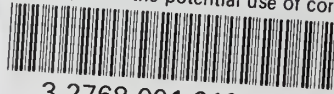
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