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April 27, 1978

Mr. Bruce T. Coleman
President
Boole and Babbage
510 Oakmead Parkway
Sunnyvale, California 94086

Dear Bruce:

On February 23rd Burton Grad Associates, Inc. began a study of Boole and Babbage to examine the nature and cause of the problems you have recently had in maintaining your accustomed product quality and reputation for customer responsiveness. You asked that we suggest approaches to be taken to improve customer satisfaction within reasonable costs.

The work plan involved use of our consulting services to direct the study with participation by Boole and Babbage personnel to supply information, review prepared material and suggest solutions which should be evaluated.

The enclosed Management System Report represents the results of the study. The principal conclusions are:

1. Boole and Babbage has been a very well managed business with a fine product line. Consistent revenue and profit growth substantiate this opinion.

2. Problems associated with a rapid change in the user operating environment, a sharp increase in employee terminations combined with the more than 100% growth in business in two years have triggered a severe erosion in the customer perception of product quality and company responsiveness.

3. This reduction in customer confidence has (and will) result in lost sales and increased costs for Marketing and Engineering.

4. The causal factors must be rooted out now through a recommended set of personnel, product and procedural actions. If this is done aggressively and effectively, Boole and Babbage can probably still achieve its revenue and profit goals for 1978 and 1979.

5. However, significant organizational changes will be required if Boole and Babbage is to continue to grow rapidly in the 1980's. The company must provide the necessary first line and middle management along with some increase in executive strength if it is to attract, train and lead the number of new employees your larger business will require.

The Management System Report consists of three phase reports with three appendices:

Phase One	-	Present Business Description
Phase Two	-	Solution Requirements
Phase Three	-	Proposed Action Plans
Appendix A	-	Product Description
Appendix B	-	Financial Data
Appendix C	-	Organization Charts

The information in this Report should assist you in determining what specific actions you will want to take to address the quality related issues and to prepare for future profitable growth.

We particularly want to thank you for the excellent cooperation we received from everyone who was asked to participate: thirty-three people were interviewed and fifteen provided feedback on the draft material. Special thanks are due to Bob Coolidge and Tom Hoger for their good advice, sound counsel and for making it so easy to work directly with their people.

Sincerely,

Burton Grad, President
Burton Grad Associates, Inc.

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MANAGEMENT SYSTEM REPORT

for

Boole & Babbage, Inc.

Sunnyvale, California

Submitted by

Burton Grad Associates, Inc.

Tarrytown, New York

May 1, 1978

CONFIDENTIAL

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PHASE ONE REPORT

PRESENT BUSINESS DESCRIPTION

Boole & Babbage, Inc.

Sunnyvale, California

PHASE ONE REPORT - PRESENT BUSINESS DESCRIPITON

General Section

History and Background

Boole and Babbage is a software products company which produces and markets programs and supporting services to enable more efficient and effective utilization of computer system resources in large scale data processing installations. It is a privately held company with venture capitalists holding the bulk of the stock.

The principal customers are the data processing systems and operations departments of companies or institutions which have installed large IBM computers. The measurement, performance analysis, job accounting and operating system monitoring and data security programs supplied by Boole and Babbage are used to guide the tuning, optimization and use of the running configuration as well as to account accurately and consistently for the allocation of computer resources.

The current family of programs has evolved over the ten years since Boole and Babbage was formed by Kenneth W. Kolence and David Katch in Palo Alto, (and later Sunnyvale) California. These two experienced computer systems analysts/programmers were convinced that, as the operations environment became more complex with multi-processors, shared memories, time sharing, data communications, large disk files, multi-programming and virtual

memories, it would be critical to have software tools to assist data processing management in effectively controlling and using the various computer elements: CPU, memory, channels, on-line storage and input/output devices. The end result of having such measurement and analysis tools would be to improve the turnaround and balance of an existing system and to be able to get more throughput for a given investment in computer facilities.

Greater operational productivity through information-based management of computer resources was the original goal when the company was formed in 1967 with only 3 employees. The initial products were the Problem Program Evaluator (PPE) and Configuration Usage Evaluator (CUE), which were first installed in 1969.

By 1971, it was realized that there was a closely associated functional area which could be addressed with similar software products; this was the area of job accounting. Along with the complexity of efficiently managing the interaction among resources, it was becoming more and more difficult for data processing management to control their operations and to formally account to end users for their use of the system. The Computer Accounting System (CAS) was released in 1972 as the first product in this area.

The most recent product area was initiated with the introduction of RESOLVE in late 1976. This is called the operations area and is concerned with monitoring and controlling the operations

environment, particularly for on-line systems, to insure effective operational performance.

Boole and Babbage became a national organization by expanding from its Sunnyvale headquarters to establish branch marketing and technical support offices in 9 cities throughout the U.S. They became international by setting up agents as representatives in 9 other countries. Canada is covered through U.S. offices.

In 1970, Boole & Babbage acquired Pacific Radionics, an electronics firm which the Company tried unsuccessfully to integrate with the existing systems measurement software business. This only led to continued operating losses until "Pitch" Johnson, one of the venture capitalists who had provided the financial backing for the firm, stepped in to run the business and recruit Bruce Coleman (an ex-IBM salesman and Harvard MBA graduate): First, Coleman served as Vice President of Marketing and Finance and then in 1972 became President and Chief Executive Officer while Johnson became Chairman of the Board. They were able to dispose of the hardware products and concentrate on software.

1972 saw the first small profit achieved through major personnel and expense reductions accompanied by business consolidation. This also provided a solid base for future improvement. In the last six years, Boole and Babbage has shown a steady growth from just over $1 million a year in revenue to well over $5 million a year with a substantial portion now coming from users outside the U.S. With more than 1000 user sites world-wide, Boole & Babbage

has achieved an enviable position of supplying one or more products to over 20% of the current large IBM systems sites.

Along with the growth in number of users, Boole & Babbage has continued to enhance its existing products through adding functions and supporting new operating systems as they are introduced by IBM, and by expanding into new functional areas. This has led most recently to CONTROL/IMS and CONTROL/IMS-Realtime for measurement and accounting in a transaction driven data communications system, RESOLVE to monitor and correct real time job management and system operations problems, SECURE which controls access to selective customer data bases and programs and CMF-Realtime for on-line measurement and analysis.

The future continues to look exciting; the further growth of networks, distributed systems and on-line applications emphasizes the need for measurement, analysis, accounting and operations control tools. This should pave the way for further new products and greater sales. Expanding markets should enable Boole and Babbage to continue to realize a strong profit margin while achieving year to year growth of at least 25%.

New opportunities and directions continue to receive close attention. Boole & Babbage has aggressively sought (and purchased) new products that enhanced its product line and has sought (so far unsuccessfully) to purchase other companies which would complement its own business. A very successful extension of the company's business has come through its negotiating with

agents in Europe to market various Boole & Babbage products. This has provided substantial additional profit from existing products. In contrast, the company, based on some earlier poor experiences, has avoided supporting non-IBM operating systems and has stayed out of the intermediate and smaller IBM computer market. One new venture deals with the use of programmable micro-computers together with specialized software to measure and control specific system components. This would stay within the current market and skills framework, but take advantage of new technologies and economic trends.

Industry and Competition

Boole & Babbage is an active member of ADAPSO, the data processing services trade association, and of SIA, the software industry section of ADAPSO. Bruce Coleman is currently a vice president of ADAPSO and the president of SIA.

The company sees itself as a leader in the systems performance and accounting areas and concentrates on providing software products within this product scope. It does not provide any customer programming services and is only involved in a small way in a services contract for a government agency.

Boole & Babbage is one of the ten largest independent software products companies with the other large software firms generally providing products in non-competitive areas: data base/data communications, business accounting, program development tools, and application programs for smaller computers.

The total software products business is estimated at $550M in 1976 with growth projected to $1,856M by 1981. This yields a compound growth rate of 28% per year.

IBM is the largest single factor in the computer related software business since it is able to market such a wide range of systems and application software for small and large systems on an international scale through the same marketing organization which sells its hardware products. Industry sources estimate that IBM has 50% of the current software sales. IBM's pricing practices

provide certain pressures on the independent software product producers: they make available key operating systems programs with their hardware systems at no separate charge; they also license most of their programs on a monthly charge basis; in addition, the prices appear to be quite low relative to function probably because of IBM's ability to forecast and sell to a large world-wide market. The result of these practices is that software products have to be priced lower than their apparent value to customers (hence they are an unusually good buy) and various stretched-out payment plans are required to compete with the IBM monthly "rental" plan.

There are a number of small and medium sized software competitors which have individual products that directly compete with Boole & Babbage's product line. ADR, Johnson Systems, Value Computing and CAPEX all have either measurement or accounting products in the marketplace. In addition, Boeing Computer Services has recently entered the measurement services marketplace and IBM has significantly upgraded its measurement product offerings by introducing a product aimed specifically at the MVS environment. Some "free" programs are still offered by Universities and User Groups.

In general, Boole & Babbage has been quite successful in marketing its products and always has had an enviable reputation for quality and support. This is reflected in the fact that several of its programs have appeared on the Datapro honor roll and a number have received the International Computer Programs awards for

sales over one million dollars and even over five million dollars.

One additional competitive area of some future concern is the use of various hardware monitors to provide information and analysis similar to that obtained from Boole & Babbage software products. There have been a few of these measurement products in the past, but they have been quite expensive and not as flexible as measurement software. Only Tesdata has been successful with a hardware measurement device. However, the recent development of programmable, inexpensive microcomputers may change this picture. Boole and Babbage is keeping a close eye on developments in this area and has already initiated a project using a microcomputer with a specialized measurement program for channel monitoring.

So, Boole & Babbage can justifiably claim that it is "the leader in computer performance, accounting and analysis products". In almost every case its products are the sales leaders in their functional/market segments.

Goals and Objectives

A recent company study resulted in a draft statement of proposed company goals with regard to the business and its people, products and finances. While these are not yet formalized nor quantified for measurement purposes, they can certainly form the basis for setting of objectives and establishing future business plans. These goals are listed below:

1. Business

   - o Maintain Boole & Babbage's role as a leader in systems performance and accounting by continued product enhancement.
   - o Become the leading company in systems productivity software,
   - o Diversify the product lines to offer stability, growth, and new opportunities.
   - o Expand market areas through a balance of in-house development and the acquisition of companies and products.

2. People

   - o Hire, develop and retain high quality, results - oriented staff.
   - o Stress continued personal growth of the individual

through energetic objectives and continued education.

- Maintain an esprit de corps and pride in Boole & Babbage.
- Offer a working environment, benefits and compensation which are above average for the industry.
- Require above average performance from each person.
- Develop and promote from within wherever possible.

3. Products

- Provide products which offer high value to customers.
- Continually enhance the product line in a timely fashion.
- Provide outstanding service to customers.
- Expand into new product areas within the systems productivity software marketplace.
- Maintain and improve the company's reputation by building reliable, usable, well-documented products.

4. Financial

- o Generate a consistently high rate of return on sales of 20 per cent or better before taxes.
- o Increase revenues yearly at an average of 25 percent per year stressing controlled and continuous growth.
- o Develop a company which is large enough to be attractive to public investors.
- o Provide a short-term return to shareholders through the payment of quarterly dividends as long as financial conditions warrant.

Boole & Babbage management is extremely objectives oriented. Specific, measurable objectives are set each year for the company as a whole, for principal functional departments, for each market and product area and even for each individual. The assessment of how well the previous year's objectives were met and a formal statement of the current year's objectives are contained in an annual business plan. This is prepared by the officers and represents the commitments of the various managers. For fiscal 1978 this was a 75 page document focussing on Marketing, Software Engineering and General and Administrative Functions. Year-to-year comparisons are made with explanations for differences both above and below plan. These excellent summary reports are available since 1973.

Policies and Problems

Characteristic of its operation, Boole & Babbage has recorded many of its policies particularly in regard to personnel practices and product definition and development. These policies are quite detailed (see the Policy and Procedures Manual) and can be interpreted too rigidly if not tempered with experienced managerial judgment.

There are a number of business problems which have become apparent recently with the very rapid growth in revenues and in the number of products offered for sale. Some of these concerns are listed below to show management's determination to address them directly so that future growth can continue and will result in profitable operations:

- Changes in IBM systems with lack of early, detailed interface specifications
  - operating systems, control systems, microcoded functions
- Low price competition
  - manufacturers, full line software producers, non-U.S. cartel competition
- Technical personnel stability and recruiting in the company
- Quality image with customers
  - capability, reliability, maintainability of products

- x Ability to develop new products or extensions to existing products on a cost effective, scheduled basis
- x A product line strategy to integrate in-house and acquired products
- x Organization structure for managing and directing growth
- x Management and personnel development to provide qualified internal candidates to fill needed new postions
- x Clearer plan for product and company acquisitions

These are obviously a reflection of the difficulties encountered during 1977 which was the second consecutive year of greater than 50% growth. Boole & Babbage is undergoing a transition from a small to an intermediate sized company and is planning to rearrange its way of doing business in some respects to respond to the pressures and opportunities of rapid growth.

Structural Section

Organization

The organization is set up on relatively traditional lines by major business function: Marketing, Engineering, Planning and Administration. However, there are some unusual characteristics in any software products business which eliminates the need for a manufacturing function:

- The process of producing individual copies of a program is done in response to a customer order and is relatively quick and inexpensive. So, there is no manufacturing organization and the "manufacturing" cost is very low.

- The cost of producing a sofware product is essentially fixed and expended prior to making any installations or receiving any revenue. So the "investment" is quite high, although it may be treated as an expense for accounting and tax purposes.

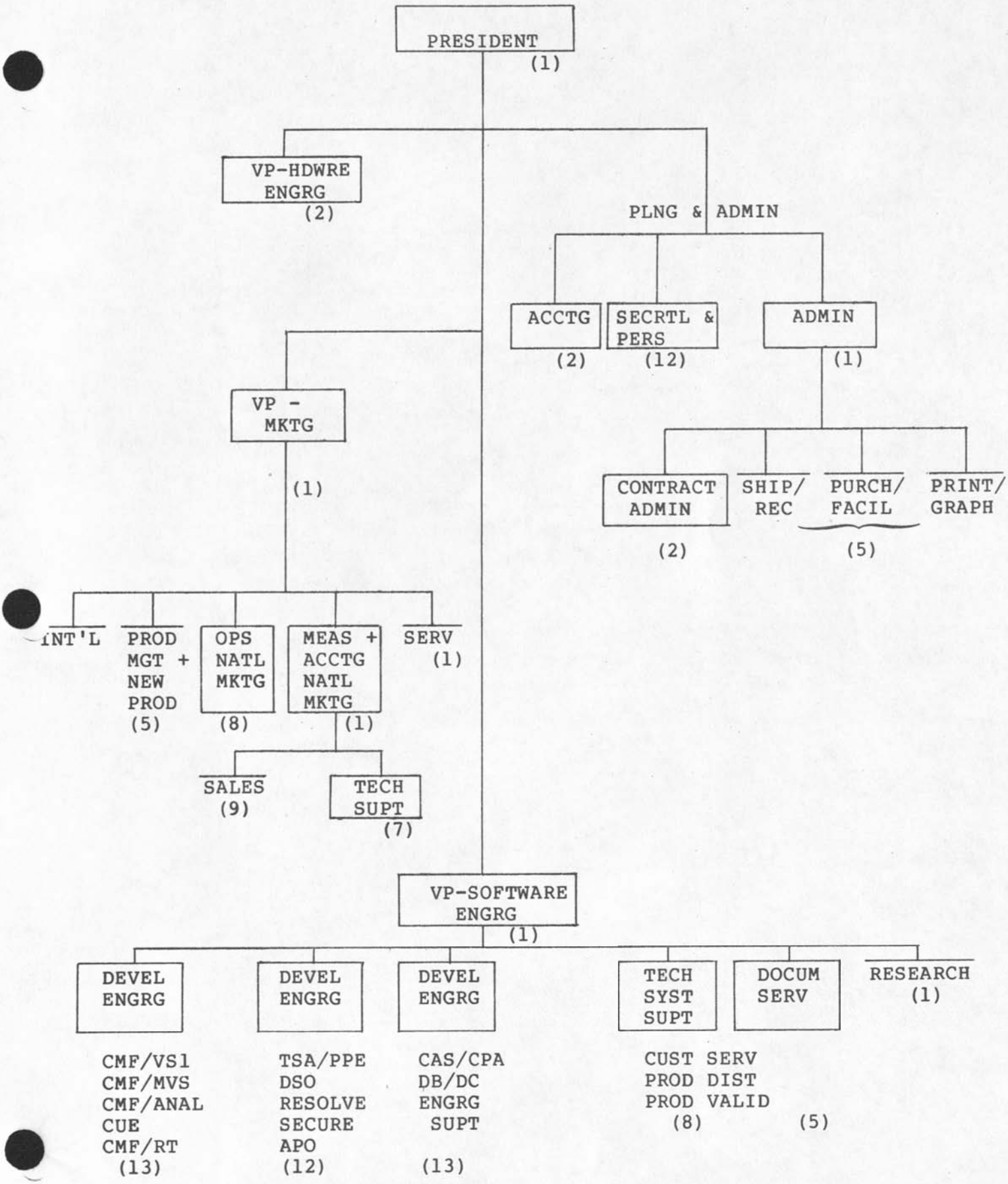
The key then to a successful software products company is to have a strong set of products normally produced through having competent software engineers (who are often called systems analysts and programmers) with a skilled field marketing organization. If one adds reasonable administrative and management talent to engineering and marketing one can create a profitable business. This

partially explains the success of the simple organization structure which Boole & Babbage has adopted.

