IBM

General Information Manual

In-Line Electronic Accounting, Internal Control and Audit Trail

In-Line Electronic Accounting, Internal Control and Audit Trail

by Price Waterhouse & Co., New York, N. Y.

Current interest in the area of in-line accounting on electronic accounting systems has focused attention on the responsibility of the controller and the auditor in the planning of such installations. We therefore asked the accounting firm of Price Waterhouse & Co. to survey the aspects of internal control and audit trail encountered in early installations of the IBM 305 RAMAC *and similar aspects which it is anticipated will arise in the future.*

The results of this survey are contained in this booklet which should assist in the installation and operation of in-line electronic accounting systems.

International Business Machines Corporation

Introduction

The increasing importance and use of electronic data processing systems in business have made essential the design of new techniques of control. The ability of large and medium scale electronic data processing systems to perform, at high speeds and with great accuracy, complex manipulation of data recorded on magnetic tape or other media has been demonstrated. The problems they pose to controllers and auditors have been recognized and reported in various publications. Solutions designed to solve the problems of internal control and audit trail for these systems have been, and are being, tested by actual operations.

It might appear on initial consideration that these solutions would almost automatically be applicable to all electronic data processing systems. However, this is not the case. Certain electronic accounting systems are now available that make possible in-line accounting, which presents unique control problems for controllers and auditors.

In-line accounting differs significantly from the batch accounting method of tabulating card systems and most electronic systems. A tabulating card system can perform only a limited number of operations at one time and, therefore, requires that the punched card input be grouped and sorted into one or more logical sequences. Both tabulating card systems and most electronic systems require historical or master information to be recorded in some physical form outside of the system. For processing, historical or master records and the transaction records must be brought into the processing system together. In contrast, an in-line accounting system processes each transaction, in the order of its occurrence, directly against the historical record continuously stored in the internal memory of the system. Grouping or sorting of like transactions is not necessary to this method of processing, but a large memory device to store the historical records is required.

To understand the problems presented by in-line electronic accounting, it is necessary to understand the characteristics of such a system. Among the in-line electronic accounting systems available, one—the IBM 305 RAMAC—has been selected to illustrate this discussion. Although specific comments relating to the components of the 305 RAMAC will not apply to all other systems, the concepts of control and audit trail developed will apply to most in-line electronic accounting systems.

The operation of the system and the control challenges center about three features of the electronic system:

First, unlike most data processing systems, a large internal memory is provided to store data on a continuing basis. This eliminates the need for batching transactions and discharging results on external records such as magnetic or paper tapes, punched cards or printed listings.

Second, the system is designed to process efficiently data introduced in random order, obviating the need for presorting and collating incoming data.

Finally, in keeping with the reduced need to discharge information, the ability to discharge data is limited to a printer, a card punch, and a console typewriter, each of which operates generally at speeds slower than the internal manipulation of the data.

To those conversant with establishing internal controls and conducting audits, the challenges presented by an in-line electronic accounting operation will be apparent:

1. By means of its processing abilities and internally stored data, the system is able to process as an uninterrupted operation substantially all the accounting for a business transaction. As an example, in processing an order from a customer, the system could relieve the inventory accounts (stored in memory) of the amount of shipment, compute and print the invoice (using sales prices stored in memory), charge the customer's account (stored in memory) and accumulate the pertinent cost and sales data (likewise stored in memory). The only visual record that need be produced would be an invoice to be sent to the customer.
   Although it is not unusual in highly mechanized accounting systems to find these operations performed automatically, it is only in electronic accounting systems with large internal data storage that this concentration or consolidation of operations appears. Transactions are processed through a series of uninterrupted operations which directly alter permanent historical records without intermediary machine processing runs and summarizations. Further, the absence of intermediary records reduces the opportunity for visual review and other controls based on the conventional concept of division of duties between employees, and eliminates one means of reconstructing the accounting transactions for audit purposes. This concentration of accounting in the machine operation and the absence of visual review requires that the machine system be carefully controlled.
2. Data stored in the internal memory are continuously altered as a result of the (intentional) posting of updated data over the prior data, automatically erasing the prior data. The possibility also exists that such data will be lost or altered by:
   (a) the deliberate or chance misposting to a wrong location in memory.
   (b) possible malfunctioning of the system.
3. The original transaction documents need not be put in logical sequence for processing purposes and, accordingly, may not be readily available for reference purposes without additional sorting and filing. The punched cards introducing the data may also be left in random order and be as difficult to locate as the original documents.
4. In-line accounting is usually adopted where it is important to maintain data on a current basis, and therefore, it may not be practical or economical to delay the processing to establish advance control totals.

