THE COMPUTER -- NEW PARTNER
IN INVESTMENT MANAGEMENT

283-67

Arnold E. Amstutz

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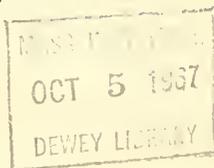
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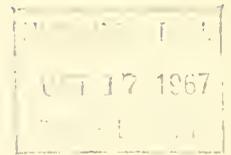
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I. INTRODUCTION

Many articles and forums have debated the role of the computer in invest-
ment decision making. Enthusiasts have proclaimed that "it will soon be
possible for portfolio managers and financial analysts to use a high speed
computer with the ease of a desk calculator".[1] "Computer portfolio selection
will eventually prove to be extremely useful to sophisticated investors."[2]
Others have vigorously objected that "... a computer will never tell you to
buy one stock and sell another ... (there is) no substitute ... for flair in
judgment, and a sense of timing."[3] Portfolio decisions must remain an art,
employing at its best a fine balance of experience, judgment, and intuition
all of which only a good analyst can supply."[4]

The Dearth of Relevant Experience

In the absence of meaningful experience with computer based investment
systems, the discussion to date has been based largely on hypothecation. The
substantial cost of data acquisition and maintenance, computer time, and
system development have effectively limited the generation of systems capable
of providing relevant experience. Those who have devoted resources to the
systematic study of security markets have offered little encouragement for
the would be practitioner of computer based investment decision making.[5]
Those who have found profitable application of the technology have preferred
to enjoy a competitive advantage in the market rather than to publicize their
activities.

Until 1963 those interested in computer-aided investment analysis faced
an appalling data acquisition task. Fundamental data (sales, earnings,

balance sheet, and P & L items) had to be manually culled from published
reports. Technical data indicating transaction prices and volume were manually
transcribed from published reports or were cumbersomely encoded from wire
service lines.

In 1963 Standard Statistics, Inc., a subsidiary of Standard and Poor's,
released the "Compustat" tapes containing fundamental data compiled annually
from 1947 for 900 companies. Coverage has now been expanded to encompass
1400 companies with data compiled quarterly.[6] Also in 1963 Scantlin
Electronics, Ultronics, and (in 1964) Bunker-Ramo began offering price,
volume, earnings, and dividend data for all listed securities. Data are now
available from these sources aggregated daily, weekly, and monthly.[7]

The Demand for Computer Output

With "machine readable" data widely available, it has become fashionable
to be "doing something" with computers. Practically every major financial
institution is now quick to point out that they have a computer.[8] Competitive
considerations motivate many firms to assure their customers of active
participation in the computer revolution. The resultant demand for computer
output places a premium on rapid generation of computer-based numbers while
largely precluding orderly conceptual development, objective formulation,
testing, validation, and carefully planned implementation.

An Example of Successful Application

This is a report on the results achieved since 1959 by one firm which has
successfully applied computer technology to investment management.[9] It is
the author's contention that performance to date establishes as fact the
principle that through carefully planned development the computer can become
a unique and active contributor to the investment process.

II. EVOLUTION OF AN INVESTMENT SYSTEM

The systems with which this article is concerned have evolved over several years as management and system specialists worked together to:

(1) Establish system objectives compatible with management goals;

(2) Explore alternative means of achieving these objectives;

(3) Develop explicit representations of existing and desired decision procedures;

(4) Determine relevant measures and criteria;

(5) Test and evaluate alternative system structures;

(6) Modify management operating and decision procedures to facilitate system utilization.

Establishing Objectives for a Financial System

Development of these systems was governed by the objectives of the firm. In the words of its senior partner:

> We wished to develop an alternative to a large staff of specialist analysts. Our objective was to provide a mechanism for focusing the attention of analysts who are generalists together with the partners of the firm on specific and actionable areas of the securities market. We were further interested in developing procedures for the continuous and objective monitoring of the market. Such procedures, in combination with criteria for the evaluation of changing market conditions, would, we believed, permit a small highly skilled group to devote their attention to a limited number of situations, confident that they would be advised of relevant changes in other aspects of the environment if and when they occurred. In short, we were interested in computer-based management by exception.[10]

This emphasis on management functions provides a significant contrast to many computer applications. "Management Systems" are often designed around particular models or mathematical techniques with little or no consideration given to management perspectives, priorities, or information requirements.[11]

A Chronology of System Evolution

Initial research begun in 1959 was restricted to thirty securities

listed on the New York Stock Exchange. Data were collected manually from published reports. Experimental IBM 650 computer programs developed to test concepts on which the present system is founded required 27 minutes to evaluate a single company.

The first experimental system was completed early in 1960, and a six-month test was undertaken to evaluate performance. Operation of this proto-type was tedious and expensive. However, test results justified the alloca-tion of additional resources to achieve increased efficiency and coverage.

In the fourth quarter of 1960, work began on an automated system designed to handle information relating to several hundred companies. Since even the experimental prototype had heavily taxed the capabilities of the IBM 650, the new system was designed for the larger, higher speed IBM 709 computer. Expanded input processing programs translated, interpreted, and filed unformatted information received from news service wires. Specialized output programs presented graphic summaries of the results of analyses on printed charts.

In August 1961 following an exhaustive series of tests, the 709-based system was monitoring the activity of 300 selected securities. This second pilot operation confirmed the effectiveness of proposed analytic techniques in isolating major changes in the market for a security.