The current organization chart is shown in condensed form in Figure 1. On board head count by function is marked. Names of incumbents have been omitted. As of 3/1/78 there were 110 full time and 5 part time people working for Boole & Babbage. These were assigned as shown in Figure 2.

The ratio of employees to managers is only 4.2 to 1. This relatively low ratio comes from a tight span of control in Engineering, requiring a three level management structure. This has been justified by the rapid growth in number of employees and the relatively high turnover, which means that much of the first (and second) level managers' time is spent in recruiting, training and closely supervising new employees.

The special aspects of the current organization will be discussed under each functional area; for instance, the subdivision of field marketing into two separate organizations by product line is unusual for a small company, but was quite logical to provide a better framework for product sales growth. Similarly, the attempt by Engineering in 1977 to separate product maintenance from product enhancement and new product development is certainly understandable; when it wasn't able to cope with a rash of product problems the organization was restructured to return to an integrated development, maintenance and modification team by product.



CONDENSED ORGANIZATION CHART (3/1/78)

Figure 1

	MGRS	EXEMPT	NON-EXEMPT	TOTAL
MKTG	4	28	0	32
ENGRG	13	32	10	55
PLNG & ADMIN	4	0	19	23
TOTAL	21	60	29	110

Note: PLNG & ADMIN also had 5 part-time non-exempt employees.

PERSONNEL CLASSIFICATION

Figure 2

There is no vice president or manager for planning and administrative functions. This has seemed quite reasonable given the president's current span of control; but it has involved the president in a level of operational detail for finance, personnel and administration greater than his involvement in the marketing and engineering functions, although these may actually be more critical to successful product and market growth management.

The international operations have had no one at corporate headquarters directly concerned with, and responsible for, its effectiveness. The roles have been played by the president and particularly the marketing vice president who have negotiated the various non-U.S. marketing agreements. The international marketing representatives have expressed some concern about the need for marketing and product support by corporate for non-U.S. customers.

Personnel

Boole & Babbage has had a checkered personnel history. From a 3 person shop in 1967 it grew to over 84 people by year-end 1970 including a substantial product assembly operation (Pacific Radionics Division). But by November 1972 it had contracted to only 35 people, all involved in producing, marketing and administering software products. Since then the personnel growth has been steady, but often of the two steps forward, one step backward variety. The relatively large number of terminations each year has caused the company to often be running as fast as it can just to stay even. The already difficult problem of recruiting quality people (especially in California's Santa Clara Valley) has certainly been accentuated by this need to replace many on-board people. This is particularly so in Engineering where only 30% of the people in the organization as of 2/28/78 were with the company on 1/1/77.

Figure 3 shows the record of people hired, terminated and on-board by year since 1970. Of particular concern is the increase in the number of terminations during 1977. Almost half of the people who were on-board on 1/1/77 were no longer with Boole & Babbage on 1/1/78. Put another way, over one-half of the people working for Boole & Babbage on 1/1/78 had less than one year service. This is doubly distressing since it implies lack of continuity and effectiveness because of inexperience, and greater than normal expenses because of recruiting costs (employment fees, advertising, interviewing and training, if hired).

	# HIRED	# TERMINATED	# ON BOARD AT YEAR END	% ATTRITION
1969			49	
1970	54	19	84	39%
1971				
1972			35	
1973				
1974			47	
1975			53	
1976	27	18	70	34%
1977	59	39	93	56%
1978 (thru 2/28)	22	5	110	

Note: Other statistics are not readily available.

PERSONNEL TURNOVER ANALYSIS

Figure 3

This discouraging pattern of employee turnover has taken place in spite of an extensive employee benefits program, a substantial profit incentive plan and salaries which are intended to be above average for comparable positions in the Sunnyvale area. Further analysis is needed to identify the reasons for leaving and how many the company was glad to see go versus how many they would like to have kept. However, one must recognize the continuing growth of the data processing industry and the dislocations which have taken place in the supply of and demand for trained computer professionals.

One special element is the headquarters location. Sunnyvale is in the heart of the Santa Clara Valley. This location has become the home of literally hundreds of high technology computer hardware and software firms. Time Magazine recently called it "Silicon Valley" and referred to it as the home of the microprocessor. The article further commented: "...companies are scrambling to snatch away their competitors best engineers and designers." This environment may well encourage people to leave if they are dissatisfied rather than work constructively within the organization to solve their problems.

The various employee benefits are described in the Boole & Babbage Policy and Procedures Manual, but, in summary, they include medical and dental plans, life and travel insurance, long-term disability coverage, normal holidays and vacations and defined sick time, all paid in full by the company. There is no pension plan. Sign-in/sign-out sheets are used to be able to

locate employees and, of course, time sheets and expense reports are required to pay for time worked and travel expenses incurred.

Boole & Babbage aggressively seeks to hire and promote on a bias-free basis. Specifically, they have recruited minorities and women for managerial, exempt and non-exempt positions. The company also complies fully with all Affirmative Action, EEO and ERISA rules.

The physical facilities in Sunnyvale are modern and attractive, and reasonably easy to reach by automobile from anywhere in the Santa Clara Valley. There is an excellent telephone system with a number of special communication features. Desks, chairs and files are new. The facilities are well maintained. A small lunch room has free coffee and other beverages available. Snacks and lunches are obtained from service trucks which visit the premises a number of times during the day. The company also helps organize some athletic and social activities for its employees.

Hiring, placement and training are the responsibility of the various senior managers in the particular functions. Because of the growth of the business there has been a continuing, aggressive hiring campaign for over a year. Yet, the company has felt that it was constantly understaffed in many functions, especially in Engineering. Essentially, Engineering has had permission to hire any competent systems programmer who is available within the defined salary range.

The profit incentive plan is an unusual means which has been used to try to attract and retain high quality people and to motivate them to control costs and expand sales. The plan provides for setting aside up to 9% of the company's before tax profits as a bonus arrangement for all employees who have been with the company more than 6 months. The money is distributed over the three succeeding years (50% - 25% - 25%) based on the employee's salary. In the last two years this has meant up to a 15% bonus. The plan results are publicized monthly showing profits achieved fiscal year-to-date and what this would mean in terms of money available for distribution.

A stock option award plan has been used for all employees (after 6 months service) to recognize their contributions to the growth and success of the business; this gives them a "permanent" stake in the company's future and a means of benefiting from future increases in market value if the stock goes public.

As part of the attention management has paid to employee development, a system called Quest has been used to survey employee attitudes, strengths and problems. This peer group program provides information to the individual for self-improvement purposes. It also gives management certain summary data to establish trends and identify areas needing change.

A recent analysis of the service dates of on-board people as of 2/28/78 is shown in Figure 4. This is a dramatic picture of a

	PRIOR TO 76	76	77	78	TOTAL
MKTG	12	6	10	4	32
ENGRG	9	8	25	13	55
PLNG & ADMIN	5	3	10	5	23
TOTAL	26	17	45	22	110
% OF TOTAL	24%	15%	41%	20%	100%

PERSONNEL SERVICE PERIODS

Figure 4

company with relatively few people who have worked together for any length of time.

The high turnover has placed a premium on employee training. The bulk of this training is of the on-the-job variety, particularly for administrative and engineering personnel. More formal programs, essentially product-oriented, have been set up for new performance engineers, sales representatives and customer service people.

Certainly, people are the key to Boole & Babbage's continued profitable growth. Major new personnel programs will be needed to provide the stability and experience essential to supporting and managing that growth.

Markets

Boole & Babbage addresses a well defined marketplace: IBM customers who use intermediate and large-scale computers and have installed various versions of OS and OS/VS. There are presently 6 principal operating systems which are supported (MFT, MVT, SVS, VS1, MVS-UP and MVS-MP/AP). It is Boole & Babbage's plan to maintain currency with these operating systems and to interface with, and effectively support, any major new operating systems which IBM announces. There are no present plans to interface with other manufacturer's equipment or with any non-IBM produced operating systems, although these opportunities are re-examined regularly. There are also no current plans to provide performance analysis, accounting or monitoring systems for smaller IBM computers or IBM operating systems designed for smaller CPU's.

One major new area which is being explored is measurement programs for various IBM produced Data Communications and Interactive Programming Systems. IMS has already been supported and consideration is being given to supporting CICS, VM/CMS and TSO environments. The introduction of distributed systems will certainly open up additional business growth opportunities to work with the same customer base that Boole & Babbage is already serving.

Generally, Boole & Babbage addresses its products to individual computer sites or to specific CPU's rather than marketing on an

enterprise-wide basis. However, product pricing consideration is given to multiple installations within an enterprise.

Also, Boole & Babbage is able to sell and install more than one product with many of its customers. This is encouraged through a multi-product pricing policy for measurement and accounting products.

Since the total number of potential sites is well defined and relatively limited, it is clear that a bad reaction to any one Boole & Babbage product would have a cascading effect and could damage sales of other related or even unrelated products. Emphasis on high quality and service for each and every product is a critical element in Boole & Babbage's product planning. It would be better for Boole & Babbage to not offer a marginally acceptable product than to risk harming the company's marketplace acceptance.

There are around 3500 potential sites in the U.S. with approximately 2000 outside the U.S. Because of continuing improvements in price/performance ratios and the greater power of individual CPU's, it is expected that the number of installed sites will not increase dramatically over the next 5 years, but there will be a continued growth in the number of units per site. Efficient utilization of computers seems to be of greatest importance to those organizations large enough to justify multiple, large, shared computer facilities along with a skilled systems programming support staff.

A recent list of customers is summarized by industry in Figure 5. This clearly demonstrates that the market covers all industries. In addition the names are a who's who of U.S. business and institutions and shows broad dispersion.

Large data processing organizations are typically structured into four major functions:

- o program design and development
- o program maintenance and modification
- o system operations and administration
- o systems programming support and performance evaluation.

The principal groups for which the company's products are designed are the last two. The accounting and operations products are of direct value to the operations and administration people and the systems measurement software products are aimed at the systems performance people.

One of the benefits of this marketplace is its professional ability to recognize the value of using quality products and its tendency to continue to use the same techniques once a decision is made to acquire a particular performance, accounting or monitoring program. Boole & Babbage has successfully sold to this technically sophisticated audience by emphasizing the functional capabilities of its programs and the ways in which competent performance analysts can exploit the information generated and displayed.

CUSTOMER LIST SUMMARY

15	AEROSPACE
20	AMERICAN TELEPHONE & TELEGRAPH
1	BROKERAGE
5	CONSULTING
1	CONSTRUCTION
1	EDUCATION
54	FINANCIAL
9	FOOD PROCESSING
79	GOVERNMENT
4	HOSPITALS
55	INSURANCE
71	MANUFACTURING
1	MINING
36	PETROLEUM & CHEMICAL
7	PHARMACEUTICAL
6	PUBLISHING
24	RESEARCH
11	RETAILING
30	SERVICES
2	SOFTWARE VENDORS
14	TRANSPORTATION
23	UTILITIES
3	WHOLESALERS
472	

Figure 5

To avoid the risks of short-term discontinuance or cancellation, virtually all products are marketed on a paid-up lease basis with subsequent annual maintenance charges to provide error correction and updating services.

A five year or longer active life of a program at a site is not uncommon. Moreover, to encourage staying with Boole & Babbage, new products are regularly produced or acquired to replace or augment existing products and additional features are made available to meet new customer requirements. The most significant elements requiring company response are the introduction of major changes into the supported operating systems and the announcement and installation of a totally new operating system. For instance, during the past 12-18 months the rapid growth of MVS installations has put substantial pressure on Boole & Babbage to provide tools to aid in effectively utilizing the new MVS features and capabilities, particularly in attached processor and multi-processor environments. This presssure was compounded by IBM's announcement and release of the Resource Measurement Facility II priced at only $250/month. The announcement was especially difficult to respond to rapidly since IBM often does not make detailed functional or interface specifications available until the product is actually delivered. Even then it was difficult for Boole & Babbage to obtain test sites on a timely and use-effective basis.

One of the major corporate concerns in managing business growth is not to let the number of products and customers exceed Boole &

Babbage's ability to respond rapidly to customer problems. This may well be the principal factor which will require Boole & Babbage to control its growth rate while it trains an adequate staff of performance engineers and customer service representatives.

This type of problem surfaced severely during 1977 when there were numerous difficulties in running customer demos successfully, customers complained about poor product reliability and lack of function, and Boole & Babbage was unable to respond rapidly to these concerns.

A recent review (excluding RESOLVE, SECURE, DISKPLAY and DFP) showed the following information:

# Active customer sites YE76	561
# New active customers during '77	114
# Customers who became inactive during '77	25
# Active customer sites YE77	650

A sample of the contracts file for measurment and accounting products showed that as of 12/31/77 there were an average of two of these Boole & Babbage products installed at each active customer site. Potentially each customer could have as many as eight measurement and accounting programs installed plus the two operations programs.

Maintenance renewals have continued at better than a 90% rate,

but this has required some special followup effort. Obtaining new maintenance agreements appears to be more difficult, although there are no firm statistics to support this impression. In a number of MVS situations, maintenance coverage has been extended since the current products did not function correctly when first delivered.

Recent customer support reports show a significant climb in problems outstanding, along with an alarming increase in the number of customer phone calls. Still, only about 1 call in 10 actually deals with a product code problem which requires fixing; the others involve lack of customer understanding on how to the use the product effectively. In some cases the customer has to be told that the problem is being worked on, but there is no immediate cure.

While data on Program Change Requests (PCR's) do not show any particular increase in program error rates, this may be a function of how the data is collected and displayed. Customer perception, as evidenced by written and telephoned complaints and impact on sales of additional products at existing customer locations, has been of a reduction in Boole & Babbage quality and a change for the worse in customer responsiveness. One conclusion may be that PCR's are a poor measure of current quality problems.

The focus of the current difficulty has been with MVS. Customer needs and expectations in this area are quite high and the product line in 1977 was really not functionally rich enough nor

well enough tested to support the statement to installed accounts that the available measurement products would handle MVS. This is gradually being corrected, but the customer perception is still not good. There is no statistical data which indicates that there may not be similar problems with VS1 coverage.

So, it appears that Boole & Babbage is in a relatively specialized market, addressing all industries and locations, with professionalism of its products and marketing support organization critical to continued growth and success.

Product and service quality have been impaired and will have to be addressed to restore the company's former position.

Products

Boole & Babbage has been successful in concentrating on products to assist the data processing systems and operations managers in most effectively using their computer facilities. The products can be classified into four principal product families:

1. System and Program Measurement - Measure the usage of system resources (computer cycles, memory space, channel time, disk accesses, individual programs); classify, analyze and summarize the data collected so as to determine its properties over discrete time intervals; display or report the findings in ways to assist systems and applications programmers in better utilizing the resources.

2. Accounting - Measure the usage of system resources by unit of work (job or transaction) and then, applying user supplied costing factors, provide for a usage charge as well as extensive data processing center financial management reports; identify what programs and organizations use system resources; measure user oriented service.

3. Operations - This new area is concerned with diagnostic and interface programs which dynamically monitor the use of system resources and allow control of and limit access to certain facilities, data or programs.

4. Mail Order Products - There are two additional programs which are marketed by mail. These are utilities involved in formatting dumps and showing disk space usage.

Products are generally made available in one of a number of full payment lease forms: One time charge (e.g. "purchase"); 1 year; 2 year; 3 year; 5 year. In addition, there is a monthly rental plan for selected programs with some credit applied if the program is later 'purchased'. There is also an annual maintenance fee associated with each program for purchase customers or those whose full payment leases have been completed. Generally, programs are priced either by site or CPU and there are many optional features available on a separately priced basis.

A formal discount policy has been adopted for each product and product family as a guide for pricing. These apply to multiple purchases of like products as well as to purchases of other Boole & Babbage products. This is done to encourage larger initial orders. There are also discounts for subsequent purchases made within twelve months of initial purchase.

Products are priced in the $5000 - $20,000 range with annual maintenance around 12% of purchase price. Options are available for some products with a price of about $1000 each with $250 maintenance. Life forecasts for products seem to show that total maintenance revenues will come close to equalling initial order revenue.