It is the purpose of this study to consider the more significant problems presented by in-line electronic accounting and to suggest means by which adequate controls may be established and suitable audit reference information provided, without unduly interfering with maximum efficiency of the operation. The discussion is based upon a review of electronic accounting systems now available and the limited in-line operating experience to date. It is not possible to specify procedures applicable to every situation or to anticipate future developments in machine design or operating technique. However, this study should provide a basis for each user, in conjunction with his internal and independent auditors, to develop suitable techniques and procedures for internal control and audit trail.

Components and Functions of the IBM 305 RAMAC®

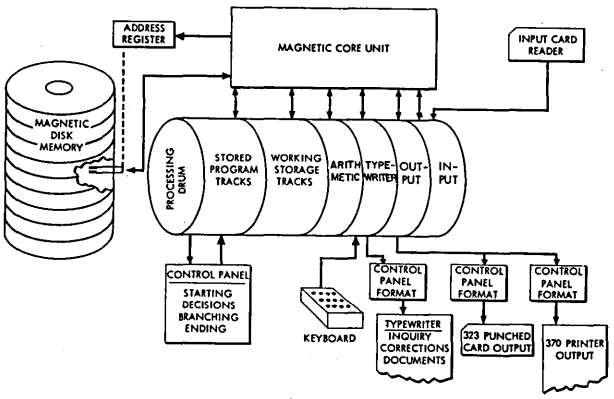
Preliminary to considering the problems outlined above, it may be well to review briefly the components of the 305 RAMAC System. A more complete discussion of the equipment and its operation will be found in the manufacturer's manual of operation.

The 305 RAMAC is an electronic accounting system with calculating abilities and a random access memory unit. Information in the form of punched cards is entered (input) into the system through a card reader which converts the punched card coding into a code of electrical impulses. The impulses are transmitted to, and stored on, a magnetic drum in the processing unit of the system.

Information is extracted (output) from the system in reverse fashion by any of three means: card punch, printer, console typewriter. These three components complete the basic machine system.

Information to be retained in the system may be stored for indefinite periods in the form of magnetic spots on tracks of the memory disks. The disks have a capacity of 5,000,000 alphamerical characters, in the form of 50,000 one-hundred-character locations.

The system is directed in its operation by coded instructions stored on the magnetic processing drum and by control panel wiring similar to that found in punched card equipment. The actual processing of the data occurs in the storage area of the magnetic drum to which the data to be acted upon are transferred from the disk memory or from other areas of the processing unit.



Schematic of IBM 305 RAMAC

Other electronic accounting systems available differ in the size of the internal memory, operating speeds, flexibility, and use of magnetic tape for input and output. Generally, the 305 RAMAC may be considered a small to medium size system.

Illustration of In-Line Accounting

The following is a simplified illustration of an electronic accounting system performing in-line accounting for a customer's order. It also demonstrates the basic abilities of an electronic system, which consist of:

1. Moving and storing of data.
2. Logical decisions upon comparisons.
3. Arithmetic computation.
4. The ability of the stored program to modify its own instructions.

Upon receipt of an order from a customer, the pertinent data from the order and the location address of the customer's account in the disk memory are key punched into a card which is introduced into the system through the card reader. Acting on instructions previously stored in the applicable section of the processing drum, and by the control panel, the system seeks the customer's record at the disk memory address indicated. The record, consisting of name, address, credit limit and current account receivable balance, is recopied onto the working storage area of the processing drum. The customer's name and address are transmitted to the printer, which begins the printing of the combination invoice-shipping notice on a multicopy carbon form.

Next, by reference to the stock number of the item ordered, the system in the same fashion copies the applicable inventory record from the disk memory to the processing drum. A comparison is made of the quantity ordered with the quantity on hand:

If the quantity on hand is greater than ordered, the system extends the quantity ordered by the sales price recorded in the inventory record and transmits the stock part number, description, quantity and extended sales price to the printer for inclusion on the invoice-shipping instruction form. The sales value would also be stored in working storage for accumulating an invoice total.

If the quantity on hand is less than the amount ordered, the system will, in accordance with established company policy, either invoice the quantity on hand and punch a back order card for the remainder, or back order the entire quantity.

In those cases in which a shipment results, the inventory record is relieved of the quantity shipped and its cost. The remaining quantity on hand is compared with a predetermined order point and, if less than the order point, a purchase or production requisition card is punched. The updated inventory record is then returned to its disk memory location where it automatically erases the prior data. The cost of the shipment and sales value are added to the cumulative sales analysis stored in disk memory.