By mid-1962 operations had been expanded to monitor all common stocks traded on the New York and American Stock Exchanges. The system was parti-cularly effective in anticipating the market decline during April and May of that year. Experience with this large scale activity revealed three areas in which major refinements were possible:

(1) Existing data sources were undependable and frequently introduced substantial errors. Constant manual review and correction were required.

(2) The system's ability to produce output far exceeded management's capacity to assimilate information.

(3) Established measures of financial performance were inadequate to distinguish between alternative models of market behavior. New concepts and measures were required to evaluate the effect of changes in criteria across the entire market over extended time periods.

In 1964 a system incorporating the proven attributes of its predecessor with significantly improved capability in the three areas of concern was implemented. This configuration employed machine-coded data, improved information-handling capabilities, and high resolution cathode ray tube graphic displays. In contrast to the 27 minutes per stock operating time cited earlier for the first prototype, this system, using an IBM 7094-2 computer, analyzed a security every two seconds and handled over five billion information elements in the course of a normal week. The 1964 design included "learning" procedures through which the computer was able to contribute directly to future refinements. Heuristics -- rules of thumb -- were incorporated to permit evaluation of alternative investment approaches. Using adaptive procedures -- procedures which change with use through time -- the computer developed new models and processes which contributed to the success of subsequent systems.

For almost two years the 1964 configuration was used to achieve two related but, at times, functionally incompatible objectives:

(1) In a research context, it provided flexible access to extensive data organized to facilitate systematic investigation of market process models and investment decision procedures.

(2) In an operating management context, it was the vehicle through which models and procedures validated within the research system were applied to the firm's investment activities.

In 1966 management began to separate these two functions. Detailed objectives were specified for two distinct capabilities: Totally integrated research support and on-line, real-time, investment planning and decision making.

Research Objectives

The following research objectives were established:

Data Structuring. High priority was placed on the ability to process and manipulate extensive files of technical and fundamental data maintained in micro-detail for all listed companies. The firm recognized the importance of maintaining a flexible data structure which could be expanded to encompass new inputs without costly modification.

Parametric and non-parametric statistical routines were included to facilitate analysis of fundamental and technical relationships. Graphic, as well as tabular, data presentation was specified. Although inclusion of this capability added substantially to system costs, previous experience had demonstrated that decisions on model development as well as day-to-day investment analysis was expedited by rapid and easily assimilable data display.

Model Design and Evaluation. Since objective model evaluation was a primary research objective, a flexible compiler was developed to permit the testing of mathematical and logical relationships against the data file.[12] Earlier success in using process models to investigate certain market phenomena, motivated the inclusion of an iterative process simulation capability.[13]

Operating Objectives

The following operating capabilities were specified.

On-Line Interaction. The term "on-line" refers to direct man-machine communication through remote access consoles.[14] Video display units were utilized to achieve rapid and silent presentation of desired information

(See Figure 1). Printed copies of material appearing on a display screen could be reproduced on ancillary printers.

Data Maintenance. Specifications emphasized a wide range of data maintenance functions including procedures designed to isolate erroneous inputs through tests of consistency, source validity, and hardware performance. Data-handling programs were to provide efficient organization packing and storage of market transaction data as well as extensive financial information on all listed companies.

Real-Time Data Acquisition. Direct (real-time) access to the security markets was desired. Through on-line interaction, the analyst was to have the ability to structure and evaluate relevant market conditions as they developed.

Interrogation and Retrieval. The system was to facilitate the acquisition of fundamental and technical measures required in the course of day-to-day industry, company, and security analysis. Communication procedures were to simplify access to frequently desired information without precluding specialized interrogation.

The Monitor Function. The system was designed to take maximum advantage of the computer's ability to apply consistent, objective criteria continuously to all activities occurring in the security market environment. It was to be the vehicle for implementing a policy of management by exception. All relevant data would be continuously reviewed, and actionable situations would be referred to management.

Advisory Recommendations. Using analytic procedures validated earlier, the operating system was to evaluate all monitored referrals and, where appropriate, to recommend specific actions (i.e., buy, hold, sell, or sell short).

The Current State of Evolution

In 1966 a system meeting these research and operating objectives was completed. Its structure and application are described below.

III. CURRENT SYSTEM STRUCTURE

Efficient realization of these system objectives, using hardware available in 1965, necessitated the use of five computers. The basic hardware configuration summarized in Figure 2 will be briefly outlined in this section to illustrate the translation of management objectives into system structure.

Real-Time Environment Sensing

A special purpose real-time computer monitors transactions on the New York, American, Midwest, and Pacific Stock Exchanges. Transaction data in combination with earnings, dividends and other fundamental information are transferred to on-line data files. The basic functions of the real-time computer may be described as follows:

1. Transactions reported by monitored exchanges are stored in an on-line data file.

2. Monitor routines determine whether the addition of the most recent trade establishes a situation meeting criteria references in the monitor file.

3. When criteria are met, a message is sent to the process computer specifying the content of file segments associated with the reported situation and the applicable criteria.

4. Data stored in the on-line file are transferred to the process computer on request.

5. At the conclusion of each business day the complete contents of the on-line file are transferred to the process computer.