In order to better understand the products, Appendix A contains a summary description of each one, structured as follows:

- o History and Market
- o Functional Description
- o Program description (size, language, modules, environments supported, shared modules)
- o Sales (#, $, U.S. and non-U.S.)
- o Quality information
- o Special Support (manuals, training, aids)
- o Special Features
- o Price Trends
- o Competition
- o Near-term plans (extension, growth or replacement)

Appendix A is organized by product family:

- * System and Program Measurement
  - A-1 CUE
  - A-2 DSO
  - A-3 TSA/PPE
  - A-4 APO
  - A-5 CMF-Realtime
  - A-6 CMF-VS1 and CMF-MVS

* Accounting

  A-7 CAS

  A-8 CPA/FMR

  A-9 CONTROL/IMS and CONTROL/IMS-Realtime

* Operations

  A-10 RESOLVE

  A-11 SECURE

* Mail Order

  A-12 DFP and Diskplay

New products are currently under development or consideration for acquisition. One effort involves replacing CUE with an integrated Comprehensive Management Facility (CMF). The initial release of CMF-Realtime has been made. It uses data collected by IBM's RMF II as input. A CMF Analyzer is under development to be used in both the CMF-VS1 and CMF-MVS programs; it will also run with data extracted by CUE. CMF/RT will be able to use the CMF Extractor data.

Other functional areas under consideration include job accounting for CICS and a job preparation and network management system.

The current product line still contains many products which were originally designed over five years ago. They have been patched and modified, usually by people other than the original authors. The end result is that the programs are generally not well documented nor easy to maintain or change and it is increasingly

difficult to add new functions or interface effectively with new environments.

The programs acquired within the past two years have greater integrity, but of course do not reflect a consistent design or programming style. In some cases there is even functional overlap. This leads to some marketing redundancy, to customer confusion and, potentially, internal sales competition and further product duplication.

Program documentation also reflects the varied sources and ages of the products. Recent emphasis has improved the clarity and readability of the user manuals, but the nature of the customers' usage is such that they frequently identify special cases or new problems that are not covered. In addition, some customers want more information on the exact interpretation or source of the data, while others are more interested in overall direction. A few customers want to modify or extend the Boole & Babbage products on their own and look for detailed logic manuals and flow charts; these are usually not made available for proprietary business reasons. Unfortunately, they are also not available for use within the company. This makes program maintenance and modification a matter of studying source listings for programs written in assembler or COBOL.

Some effort has gone into sharing common modules across programs. The use of common data acquisition modules and of report preparation facilities does reduce the amount of code which has to be

written, maintained and modified. It increases the need for careful testing of changes to insure accuracy for all programs using the common modules.

Data is shown in Figure 6 on the number of current installations by operating system for each product. This data is somewhat suspect since it is difficult to verify all operating systems at a site for the measurement and accounting products.

Some of the future product directions which need to be considered or expanded are:

- Use of microcomputers (hardware/software combinations)
- Deeper analysis and understanding of functions and environments
- Extension of common modules
- Simplification of product line/extension functional concept
- Seek additional new products from outside
- Specifically address on-line systems with on-line monitor/control programs.

Products are the underlying asset of a software products company. If these products are not functionally operative and of high quality, even the finest marketing effort will not be successful over any period of time. This is especially so when the customer

PRODUCTS	ENVIRONMENTS					
	MFT	MVT	SVS	VS-1	MVS	TOTAL
CUE/DSO	25	114	128	122	297	686
TSA/PPE	10	63	73	47	154	347
APO	-	-	5	6	22	33
CAS/CPA/FMR	9	37	39	79	75	239
C/IMS						79
RESOLVE	1	14	30	11	81	137
DISKPLAY						96
DFP	2	14	6	6	23	51

PRODUCTS INSTALLED BY OPERATING SYSTEM ENVIRONMENTS

Figure 6

set is limited, sophisticated and technically competent as in the performance measurement and operations areas. The current product and customer problems must be resolved so that growth can continue.

Finances

Boole & Babbage is a financially successful, growing business. After the first five years, which saw significant technical achievements, but relatively limited marketing success, new professional business and marketing managers were installed to insure profitable growth. This has certainly taken place. With 1977 sales of over $5.7 million, Boole & Babbage was able to realize 11.8% profit after taxes. While this was down from an extraordinary 14.1% in 1976, it was considerably above the average of the previous three years. The profit objectives were accomplished along with a revenue growth of 52% from 1976 to 1977. Based on these results, Boole & Babbage was able to pay out a dividend which represented 58% of the previous year's earnings after taxes. The current cash position is very strong, with over $1 million in cash and cash equivalents and no short or long-term debt. Stockholders' equity is now assessed as over $1.8 million.

Figure 7 shows the financial summary since 1969.

The Balance Sheet (Appendix B-1) and Statement of Income (Appendix B-2) for Fiscal 1977 indicate the inherent conservatism of the business financial records: all programs constructed in-house have been fully expensed during the years that they were under development; therefore there is no book value to represent these substantial assets. Purchased computer software is shown as a net value of only $47K since it is depreciated over a two to three year period rather than its expected, longer life.

BOOLE & BABBAGE, INC.

NINE YEAR FINANCIAL COMPARISON

Accounts	1969	1970 (1)	1971 (1)	1972 (1)	1973	1974	1975	1976	1977
New Product Sales		1028956	1083473	763666	835225	1188310	1542677	2476873	3999594
Maintenance & Use		59695	213907	137654	228084	300162	472678	786983	1063124
Studies & Other & GSA		17973	223165	204132	268820	134334	124668	134582	71404
Royalties		-0-	53205	59083	79905	106162	192211	380465	600738
Hardware		-0-	49990	39634	8959	-0-		-0-	
Net Revenues	505791	1562958	1623740	1204168	1420994	1728968	2332244	3778903	5734860
Commissions				77807	97091	122770	167420	363972	389947
Royalties	130715	448146	375503	-0-	12388	20172	34894	79338	223222
Cost of ME Sales				31796	4162	-0-	-0-	-0-	-0-
Net Contribution	375076	114812	1248237	1094565	1307403	1586027	2129931	3335593	5121694
Expenses:									
Interest		30472	30888						
Services	-0-	-0-	-0-	62882	91696	74186	105337	101929	37449
Marketing	162609	452443	418568	436999	469460	551011	735007	936935	1351961
Software Engineering	99973	292619	358847	192827	197741	372540	458233	751644	1424720
Hardware Engineering				46099	17276	-0-	-0-	-0-	-0-
Gen. & Admin.	323487	614894	705858	347262	281301	295687	361968	559968	895775
Mini-Software							4419	3032	7935
Total Expenses	586069	1390428	1514161	1086069	1057474	1293424	1664964	2353508	3717840
Net Operating Profit	[210993]	[275616]	[265924]	8496	249326	292603	464967	982085	1403854
Other Income					14397	23571	57154	88868	156818
Extraordinary Expense					31196				
Net	[210993]	[275616]	[265924]	8496	233130	316174	522121	1070953	1560672
Total Assets	102894	362593	374494	357868	407185	692330	1246220	2338817	3460994
Total Liabilities	285782	436831	335716	305123	148970	166180	392794	939826	1602087
Total Equity	<182888>	<74238>	38778	52745	258215	526150	853426	1398991	1858907

(1) Includes Pacific Radionics

Figure 7

All leases are non-cancellable and the unpaid portion is carried on the books as an asset; this amounts to $700K as of 9/30/77; However, only those sums which represent earned income are included; essentially the future years' maintenance costs are excluded since these are not earned until the maintenance services are performed.

The accounts receivable of $1.1 million are normal trade invoices; payment is generally within 60 days, although about 22% of the outstanding balance is currently over 60 days. Since the customers are among the largest corporations and governmental institutions in the U.S., these seem to be solid receivables; nevertheless a 5% doubtful account reserve has been set up as a further conservative measure.

Stock options have been granted to officers and employees at option prices varying between $2.00 and $3.25 per share. The current shareholder's equity is $2.61 per share. The 1977 dividend was .40 per share. In 1977 net earnings per share were $ .94; in 1976 they were $.74 per share. There is no public market in B & B stock and option prices are determined at "fair value" by the Board of Directors as of the date of grant.

A profit incentive plan insures that all full-time employees with more than six months of service share in the company's success. The formula is a function of sales and pre-tax profits and the money is distributed as a bonus based on salary over a three year period. In 1977, the profit incentive bonus was over 8.5% of the

pre-tax profits. In 1976 it was approximately 9.5%

Revenue continues to come from a wide range of products. In 1977, growth came through increased sales of previously available products, larger maintenance fees, introduction of new products at the end of 1976 and from increased royalties from non-U.S. markets. Virtually all products performed above the targets for the year.

The marketable securities held during 1976, generated interest of $150K directly to pre-tax income. On the revenue side, commissions and royalties in 1977 were 10% of revenues; these represent payments to developers of purchased programs and commissions to salesmen. This is forecast to increase to 11% in 1978. (See Appendices B-3 and B-4 which provide a forecasted profit and loss statment and a projected balance sheet for fiscal 1978.) Marketing was 24% of 1977 sales and is expected to increase to 29%; 1977 expenses were lower than planned because of difficulties in recruiting additional salesmen and performance engineers and in replacing those who left. Similarly, Software Engineering, which was 25% of sales in 1977, will climb to 29% if staffing can be carried out expeditiously and effectively while employee turnover is better controlled. Finally, General and Administrative expense should stay at the 16% level during 1978 as it was during 1977.

The principal expenses are for salaries and related costs (planned for $2.5M during 1978 or 47% of total costs); rent and

telephone ($.4M or 7%); Travel ($.6M or 11%); computer usage ($.5M or 9%); and advertising ($.2M or 4%). These account for 78% of planned total costs. Other substantial items are for employee recruitment and education, operating supplies, equipment leasing and software amortization. All together these account for approximately $.6M or 11%.

There is an excellent general accounting system in place which provides detailed revenue and expense analysis by function and location on a monthly basis, with an unaudited balance sheet and profit and loss statement. A detailed budget (see Appendix B-5) is prepared by function, line item and month for the Fiscal Year Plan. The monthly statements measure progress against these budget targets. This enables close, account by account, monitoring and careful review of overall position for each function.

There is no product cost accounting so it is not possible to readily construct a product P & L analysis.

One other useful way to review the revenue/costs/profit of the business is to picture it in terms of "profit" centers. This would treat all marketing expense as a cost of sales to reduce U.S./Canadian revenue to an equivalent of international royalties received. This might give a clearer relationship between U.S. and international marketing productivity and the contribution each makes to cover product costs and achieve company profits.

Marketing

The marketing organization has been structured to recognize the characteristics of the marketplace and the nature of the products which Boole & Babbage supplies. There are three principal functions: market/product planning (Product Management); field marketing (Sales); field technical support for Measurement/ Accounting products (Performance Engineering). There are two field organizations (Measurement/Accounting and Operations) which cover the U.S. and Canada. The sales function in other countries is through marketing agents, some of whom cover the full line in a particular country or region while others only sell a specific product in an area. The international marketing structure is still evolving to insure that Boole & Babbage products are being effectively represented and supported in all areas of opportunity.

A detailed marketing organization chart is shown in Appendix C-3.

At present, U.S./Canadian field marketing is separated by product line. The systems measurement and accounting products have a national marketing manager with nine district sales managers in eight principal U.S. cities. There is a separate technical support organization with performance engineers in six locations to provide demonstrations, installation support and customer training for these products.

Operations was set up as a separate sales organization in 1976 with its own national marketing manager. The seven district

sales managers are currently located in seven principal cities and, because of the nature of these products, and possibly the sales staff, there has been no need for a separate technical support group. These products can be demonstrated, when required, by the salesman. Therefore, the salesman can handle the entire account relationship including installation assistance.

At corporate headquarters in Sunnyvale, there are three product managers assigned, each of whom is responsible for determining the marketing strategy for their products. This includes: identification of future requirements, product configuration, announcement and release timing; communication with sales offices; effectively interfacing with the development/maintenance engineers; providing adequate product training for the salesmen and the performance engineers; working on key sales situations, technical problem resolution and international assistance. Each product manager covers one of the areas: measurement, accounting and operations.

It has become more difficult for the field to directly handle customer support and usage problems because of the recent relatively high turnover of performance engineers (some into new jobs within Boole & Babbage, but mostly out of the company) and the longer training cycle for new PE's, (due to the larger number of products and their greater complexity). This has resulted in a very large increase in the number of calls to headquarters customer support personnel who have been a separate part of the

Engineering organization for the past year. Buried in the mountain of customer calls are the real product failure reports which require the attention and response of the skilled headquarters software engineers. Unfortunately, sorting out the customer information chaff from the product failure wheat has been a time-consuming task with a real problem in deciding what type of person is really needed to perform this function - should it be a development programmer, a performance engineer or simply a well-trained customer service representative? Various organizational and functional alternatives have been tried, with none yet producing satisfactory results.

International sales and support presently depends on nine separate marketing organizations which serve as sales representatives. The European Common Market is well covered, but through four different firms. Scandinavia, Australia/New Zealand, Israel, Japan and South Africa are handled through one firm in each location. In each case, some form of royalty arrangement has been made with defined (and protected) territories for specific products for stipulated time periods and measurable (and required) sales objectives. Programs, documentation, training materials and maintenance service are all provided by corporate headquarters, however there is no single person responsible for coordinating and integrating the diverse non-U.S. activities. Nevertheless, it is apparent that measurement and even accounting products know no national boundaries and can be successfully sold and used in any country which has the appropriate computer configurations and operating systems.

Recently, a manager for new product acquisition and research was appointed to better determine the value of offered products and more effectively introduce them into the marketing main stream.

Finally, there is a services operation at a government agency which is being phased out. This currently involves just one programmer supplied by Boole & Babbage.

1977 saw a major change in the ability of the field marketing organization to sell by demonstration, which had been the principal way measurement products sales had been closed in the past. It became far more difficult to be sure that a program could be installed and work reasonably well at the end of a one-day demo. Particularly in MVS environments this was very risky, so some of the district sales managers began selling without demos and others took their chances and paid the price of lower close rates when it required two or three tries (sometimes weeks apart) to get the demo to work successfully. Figure 8 shows the change in demo frequency during the past 11 months.

A number of Boole & Babbage caused factors seem to have contributed to this difficulty. First, technical problems with the programs and some associated trouble in getting timely, accurate corrections; and second, the shortage of trained, available performance engineers. In some cases, a third problem was that demo tapes (and even customer tapes) were sent out with omitted or incorrect contents. Finally, the demo procedures were not well documented which might have assisted the new performance engineers.

DEMONSTRATIONS FOR MEASUREMENT AND ACCOUNTING PRODUCTS

	CUE	DSO	TSA	PPE	APO	CAS	CPA	FMR	CMF	TOTAL
APRIL 1977										54
MAY										61
JUNE										52
JULY										74
AUG										39
SEPT										21
OCT										21
NOV										27
DEC										32
JAN 1978										41
FEB										22
TOTAL	85	80	93	36	25	56	59	1	9	444

Note: Data can be calculated to fill in chart elements.

Figure 8

The district sales managers are paid on a salary and commission basis. Commissions are dependent on new product sales and any maintenance sold with the initial contract. Follow-on maintenance contracts do not yield any sales commissions. Commission rates are set at one level for sales up to quota and at a higher rate for sales above quota. Successful district sales managers have been able to realize 125 - 175% sales performance over the past two years. Sales quota increases have been kept relatively small (around 15-20% per year) even though sales have averaged a year-to-year increase of around 50%. Sales districts have been added so the number of prospects per territory has been somewhat reduced.

Among the major organizational questions currently being considered by marketing management are:

- o the role, scope, staffing and structure of <u>product management</u>. The range of tasks is very large, but the product managers are essentially "one man bands". They appear to be the fulcrum for getting product leverage, but are limited by having to do the bulk of the work themselves. They lack authority to mandate Engineering action and do not have line direction of the field sales force. So, their principal weapons are persuasion and technical leadership.

- o The role, quality and reporting relationship of the <u>performance engineers</u>. There appear to be two different parts to be played. The first is that of

direct sales and installation support which needs to be a partnership with the district sales managers. The second role is to handle customer questions (after installation) in support of the ongoing maintenance commitment (and revenue). This role has been abdicated during 1977 and corporate headquarters has, of necessity, picked up this responsibility. However, a transcontinental phone call is often not an effective substitute for a known "local" person, even if the central customer service representative is quite able to handle the technical issues which arise, and the "local" person is frequently out of the office.

- The subdivision of products between measurement/accounting and operations. At present, neither group is well-defined. They exist on a product by product basis with some evidence that they may act competitively in at least one product area. If the product lines can be logically structured and assigned so that there is no overlap, then it will be clearer to the sales force and more rational to the customers.