This inventory procedure is repeated for each item on the customer's order. After the last item is processed, the various sales values accumulated in working storage are totaled and inserted on the invoice. The total is also added to the customer's current account balance, previously stored on the processing drum. A credit limit recorded in the customer's record is then subtracted from the combined total. If the result is a negative amount, indicating adequate credit, the customer's record is updated for the amount of the shipment and returned to disk memory, and the invoice is released. If a positive amount resulted from the test of the credit limit, the pertinent credit data would be coded on the invoice form for follow-up by the Credit Department and the sales value recorded on a punched card. The customer's record on the disk memory would not be altered.

If the Credit Department, after review, authorizes the sale, the punched card recording the sales value will be returned to the system to update the customer's record. If the Credit Department rejects the sale, the customer's order card, punched at the beginning of the operation,

will be coded as a sales cancellation transaction and returned to the machine, together with any back order cards, for restoring inventory and adjusting sales and cost of sales statistics. In a similar manner, any unshipped sales orders will be reversed in the accounts at the end of each financial reporting period.

At the end of each month, the accumulated totals of sales and costs of sales are extracted through the console typewriter for posting to the general ledger. Periodically, trial balances of accounts receivable are printed or punched for review and comparison with the detail of open items kept on file outside the system. Credit limits are included on the trial balance to permit review by the Credit Department. Inventory trial balances are also obtained as required. Sales prices, listed on the inventory trial balance or extracted separately, are reviewed by the Sales Department.

The foregoing illustration is intended only to demonstrate how an in-line electronic accounting system can operate. For simplicity in description, certain additional operations commonly included in the instruction programs to good advantage have been omitted. For example, address conversion by a process of randomization of the identification number may be employed when the identification number of the record cannot be used also as its disk memory address; substitute stock items can be automatically selected in the event that the stock item requested is out of supply; and provision can be made for random interrogation of the disk memory without discontinuing the processing operation.

Many installations of in-line electronic accounting equipment will be used for a variety of tasks, for each of which a special instruction program may be necessary. These additional programs will normally be stored in the internal memory of the system and will be moved to the processing drum when needed. In order to minimize time consumed in changing programs, control panels and output forms, the in-line processing of data as transactions occur, may be restricted to time-urgent applications. Other applications, such as payroll, may be processed periodically in batch fashion.

Control of the Flow of Data

Internal control consists of the checks and balances established by management to safeguard the assets, provide reliable financial statements and obtain adherence to management policies. Management's interest in the system of internal control is shared by the independent auditor who is charged with evaluating the internal controls in determining the scope of his examination.

Accounting information is one of the most important internal control devices and, accordingly, the personnel, procedures and machine operations which produce the accounting information are of vital importance to management and the independent auditor. Controls relating directly to the accounting information are usually referred to as internal accounting controls. Such controls rely heavily on a division of duties among the employees of an enterprise in such a manner that no one person has complete accounting control over substantially all phases of a business transaction, and that the work of one employee or group of employees is checked by another employee or group of employees.

In in-line accounting, the machine system and the employees operating it perform major portions of the accounting for the transactions. This leads to the crux of the problem: how to attain efficient use of the machine system by assigning to it as much as practical of the processing of an accounting transaction while, at the same time, retaining adequate internal controls.

The answer appears to be to place great stress on controlling the *flow of data.* This departs from the usual horizontal level of internal accounting controls whereby, for example, the work of the accounts receivable clerk checks the work of the sales analysis clerk, which in turn operates as a check on the materials charged out by the perpetual inventory clerk.

Control of the flow of data can be achieved by separating the following duties:

1. The initiation of accounting data.
2. The processing and accumulating of the data.
3. The ultimate summary recording and review of the data.

In relation to the operation of the machine system, this division of duties can be expressed as control of the initiation and input of data to the system, control of the machine operation, and control applied to the output of the system.

Input Controls

Input controls are concerned with insuring that the input data properly reflect all transactions occurring and that the transactions are authorized by appropriate officials; for example, that all material received is properly recorded on the receiving report and has been authorized by a purchase order.

The purpose of the input controls in the operating departments, obviously, is not affected by the method of subsequent processing. However, specific problems are presented in:

1. Accumulating control totals prior to the introduction of the data into the system.
2. Ensuring that data are accurately transcribed into a form that can be read by the system.