On-Line Processing

An on-line process computer receives and responds to transmissions from the real-time computer and two communication units. Basic functions performed by this portion of the System include the following:

1. An intermediate history file is updated using data provided by the real-time computer.

2. Information stored on the drum is retrieved on request.

3. Analytic programs utilizing data stored on the drum or obtained from the real-time computer may be initiated by the real-time computer or communication units.

4. Messages originated by the real-time computer and the process computer are transferred to the communication units.

5. Real-time data are transferred to the communication units on request.

6. Contents of the intermediate history file are transferred to the master control computer at regular intervals.

Communication Processing

Two communication control units transfer messages between the process computer and display devices.

1. Message content and functional requests originated at display stations are encoded and transferred to the process computer.

2. Transmissions generated by the process computer are received, decoded, and displayed on a printer or cathode ray tube.

Analysis and Control

Analytic programs operating on a large scientific computer provide central control for the system.

1. Disaggregated history files containing a complete chronological record of activity on monitored exchanges are updated with information provided by the process computer.

2. Monitor reference criteria used by the real-time computer are generated and transferred to that system segment.

3. Data for the intermediate history file are prepared for transfer to the process computer.

4. Analyses based on recently generated and historical data are developed.

5. Summary reports incorporating actions taken by the real-time and process computers are generated.

6. Output tapes containing printed report and graphic display content are prepared.

Report Generation

Report generation is handled by two "slave systems" controlled through magnetic tape generated by the analytic system.

1. A small computer operating as a report generator produces all printed output.

2. A cathode ray tube display system generates graphic microfilm output which is later converted to "hard copy".

IV. SYSTEM OPERATION

The remainder of this article is devoted to sample outputs generated using the system configuration just described. Research and operating functions will be considered separately.

Research Functions

The System evaluates process and decision models against historic or hypothetical company, market, and economic conditions. It is able to recreate conditions existing at any time since 1959 and to test the effect of alternative analytical approaches to determine "what would have happened if" a particular decision procedure or rule had been employed during the specified period.

Simulation Testing of Proposed Policies. Proposed policies are evaluated through investment analyses of the type illustrated in Figure 3. This report summarizes actions taken with respect to two securities under a simulated policy. The first three entries in each line indicate the date, action taken, and average action price. In the Paramount example, the stock purchased February 17, 1961, at $64.0 was sold on May 5, 1961, at an average price of $80.3.

The Investment Report entries to the right of the reference price relate to a "Conservative Policy" governing a cash account in which only long

positions are permitted, and a "Speculative Policy" controlling a margin account (50% margin during 1961) in which short as well as long positions are allowed. The computer calculates the profit per share, dollar investment, and percent return realized during the simulated period. In the Paramount example, the initial 1961 trade resulted in a $16.2 per share profit on an investment of $6,405.00 in the Conservative account, and $3,302.00 in the Speculative account, yielding returns of 25.3 and 50.7 per cent respectively.

After selling Paramount on May 5, 1961, the System took a short position in the margin account. This short sale, which was covered on May 17, 1963 at a price of $40.7, is noted under the Speculative Policy but does not affect the cash account. Having covered its previous short, the System established a long position in both the Conservative and Speculative accounting on May 17, 1963.

The reports presented in Figure 3 were prepared as part of a simulation test covering the time period from January, 1961 through March 20, 1964. The System has, therefore, closed its accounts in Paramount and U. S. Steel at the prices prevailing at the close of market on the final day of the simulated period.

Evaluation of Simulated Performance. The final performance evaluation in Figure 3 indicates the average number of weeks held and the annualized percent return on invested capital. The Conservative Policy in this simulation test produced average holding periods of 28 and 22 weeks and an annual return of 66.3 and 19.3 per cent respectively for Paramount and U. S. Steel. Under the Speculative Policy simulation holding periods averaged at 53 and 35 weeks, and annual returns were 67.9 and 40.5 per cent respectively.

The simulation process permits years of hypothetical operating experience to be evaluated in a few minutes of research. Following extensive testing of

alternative criteria, high performance decision procedures are implemented in the operating system.

Operating System Functions

The majority of the operating functions defined by previously established objectives require access to a complete and extensive historical record of company and security activity. As new data are added to the System, existing file contents are updated rather than replaced. The resultant disaggregated data file is the basic reference for system evaluation of market, industry, or company conditions in light of current and historical performance measures.

Disaggregated Data Files. Disaggregated data file maintenance creates significant problems. A single status evaluation for all securities monitored may involve reference to billions of data items. However, the disaggregated file, in combination with flexible data structuring routines which aggregate to the level appropriate for analysis and/or presentation, is the foundation of the operating system. Since detailed data are maintained in chronological order, no structural biasing is imposed by aggregation along lines appropriate for analyses conducted at that time, many operations of the present System would be precluded by data limitations.

Response to Interrogation

In addition to standard reports generated on request, generalized input-output programs provide flexible communication between the computer and its human associates. The financial analyst may obtain specialized tabulations of present or historical conditions, selective reports of the existence of particular conditions, and a wide variety of visual presentations to aid in the assimilation of data. The System is able to provide output relating to a particular company, an industry, or an entire market and to aggregate present

or historic information in forms specified by the analyst at time of interrogation.

The Monitor Function

Since the monitor capability is among the System's most important attributes, it may be useful to review the basic characteristics of a monitor system operating in the financial management context.