Excellent selling has certainly been a major factor in Boole & Babbage's success during the past five years (and particularly during the past two years). Ways must be found to capitalize further on this success through increasing the average order size and the number of follow-on product and feature sales.

Synergistic marketing of the entire product line should pay substantial dividends in terms of revenue and profit. This can only succeed if the products are of suitable quality and are well supported technically.

There are very few marketing statistics to permit any quantitative in-depth analysis of problems or their causes. For instance, there are no formal reports distributed centrally on sales calls, demo success and yield or cost per order obtained. Some of these statistics may be worth while in order to better coordinate tactics for use by field sales. Better communication vehicles may be needed to integrate the present "blizzard" of memos and to interchange winning work plans.

Engineering

The Software Engineering organization has full responsibility for specifying, designing, programming, testing, releasing for sale, maintaining and modifying all programs and their related documentation. They are also on call to answer customer and marketing questions and problems regarding the use of the programs.

Given the relatively large number of products requiring active maintenance and enhancement, plus marketing requirements for new and replacement products, it is critical to the technical reputation and continued growth of Boole & Babbage that there be a substantial, competent Engineering organization. The present structure is shown in detail in Appendix C-4, which is the result of a major recent reorganization to better enable Engineering to balance the twin objectives of development and maintenance within the constraints of cost effectiveness and schedule integrity.

There are four principal functional components: line engineering which designs, builds and maintains the products; engineering services which provides common subsystems, does internal application programming and handles the computer operations interfaces; customer services which handles customer questions and product problems, and physically validates and distributes products; and documentation services which provides the manuals needed by customers to effectively use the products.

The current line organization has three engineering managers. One manager has responsibility for all CMF products, including

CMF-Realtime, CMF Analyzer, CMF-VS1 and CMF-MVS plus maintenance and extension of CUE. The second engineering manager has TSA/PPE, DSO, APO and the two operations division products: RESOLVE and SECURE. The third engineering manager has the remaining products: CAS/CPA/FMR and the DB/DC programs - CONTROL/IMS and CONTROL/IMS-Realtime.

In addition, the third manager has the Engineering Technical Support role which includes providing various subsystems to improve product development, internal application development and control of computer facilities and procedures. Computer services are provided on a remote time-shared basis with two principal methods of entering and receiving information. There is remote job entry and printing for computer services plus a number of screen terminals (about 1 for every 3 engineers) directly connected to the computer facilities. In addition, there is direct entry to a nearby batch data processing service which produces and delivers to Boole & Babbage the product tapes to be sent to customers. The batch entry and printing equipment is in one office and the screen terminals in another. Engineers generally have to go to these offices to run the equipment and terminals, although there are a few portable terminals available.

There are two additional groups reporting to the Engineering Vice President - Documentation and Technical Systems Support. Documentation is responsible for completing and releasing the various technical manuals distributed for each product. These include user, installation and pocket guides. The engineers

produce the initial drafts which are then edited and published by Documentation. Extensive writing is required for new user guides to provide logical structure, make them more tutorial, and improve clarity through the use of customer terminology. The documentation work is supported by on-line entry, edit and formatting terminals. There is also a graphics arts specialist and in-house printing and binding equipment available. Documentation does not have the responsibility for marketing manuals or training materials. Documentation does have the responsibility for compiling product status reports (by family, bi-weekly or monthly) to formally communicate all product revisions and updates including listing all code changes made through PCR's.

The other group in Engineering, Technical Systems Support, has three main functions:

- Customer Service will handle all incoming customer product related calls (initially for measurement/ accounting and later for operations). For those which can be answered through general product knowledge or reference to manuals, the customer service representatives will complete the transaction. If there appears to be a product code problem or the question is too technical, then the call will be referred to the responsible software engineering group. Four people were recently hired for these jobs; they have been undergoing a month of product training and will then have to have their response skills verified before they go "live" on the new "hot line" connection.

- Product validation will insure the accuracy of new product releases through reviewing customer beta test results. General release does not take place until the product quality has been independently verified.

- Product Distribtuion will arrange for the packaging of all products for shipment to individual customers. This includes obtaining a product tape from the near-by data processing center, providing recent PCR's that are not yet on the tape, assembling documents needed and sending the material to the customer through the Shipping department.

The February 1978 reintegration of development and maintenance responsibilities is an attempt to answer the 1977 problems of timely correction of program quality errors. In January 1977, a separate program maintenance group was established to be able to free up the development teams to produce new features and to construct new programs on a firm schedule. However, the new maintenance people were not able to take over rapidly enough to keep pace with the product problem reports nor to permit new engineering work to proceed effectively enough. So, the new structure is an accommodation to the maintenance problems with the hope that strong, objectives-oriented management will be able to still produce major modifications and new programs on schedule.

Four key measures are generally used to gauge the competence and performance of a software engineering team:

- o Ability to design and produce quality products
- o Ability to estimate and meet reasonable cost objectives
- o Ability to plan and achieve realistic time schedules
- o Ability to correct errors quickly and add function readily

Boole & Babbage's Engineering department has set its sights on measuring up on all four counts. Specific objectives are being set on a weekly basis for each engineering manager (second level) and each project manager. Spans of control for the first line and second line managers are generally small (3 to 5 people) in order to get concentrated management attention on each project and on training the many new people who have joined the organization in the past year (and particularly in the last three months).

The statistics on engineering employee turnover certainly highlight the nature and extent of the problems Engineering has had in keeping available a large enough group of trained programmers to permit timely maintenance and satisfactory product line enhancement. Almost 70% of the Engineering people on-board as of the end of February, 1978 were not Boole & Babbage employees as of January 1, 1977. The average tenure even for those 30% of the current employees who were on board on 12/31/76 is only 3 years. There were 17 engineering employees terminated during 1977 and 27 new hires. January and February of 1978 showed a major improvement - only 1 termination and 13 new hires.

The employee continuity problem is even more difficult than these numbers indicate. When one reviews how long engineers have been assigned to a particular product, less than 25% have worked on their currently assigned program for as much as one year. This constant change of players to compensate for terminations and integrate new hires precludes any build up of in-depth program knowledge. This is further aggravated by the lack of detailed formal program logic manuals or agreed-upon, published program standards.

Much of Engineering management time has been occupied with these problems, yet there has been a considerable amount of new code generated and much effort is being applied to correct the product program errors and functional deficiencies.

In order to make up for the difficulties in constructing major new products, especially in new application areas, there has been a company strategy of outside product acquisition over the past three years. Most recently, RESOLVE and SECURE were acquired from other companies; in both cases they had been completed and marketed and installed in a limited number of customer sites by the producing company before acquisition. While this policy has expanded the marketplace, it has introduced a further element of complexity in that the new products do not follow any consistent set of programming or documentation standards, nor do they share common functional modules with the rest of the product line.

The Hardware Engineering group (See Appendix C-5) has initiated an exciting new internal development project aimed at joining the flexibility of performance analysis software with the efficiency of a programmable micro computuer. Specifically a standard micro processor is being programmed to provide measurements on a high speed computer communications channel. Additional analysis of these results will be displayed for use by communication specialists to determine the use of the channels.

Many people believe that the future of the channels measurement area will depend heavily upon effective use of micro processors. By tackling this kind of project now Boole and Babbage will gain an early insight into this potentially vital area while at the same time producing an economically viable product.

Planning and Administration

The administrative functions of Boole & Babbage contain three main areas:

- Accounting
- Personnel and Secretarial Services
- Administrative Services

Each of these areas is led by a manager, reporting directly to the president, who himself acts as manager of Planning and Administration. The organization is detailed in Appendix C-6.

Accounting takes full responsibility for all initial bookkeeping entries, general ledger, budget and other financial functions, including accounts payable and payroll. Excellent expense analyses are prepared by computer to permit detailed examination and control by functional area.

Personnel and Secretarial Services is responsible for all employee benefit programs and claims, personnel files, general employee policies and practices and new employee orientation. All special personnel reports such as EEO, Affirmative Action and ERISA are covered through this function. This organization conducts the corporate secretarial functions, including issuing stock and preparing the agenda for and minutes of Board of Directors' meetings and Annual Shareholders meetings. All word processing services are provided through a team of secretaries and typists for greater efficiency and flexibility. This

includes preparation of all product and marketing documents. Telephone and teletype are also covered through this group.

Administrative Services includes contracts administration which manages the customer data base, billing and accounts receivables; maintenance renewals, commissions and royalties and a dozen monthly reports on sales and billings; it also has purchasing and travel, print shop, graphics, shipping and receiving and facility management work. A new customer information system is being designed and implemented to achieve greater efficiency and flexibility.

While there has been a considerable turnover of people in the administrative area, there are 8 people who have been with the company for over 18 months; these include the managers of the various functions and certain other key employees. This has provided effective continuity and a smoothly running administrative operation.

There is a continuing plan to expand the use of data processing and word processing equipment to further increase productivity and maintain tight control of G & A costs in relation to revenues.

Operational Section

Activities and Resource Utilization

While the previous information in this report has focussed on the background and structural elements of the business, this section looks at the business from an operational or procedural point of view. The term, activity, is used to define a logically related set of operations, processes or tasks which, together, accomplish some goal-directed purpose in a business.

If activities are well defined, they will begin with an external stimulus and conclude by providing a product or service to the marketplace. A well defined activity will be essentially self-contained and is not limited or restricted by organizational boundaries.

There appear to be three principal activities at Boole & Babbage:

- New product (or version) design, construction and release to "inventory" for both in-house developed and acquired programs
- Product sale, shipment and installation for both measurement/ accounting and operations products
- Maintenance and modification of existing products

Each of these are described in some detail in the subsequent portions of this section. Note that these activities involve multiple organizational components, are reasonably self-

contained, are triggered by external events and provide an output to the marketplace.

There are a number of other activities which are of a support nature. While they are vital to the success of the company, they are not line activities as are the three listed above. Some of the other activities are:

- Financial recording and reporting
- Communications (including word processing, secretarial, telephone and teletype)
- Personnel recruiting, training, managing, terminating
- Buying, storing and distributing supplies and services
- International sales and support
- Physical facilities operations

To complete the picture of a business, it is valuable to relate the organization structure to the activities and show what resources are used to carry them out. A document called the Resource Usage Sheet can be used to display this pattern, tying together organization, activities and costs.

Product Design and Construction

Certainly the most fundamental activity in the software products business is the production or acquisition of products. Without products in "inventory" there's nothing to sell.

The process of "building" a new product usually starts from the identification of a customer requirement or by an offer from an outside company to sell a product to Boole & Babbage.

For products which are already in the line there is usually continuing marketing and customer pressure to provide additional capabilities or to improve the analysis or display functions. So a process of successive releases is the normal business mode.

In addition, there are a variety of separately priced options offered with certain of the products where it was felt that this would provide a better way to upgrade capability and function without raising the entry price.

There are five types of in-house product releases:

- maintenance release to incorporate PCR's
- level release to include some new functions and capabilities
- version release to provide major new functions or interfaces
- option release to provide separately priced enhancements to existing products.

- o new product release to introduce a replacement product or a wholly new functional entry

The same development procedure is generally followed for all of these releases although the length of time required and resources needed will vary considerably from as little as a few weeks to as much as twelve to eighteen months. The details of the construction process are spelled out in a draft Engineering Standards and Procedures Manual. While the activity is described serially, many of the processes go on simultaneously or out of sequence.

For those programs purchased from outside the company a totally different process is followed; this is not detailed in the current report. This chapter deals primarily with version, option and new product releases. Maintenance and level releases are covered in chapter 16.

1. When an existing project for an engineering team is coming to a close or is completed, the project manager or leader reviews the planned timing and content of the next maintenance or level release. Usually the team has a list of suggested enhancements which have come from the product manager, customers or performance engineers. The team technically assesses this information and provides their recommendations to the product manager on whether a new version release is needed or if a level release is sufficient.

New versions often come about through a longer-range decision to support additional interfaces (when IBM delivers a new operating system) or to restructure the code for better performance, function or maintainability. There has probably been considerable field input, possibly lost sales or a conscious planning effort before triggering a new version.

Similarly, new in-house options and products don't just happen. A new opportunity has become evident through customer need or through internal technical innovation. This may result in a decision to offer an option on top of an existing product or, if the program will be large enough and different enough, then it can be marketed as a separate product. Customer visits and field and technical assessments will often precede the decision to go ahead with a new feature or a new product.

2. In any case, the product manager (alone or with the project manager) then writes a POR (Product Objectives and Requirements) describing those enhancements or new product capabilities which are felt to be most important and valuable. The purpose of the POR is to state in general terms what is planned for the next release or for a new product. It should not detail how the enhancements will be made. The size of the POR can vary from a few pages to a 25 page document. If a POR is needed for a level release the Engineering/project manager is likely to prepare it.

3. The POR is routed to the Engineering and Marketing V.P.'s, the national sales manager, the project manager and the

engineering manager. Each signs off when satisfied with the enhancements planned for an existing product or the characteristics of a new product. If not satisfied, a TREB (Technical Review and Evaluation Board) can be called to work out a compromise.

4. When the POR is agreed to, the project team writes an ERS (External Reference Specification). This document should specify all external interfaces (report formats, screen layouts, documentation, general system design, etc.). It also details the resources needed (person-days) and a planned work schedule. This is reviewed by the same people as the POR and a TREB may also be called to resolve ERS issues and to check on design validity.

5. After the ERS is completed, the project team does the detailed design of each module and produces an Internal Design Specification (IDS). Actually, there is often a great deal of overlap between the POR, ERS, and the IDS.

6. After design, the team codes the modules. Unit testing is done on each module, if possible.

7. Documentation is prepared to describe the system from a user and installation viewpoint. These manuals are based on project team drafts.

8. Alpha testing (internal system testing) occurs next. This may overlap with coding if the project is scheduled well. Currently most teams do not develop a formal Alpha test plan.

9. For Beta testing (external system testing) the team writes a formal test plan. This specifies exactly what runs are required and what reports and documentation should be returned to corporate.

10. The project team is now responsible for finding the Beta sites. They must get a decision from marketing on what they can offer the Beta sites as incentives to test the product and what sites they can contact. This responsibility has recently been changed and the roles are not clear at this time.

11. The project team then ships the product to the Beta sites and monitors the sites to correct any problems that occur and to see if all planned tests are carried out on schedule.

12. When all of the Beta sites have completed the test plans and all problems reported are corrected, PCR's are written and the product is released from Engineering. If changes are very extensive the program may require reassembly prior to release.

13. For all maintenance, level or version releases, the product manager writes a newsletter telling about the features of the new release which is sent to all active customers in the next Product Status Report.

    If this is a new option or product, the product manager will prepare an entire marketing package, including sales brochures, advertisements, mailings, presentations or any other

means felt to be warranted to motivate field and customer interest for the new product. During the development process, the product manager has had to establish product prices and any special terms and conditions for the offering. The product manager must also arrange for training sales and field technical support.

14. Depending upon the complexity of a new version or product, it may be shipped to a few customers during the first one to two months and their experience monitored before it is released for shipment to all customers.

15. The new release is not sent automatically to all active customers (e.g. those who have current maintenance agreements). The availability of the new maintenance, level or version release will be made in the next PSR and each customer will order the program and documentation when they wish to install it. Any new customers will, of course, receive the new version of the product. If this is a new option or a new product, it is "put on the shelf" and will be used to satisfy new customer orders as they are received.

Product Sales, Shipment and Installation

While it is essential to have quality products available, they don't make a business profitable until someone sells and delivers them to customers. This activity covers those operations necessary to make a sale and to deliver the product to the customer.

The sales procedure varies somewhat depending on whether the product is being sold by measurement/accounting or by operations. It will also vary based on the particular product. If it is a first sale to a customer, there are more steps than if it's a follow-on sale to an existing customer. Similarly, sales to additional sites for a single enterprise may be simpler than first time sales.

The procedure does not describe the handling of maintenance agreements except as they may be included in the initial order. It also does not cover international sales or mail order sales.

1. Based on the well defined prospect list (a known IBM large-system account), a response to advertising or a seminar, or reference from a user, the sales representative will try to set up an initial visit with the data processing operations or systems management to present the Boole and Babbage product story, related to the particular prospect interests if possible.

2. The presentation should lead to an opportunity to discuss

particular prospect problems in some depth with the technical people; a Boole & Babbage performance engineer may be involved in some of these calls. The result should be agreement on the need for one or more Boole and Babbage products.

3. If useful in closing a sale in a timely fashion, a demonstration can be arranged for most products at the customer site, either with or without the customer paying a service charge. The demo is designed to prove to the customer that the information collected and the reports prepared from that information can lead to significant performance improvements or to better job accounting. A demo can also be used to stimulate interest.

4. If the above processes are successful, the customer will order some set of products on one of the approved lease or rental plans. The order is forwarded from the district sales office to corporate headquarters. This may be a purchase order from the customer, a sales agreement from the sales representative, or some other authorized ordering documet.