Accumulation of control totals of data to be processed is important to ensure the processing of all data. Such totals, also, often provide the basis for the subsequent summary checking of the accuracy of the processing. Control totals of dollar amounts are desirable, but if the input data are not expressed in dollars (for example, quantity of materials ordered, to be priced and extended in the machine system), control totals expressed in quantities, number of items, identification numbers, etc. are useful. When the input data are initiated in, or sorted into, logical transaction groups and sequence, it is not difficult to obtain control totals and to use the sorted detail data to investigate differences from the totals. However, because of the random access faculty of the system, the input data need not be in any logical transaction groups or sequences. For example, material receipts and sales may be interspersed and out of sequence. Under such conditions, there are a number of techniques available for obtaining the desired control totals and facilitating investigation, without extensive presorting or pretabulation:

1. By use of data normally kept by the originating department for its own internal control or operating purposes.
   (a) Processing control data, such as, total cash deposited.
   (b) Operating statistics, such as, number of items produced.
   (c) Sequence numbers of prenumbered forms issued, which provide a control for the number of items or records.
2. By a minimum of sorting.
   (a) Gross control totals for all input items obtained without sorting, such as total of material received less material issued. Sort only if the total processed by the machine differs from control total and requires investigation.
   (b) Input data grouped into small control batches to localize differences and to permit investigation of differences without further sorting.
3. By using the system to accumulate control totals apart from the actual processing of the data.
   (a) Storing input control data on a memory disk during processing; discharge data when the printer is available after the completion of the processing.
   (b) Passing input data through the system twice; first, to print the input as a multi-column analysis by control classification, and then again for the actual processing.

The suggested use of the system to accumulate control totals indicates that it is not necessary, although preferable, to create control totals prior to processing. However, when control totals cannot conveniently be established in advance, it is important that the input data, or copies thereof, be physically controlled until control totals can be established after processing. This situation may arise when transactions are processed individually as they occur, or if there is a need to process a group of transactions immediately and if the delay for creation of control totals is not practical.

The second input control problem of ensuring accurate transcription of the original data to punched cards, which can be read by the system, may be solved by well established punched card procedures. The input cards may be key verified or tabulated for comparison with totals independently derived from original documents.

Machine Processing Controls

It is usual in electronic accounting and data processing installations to establish a service unit of machine operators to operate the equipment. Input data are received from outside sources ready for processing. The data processing center has no part in initiating or authorizing the accounting for a business transaction. It is concerned solely with the processing of submitted data in accordance with previously established instructions. Under these circumstances, it is possible to establish controls over the employees of the center to ensure the processing of all, and only, authorized data and to test the over-all correctness or reasonableness of the processing. The exercise of these controls is generally delegated to a group organized for this purpose and is discussed under "Output Controls."

The accuracy of the processing of individual transactions is dependent on the accuracy of the programming, the checks built into the system by the manufacturer, and the checks incorporated by the user in his programming of the system. Programming accuracy is basic to the correct operation of the system. It depends on the careful conception and implementation of program instructions, proper program documentation, adequate review and approval. Most important for the correctness and completeness of the programs is the thorough testing with simulated data and parallel processing of "live" data on the electronic accounting system and on the predecessor system for a period prior to the abandonment of the former system.

In the 305 RAMAC, the built-in checks include a general "clock" check to detect and stop the operation if the timing control circuits are out of time. In addition, there are the following built-in checks on the transfer of data within the system:

Input: In each of two separate operations the card reader reads every punched card, converts it into the machine code and transmits the data to the magnetic drum. The two inputs are compared, and any discrepancy will stop the machine.

Printer output: As each character is printed, a check is made to ensure that the print unit is set up correctly to print the desired character. The printer can be wired either to stop or signal any errors detected.

Punched output: The card punch can be wired either to stop or signal any double punch or blank column.

Input to disk storage: A sequence of write, read back and compare is carried out whenever information is written into disk storage. Any error will stop the system.

Parity bit: To detect alteration of the magnetic bits comprising a character in the machine code, each character is given an odd number of magnetic bits. In every transfer of data within the system, each character is tested for an odd number of bits. An even number of bits will stop the operation.

In addition, programmed checks may be introduced as desired by means of coded instructions and control panel wiring. Some programmed checks with common applications are:

To detect loss or non-processing of data:

Record count: The system may be programmed to count the number of items it processes and the resulting total can be compared with a predetermined count. Also, when the data pertaining to a single transaction require more than one input card, the first card may indicate the number of cards comprising the record and the system can check that the correct number of cards follows.

Sequence check: A sorted sequence of records is checked to see that the desired order has been maintained throughout. If the records are consecutively numbered, the system can also check the completeness of the sequence.

Check of totals: If the total of a field of the input or output has been predetermined, the system can accumulate a corresponding total and compare it with the predetermined total. A modification of this technique is "hash totals" of items not normally added together—quantities, account numbers, stock numbers, etc.