The financial analyst who is following particular situations at a time when substantive changes occur will usually note these changes and take action based on them. Unfortunately, it is impossible for an analyst to be totally "on top of" -- to be monitoring -- all data relating to even a small portion of the relevant environment at any point in time.

The computer functions in this context to extend the coverage of the competent analyst by applying to all available data the objective reasoning which, given sufficient time and an appropriate supporting environment, the analyst would perform himself. Therefore, a small group of generalists are free to focus their attention on actionable situations confident that the market is being continuously monitored and that the System will alert them to relevant developments.

Advisory Recommendations

The System incorporates programmed procedures designed to isolate and evaluate potentially actionable market situations. Conditions meeting specified criteria are referred to management along with recommendations for action. At the time of referral a decision record identifying the recommended action is automatically updated. The Status Log containing all such decision records provides an unequivocal chronological record of the System's performance as a decision-maker. Thus, while management has the option to

accept or reject system recommendations, validation of unaided system performance has been established by means of the Status Log record of actions taken under conditions existing in the monitored environment since 1958.

A sample Status Log record is illustrated in Figure 4. Entries for Abbott Laboratories traded under the symbol ABT are used as an example. The number (200) separating the symbol from the name is a sequence control used in audit procedures. The line following the Abbott identification summarizes the status of that security at close of market on the reporting date.

The sample report indicates conditions existing on Friday, March 20, 1964. Therefore, the first entry in each stock record specifies "3/20/64". The second entry defines the issue's status on that date. The Abbott Laboratories status is "CLOSED". Five status indications are possible. These are:

1. Bought - indicating that the issue was purchased on the specified date;

2. Sold - indicating that the issue was sold on the specified date;

3. Hold - indicating that the issue has previously been purchased and is now held in the system portfolio;

4. Closed - indicating that the issue has been previously sold and is not now held in the system portfolio;

5. None - indicating that, as of the reporting date, the computer has not taken action with respect to the specified security.

To the right of the status specification in the second and succeeding lines is the security's price at close of market on the indicated date. The last sale of Abbott Laboratories on March 20, 1964 was $114. The next entry specifies the average daily trading volume in round lots (1800 shares in the case of ABT).

The next four entries indicate the latest reported per share earning and dividend rates, the yield based on the last reported dividend, and the

applicable price/earnings ratio. To the right of the company price/earnings ratio is the average price/earnings ratio for a reference industry (25.6X for the Drug Industry in the case of Abbott). Data in succeeding lines summarize conditions prevailing on the preceding Friday and at the time of the most recent system actions with respect to the security.

On-Line Interaction

Much of the on-line information generated by the system is proprietary. However, portions of representative displays will be reproduced to illustrate on-line system operation. For purposes of exposition, let us imagine an analyst seated at his desk near a video display console or printer.

Monitor Messages

At 10:28 on the morning of November 25, 1966, the report reproduced in Figure 5 appears on the television screen. It is a monitor message generated by the real-time computer bringing to the analyst's attention a positive (POS-2) situation in First Charter Finance. The "-2" indicates a level 2 criterion has been met.

The second line of the display indicates the time of the computer's decision (10:28) and the bid, ask, high, low, and last trade (14.9, 15.1, 15.0, 14.6, and 15.0 respectively). The sixth line of the display notes that 73 round lots have been traded thus far in First Charter, and that no shares traded the preceding day. (Thanksgiving was a market holiday.) The average trading levels in that stock during two preceding reference periods were 103 and 87 round lots per day.

The first entry in the seventh line of the message indicates that the company is presently earning $1.79 per share which produces a price/earnings ratio based on the last trade of 8.4 as compared to an industry ratio of 8.3. The final item in the display notes that the system previously brought this

situation to the analyst's attention as a positive (+) level 3 consideration

on November 4, 1966, at which time the security was trading at 11.2.

Throughout the day the computer continues to refer finance companies to

the analyst. At 10:46 a level 4 Monitor report on United Financial of

California (Figure 6) is displayed.

While noting the position in several other finance companies, the system

is by no means myopically focused on that industry. At 11:00 while noting a

level 6 interest in Far West Financial (Figure 7), it also reports a level 4

development in Eastern Airlines at a price of 73.0. The final item in this

message illustrated in Figure 8 specifies that Eastern Airlines was previously

brought to the analyst's attention as a level 2 short (-) action on

July 15, 1966, at a price of 105.0.

Response to Interrogation

At the close of the day the analyst returns again to United Financial

of California and asks the computer to summarize the day's trading in

perspective of the last five days. When the display appears on his television

screen, he requests a printed copy from the computer to produce the output

contained in Figure 9. This display indicates that United Financial has

traded as high as 7.3, as low as 6.5, and closed at 7.2 on a total volume

of 105 round lots. Data for the preceding five days supplied at the analyst's

request places this activity in perspective.

Turning to fundamentals, the analyst requests a summary of the

unadjusted 12 month moving cumulated earnings and dividends reported

quarterly by United Financial during the preceding three years. The

system's response to this interrogation is illustrated in Figure 10.

V. SUMMARY

This article has reported on one firm's progress in applying information technology to investment decision making.

System Characteristics

System evolution from 1959 to 1967 has been described with emphasis placed on three characteristics of the system development process.

1. The systems have been designed to achieve specific management objectives.

2. Agreed upon measures of market and company performance are maintained in complete detail in disaggregated, chronological data files.