5. Orders are given to Contract Administration which checks the paperwork involved, looking for changes to standard agreements, special incentives, accuracy of pricing information or any other unique information on a contract. The status of the customer (new or old) must also be determined. If there are any problems with the paperwork, the salesman will

be notified and the order may need to be revised or resubmitted.

6. Contract Administration will then put new customer information on coding sheets and send that information to the data processing services firm to be incorporated in the customer master file. When the changes are returned to Contracts, they verify that the changes have been incorporated accurately and completely. Incorrect inputs will be returned for correction.

7. After the customer master has been updated, Contracts will submit an order for a tape to Product Distribution, which will run the job, according to the order, at a selected data processing center. If the job does not run successfully, Product Distribution researches the problem and re-submits the job. A successfully run job results in a tape which is delivered by the data processing center to Product Distribution.

8. Product Distribution sets up the documentation package that must accompany the tape. When the tape arrives, it is added to the documentation package with the shipping instructions as specified by Contracts on the order form.

9. Product Distribution updates its records and sends a verification letter on a completed order to Contracts. Any delays in product distribution will be communicated to Contracts by Product Distribution upon request.

10. Contracts expects receipt of a verification letter in 3 days from submittal of the order. If one is not received, Contracts pursues the reasons for the delay and expected length of the delay. A delay of longer than 5 days requires notification to the salesman. The salesman decides on whether to notify the customer.

11. When a verification letter is received, Contracts invoices the customer. Product Distribution only verifies receipt of the product with the customer on new customers. Failure to receive a product prompts an immediate search by Product Distribution and a reshipment if the tape is not recovered rapidly.

12. The salesman or performance engineer may assist in installing the product at the customer site after the tape has been received.

13. For many products a specific number of training days are committed usually to be given at the customer site after the product is installed by the performance engineer or salesman (occasionally by the product manager).

Product Support and Maintenance

While easily overlooked as a principal activity, the maintenance of Boole & Babbage products probably generates, over the life of a product, almost as much revenue as is obtained from the initial sale. So, maintaining the quality and currency of a product is clearly vital to running a profitable software products business.

There are two principal triggers which lead to changes in the existing products. The first route is through the discovery of a product problem, where the program does not in fact perform as described. This may be caused by either code or documentation error. Finding the cause for the error and correcting it is usually referred to as program maintenance although it also includes documentation correction. In Boole & Babbage, program maintenance is called Product Problem Report/Program Change Request (PPR/PCR) processing.

The second type of change relates to a product deficiency or new opportunity. Usually, one or more customers or prospects will request that a program perform some additional functions, improve its performance, add new report formats, use less memory, etc. The decision to make these kinds of improvements is generally treated as modification or project work and is handled through the building of a new level release.

The production of a maintenance or level release (see 14.0) can really be considered as a part of the product support and maintenance activity, since it does not directly result in a new

product; the modified release is available on request to all current customers who are under a maintenance agreement.

Version releases are essentially viewed as new products even though they also are available to existing maintenance customers at no additional charge.

So, one can look at maintenance as incorporating the PPR/PCR work as well as that modification activity in preparing maintenance and level releases.

This activity will only cover maintenance through the availability of a PCR and a Problem Status Report (PSR) to all active customers and then incorporation of these changes in a maintenance or level release.

1. Customer calls in with problem/question. Problems are also reported via twx (especially from Europe) or by mail. These follow similar procedures to phone calls, except that documentation normally accompanies the mailings.

2. Boole & Babbage's telephone operator makes initial determination if the question should go to customer service or marketing.

3. If only information is needed, customer service answers the questions.

4. If a product problem, customer service makes out a PPR and reviews existing PCR's to determine if it is a known problem.

5. If a known problem, the PCR is given over the phone. If not, documentation may be requested which would have to be mailed in. Once a week, a list of all outstanding PPR's and their status is compiled into the Outstanding Problem List.

6. When the documentation is received, the development team reviews it to determine how difficult it will be to fix. This is reviewed with the project manager (usually daily but at least weekly) who, if the workload is high, the priority is high, or the problem too difficult, may assign the problem to another development engineer.

7. The assigned engineer tries to solve the PPR; when a solution is determined, a PCR is made out which may be a zap or a source change and/or a DCR is prepared to correct the documentation.

8. The PCR is sometimes tested internally, but most often it is sent (phoned) to the customer reporting the problem to insure that it corrects the specific problem. The customer is asked to call back to verify that the PCR worked correctly.

9. After verification, the PCR is released to Product Distribution.

10. The PCR must be printed and sent to three places:
a. Product Distribution must have copies to send when the product is shipped to new customers; b. The PCR must be sent to any existing customers who have already reported the same problem (or to all active customers if it is a critical

error); c. The project team must have a copy to apply to the next release.

11. All active customers receive the PCR's through the PSR (Product Status Report) which is now to be published every two weeks or once a month (instead of every two months as before). The preparation of this report is the responsibility of Customer Services but it is compiled by Documentation. The PSR contains all PCR's for the products within a particular area (e.g. measurement, accounting or operations). The customer list for the product is obtained from the customer master file which is maintained by Contract Administration. The PSR's also contain the critical PCR's for the sake of completeness.

12. At longer intervals (3 to 6 months) all PCR's will be incorporated in a maintenance release or combined with enhancements to make up a level release. Depending upon the degree of modification the development team will use the steps needed from chapter 14.

Product Quality Assessment

The following notes attempt to summarize the various elements which relate specifically to the quality problems which Boole and Babbage has experienced over the past year. This does not try to solve the problems nor establish criteria for selecting among potential solutions; rather it is an operational view of the symptoms and certain procedural or structural factors which may have contributed to causing the problems.

All elements of the company seem to be aware of and concerned about the quality issues. Marketing is focussed on loss of company reputation, demo failures, lost orders and customer complaints. Engineering sees a climbing program problem backlog and an extremely heavy maintenance and customer support load. Planning and Administration sees the extension of existing maintenance agreements with consequent loss of renewal revenue along with special staff work on customer complaint hot lists. Many special meetings have been held and an extensive set of actions have already been set in motion: Engineering has been reorganized and new emphasis placed on hiring engineers and performance engineers to fill all open slots. Training for field people has been increased and a new customer service staff recruited.

Still one wants to better understand what actually went wrong, why it wasn't picked up and responded to earlier and how similar problems could be avoided in the future. The remaining comments address the first two of these questions.

What are the symptoms of product quality problems?

- Much higher demo failure rate
- Product failure reports increased
- Customer complaints and questions increased
- Product problems took longer to resolve
- Product functions are "inadequate" for MVS AP and MP
- Some customers state that they will not order additional Boole and Babbage products because of "failures" on other products
- Some customers refuse to renew or initiate maintenance agreements or even refuse to pay for previously agreed to maintenance
- Sales of certain products have slipped significantly

Review of these symptoms leads to the identification of a number of factors which contributed in some way to the change in the customers' perception of Boole and Babbage as the finest company in the computer performance measurement and accounting area. It appears that no one of these factors is the villain, but that, in concert, these various items triggered the problems and precluded their ready solution.

- Rapid growth in the number of customers and in the sites using MVS, particularly those with attached or

multi processor configurations. Generally, the Boole and Babbage products had not been modified or tested to work effectively under MVS.

- IBM announced and released RMF II which provided a good set of functions for performance analysis under MVS. These facilities leap-frogged Boole and Babbage product capabilities at an attractive rental price.

- There was over a 50% turnover of performance engineers with subsequent difficulty in recruiting and retaining competent replacements. Performance Engineering was undermanned all through 1977. Customer training also decreased during the year.

- The Boole and Babbage product line grew considerably during 1976 and 1977 so that there were a greater number of products for the performance engineers to learn and for the software engineers to maintain and modify. Two 50% growth years in a row were hard to digest.

- Software Engineering reorganized to separate maintenance from product development. All new people were hired for these maintenance positions. It was difficult filling these jobs with experienced programmers. Many of the products (not just the MVS versions) showed significantly increased PPR rates.

- There was a significant increase in employee terminations in Software Engineering causing changes in managers as well as engineers.

- It was very difficult to hire skilled software engineers on a timely basis. Engineering was always far under authorized head count.

As a result of all these factors, the normal modes of doing business were impacted: established communications between peers were affected so that the usual feedback seems to have been short circuited or not given sufficient credence.

Figures 9, 10 and 11 display some of the data which is available to document the measurable scope of the quality problems. Unfortunately, there is no way to effectively describe the change in customer perception, nor to accurately measure the lost sales or even the change in market share. It is also hard to identify measurements which would enable management to spotlight when the problems are starting to ease up and Boole and Babbage is on the road to quality improvement.

CUSTOMER CALLS - (Incoming and Outgoing)

	<----1977---------->			<--------1978------>	
	OCT	NOV	DEC	JAN	FEB
CUE/DSO	147	181	213	207	135
CAS/CPA/FMR	154	209	215	192	221
TSA/PPE	275	208	223	245	191
RESOLVE	161	141	123	104	107
C/IMS	46	69	35	Not Recorded	124
OTHER	78	41	50	97	27
TOTAL	861	849	859	845	805
# CALLS/PPR	14.0	8.3	10.7		

Note: There is no listing of calls for APO, CMF-RT, FMR, SECURE, CIMS-RT, DFP or DISKPLAY.

Figure 9

PRODUCT PROBLEM REPORTS - 1977

Outstanding Open Problems end of Month

	J	F	M	A	M	J	J	A	S	O	N	D
CUE/DSO	37	19	5	11	18		24	28	14	6	6	11
TSA	0	0	0	0	2		2	8	12	10	15	20
PPE	0	0	0	0	4		6	29	40	26	20	24
CAS	0	1	1	7	6		7	5	6	6	4	6
CPA/FMR	0	0	0								6	8
C/IMS	12	0	1	9	9		8	2	4	4	9	6
RESOLVE					4		4	3	2	1	3	8
TOTAL	49	20	7	27	43		51	75	78	53	63	83

Problems received during month

CUE/DSO	6	9	21	19		15	10	15	15	15
TSA	2	1	9	3		6	4	4	20	9
PPE	8	8		10		28	27	6	32	12
CAS/CPA	10	3	8	0		6	18	13	16	20
C/IMS	4	3	1	4		2	6	3	11	
RESOLVE						3	6	10	9	16
TOTAL	30	24	39	36		60	71	61	103	72

Figure 10

PROGRAM CHANGE REQUESTS

Number Issued (By Fiscal Year)

	72	73	74	75	76	77	(Oct 77 - Feb 78) 78	TOTAL
APO					11	18	7	36
CAS	2	99	56	69	75	46	17	364
CI					46	41	23	110
CMF							3	3
CPA					38	13	26	77
CUE	8	67	74	116	114	64	19	462
DSO	1	9	14	32	12	6	1	75
PPE	4	38	41	59	54	74	13	283
RES						8	45	53
SEC							14	14
TSA			3	43	44	34	12	136
TOTAL	15	213	188	319	394	304	180	1613

Figure 11

Customer call data (Figure 9) was not consistently reported during 1977 since it depended on personal records not kept in a central file. Nevertheless it appears that the number of calls was quite stable during the past six months (although stable at a high level).

Product Problem Reports (Figure 10) shows a dramatic increase in the number of problems received each month beginning with August 1977. The number of open problems started climbing in April although the rate of reported problems did not increase. By year end the number of open problems was climbing again and this continued into January and February 1978 to levels above those previously experienced.

Program Change Requests (Figure 11) show very few definable trends; however, one can conclude that maintenance will continue to be needed even on programs which have been in the field as long as six years.

With this review of the facts about the current quality problems we conclude the phase one report. It should have provided a clear report of "that which is" - the structure and nature of the Boole and Babbage business as of March 1978.

PHASE TWO REPORT

SOLUTION REQUIREMENTS

Boole & Babbage, Inc.

Sunnyvale, California

PHASE TWO REPORT - SOLUTION REQUIREMENTS

Analysis Section

Problem Analysis

The quality problems which have become of such significance to all levels of the Boole and Babbage organization over the past six months did not happen suddenly, but rather are related to the general operation of the business over a period of at least two years. Even in early 1976, product failures in demonstration and other sales situations were evident and getting careful Engineering attention. Nevertheless, the individual problems were apparently not appreciated for what they were: symptoms of a severe erosion in the company's product quality and hence a threat to future market competitiveness. The outstanding sales successes of 1976 and 1977, across almost the entire product line, clearly gave senior management a very affirmative viewpoint toward the business, its products and its future growth. Any warnings looked like very small clouds in a very sunny sky.

Yet, in retrospect, looking at the nature of the difficulties encountered, one can ask whether these symptoms should not have been analyzed sooner, whether the company Engineering and Marketing resources should not have been mobilized earlier, to identify and attack the underlying problems in an organized and constructive way. The special attention given to correcting the various quality concerns since December, 1977 has been intense, but has not yet resulted in much measurable change in product quality or market image. However, problems which have come about

as a result of two years of neglect can seldom be solved in a few months with short-term corrective measures.

There should be little doubt in anyone's mind that the causes for the present quality problems are in fact deep-seated and will require fundamental changes in the way Boole and Babbage plans and conducts it business. The changes will affect not only procedures, but people; not just products, but strategies; not just Engineering, but Marketing and Administration.

The following scenario shows how pervasive the situation had become by late 1977 with some exaggeration to make the points more clearly:

- problems which might have been solved locally or with a phone call were escalated to corporate.

- corporate blamed its slowness in solving problems on the fact that there was a new customer engineering group and that they simply needed time to take over.

- the failure to deliver the needed product improvements for MVS as scheduled was viewed as a management problem which could be solved if the assigned managers stepped up to the challenge, hired and trained their new systems programmers and set and controlled energetic project objectives.

- New procedures were introduced to record and report on customer inquiries and program problems; similarly, new methods for customer tape preparation and distribution

were introduced. In the ensuing confusion, it was difficult to tell whether things were any different from what they had been or to pinpoint specific causes for bad customer tapes or demo failures.

- Compounding these already severe issues, there was a drop in amount and quality of customer training, the software engineers had to be switched to products with which they were not familiar and the spiral of spending time explaining why they were behind schedule caused still further erosion of available time.

- Finally, executive management attention tended to be focussed on the acquisition of new products, on making the new Operations Division successful and far too little on what was happening to the system measurement and accounting people and products.

What is needed is to relook at the business and consider how to organize the resources to carry out the activities to achieve the necessary quality goals and objectives within the revenue and profit plans.

To address this set of problems in a systematic way it is useful to treat quality management as though it were an activity - hence it should be defined, described, have goals and objectives and requirements for solution established. The balance of the Phase Two Report will deal with this pseudo-activity - the Quality Management System.

Activity Definition

What should be encompassed within a Quality Management System? What is it required to do that will have direct value to the business?

Following the same reasoning as in the Phase One Report, we should start by examining the present operations and identify the key quality related functions currently being performed. We will then pose questions regarding the key steps from each of the three principal Phase One activities.

1. Product Design and Construction

Key Operations:

* Establish market requirements (POR)
* Design system (ERS)
* Prepare internal specification (IDS)
* Code program
* Document program
* Test program and documentation
* Validate package and prepare for shipment

Questions:

* For in-house products, what is the accuracy of the POR? of the ERS? of the IDS?
* Do acquired products meet a well-described customer need? Are the external specifications satisfactory?

* For all products, is the design modular with specified interfaces? Is it easy to modify? Is it well documented for users and for developers and maintainers?

* Are the unit and system test cases defined in advance of coding? Do they adequately cover all product functions under all support environments?

* Is there a sound Beta test plan with identified customers?

2. Product Sales, Shipment and Installation

Key Operations:

* Presentation of products
* Propose specific offerings
* Demo products
* Process Customer Order
* Prepare product for distribution
* Ship product
* Install product
* Train customer in use of product

Questions:

* Are the products being correctly proposed, within their capability, so that customer expectations are realistic?
* Are demos only being used where needed to close an order? Is the performance engineer

or salesman able to make the demo work properly?

* Are the products being installed correctly? Are the customers being trained to use the products effectively?

3. Product Support and Maintenance

Key Operations:

* Respond to customer concerns
* Prepare Product Problem Reports
* Diagnose and correct product errors
* Prepare Program or Document Change Reports
* Distribute Product Status Report
* Distribute maintenance and level releases as requested

Questions:

* Are product concerns reported promptly and directly? Is there a clear responsibility for handling problem reports?

* Are the engineers working on program maintenance sufficiently knowledgeable of their assigned programs? Do they have effective descriptions of the current programs?

* Are the diagnostic and modification techniques available of adequate help to the engineers in correcting errors? Do they have

facilities to replicate a reported problem or to test the correctness of a proposed solution?