To check arithmetic functions:

Limit check: This is a check of a record, or of the result of a calculation, to see whether predetermined limits have been exceeded. A limit check can be built into an invoice preparation program so that the invoice amount may not exceed a predetermined limit, for example, $1,000, without a special authorization.

Crossfooting balance check: This is a type of check ordinarily employed by accountants in the preparation of work sheets. It is equivalent to cross casting individual calculations, such as gross pay to net pay, vertically adding the detail amounts and cross casting totals to prove.

Proof figure: An important series of multiplications may be checked by a proof figure calculation. An arbitrary figure, which must be larger than any multiplier among the data to be verified, is selected as proof figure. Each multiplicand is then multiplied twice, once by the multiplier originally provided in the data and a second time by the difference between the multiplier and the proof figure. The totals of both multiplications for all items processed are accumulated and compared with the product resulting from a multiplication of the total of all multiplicands by the proof figure.

Double or reverse arithmetic: It is feasible, although not generally considered necessary, to use double or reverse arithmetic. As implied, double arithmetic consists of executing the same operation twice and comparing results. Reverse arithmetic is a variation, whereby a calculation of A times B equals T is checked by extending B times A, subtracting T, and ascertaining that the result is zero.

To avoid mispostings:
Identification comparison: To avoid reading from or posting to incorrect disk memory files, a comparison may be made of some common items appearing in the file and in the data to be processed. This comparison may be made of memory address, stock number, unit of issue, etc.

Blank transmission test: The system monitors every transfer of information to determine if it consists of blanks or zeros. By control panel wiring the blank transmission test may be utilized to detect a loss of significant data and to avoid the erasure of a disk memory file by the posting of zeros.

Alteration test: Failure to post to a disk memory file may be detected by comparing the contents of the file before and after each programmed posting to determine that the contents of the file have been altered.

Related to programmed checks, and of at least equal importance, is control of instruction programs. An undetected error in processing an item will result in an incorrect transaction. However, an undetected inaccuracy in the instruction program will distort all transactions processed by the program, until discovered by input or output controls. In an electronic accounting system with stored programs, the opportunity for accidental or deliberate alteration of a program exists both when the program is being used, and also when it is being stored in internal memory while another program is operating on a different task. In electronic data processing systems without the large memory characteristic, programs are stored outside the system on tape or cards and, accordingly, are not as subject to alteration.

Some techniques for controlling programs against inaccuries or alterations are:
Advance testing: The careful preparation of the program and extensive testing, as discussed above, is a basic requirement for accurate operation. All changes in the program should be similarly tested and approved by supervisory personnel before being placed into operation.

Control copy: A copy of the approved instruction program, and diagram of the control panel wiring, retained by supervisory personnel, or the audit group, can be used for test comparisons with the program and wiring used for operation of the system.

Test data: Either as an alternative to comparing the control copy of the program with the operating copy, or as a supplement thereto, the processing of controlled simulated data, including data deliberately designed to violate the machine processing controls, is an excellent test of operation of the program and the equipment.

Console typewriter control: The printout of the console typewriter can be reviewed by supervisory personnel for correctness and propriety of any data introduced into the process by the operator, or alterations by him of the programmed operation.

The effectiveness of these controls depends on the familiarity of the supervisors with the programs and the machine system and on their independence from the operation of the equipment.

A further check on the operation of the system is the continuous preventive maintenance program by the manufacturer designed to detect and correct possible failures in the system.

Output Controls

The function of output controls is to determine that the processed data do not include any unauthorized alterations by the machine operation group and that they are substantially correct or reasonable. It is desirable that the personnel responsible for the output controls have no control of the physical assets involved, the detail records, the machine operation, and the authorization of transactions. Some output control techniques are:
Comparison of control totals of data processed with summary totals obtained independently from original source data: total of dollar amounts, count of items for processing, hash totals of quantities or identification numbers. This should be considered the basic control.

Control by exception:
1. Investigation of exceptions or limit violations produced by the machine operation.
2. Investigation of differences revealed by periodic physical inventories and communications from customers.
3. Comparison of totals with totals of the prior period and summaries of intervening changes.
4. Statistical analysis of totals (gross profit percentage, average hourly rate, etc.).

Systematic sampling of the accuracy and propriety of individual items processed, originating tests both from input and output records.

Submission of reports and analyses of processed data to originating group for their review and check of unusual or abnormal items.