3. Increased system scope and sophistication have been achieved through a carefully planned process of gradual expansion and refinement.

System Function

Research and operating functions of current and earlier systems have been described. Research evaluation of market process and investment decision models was discussed with reference to simulation based analysis. Retrieval, monitor and advisory functions were illustrated by representative on-line system outputs.

Management Implications

The impact of the computer and systems analysis techniques has been assessed in terms of demands made on the partners of the firm. They have been called upon to establish highly specific objectives for research and investment programs. They have been asked to establish quantitative criteria which permit the computer to choose between alternatives on the basis of rational evaluation. They have been challenged to make implicit theories explicit and to discard concepts with which they have worked for many years.

It has not been easy for management to accept the computer as a partner. However, their success in incorporating computer-based systems into the investment decision process is indicative of the potential which can be realized through intelligent synthesis of advanced technology and sound financial judgment.

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Footnotes

[1] J. Gal, "Man-Machine Interactive Systems", _Financial Analysts Journal_, May-June 1966, p. 126

[2] D. Dwyer, "Using a Computer for Portfolio Selection", _Banking_, July 1964, p. 44

[3] _Wall Street Journal_, April 23, 1962, p. 4

[4] William J. Baumol, "Mathematical Analysis of Portfolio Selection, Principles and Application", _Financial Analysts Journal_, September-October 1966, p. 95

[5] See, for example, Cootner, Paul H. (ed.), _The Random Character of Stock Market Prices_ (Cambridge, Mass.: The M.I.T. Press, 1964)

[6] For a description of the "Compustat" service see _Compustat Information Manual_ published by Standard and Poors Corp., New York, New York, available from Standard Statistics, Inc., 345 Hudson Street, New York, New York

[7] Information regarding these data sources is available from Bunker Ramo, 75 Varick Street, New York, New York; Facts, Inc., 345 Hudson Street, New York, New York; and Scantlin Electronics, 60 Broad Street, New York, New York

[8] See, for example, _The Wall Street Journal_, April 23, 1962, p. 4; August 19, 1963, p. 12; January 17, 1964, p. 11; June 30, 1964, p. 23; August 10, 1965, pp. 1 and 22; and December 27, 1965, p. 5.

[9] Systems described in this article have been developed and implemented at Jesup & Lamont, a New York brokerage firm with which the author is affiliated as a Limited Partner.

[10] Excerpts from remarks by A. L. Villa of Jesup & Lamont, September 20, 1966.

[11] One frequently finds advocates of a particular model promoting its potential application to investment decision-making. For example, linear programming and the Markowitz portfolio selection procedure have been often discussed but, to the best of the author's knowledge, remain to be effectively implemented. A highly readable account of the Markowitz process is provided by William J. Baumol, "Mathematical Analysis of Portfolio Selection, Principles and Application", _Financial Analysts Journal_, September-October 1966, pp. 95-9. A more general review of techniques is provided in Lawrence S. Bloomberg, "Financial Analysts -- Computers and Mathematical Tools Change Status" in McGill's _Journal of Business_, October 1964, pp. 13-9.

[12] A modified IBM FORTRAN (Formula Translator) monitor system provided the basis for this capability.

[13] The Microanalytic Simulation Approach to Market Process Representation is described in Arnold E. Amstutz, _Computer Simulation of Competitive Market Response_ (Cambridge, Mass.: M.I.T. Press, 1967)

[14] For a description of a prospective investment service based on the use of time-shared computers, see Joseph J. Gal, "Man-Machine Interactive Systems and their Application to Financial Analysis", _Financial Analysts Journal_, May-June 1966, pp. 126-36

Figure 1

VIDEO DISPLAY UNITS
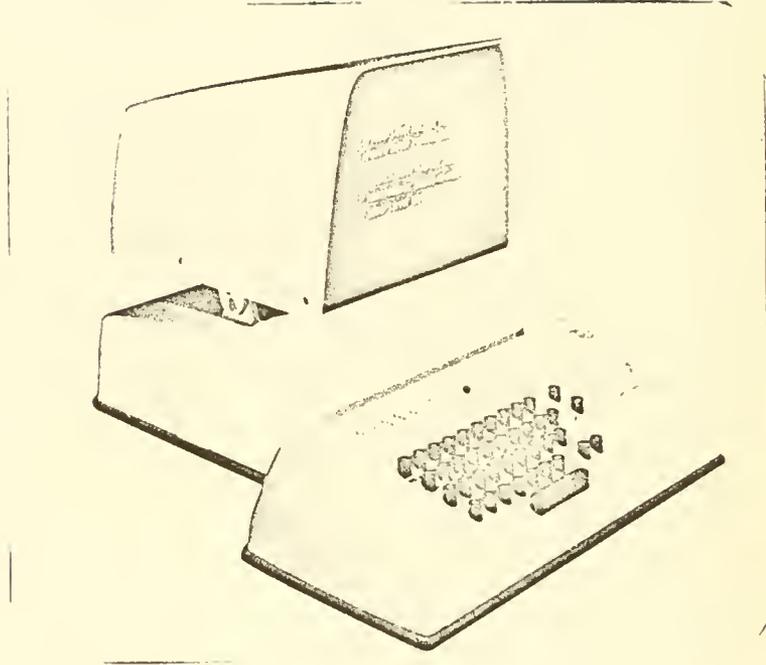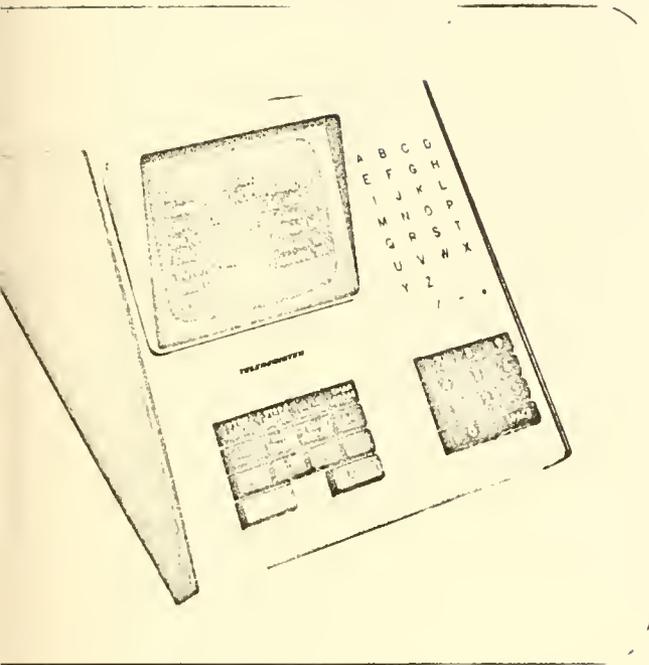
FIGURE 2 -- BASIC HARDWARE CONFIGURATION