* Is the present mode of distributing corrections and supplying maintenance releases satisfactory to customers?

* Are modifications selected carefully enough to meet most urgent customer requirements and to maintain product currency?

Now, to establish the scope of the Quality Management System it is necessary to think in terms of the actual operations which produce the product as well as special quality measurement and control processes which permit an objective (or even quantitative) evaluation of how well the operations are being done. In each relevant area the ability of the resources (and organization) to carry out the work (within cost and time expectations) must be assessed and explicit additional checks have to be made to insure that the desired quality results are being achieved. The point to remember is that setting up quality measures or after-the-fact tests won't improve the quality of the product or the service, but only prevent poor quality products from being shipped.

Normally, then, the best place to start with quality-oriented planning is as early in the system as possible. The effort spent on post-error correction is always more expensive and seldom affects the real causes of quality problems.

Quality Goals and Objectives

While the ultimate business goals are revenue and profit, we need more immediate direction to relate the problems and their fixes to the Quality Management System.

Goals:

1) Delivered products should meet customer expectations for capability (function, performance, usability), availability (up-time, fail-soft, reliability) and currency (timely and accurate error correction, support of changing systems)

2) Marketing, Engineering and Administrative organization and people should meet management expectations for the time, cost and accuracy of the various activities, operations and processes.

Objectives:

1) Reduce the number and severity of customer problems in installing and using Boole & Babbage products.

2) Improve accuracy and timeliness of response to customer product problems.

3) Increase customer acceptance of Boole & Babbage products.

4) Better control of costs associated with product quality management.

There are many techniques for determining whether the quality goals and objectives have been achieved. It is appropriate to consider:

* product and customer sampling
* 100% measurement and recording
* independent audit
* historical correlation of cost, structure, style, language, etc. versus quality results
* comparative analyses of high quality versus poor quality products in terms of people, tools, specifications, changes, functions, etc.

Some principles which will probably apply are:

* Programs that are unstructured will be difficult to maintain and modify
* Lack of detailed documentation will severely penalize the next person responsible for the product
* Careful planning, design and coding will save on testing and correction for many years to come.

Resources

The present organization structure focuses on the balance between Engineering and Marketing, with Administration providing an essential, but still supportive, service. The nature of this balance is critical to Boole & Babbage's success in continuing to run a profitable business. Therefore, in solving the current quality management problems, consideration is required of:

* What roles are assigned to each organization
* The dependence of one on the other
* The potential contention between them
* The communication among the individuals in each group.

Three challenges are posed in examining the quality issues:

* to understand what has happened and identify root causes
* to propose policies and structures which will correct the root causes and reduce the likelihood of reoccurrance of quality problems.
* to establish procedures and practices which will efficiently produce quality results and provide early warning of changes which indicate new quality problems.

The key problems and their root causes are listed below; they are not in priority sequence, nor should it be assumed that if any one of them had not existed that the entire problem would have gone away:

* ENVIRONMENT - A rapid increase in the number of products, the number of installations and the complexity of the users' computer system.

  - Boole & Babbage cannot manage the environment except through its own actions in introducing new products and limiting sales growth.

* PRODUCTS - A sharp drop in the ability of the available products to meet customer expectations along with great difficulty in improving the products or even correcting specific program errors.

  - The turnover in Engineering personnel combined with reorganization and understaffing have played havoc with the development and maintenance process.

* CUSTOMER SERVICE - A significant reduction in customer training and technical support on site and by phone.

  - The turnover in performance engineers and the reorganization in Engineering were the principal factors.

* MANAGEMENT - No significant change in the way of doing business; no response commensurate with the problems.

  - Overriding all of the individual causes, lies the lack of effective management understanding and involvement early enough to avoid the brunt of the difficulties. Management concentration on near-term growth and profitability took their attention away from quality and long-term value and stability. The absence of any unified market or product strategic planning certainly contributed to the MVS "surprise".

Addressing these root causes means that any proposed solutions must come to grips with the changes in the various resources of the business:

Organization - Adequate number of executives; control of Marketing/Engineering contention; qualified middle and first line managers with effective span of control.

Marketing - Clarify the present product assignment anomalies; define the role and organization of performance engineering; establish a reasonable product management function.

Engineering - Rationalize product assignments and individual responsibilities; insist on documenting existing products for

maintainability; prioritize improvement projects to address most critical areas.

Personnel - Stop the employee turnover hemorrhage; focus on more effective reward/recognition schemes to improve employee productivity.

Finances - None

Planning and Administration - Establish a strategic planning group to set business, market and product direction.

Operations

The present operations which carry out the development activities have evolved over a number of years, but are just now being formalized through the preparation of a Standards and Procedures Manual for Engineering. There are no current plans for a comparable document for Marketing. Most of the people who are involved in both the engineering and marketing work tend to only see their portion of the "elephant" and not effectively understand the interconnections and interdependencies among the various roles.

To assist in seeing the full range and scope of the quality issue in operational terms, the items below indicate the major elements needed to have a comprehensive quality management system:

1. Qualified, trained people who are dedicated to designing, producing and marketing quality products.

2. A marketing approach which only sells what is known to work and is responsible for successful training of their customers.

3. An engineering approach which insures a well architected product line, products carefully designed for ease of maintenance and modification, documentation of the detailed designs, professional coding and then substantial testing before any products are released for sale; competent programming to correct those errors that do occur and to make future modifications as required.

4. A company management committed to spending the money and the time necessary to justify and maintain a reputation for quality and service.

In order to turn these global statements into useful solution measurement yardsticks it is necessary to relate specific quality problems to the principal operations which affect them. This can best be viewed by separating near-term, intermediate and long-term impact.

* Market Requirements (POR)
  - for new versions or new products, this is primarily a long-term vehicle.
  - for maintenance and level releases, this could have intermediate-term value to insure focussed attention on correction of program deficiencies and integration of previous "patches".

* Product Architecture and Design Specification (ERS)
  - for new versions or new products, this would have a long-term impact
  - it does not appear to apply to maintenance and level releases.

* Detailed Design (IDS)
  - This could be applied to level releases or even maintenance releases by carefully defining and clarifying the structure of the existing program. This would give it intermediate-term value.

- As a practical way of introducing a consistent programming style it would have long-term benefit by insuring that all programs had a well-structured, understandable framework, well documented for later maintenance and modification.

* Program Coding and Unit Testing
  - Carefully written instructions following an agreed upon set of coding rules and procedures could give an intermediate-term benefit by avoiding "surprises" in Alpha or Beta test.
  - The long-term value would come from the subsequent ability to transfer program responsibility readily and to depend upon ease of change in the code.

* Product Testing and Evaluation
  - There are near-term implications in this area. Testing is the final gate which can preclude poor quality products from reaching customers. The ability of those manning the gate to effectively assess the usability of a new release and to withstand the pressures for delivery of needed functional improvements or new products is critical to the prevention of additional customer problems.
  - On an intermediate or long-term basis a far more productive way must be found to establish comprehensive test cases, run them in a controlled

environment and obtain customer participation and evaluation.

* Sales
  - On a near-term basis there are few weapons as powerful as a knowledgeable, effective salesman who is motivated to straighten out current customer usage and maintenance problems, not just to bring in new orders. This also means only selling what is known to work properly in the specific customer environment.
  - On an intermediate-term basis, attention to insuring that each new installation is working effectively through installation support and customer training may do much to prevent erosion of goodwill and provide early identification of usage problems.

* Customer Problem Response or Correction
  - The work in this area can have the most dramatic near-term results. First, if trained people can field questions quickly and competently, an apparent problem can sometimes be turned into a benefit. Second, rapid, accurate corrections of program errors will preclude their impacting multiple accounts, as well as resolve the original difficulty before it has time to become aggravated.

- Intermediate-term and long-term impact will come from structural improvements to the code and from an Engineering organization that provides continuity of product knowledge and responsibility.

Solution Criteria

The primary issues must be attacked head on. While it is necessary to make short-term adjustments to maintain market credibility, it is more important to make the significant structural changes which will address these problems on a satisfactory long-term basis. To do this, it's valuable to isolate the causes and set criteria for measuring the "goodness" of any proposed solutions.

People

The basic source of Boole and Babbage's current problems is people.

* The level and experience of people who have been hired for engineering and performance engineering work.
* The very high turnover of these engineering people

Even these negatives might have been managed except for:

* The reorganization that took place January, 1977 to separate customer maintenance service from development engineering.
* The continuing rapid growth in sales of existing products to customers with changing measurement needs (e.g. MVS)
* The introduction of new products without prior technical digestion.

If you don't have top quality people and you can't keep what you have long enough to train them, then you can't cope with overly complex problems and you can't afford to change the organizational ground rules very often.

Any near-term solution will have to show that it can function with the people that are currently on board, assuming a continuation of a relatively high turnover rate.

Any long-term solution should show how it will change the mix or skill of the people on board through better hiring, pertinent training and reduced turnover.

Products

The current product line is in disarray. While some individual products may be satisfactory at this time, the lack of a consistent, documented architecture will continue to lead to unpleasant surprises. The present product error level is unreasonable for seasoned products. The lack of clear maintenance documentation is a severe burden. Correction cannot take place one bug at a time. Tying up the bulk of the engineering resources in fixing previous errors or making minor improvements must be ended.

The near-term solution to the product problems obviously depends on some permanence in people assigned, identification and correction of faulty modules and fast enough turnaround to avoid multiple customer problem reports of the same error.

Long-term solutions must deal with architecture and design, design documentation and standardized programming style.

The solutions here must be described product by product in the near-term and by family for the intermediate and long-term.

Customer Support

The Boole and Babbage products are generally too complex in function and use to simply be dropped into a customer site and installed automatically by the customer alone. While the progam may physically function, if there are no odd configurations or operating systems characteristics, there is low likelihood that the customer will know how to get full value out of the information available.

Whether done through more technically trained salesmen, more experienced performance engineers, better quality, hands-on customer training or whatever, the company must direct its attention to making sure that the customer can use the product profitably soon after it is installed. So, on a near-term basis, specific solutions will be examined to see if they provide concrete ways to review and clean up present customer situations and prevent new ones from going sour.

In the long-run, solutions have to recognize the nature of the market and provide more available (e.g. local) customer sales and technical support with marketing programs geared to how the products are used by customers.

Procedures

Present methods for processing orders, packaging and delivering products, handling program changes, etc. are woefully out of date and require too many hands with too many opportunities for organizational buck passing. It's time to change this in such a way as to clearly assign total responsibility for all formal customer deliveries (programs, manuals, changes) to one organization with sufficient in-house resources to do a quality job, quickly.

Similarly, procedures for new product definition are muddy, not well understood and terribly time-consuming. The entrepreneurial spirit and judgment should be cultivated, not stultified. Solutions should be judged on whether they avoid bureaucratic squabbling and permit crisp, informed decision and execution.

The newest error handling procedures seem prone to excessive path length, misinterpretation and substantial delays in resolving what are hot customer concerns. Too many hands get into the act. To the extent that full product responsibility, including error service and response, are concentrated in one group for each product or related product family, there should be an improvement in quality performance at a lower cost.

Strategic Planning

While the annual Business Plan carefully spells out specific objectives for each function and each product, it does not appear

to be done in an agreed-to and well-understood strategic context. The effort in 1973 to formalize the company's strategy in each product area was done very thoroughly with much attention to projected IBM strategies and changing equipment technology. However, it did not present a Boole and Babbage customer/market oriented point of view, but rather concentrated on a technical view of product growth.

On the other side, the process followed recently in the acquisition of RESOLVE and SECURE illustrates how Marketing, with executive management participation, has proceeded to select and buy products with, at best, cursory attention to the technical strategy and issues and little attempt to effectively fit these offerings within existing or planned product families.

New solutions should be measured on their ability to establish a fair planning mechanism which will be set up, on an on-going basis, to establish market opportunity and a technical base and associate these aspects of the solutions with resource limitations and reasonable financial objectives.

Specific Measurements

It's useful to quantify where you are, where you want to go and to be sure you have numbers to support your assessment of progress against these objectives. Listed below are some of the specific measurements which will be used to gauge the effectiveness and impact of any proposed solutions:

Finances:

* Revenue - maintain at least 25% growth over previous year
* Profitability - achieve at least 10% on revenue after taxes

Investment:

* Acquire new products or businesses for less than 50% of current liquid assets
* Future payments for acquisitions should depend wholly on revenue or profits generated.

Personnel:

Staff Level - Maintain adequate number of people in each critical area. Specific ratios of staff to number of units installed should be set and measured regularly. This has to include a planned-for turnover factor, so some on-board people may represent "bench" strength.

Permanence - turnover by job category should be less than set targets.

Salaries/Benefits - Specific annual guidelines (based on external information) should establish a framework for setting salaries for both new and experienced employees. Measurement of actual versus objectives should be done regularly.

Training - a specific number of training days and subjects should be set for each individual and then measured for achievement to insure technical currency.

Assignment Stability - length of time on a specific product should be planned and measured.

Customer Acceptance:

Renewals - A >95% rate per product should give a good clue of the value customers place on maintaining an on-going relationship with Boole and Babbage.

Propsect Sales - Ratio of conversion from first presentation to sales; ratio of demos to sales.

Customer Calls - number and nature of calls versus preset criteria.

Customer Complaints - Formal log of letters, requests for maintenance credit.

Product Development and Maintenance:

Scheduled Length - Development of new product; development of new version; development of new level; preparation of maintenance release. Specific time targets should be established.

Product Problems - Rate per 1000 lines of code; number of days since first reported; man-hours per problem resolution.

Test Experience - Number of errors detected.

PHASE THREE REPORT

PROPOSED ACTION PLANS

Boole & Babbage, Inc.

Sunnyvale, California

PHASE THREE REPORT - PROPOSED ACTION PLANS

Structural Section

Organization

The changes to be made at Boole and Babbage have to be carefully considered in the context of a three to five year plan as to where the company will be and what it will be doing. A relatively small company can't afford the luxury of stirring the organization pot too often if it is to remain an efficient entity. Also the total number of changes to be made have to be weighed to decide if there are sufficient people to carry them out effectively. In sum, a clear picture is needed of the long-term directions so that the near-term and intermediate-term actions can be selected to lead constructively toward the company goals and objectives.

So, the first solutions which will be examined are the structural changes necessary to position the company for the next three to five years.

Assuming an effective growth rate of 25% per year, one is looking at a $14M company in fiscal year 1981. Translated into people terms, this would mean around 280 people working for Boole & Babbage ($50K revenue per employee). To run that large a company (triple the size as of 1/1/78) means many things:

Span of Control - If there are five employees per first line manager then there would have to be over 40 first line managers; if we assume a span of 4 above that level there

would have to be a total of 10-12 senior managers, 4 V.P.'s and a 4 level management structure (President, V.P., Senior Manager, 1st line manager, employee) in the most complex area (i.e. largest number of employees).

Hiring - To go from 110 employees (with 21 management people) on 3/1/78 to the levels discussed above probably means hiring 450 people assuming a 50% total attrition on those hired and on those currently on board. That's an incredibly large number for a 110 person company to successfully digest, while trying to run the business profitably. This translates into an average of over 100 people hired per year (essentially exceeding the number of people on board as of 1/1/78). Remember that this is a relatively low number compared to what would be required if the 1977 turnover rate continued. 50% attrition over 4 years is an effective rate of less than a 15% loss per year. This compares to the over 50% loss experienced in 1977.

Training - Similarly, one can analyze the number of first line managers to be trained assuming some (hopefully lower) turnover and obviously anticipating some growth of first line managers to senior managers, to vice presidential, and to senior staff and planning positions. The employee training, whether on the job or through formal courses, boggles the mind.

The organizational conclusions are fairly clear. To manage this

projected growth without excessive pre-hiring and churning, and hence serious erosion of profit margins, it is essential to set up, in advance, the larger company management framework and then isolate much of the new hiring and training into special units that do not impact the ongoing sales, customer service and product support work.

It is also clear that this means setting up a structure with adequate staff and training facilities and, if necessary, scaling down some of the current growth plans to accommodate the reassignment of competent on-board people to these functions.

The following steps in setting up a proper organizational infrastructure are the keys to permitting the company to double, on a manageable, profitable, planned basis, over the next 3 years:

- The principal present weaknesses should be resolved by adding a V.P. for management and control and establishing senior managers for key planning functions (product management, strategic planning, personnel, customer service and training, communications, and advanced technology development).

- Within that framework, a method must be evolved (particularly for Software Engineering, but also to some extent for Marketing, to train prospective managers by assigning "leader" roles and also using appropriate educational opportunities.

- Finally, special training cadres will need to be set up to permit bringing the new people to an acceptable level of knowledge of Boole & Babbage products and style before they are integrated into the regular operations of the business. This is somewhat less important for the administrative positions, but quite significant for Marketing and critical for Engineering.