The output control group, of course, may also be responsible for controlling additional functions not directly related to the operation of the electronic accounting system, such as payment of invoices, distribution of payroll, or maintenance of general ledger. In addition, other controls are exercised by groups outside the accounting area; for example, review of sales prices by sales personnel, review of credit limits by the credit group, review of inventory usage by the purchasing group. The internal control techniques applicable to these functions are not discussed here, as they are well established and are beyond the immediate purpose of this report.

Loss of Stored Data

In an in-line electronic accounting system, vital accounting data, such as accounts receivable, inventory balances, sales statistics and costs analyses, may be stored in internal memory. As previously discussed, data stored in internal memory are continuously erased in the normal updating process and may also be lost by incorrect processing or malfunctioning of the system. One common fear, the loss of the entire memory file as a result of an interruption of the electric current, is unfounded. Data are stored in the disk files in the form of magnetic spots that are not dependent on a continuous supply of electric current. Data in the processing area, however, may be lost or distorted by an interruption of the electric current.

The possible loss of the data by incorrect processing can be minimized by the program checks noted under "Machine Processing Controls" and by the preventive maintenance program. The technique of identification comparison is particularly valuable for this purpose. However, losses may still occur. Therefore, a means of reconstructing the data should be provided. Basically this requires a cut-off balance at some prior date and details of subsequent transactions. Methods for obtaining such information are discussed in the "audit trail" section that follows. It should be noted that the requirement that transaction details be available for the period since the last cut-off balance imposes a minimum retention period for the records involved.

Organizational Changes

The titles assigned to the control groups above were selected to illustrate their relation to the electronic accounting system. A review of their functions will indicate that counterparts to such groups already exist in many of the organizations contemplating the use of an electronic accounting system. For example:
Input control group: timekeeper/foreman (payrolls), storekeeper (inventories), sales/credit department (shipments to customers), cashier (cash receipts), and, in some cases, the general control group listed below.

Machine processing group: tabulating room personnel, comptometer operators, billing clerks, posting clerks, accounting machine operators.

Output control groups: General: controllers division, general accounting department, general ledger clerk, internal auditor. Specific: paymaster, shipping clerk, storekeeper. Where such groups exist, the conversion to in-line accounting on an electronic system will present principally the problem of organizing and adapting old techniques and re-appraising the extent of controls required, based upon the procedural changes and the reliability of the new system as compared to the prior system. It should be appreciated that, as in most tabulating and electronic data processing systems, the major portion of the control will be exercised by the controllers division and related departments named above as the general output control group. However, the other groups should be utilized whenever the circumstances permit or make it desirable.

Creation of an Audit Trail

Beyond the need for controlling the day-to-day operation of the electronic accounting system, there is a need for what has come to be known in discussions of data processing systems as an "audit trail." This term is used to describe the means by which the details underlying summary accounting data may be obtained. It also includes methods of locating supporting documentary evidence.

Unfortunately, the term is somewhat misleading. The reference to "audit" often infers that this is a singular concern of the auditors. A moment's reflection on the auditor's requirements for an "audit trail" will indicate that in almost every instance, management itself makes more frequent use of these audit trails in the normal operation of the business than does the auditor in his examination. The auditor, for example, does require means of obtaining the details of accounts receivable balances for confirmation purposes and for investigating differences reported, but management with much greater frequency will utilize the same means for analyzing customer balances and answering customer inquiries. In addition, management must meet legal and tax requirements for retaining a record proving the validity of accounting transactions, and must provide means of reconstructing data lost from internal memory, as discussed previously.

The joint interest of management and the auditors in an audit trail suggests that the requirements of both be considered in installing the in-line electronic accounting system. In order to permit maximum utilization of the system, an audit trail should, to the greatest extent possible, provide for the needs of both, and be produced incident to the other operations of the system.

The most direct means of providing an audit trail is to have the system produce a punched card with the details of every transaction processed. The cards could be listed in a transaction register and then sorted and filed by account to provide a complete up-to-date analysis file of each account. This card file could be designed to provide the same information available under the present system of processing. Supporting documentary evidence could also be sorted and filed by account to provide ready reference.

This direct method of producing and filing of transaction cards would provide an excellent audit trail, but it possesses two disadvantages:

1. In most cases it will be an addition to the operations necessary for the processing of the data, and will place a heavy added burden on the output facilities of the system and reduce its efficiency.

2. It requires that manual or tabulating card files be maintained in addition to the information stored internally and the other supporting data available.

In terms of cost and system efficiency these two disadvantages may be material. However, unless the processing input or output provides substantially the same information, the suggested direct means of providing an audit trail will be worthwhile, at least until the system and programs have been proven by operating experience.