S.I.M.S.-II PROCESSING RUN -- WEEK 277 -- FRIDAY MARCH 20, 1964
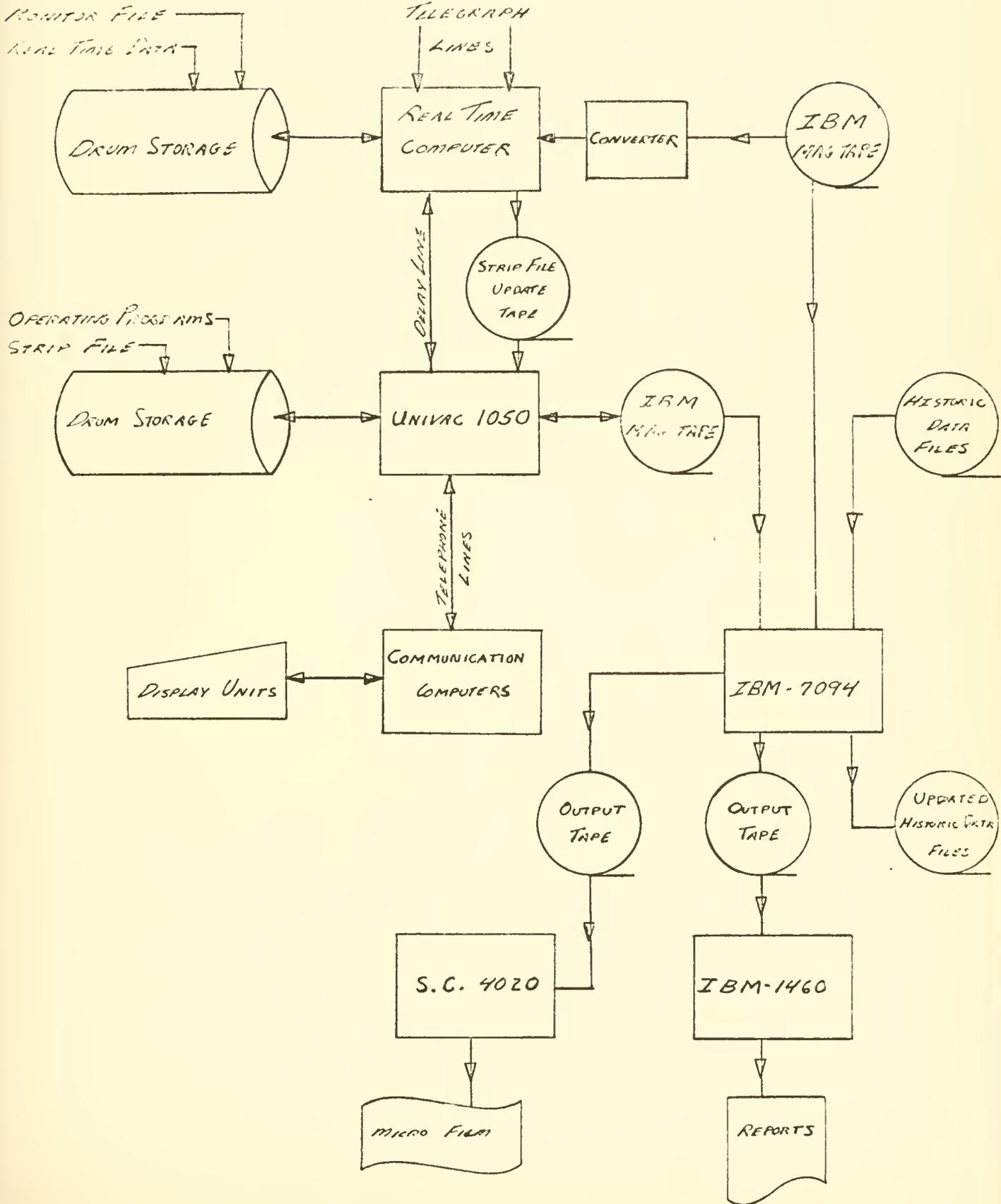
INVESTMENT REPORT