The list below summarizes those organizational changes which are recommended for consideration during the next 12 months (by 4/30/79) with an indication of when they should be implemented (N - next 3 months, I - 3 to 6 months, L - 6 to 12 months).

Management and Control - (formerly Planning and Administration)

V.P. -	(N)
Mgr - Strategic Planning	(N)
Mgr - Documentation/Product Distribution	(N)
Mgr - Personnel (include internal training)	(N) to (I)
Mgr - Computer Operations	(L)

Advanced Technology (formerly Hardware Engineering)

V.P. -	(L)

Marketing

Mgr - Product Management	(N)
Mgr - Customer Support (include Quality Acceptance)	(I)
Mgr - International Sales	(I) to (L)
Mgrs - Sales for agreed to geographic or product alignment.	(L)

Software Engineering

Mgr - Engineering Training Cadre (N)

Mgr - Engineering Technical Services (N)

Mgrs - Engineering for agreed to product or functional alignment (L)

Computer Service -

Consider acquiring a computer services organization in the Santa Clara area. This could be done through picking up a data servicer or by setting up a facilities management function for a near-by company. The key to this would be to get a reasonably large system (capable of running MVS or VM) with a competent existing staff of operations people. It should be self sustaining and viewed as a profit center with "charges" for machine use for Engineering, Administration and Marketing.

Software Production -

Consider acquiring a software producing organization (either custom or product) where there are substantial systems software skill. This group should probably be in a completely different labor market so that independent recruiting could take place. If current products are acquired, they should be sold off unless they fit comfortably within the Boole and Babbage market/business concept.

Personnel -

The analysis in phase two and the previous discussion in this section certainly spell out how vital it is to stop the loss of qualified people. Before all else, a specific set of actions should be consciously designed and implemented to stop the unwanted terminations, particularly in Software Engineering.

The changes in policies or practices however will not have any real effect unless the management style and tone is changed to show people that they are wanted, are important, and will be fairly recognized and rewarded. Rigid adherence to any set of rules, no matter how benevolent or fair, will never substitute for a skilled manager who really understands each person's particular needs and goals and is able to reinforce them in a positive way. Therefore, along with a recommended list of changes in personnel practices, there is a clear requirement to establish a management training program aimed at improving management sensitivity to their people and to each other and gaining an understanding of the purpose of the new personnel practices, not just their mechanics.

Usually one looks to each personnel change to help accomplish one or more of the following objectives:

- Keep the competent people who are currently in the company.
- Motivate the people to perform with high productivity.
- Recruit and integrate qualified new people into the company.

The value of any particular set of policies, practices or benefits is how it will appear in the eyes of the employees, individually. This means that any time there are different forms of recognition, reward or status for one group of people (whether they be management or sales or engineering or administration) it must appear rational and fair - not a means of establishing a privileged class of corporate citizens.

The obvious other restraint is that the company exists in the midst of an incredibly rich job market so that it is often easier for someone to vote with their feet (by leaving) them to articulate and resolve their concerns in a mature, responsible way. This must be directly addressed by finding ways for executive and senior managment to be very aware of employee attitudes and feelings and insure a climate where slights and differences cannot fester into gaping wounds and then amputations.

The most important near-term actions must deal with retraining and motivating the competent people now on-board. From a long-range standpoint this will probably have the greatest effect on the company's ability to attract additional good people. So, the recommendations listed below for consideration are all addressed toward improving the spirit and response of the current people, particularly those in Software Engineering.

Recommended Actions -

1) Modify rules on sign-in/sign-out, sick leave, personal

time, compensatory time.

2) Increase salaries to meet (or beat) competitive salary rates in the area (as determined by actual surveys).

3) Eliminate the Profit Incentive Plan; there is insufficient bang for a very substantial buck, eliminate the Stock Option Plan for all except executive officers, it isn't relevant to work assignments or the individual's ability to control the value of the stock. However these eliminations must not be seen as a salary reduction, so the announcements would have to be combined with other increases.

4) Set up new reward and recognition schemes (high frequency, performance related) to publicly say thank you for both hard work and specific accomplishments.

5) Encourage self-development through in-house courses, educational reimbursement and self-study materials.

6) Make objectives setting and measurement a truly joint effort, with less emphasis on strictly quantitative or short-range achievements and more focus on the employee's (or manager's) style and reasoning. In many cases the manner of approaching a problem or the way of talking to a customer may be as important as whether the particular problem report is solved in one day or two.

7) The appraisal process should be time-wise disengaged from the salary process. It means too much is riding on the appraisal. It also puts raises on a somewhat mechanical basis.

8) Build up the total job so that there can be sufficient job satisfaction with a particular product or product family for relatively long periods of time (2 to 3 years) and so less time is being wasted in continuous retraining. Some means is needed to give special bonuses (financial, but non-salary) for length of time on a product area, without penalizing those who move to a new project at management's request.

9) Assign a personal terminal to each qualified software engineer, documentation specialist or administrator who can effectively use it in her/his work. This should improve productivity and concretely demonstrate management's interest in improving the professional work environment.

10) Significantly improve the access to and quality of machine services for program and documentation development, problem diagnosis and program testing under various operating system environments. Better library facilities would be of benefit.

11) Provide engineering team involvement in product improvement planning so that schedules and commitments

reflect team insight and understanding.

12) Establish mechanisms for increasing on-site customer contact for software engineers (particularly in non-problem situations); also improve attendance at conferences and user group meetings to give them a better picture of customer needs and attitudes.

13) Set up a procedure and policy to further encourage promotion from within. Publicize technical as well as managerial promotions.

14) Similar actions as above are needed for technical marketing personnel and key administrative people. The message is to aim the changes specifically at what the employees in their jobs want in the way of recognition and assistance and not on actions which appeal primarily to executive or management people. This can only be determined by in-depth interviews by executive management (or by a competent personnel consultant or very experienced personnel manager).

15) Selective recruiting of new people, either representing fresh talent who can be trained (and motivated to stay) or experienced people who can provide technical leadership in special functional areas (CICS, IMS, VM, distributed processing). While numbers will be important (the company can't afford to be understaffed if it is to grow without serious dislocations), quality will be more important. Extra salary (or hiring bonuses) for

proven people will be a good investment to avoid turnover and additional learning time. Providing bonuses for current employees who help recruit new employees is probably valuable, if definitions are clear and bickering can be avoided.

Markets/Products -

An integrated concept of strategic and tactical planning and execution is essential to minimize the risk of future missed opportunities or deficient products. The present product management/engineering management procedures are not satisfactory in this report.

The start has to be with establishing a Strategic Planning team as part of the V.P. Management and Control area. The principal participants would be from Marketing and Engineering. The assigned role would be to provide a long-range (3 to 5 year) business, market and product plan within which the various tactical and organizational decisions could be made. This would include growth and profit objectives, market definition and sizing, penetration by Boole and Babbage and competitors, and opportunity analysis. Next, there would be a current product assessment, product family definition, and then establishing strategic directions for each family and product and suggesting priorities and emphasis. Finally, appropriate business case analyses would be prepared (historically and projectively) and business ratios for cost and revenue elements would be derived and projected.

The work of Strategic Planning would require the participation of a Planning Council at two levels - Executive Management and Senior Management. In general, the senior managers - Product, Engineering and Administrative - would input their assessments of

market, product and business trends to the Strategic Planning staff which would produce a potential plan. This would be evaluated by the senior managers and then negotiated into final, publishable form through formal presentation to and consultation with, executive management.

The translation of these strategic directions into action plans would be the responsibility of the tactical planning groups, principally product management and engineering management. Specific marketing programs and engineering products would be defined through joint efforts. Each group must realize that its decisions can't be made without consulting with the other groups affected. For example:

- Marketing plans are principally the responsibility of the sales and product managers, but input is needed from engineering and finance.
- Product decisions principally belong to the engineering and product managers, but input from sales and administration are also valuable.
- Business decisions are usually of an executive nature with additional financial evaluation, but obviously, market, product, and personnel inputs can strongly flavor the plans.

There are many new product and market directions which should be analyzed as part of the strategic/tactical planning process.

Extension of the product line to fill various functional needs of

the data processing operations and systems areas should certainly be looked at; but also handling of non-IBM operating systems may be worth a second look. A further exploration might be profitable on how to use hardware/software combinations to better gather and analyze data on batch, interactive and DB/DC systems. Efficient operation of expensive new devices like mass storage and high speed printers could build upon current experience with disks and channels.

Explicit attention should be given early to the efficient management of distributed processing systems, including their communication networks. These will become of great concern to most of the large IBM customers within the next 2-5 years and therefore Boole and Babbage should be positioned to take advantage of this strategic direction in a timely way (not after the fact as with MVS).

It may be instructive to look at the various products as having the following general functional structure:

- o Extraction of information
  - sampling (frequency up to 100%)
  - statistical aggregation and characterization
  - selection of only non-expected values based on previous measurement criteria
  - event recording versus recording of status changes
  - granularity of measurement

- end result is a general purpose data base related to computer elements, system components, jobs, programs, time of day, week, month; to the extent that all data is logged and identified, future use potential is increased.

o Analysis of data base information
  - selection of operational subset
  - batch analysis versus on-line evaluation
  - specific analytic, statistical and simulative techniques which may provide an satisfactory level of accuracy

o Display of analytic results
  - relate findings to time and space
  - show models of good versus poor behavior
  - relate to configuration, jobs, programs, user tasks
  - on-line display versus printed reports
  - graphics for understandability
  - interactive facilities for query and display

o Control of configuration, resources, priorities
  - change job or program priorities on-line
  - reallocate resources on a batch or on-line basis
  - determination that reassignment of disk space is necessary or that paging algorithms should be modified.

Marketing/Engineering/Administration

Implementing the proposed changes will require some reassignment of functions among the principal organizations. In this chapter we will not discuss when the changes should be carried out, but rather concentrate on what changes should be made. While many of these changes are closely related to the current quality problems, others are essentially part of the organizational streamlining needed to position the company to plan for and manage future growth in a professional, business-like way. For each present organizational component we have listed the current functions and indicated what changes we recommend (if any):

Marketing

Operations Sales - no change except to rationalize product line definition and consider future geographic structure.

SMS Sales - same as above plus centralization of technical support responsibility as part of customer support. There would still be performance engineers in all key locations.

International - set up manager

Services - no change until phase out

Product Management - set up manager of product management with full tactical planning and product profitability

responsibility. Operates in a 1-2 year time frame.

Performance Engineering - manager of customer support would direct performance engineers in sales offices plus have customer training role. Consider taking over customer service group at a future time. Set up quality assessment function at headquarters.

New Product Research - Assign to V.P. Management and Control (Strategic Planning)

Advanced Technology

Hardware Engineering - part of new advanced technology function. Other major new hardware/software projects would be set up with own project leaders (or managers, if large and permanent enough)

Advanced Development - initiate investigative work on new directions, algorithms, equipment and applications to set technical base for new internal or externally built products.

Engineering

Engineering Development	-	keep current 3 groups, but look toward rationalizing assignments by product family (accounting, measurement or operations) or technical functions (extractor, analysis, display, control).
Research	-	assign to either VP - Management & Control (Strategic Planning) or to VP - Advanced Technology.
Engineering Technical Support	-	rename as Technical Services and have report directly to VP - Software Engineering. Formally assign internal applications development work; author of standards and procedures manual.
Technical Systems-Support		hold customer services for the present; consider move to Marketing Customer Support later. Move product validation to Quality Assessment in Marketing Customer Support. Move Product Distribution to VP - Management and Control Documentation/Product Distribution.

Documentation	-	Move to VP - Management and Control Documentation/Product Distribution.
New Engineering Employees	-	Set up Cadre Manager to train these new professionals in Boole and Babbage practices; they would be used in a support, "bench-strength" role for the first 3-6 months with the company: set up test cases, assist in documenting existing programs, reprogramming selected modules.

Management and Control

Accounting	-	OK as is
Personnel	-	set up Personnel Manager with responsibility for all recruiting, hiring, employee policies and practices, training, etc.
Contracts	-	associate with Accounting area
Shipping/Receiving, Facilities Management and Purchasing	-	OK as is
Secretarial, Word Processing & Telephone Communications	-	OK as is

Graphics/Print Shop	-	OK for now. Later consider assigning to Documentation/Product Distribution.

General

New functional groups include Strategic Planning, Personnel, Documentation/Product Distribution, Accounting and Contracts (and later Computer Operations) under the new VP - Management and Control.

Marketing would set up a Customer Support Manager, a Product Management Manager and an International Sales Manager.

Engineering would set up a Cadre Manager.

Near-Term Actions

Improving the quality management of the company's products will require major changes in the various activities and their operations. These are the specific actions which should result in better product quality with increased customer respect for Boole and Babbage value and service. These changes have been subdivided into those items which should be carried out in the near-term (within 3 months), intermediate-term (3 to 6 months) or long term (6-12 months). One chapter is devoted to each of these time frames.

First we will cover those actions which should be implemented right away to most rapidly counteract the present quality problems and change the customers' perception of the reliability and capability of the various products. In almost every case, these actions require minimal organizational changes and reflect analytic and procedural improvements. It is assumed that selected personnel oriented actions have been implemented along with integratation of documentation and product distribution functions; the customer support and training role must also be defined:

1) Establish Quality Assessment for each program:

   ENG - Analyze program for module construction, documentation, error rates, etc.

ENG - Estimate cost to bring program to usable state for full market.

PROD MGT - Forecast revenue potential with and without corrections.

PROD MGT - Produce incremental revenue/cost summary.

PROD MGT - Prioritize programs on a cost/benefit basis.

2) Assign people to fix up present programs based on value priorities -

ENG - Convert PPR's into PCR's for selected programs.

ENG - Provide enhancements to permit satisfactory operation with MVS (particularly AP and MP); also with VS1.

ENG - Clean up "buggy" modules by rewriting code or producing logic diagrams.

DOC - Write new documentation to describe current functions and usage.

ENG - Set up software engineering cadre to provide future trained people for program maintenance and development.

3) Improve Customer Support:

MKT - Set up PCR and release test plan

- Specific test cases for internal verification
- Agreements with concerned customers for external (use) test.

- Rule: No product is released for general use until Quality Assessment has signed off.

SALES - Demonstration procedures and control of use.

SALES - Set up customer new product installation plan for those products that need it.

MKT - Set up customer training (and retraining) on selected Boole and Babbage products on a regional, system or product basis.

4) Streamline customer order handling and maintenance servicing.

CONT - Establish new customer order processing procedures.

DOC - Establish new product distribution procedures including all product manuals writing (where needed), editing, formatting, publishing, marketing brochures and materials, graphic preparation, production of all printed materials, production of all customer deliverables including programs and distribution of product packages and literature.

CUST SERV - Closely monitor and clarify new customer question/complaint and response procedures (e.g. PPR and PCR)

DOC - Set up new correction, maintenance and update distribution procedure. (PCR, PSR)

5) Establish specific measurements to judge status and progress for each program.

MKT	o	Quality Assessment
SALES	o	Customer Acceptance
ENG	o	Maintenance Volume

Intermediate-Term Actions

During the next 3 to 6 months, a number of the initial structural changes should be completed and the modified personnel practices should begin to bear fruit in reduced turnover and improved productivity; by this time the VP of Management and Control and the Personnel Manager should both be on-board. The Manager of Product Management should be in place and the Strategic Planning people already working on their first Fiscal Year Business Plan. Now, the ground on quality management shifts from stopping the erosion of customer confidence to begining to build a foundation for later product and market growth. Most of these actions depend on using current people, but sometimes in modified or new roles. Selective recruiting should now be started:

1) Initiate Strategic Planning process for intermediate and long range objectives. Produce a 1-2 year plan (the Business Plan) which realistically balances current problems against the corrections already under way and reasonably achievable during the projected period.

   o First Strategy Council meetings should be held so that 1979 plan reflects coordinated point of view. Movement should be targetted into transaction driven and interactive systems measurement, accounting and control.

2) Reorganize Product Management to focus on tactical

product planning within new strategic framework.

Initial work should be:

- o Identifying critical new functions to restore (or retain) competitiveness for each program.
- o A business case should be prepared using forecast and cost data.
- o Priorities should be established.
- o Implement key functions of product direction, field communication support, sales aids, product promotion, pricing to achieve forecast and profit objectives.

3) Initiate Customer Support functions to provide technical and training function for Marketing. Integrate performance engineering by accepting selected tasks currently assigned to product management.

- o Relocate some performance engineers into headquarters to become product specialists.
- o Set up recognition, reward and salary scheme to retain experienced performance engineers.
- o Take over customer training role.

4) Establish key customer councils for product feedback, application requirements and new product testing.

5) Prepare and release Product Engineering Standards and Procedures Manaual to cover code and documentation style and structure.

6) Continue product improvement plan by working on assigned new level releases and new versions of current programs.