Some alternative techniques of providing an audit trail at less cost and reduced restriction on machine efficiency are discussed on the following pages. In some circumstances, these techniques may provide the required information as readily as the direct method suggested above. In other instances, the approach may not be as direct, but may still provide an acceptable substitute if the information is required so infrequently that the cost of more direct means is not justified. In considering alternative means, it is recognized that sporadic and special requests for information are a particular problem for electronic systems, because an efficient system usually is operating on a rather full schedule. In addition, the programming and set-up effort required to obtain special information may be extensive. Finally, the electronic system may not have retained the information required to meet unanticipated requests.

Except for a mention of some novel auditing techniques suggested by electronic accounting systems, this discussion has been confined to considering methods of providing an audit trail. It is assumed that those concerned with the problem will be acquainted with the various audit techniques and procedures and will be aware that the techniques and procedures to be applied in any specific circumstance cannot be generalized but must depend on the auditor's judgement. This judgement would be based on his review of the internal controls, his knowledge of previous experiences of the company, the materiality of the amount and other factors.

Generally, the requirements of the auditor for information from accounting records fall into three categories:

1. Balances—details of the items that comprise a control balance at a given date.
2. Transactions—analysis of transaction totals for the period, whether directly reflected in accounts or not.
3. Underlying documents—a means of access to the underlying and supporting documents for the balance, and the transaction details.

Balances

In in-line electronic accounting, balances are stored in internal memory and are updated for each transaction. Use of the balances by management can be:

1. Within the system, as outlined in the illustration: to check credit limits, to determine balances less than order points, etc., or
2. Outside the system, and requires discharge of the information: to review accounts receivable for aging, or inventories for production planning.

Even balances regularly used within the system require some manual review for management purposes, necessitating a discharge of the balances. In addition, the erasure of previous balances and possible loss of stored data make it essential that balances be discharged from time to time to create a permanent record to be used in reconstructing any lost data.

The usual method of reproducing balances is on a periodic basis, either a complete trial balance (usually as of the fiscal reporting date) or on a fractional cycling plan, perhaps cycling the more active or significant accounts more frequently than the others. An alternative method, requiring less system time but not providing the information as regularly, is to record the individual adjusted balances on transaction output records required for other purposes (for example, the file copy of the customer's invoice) and have the system check internally that the current balances agree with the control total.

Trial balances prepared for management purposes may provide the auditor with the information he requires, particularly if the trial balance is prepared as of a fiscal reporting date. If trial balances are not normally reproduced at the date required by the auditor, he can obtain the balances by requesting them in advance. Trial balances on a surprise basis can also be obtained; however, the auditor must be familiar with the system in order to properly time his request and arrange to be present at such time.

What if it is not feasible for the auditor to foretell his needs or to schedule his work so as to be able to request trial balances in advance? These or other special circumstances, including the loss of stored data, may require the balances as at a past date. This presents a problem. As mentioned previously, normally in the updating of a balance, the previous balance is erased and lost. Also, the voluminous details of transactions are not usually stored in the internal memory. Under such conditions, the system will not be able to supply or compute prior balances from the internally stored data. It is possible, of course, to reconstruct specific balances by manually reprocessing all transactions since the last preceding balance available. In an extreme situation, it is also possible to reconstruct many balances or a complete file by reprocessing on the electronic system or on tabulating equipment. Although feasible, both approaches are usually involved and costly. This suggests that unless the balances are available in some permanent record apart from the system, the auditor will facilitate his work by arranging in advance for the required information.

The auditor can also facilitate his work and reduce the demands on the system by requesting information only for the accounts he wishes to investigate. Such accounts can be designated either individually, or by a statistical sampling technique or a characteristic of the account, for example, in excess of $100, inactive more than thirty days, etc. The system can be programmed to select and extract only such accounts and to accumulate the total of the accounts not extracted to permit reconciliation with the control totals.

Transactions

The auditor is interested in the details of transactions as an explanation of changes in account totals and in order to test the operation of internal control procedures. In most examinations, the auditor tests only selected individual transactions. Accordingly, in this area as well, his interest is often less than management's, who usually require considerable information for detailed operating

analyses, budget comparisons, cost allocations, etc. As a general rule, by coordination during the planning stage, the operating data accumulated for management's purpose can be used also to serve the auditor's needs.

In any case, the amount of transaction information to be permanently recorded will depend upon demands for such information and, thus, there may be a direct correlation between the needs of management and of the auditor. As an example, in some companies, it may be necessary to maintain a ready analysis of customer accounts receivable to answer inquiries and for audit checks. In another organization, the small number of customer inquiries and limited credit review may not warrant the cost of accumulating a ready analysis. Similarly, in the latter case, the number of differences requiring additional investigation by the auditor can reasonably be expected to be small.