PXN   8250C. PARAMOUNT PICTURES CORPORATION

DATE	ACTION	PRICE TODAY	WEEKS HELD	REFERENCE PRICE	CONSERVATIVE POLICY			SPECULATIVE POLICY		
					$ PROFIT/SHARE	INVESTMENT	RETURN	$ PROFIT/SHARE	INVESTMENT	RETURN
02/17/61	BUY	$64.0								
05/05/61	SELL	$80.3	11	$ 64.0	$ 16.2	$ 6405.	25.3(	$ 16.2	$ 3202.	50.7(
05/05/61	SHORT	$80.3								
05/17/63	COVER	$40.7	105	$ 80.3				$ 39.5	$ 4014.	98.5(
05/17/63	BUY	$40.7								
03/20/64	CLOSE	$56.4	44	$ 40.7	$ 15.6	$ 4075	38.3(	$ 15.6	$ 2038.	76.7(

PXN ANNUALIZED AVERAGES 28.WKS HOLD PRD CONSERVATIVE POLICY$ 4541. 66.3(
                          53.WKS HOLD PRD SPECULATIVE POLICY$ 3415. 67.9(

X   110600. U. S. STEEL CORPORATION

DATE	ACTION	PRICE TODAY	WEEKS HELD	REFERENCE PRICE	CONSERVATIVE POLICY			SPECULATIVE POLICY		
					$ PROFIT/SHARE	INVESTMENT	RETURN	$ PROFIT/SHARE	INVESTMENT	RETURN
06/30/61	SHORT	$81.0								
04/12/63	COVER	$51.0	93	$ 81.0				$ 30.0	$ 4050.	74.1(
04/12/63	BUY	$51.0								
10/25/63	SELL	$53.6	27	$ 51.0	$ 2.6	$ 5100.	5.1(	$ 2.6	$ 2550.	10.3(
10/25/63	SHORT	$53.6								
11/29/63	COVER	$52.9	5	$ 53.6				$ 0.7	$ 2681.	2.8(
11/29/63	BUY	$52.9								
03/20/64	CLOSE	$58.5	16	$ 52.9	$ 5.6	$ 5288.	10.6(	$ 5.6	$ 2644.	21.3(

X   ANNUALIZED AVERAGES 22.WKS HOLD PRD CONSERVATIVE POLICY $ 5170. 19.3(
                         35.WKS HOLD PRD SPECULATIVE POLICY $ 3555. 40.5(

Figure 3

SAMPLE INVESTMENT REPORTS

S.I.M.S.-II PROCESSING RUN -- WEEK 277 -- FRIDAY MARCH 20, 1964

STATUS LOG SUMMARY

DATE	STATUS	PRICE	AVG VOL	EARNINGS PER-SHR.	DIVI-DENDS	YIELD	P/E CO.	RATIO IND
ABJ	100.	ABACUS FUND						
CONDITIONS PREVAILING WHEN ISSUE WAS BOUGHT ON 1/25/63								
CONDITIONS PREVAILING WHEN ISSUE WAS SOLD ON 10/18/63								
CONDITIONS PREVAILING ON FRIDAY PRECEDING DATE OF REPORT 3/13/64								
CONDITIONS PREVAILING ON DATE OF REPORT GENERATION 3/30/64								
ABT	200.	ABBOTT LABORATORIES						
03/20/64	CLOSED	$114.0	18.	$ 4.41	$ 2.40	2.1(	25.9X	25.6X
03/13/64	CLOSED	$115.1	18.	$ 4.41	$ 2.40	2.1(	26.1X	25.6X
10/18/63	SOLD	$110.7	31.	$ 4.33	$ 0.	0. (	25.6X	25.6X
01/25/63	BOUGHT	$ 79.2	19.	$ 0.	$ 0.	0. (	0. X	25.6X
ABC	300.	ABC VENDING CORP.						
03/20/64	HOLD	$ 14.0	27.	$ 1.03	$ 0.60	4.3(	13.6X	-0. X
03/13/64	HOLD	$ 13.5	23.	$ 1.03	$ 0.60	4.4(	13.1X	-0. X
01/11/63	BOUGHT	$ 14.5	36.	$ 0.	$ 0.	0. (	0. X	-0. X
06/09/61	ISSUE WAS SPLIT APPROXIMATELY 2 TO 1							
ACF	400.	ACF INDUSTRIES, INC.						
03/20/64	HOLD	$ 70.5	35.	$ 3.26	$ 1.60	2.3(	21.6X	16.7X
03/13/64	HOLD	$ 69.5	34.	$ 3.26	$ 1.60	2.3(	21.3X	16.7X
03/06/64	BOUGHT	$ 67.1	31.	$ 3.26	$ 1.60	2.4(	20.6X	16.7X
11/15/63	BOUGHT	$ 55.0	29.	$ 0.	$ 0.	0. (	0. X	16.7X
ACS	500.	ACME MARKETS, INC.						
03/20/64	NONE	$ 65.5	7.	$ 5.30	$ 2.00	3.1(	12.4X	14.3X
03/13/64	NONE	$ 67.0	8.	$ 5.30	$ 2.00	3.0(	12.6X	14.3X
ACO	600.	ACME STEEL COMPANY						
03/20/64	HOLD	$ 21.1	36.	$ 1.53	$ 0.80	3.8(	13.8X	16.8X
03/13/64	HOLD	$ 21.1	30.	$ 1.53	$ 0.80	3.8(	13.8X	16.8X
11/16/62	BOUGHT	$ 12.5	31.	$ 0.	$ 0.	0. (	0. X	16.8X
01/05/62	SOLD	$ 18.1	35.	$ 0.	$ 0.	0. (	0. X	16.8X
ADX	700.	ADAMS EXPRESS COMPANY						
03/20/64	CLOSED	$ 25.5	16.	$ 0.	$ 0.	0. (	0. X	-0. X
03/13/64	CLOSED	$ 25.5	17.	$ 0.	$ 0.	0. (	0. X	-0. X
09/08/61	SOLD	$ 29.8	3.	$ 0.	$ 0.	0. (	0. X	-0. X
01/13/61	BOUGHT	$ 26.0	6.	$ 0.	$ 0.	0. (	0. X	-0. X

S.I.M.S.-II PROCESSING RUN -- WEEK 277 -- FRIDAY MARCH 20, 1964 (CONT.)

STATUS LOG SUMMARY

DATE	STATUS	PRICE	AVG VOL	EARNINGS PER-SHR.	DIVI-DENDS	YIELD	P/E CO.	RATIO IND
ALL	800.	ADAMS-MILLIS CORP.						
03/20/64	CLOSED	$ 9.1	5.	$ 0.53	$ 0.40	4.4(	17.2X	-0. X
03/13/64	CLOSED	$ 9.1	5.	$ 0.53	$ 0.40	4.4(	17.2X	-0. X
07/19/63	SOLD	$ 10.0	5.	$ 0.	$ 0.	0. (	0. X	-0. X
01/11/63	BOUGHT	$ 13.4	11.	$ 0.	$ 0.	0. (	0. X	-0. X
AIN	900.	ADDRESSOGRAPH-MULTIGRAPH CORP.						
03/20/64	CLOSED	$ 49.9	94.	$ 2.10	$ 1.20	2.4(	23.7X	43.6X
03/13/64	CLOSED	$ 48.5	93.	$ 2.10	$ 1.20	2.5(	23.1X	43.6X

Figure 4

SAMPLE STATUS LOG PAGE

```
MON   POS-2   FCF      FIRST  CHARTER  FI

1028    14.9    15.1    15.0    14.6+   15.0

~~55/09   63/64   59/59   55/55   50/50      58~~

15.0    9.9     12.5    14.8    14.8    14.8

~~15.4   10.3   12.7   3.04/016      15.1~~

    73        0    103      87

  1.79      8.4/08.3    0.00      0.0/00.0

~~5.43/11/          3.2~~  13+11/046    11.2
```

Figure 5
1028 MONITOR DISPLAY


```
MON   POS-4   UFL      UNITED   FIN   CALIF

1046    6.9     7.0    07.0    06.5+   07.0

~~99/00   61/59   55/54   54/53   50/50   57~~

6.4    4.5     5.4     06.5   06.5    6.5

~~6.4   4.5   5.4   1   008800      0.2~~

    32        0     16      17

  .39      17.9/08.3    0.00      0.0/00.0

~~2.28   270   2.8~~  I2+10/216    5.2
```

Figure 6
1046 MONITOR DISPLAY

```
MON   POS-6   FWF    FAR  WEST  FINANCI

1100    6.1     6.3  06.2  05.7+  06.2

5.5    4.3    4.9   05.8  05.8    5.8

80        0     14    14

1.19-  5.1/08.3  0.00          0.0/00.0

              13+11/236          5.0
```

Figure 7
1100 MONITOR DISPLAY (FINANCE)

```
MON   POS-4   EAL      EASTERN AIR LINE

1100    73.3   73.8    73.5  68.6-  73.1

70.0   39.9    55.0    68.5  68.5  68.5

251        0   584      496

2.22    32.9/18.3      0.60  0.8/01.5

              12-07/156  105.5
```

Figure 8
1100 MONITOR DISPLAY (AIRLINE)

COPY-11/25

QAILY P/V UFL   UNITED FIN CALIF

DAY	HIGH	LOW	LAST	VOL
11/18/66	6.0	5.6	5.7	32
11/21/66	5.8	5.7	5.8	17
11/22/66	5.7	5.7	5.7	12
11/23/66	6.5	5.8	6.5	61
11/24/66	6.5	6.5	6.5	0
TODAY	7.3	6.5	7.2	0105

Figure 9
RELATIVE PRICE DISPLAY

COPY-11/25

QRNS-DIV UFL   UNITED FIN CALIF

YR		QTR 1	QTR 2	QTR 3	OTR 4
64	ERNS	2.91	2.62	2.78	2.90
	DIVS	.50	.50	.50	.50
65	ERNS	2.88	1.09	.86	.79
	DIVS	.50	.00	.00	.00
66	ERNS	.55	.50	.42	.39
	DIVS	.00	.00	.00	.00

Figure 10
EARNINGS/DIVIDENDS DISPLAY