Whatever the need for transaction information, it will probably have to be accumulated outside of the system as the internal memory is usually more effectively used to store balances. Aside from producing a special record for each transaction, there are three sources of transaction information which may be utilized.

1. Input data

   This may be either of two types: a manually prepared document and a punched card prepared from this document; or a single document, a card which is manually completed and then punched. The use of the original document to obtain transaction details has the advantage of simultaneously obtaining the authorization. However, its use has certain limitations because the documents:

   (a) may be in random sequence and possibly be interspersed with various types of documents if input to the system is not presorted;

   (b) may be filed elsewhere in support of another part of the transaction: the receiving report, for example, supports the charge to inventory and the invoice payment;

   (c) may not contain the same information as that processed: a customer's order may include ten items, but only eight may be shipped;

   (d) will not contain full financial details of a transaction if some data are introduced from the internal memory: when processing stock requisitions, the cost information may be computed from internal memory—only the quantity would appear on the input record.

   If any of these limitations serve to restrict the use of the original input data for audit trail purposes, it may be well to consider overcoming the limitation by sorting or mechanically reproducing the document, if this source of information imposes the least cost and the least reduction of efficiency of the system. In either event, it is essential to set retention periods for the input data which will provide the necessary references for the agreed period.

2. Output data

   Frequently, the system will be required to produce a document for use elsewhere, such as the sales invoice, cash receipts listing, listing of material charges by budgetary account, etc., a copy of which may serve as transaction information. Copies may be printed either by the use of carbon paper or by printing on a master for use with duplicating equipment. Punched cards may be mechanically reproduced, or possibly be retained if only a listing is required elsewhere. This method of providing an audit trail adds little or no extra cost and does not affect the operating efficiency. Depending on the portion of the transactions covered and the adequacy of the form and content of the output document, the transaction file so created may be equivalent to producing a transaction card for every transaction processed as discussed above.

3. Special output

   For any type of transaction for which the above two methods provide inadequate information, it may be necessary to produce a special output record for the purpose of providing transaction data. Because of the ability to print and punch simultaneously while processing other data, certain special output may not add to the operating time. In one installation, a special transaction card is punched within the time it takes to print the same data on the sales invoice, hence, no additional operating time is required.

When master tables of data used for processing transactions are stored in the internal memory, an easily accessible record of all changes to the tables should be kept. Otherwise, the results of subsequent tests of the transactions may not be reconcilable. For example, if sales prices are stored in a table in internal memory for preparing sales invoices, a dated record of price changes should be kept to enable the auditor to check the invoice amounts.

Underlying documents

Both the auditor and management require means for obtaining quickly and easily the underlying documents supporting transactions. If the supporting documents are sorted into some logical sequence, the problem is only one of indicating some cross reference code in the transaction detail. However, if the input is accepted in random order and the documents are not sorted into any logical sequence, the problem is more complicated. Some techniques used to cope with this condition are:

Coding transaction type, batch number (or date) or an internally generated number indicating the sequence in which transactions were processed, into the output record from which inquiry may arise. This technique may be extended by storing in internal memory the code for the most recent transaction and reproducing it in the next succeeding output record. This permits complete reconstruction of the transactions and a cross reference to supporting documents by a "leap frog" procedure of stepping backwards from each transaction to its predecessor.

Reference may be made to another copy of the document retained elsewhere in some logical sequence; for example, a copy of the receiving report retained by the storekeeper in numerical sequence.

Introducing data into the system in random order to avoid delay, and subsequently sorting the data into a logical sequence when sorting equipment is not otherwise used.

Using the Electronic System to Help the Auditor

The following indicates some of the ways in which the auditor may take advantage of an in-line electronic accounting system to reduce the time required in his examination. Although these techniques have not been observed in actual use, they appear feasible and economical for the auditor to adopt:

Use the system to foot balances and to select items with designated characteristics for further audit.

By reference to the customer's name, address and account balance stored in internal memory, have the system prepare confirmation requests.

Have the system compare inventory count cards with recorded balances and report details of any differences.

Process simulated data as a test of the instruction program and system operation.

Conclusion

Certain significant problems of internal control and audit trail are presented by in-line processing on electronic accounting systems. The seriousness of these problems will vary directly with the extent by which management, through imaginative planning, makes use of the abilities of the system. However, by equally imaginative advance planning, controllers and auditors can resolve these problems within the framework of an efficient operation, and may well be able to use the system to expedite their work.

IBM®

International Business Machines Corporation
590 Madison Avenue, New York 22, N.Y.

Printed in U.S.A. 32-0753