7) Establish an integrated measurement scheme to collect relevant data on resources used, and results obtained, in this quality area; displays and reports should now be consistent for all reports.

Long-Term Actions

A number of longer-term changes should be considered to set up the company to plan and manage its growth in the software products business. These actions are generally not explicit to improving the quality management system, but should, through strengthening the organization, extending user communications and providing concrete direction and plans, help avoid similar situations in the future.

1) Construct the first 3 to 5 year strategy to guide future market and product decisions.

2) Rebuild the product line to fit family structure and use modern architecture, design, programming and documentation concepts and techniques. Each product design should be based on a business case analysis (forecast, cost estimate, profit projection) with market priorities used to help determine which products to build. This would probably be the best opportunity to introduce cross-product modules and subsystems (like CMF-VS1 and CMF-MVS use of CMF Analyzer).

3) Initiate technology, algorithm, system and application research. Also conduct some advanced test development work on new terminals, storage devices, microprocessor languages, etc.

4) Consider obtaining own computer operations facility

either through purchase of a data services company or by undertaking a facilities management contract. This could support all environments for thorough program use testing as well as providing both development support and internal application processing.

5) Consider acquiring an existing software producing company, preferably custom, but possibly package, if product line is compatible or can be successfully sold off without losing the people. It would probably be desirable if this new group were located in a less personnel competitive area than the Santa Clara valley.

6) Consider reorganizing both Engineering and Marketing to clarify product family assignments and strengthen management structure.

7) Design and install a Management Information System to permit on-line access to and analysis of product development, maintenance and sales data. This could also be used for business and text processing operations.

There are a few other long-term actions to be carefully examined, which may or may not be valuable for managed growth:

1) Executive Management -- Maintaining the closeness of a small company, while permitting the senior and first line managers to make their own decisions is a very

difficult balance. Management must consciously analyze and evaluate its style, forms of communication and means of reaching solutions. Statements which are intended to set direction can be interpreted too literally and can force the people through pendulum-like swings in attitudes. Considered judgment or planned risk taking may appear to be "shoot from the hip", "seat of the pants" or even panic reactions to problems.

The interactions among the executives is also critical, since employees may magnify small differences into cause celébres and legitimate policy contention into personal vendettas. Again, the aim is to do well by the company, but to be sure that the process is accurately perceived by the people who work for the company.

2) Product Acquisition -- The present strategy of obtaining many of the new products from outside the company has been a mixed blessing. On the one hand it has certainly introduced significant revenue and profit growth with relatively minimal front-end investment. However, it has continued to complicate the product line with further overlapping, non-compatible programming styles and additional maintenance load. Some way of better isolating the new products from an engineering, and possibly sales, standpoint might help.

Much greater involvement by Engineering in the search and evaluation process might also assist. At some point, thorough consideration must again be given to growth from within (possibly using ideas from without) rather than through relying on product acquisition.

3) Cost and Profit Accounting by Product - The basic data is not currently available to put together a profit and loss statement for each product, but this would be valuable for pricing of initial offerings and maintenance. It would also assist in making current decisions (i.e. whether to put more money into a particular product). After building up a present product picture (revenue, direct costs and allocated expenses), incremental analysis can be used for each new version or product replacement plan. This procedure can help determine the relative profit contribution from internally developed versus acquired products, from initial sales versus maintenance agreements, from international versus U.S./Canadian sales. While there will be some start-up cost to go back over the records for each current product to reconstruct a historically valid P & L statement, this should be high on the to-do list for the Strategic Planning and Accounting groups. A Resource Usage Sheet for each year to allocate costs by activity and product is a valuable aid. Similarly, a Revenue Analysis sheet for each year by product and source would be necessary.

4) Communications - More formal interchange of ideas and information between the field and headquarters, between Engineering and Marketing, and among the various Engineering groups should encourage more of a team feeling and less of an "Us - Them" attitude. Joint meetings, informal visits to the field by engineering development managers, involvement of salesmen in product planning, all should contribute to a more open set of communication channels. Possibly, inviting a few of the headquarters engineering and administrative management people to attend the annual "Retreat" as a reward would also help to increase the extent of the interaction. Additional forms of management and manager-employee communication might be worth trying, like management workshops (off-premises), executive interviews and anonymous "sound-off" procedures.

The conclusion to the recommended operational actions is to repeat what has been stressed in this Phase Three Report. Unless Boole and Babbage can attract good people who will stay with the company for at least 2-3 years, all of the procedural changes will carry little weight. Growth will be limited by lack of stability and lack of technical continuity.

So, the first item to concentrate on is how to keep the present people through improved personnel practices, through a better organizational structure and through more satisfying product assignments.

Benefits, Costs and Risks

It is always difficult to measure the increase in revenue, decrease in expenses or improvement in profit which will result from a proposed change in the management system of a business. It is particularly hard when the objective is to provide better quality products and support, which tend to be relatively intangible items. On the other hand, it is quite easy to point out the extra costs incurred by adding people to the payroll, renting more terminals and increasing salaries or employee benefits. So, the equation for judging the value of a proposed change often appears unbalanced with hard, firm costs on the one side and conjectural "iffy" benefits on the other.

It is worthwhile to try to identify in what areas the extra values will show up. Where should you see the advantages of the various changes? In this chapter we will look at the kinds of benefits to be expected without trying to attribute them to a particular change or cause. We will then look at the principal costs which would be increased and finally at some of the other risks (of commission or omission) which might occur.

Benefits - Since many of the changes are oriented toward the people area, we can expect to reduce those costs associated with recruiting and training new employees. For any set hiring goal (say 25 people), with the current situation, we would have to hire at least 50 people to end up with 25 at

the end of a two year period. The cost of hiring 25 extra professional people would be at least $250,000 (advertising, interviews, recruiter fees). Now the turnover cannot be reduced to zero, but if it were even cut in half, a $125,000 per year saving would be realized. Further, the time and cost for training the extra people would be avoided. At minimum, a new professional person is not productive for at least three months, so assuming $2000/month salary for 12 people, there would be a total of almost $75,000 saved over a three month period.

On the people side this still doesn't take into consideration the errors produced by inexperienced people, the time of experienced people to train them, the extra cost in making program corrections or the delay in delivering planned enhancements. Nevertheless, one can readily say that if the employee turnover can be cut by even 12 professional people per year there is a minimum savings of $200,000 per year.

A reduction in customer discovered program errors would impove the customers' perception of Boole and Babbage quality. To translate this into concrete terms, it might help to keep some customers on maintenance who would otherwise drop use of the product (a 5% delta would mean $50,000/year) and would increase the likelihood of customers ordering additional products from the company (a 5% increase in add-on orders could mean $50,000 - $100,000 in extra revenue).

Another benefit of improved product quality would be to reduce the future maintenance costs. Since there are no firm data available on what maintenance is presently costing it becomes somewhat a matter of conjecture. Many students in the field claim that maintenance programming (correction of errors) can amount to 10-20% of the original development cost per year for as long as the program is under active modification or improvement. There appear to be approximately ten software engineers in Boole and Babbage who are currently working full time on correction of errors (responding to PPR's and writing PCR's). This would imply a cost of around $400,000 including machine time and direct management support. Even a 20% reduction of maintenance required would be a saving of $80,000 per year.

Clearly, the largest gain will come from a sharply increased ability to sell the company's products. This can be viewed two ways, either as an increase in annual revenue through greater sales acceptance or as a reduction in sales expense through the greater productivity of the salesman. Using the latter approach one can say that a 5% cut in marketing cost per sales dollar would be a $100,000/year savings.

In summary, there are many explicit areas which should realize cost savings or revenue improvement as a result of improved personnel practices and better product quality. These could amount to as much as $500,000 of identifiable pre-tax profit improvement.

Costs - The principal added costs will be for the increased number of people over and above the current planned staffing levels. In all probability this will amount to bringing at least 10 people on-board who aren't in the fiscal 1978 budget. As it appears, since Boole & Babbage has been below headcount most of the first six months of this fiscal year, there are sufficient funds in the expense budget to cover this exposure.

Detailed costs should be analyzed for each major change which is to be made over the next 12 months so that the budget impact can be accurately assessed.

As a planning figure it would be reasonable to budget between 5% and 10% extra salary ($200,000 to $400,000 in 1978-9 terms) each year to have people on board in advance of urgent need. This may be for training cadres, additional managers or staff positions.

Risks - Most businesses (and people) will sacrifice some opportunity for maximum gain in order to reduce the risk of substantial loss. This can be viewed as accepting a lower expected value in order to minimize the variance.

For most of the changes suggested (particularly the near-term and intermediate-term ones) there is little down-side risk. The new idea is often worth trying, because if it doesn't improve things nothing precludes you from trying something else. But there are some of the long-term changes

which do cast the die in a relatively rigid fashion which cannot be undone easily. Product assignment to sales organization is an example of a major commitment; it would take at least one year to unwind such a change.

Conversely, some changes have very narrow time windows in which they can be implemented. Using sales as an example, the only reasonable time to assign new products and set new quotas is at the beginning of the fiscal year.

One element of risk which is quite difficult to assess is whether the people in the company are capable of effectively managing rapid change. Remember, they have the option of not making the effort necessary to adjust, but rather leaving a new situation. Experience with some of the earlier changes may give a good indication of this adaptation ability.

While the recommended changes are not "riskless", the risk of doing nothing or continuing to pursue piecemeal solutions is probably the most expensive decision that could be made.

Implementation Plan

Finally, we come to a discussion of a plan for carrying out the recommendations made in the Phase Three Report. Since the changes affect every organizational component it becomes vital to involve each group in making the suggested improvements.

Rather than provide a specific schedule and identify the people who should carry out each step, we are only going to note some of the factors that should be considered in putting together the actual work plans.

First, the recommendations which are to be pursued should be identified and those which require immediate implementation singled out. For these you should designate who will have the responsibility for making the new organization or procedure function correctly and that individual should, if possible, have the assignment of fully defining and implementing the solution.

When the initial group of projects and people are selected, a detailed plan should be prepared to announce the proposed changes.

In a number of cases people will have to shift assignments or change managers and these must be pre-arranged and agreed to.

Each new organization should be described with an appropriate statement of mission, objectives and resources. Each new procedure should be described in written form, presented for discussion to those people affected by it, and then adjusted to

meet legitimate concerns.

Where possible, before and after measurements should be established so that one can hopefully observe the improvements which will take place.

All of these details should be guided by a designated individual who maintains a master control sheet on all planned actions, noting who is responsible and when various check points are to be met.

Good administrative management is an essential ingredient to a smooth transition.

Monitoring of changes after they have been implemented should provide for tuning to meet unexpected situations or new problems.

Boole and Babbage's ability to set specific objectives and measure progress against them should serve in good stead in carrying out the kinds of changes recommended in this report. Without the executive and management talent already on-board there would be no way to pursue such an ambitious list of planned improvements.

The time is now to proceed to strengthen the business by implementing a Quality Management System. With the thoughtful consideration of people needs, careful adjustment in organizational roles and aggressive introduction of better planning, execution and measurement procedures, Boole and Babbage can restore its quality image and begin again to grow and prosper at the planned level.

PRODUCT SUMMARY - CUE

I. HISTORY AND MARKET

Computer Utilization and Evaluation (CUE) was first sold in 1969 and has had two follow-on versions developed since then. It is sold to either the data processing manager or the director of data processing and is used by the systems programming staff. CUE has been extremely successful since it assisted the customer in managing the computer resources and because it had no serious competition in the marketplace until recently. It is the base of the product line.

II. FUNCTIONAL DESCRIPTION

CUE measures the capacity of the machine as it is being used to help the user determine if and when a new machine will be needed. It is also used for short-term measurement and tuning to identify and correct bottlenecks in any major resources (CPU, channels, devices, and some software measures of the operating system) so the systems staff can improve performance.

III. PROGRAM DESCRIPTION

The following are the approximate numbers of modules:

	Extractor	Analyzer
# Modules 0-100 lines of code	2	0
# Modules 100-500 lines of code	0	0
# Modules 500-1000 lines of code	2	0
# Modules more than 1000 lines of code	31	11

An attempt was made toward a modular structure, but it was not successful at the (SECT level. Common routines and subsystems are used to a limited extent.

IV. SALES

PRODUCT	YEAR	REVENUE
CUE/DSO	1972	$466K
CUE/DSO	1973	418K
CUE/DSO	1974	604K
CUE/DSO	1975	689K
CUE/DSO	1976	1096K
CUE/DSO	1977	1440K

(Note: Those figures for 1972, 1973, and 1974 available included both CUE/DSO and PPE. The above numbers were based on the approximation that 60% of the total figure was due to CUE and DSO.)

V. QUALITY

PRODUCT QUALITY - CUE

	EXTRACTOR	ANALYZER
PPR's per year	142	53
PCR's per year	41	29

Phone calls average 200 calls/mo.

Certain modules seem to have many PPR's:

CUE5EL02	CUE5V22L1
CUE3EL02	CUE3EXT
CUE3EL1B	CA8DMSS
CUE5EL1B	SRDBP525
CUEA	
CUEOACHP	

There are 3 people in the company who are currently familiar with the internals of CUE.

There are a number of major problems with the CUE program:

1. Disorganized use of control structures

2. Naming conventions are meaningless.

3. Poor Coding Techniques

    a. Modifying instructions on the fly

b. Not understandable coding techniques.

4. Lack of comments before routines.

5. Lack of comments on instructions.

6. Poorly defined data structures.

The most serious problem facing the Extractor and Analyzer is maintenance. Instead of reassembling and cleaning up the code, superzaps have been applied. Therefore, the current source listings do not match the product in the field. The listings are terribly marked up and worn out, making maintenance very difficult. This also results in solving the same problem more than once.

VI. SPECIAL SUPPORT

CUE is dependent on the internals of the operating system. Therefore, CUE is sensitive to new releases of the operating systems, any modifications to the operating systems, and any new devices being announced by IBM or any other vendor. Deliveries of support for new operating system software always lags dangerously behind IBM announcements and impacts both sales and development efforts. MP support has been very difficult and is still a serious problem because it is not available yet.

VII. SPECIAL FEATURES

There are many special options to the CUE product. The

Graphics Option allows the user to plot measures in order to find the time periods when problems exist. The Linkpack Option gives him information so he can better pack modules within the linkpack area. These two options have been the most popular. Other options available measure resource utilization by protect keys, partitions, initiators, terminators, and the linkpack area under MVT.

VIII. PRICE TRENDS

CUE started off at a price of $6250, was raised to $8800, $9800 and most recently to $11,500. A total CUE/DSO package with options sells for approximately $22,000.

IX. COMPETITION AND MARKET POSITION

CUE was virtually alone in the market for a long time. IBM has now seriously entered the measurement business.

CUE is currently seeing competition from a series of IBM rental products named VS1PT, SVSPT and RMF. These products rent for $250 per month and the user can cancel them at any time. RMF also measures many MVS oriented numbers which CUE does not at the present time measure.

X. NEAR-TERM PLANS

CUE is presently being rewritten as the CMF product which includes many MVS measurements. CMF will include an Extractor, Analyzer and Realtime products that will be better than the presently announced RMF functions. It is also planned that TSA and DSO will also be members of the CMF Extractor Family.

INTRODUCTION

The Configuration Utilization Evaluator is a Systems Measurement Software product which measures computer hardware/software performance. The measures allow a systems analyst to gain maximum efficiency from his current system, as well as aid his evaluation of proposed system changes.

CUE gathers hardware usage data on the CPU, channels, and input/output (I/O) devices. CUE also measures software activity in the system, including queueing for hardware and software resources, SVC loading, and virtual storage paging activity. The information is displayed in tabular and graphical reports giving the analyst easy access to the data required for effective system tuning and balancing.

CUE contains two main programs, the Extractor and the Analyzer. Several Special Options may be separately purchased to provide measurements and analysis not available in the standard CUE.

The Extractor collects a statistical sample of system performance while the system is processing a normal workload. The sample is stored in either a tape or disk data set. The activity observed and the size of the sample are controlled by user control cards.

The Analyzer processes the Extractor data set to produce the reports requested by the user. The user may modify many features of the report format and content with control cards.

The standard CUE package will:

Indicate usage of the CPU, channels, and I/O devices as well as queueing for the CPU, channels, control units and I/O devices. These measures suggest possible reconfiguration to reduce resource contention.

Measure SVC loading from the disk in order to decide the optimal set of SVC's to make resident in core. This enables the user to reduce the number of SVC loads and to make more effective use of core storage.

Study device head movements to allow the user to minimize average seek time.

Display VS paging activity in order to better balance the system.

The Special Options are described in chapter four of this User Guide. These options will:

Measure link pack area module usage and job pack area re-entrant module usage. These measures permit the optimal set of modules to be loaded into the link pack area (Module Usage Option for MVT).

Measure initiator/terminator activity or partition activity to point to problems which cause poor utilization of initiators or partitions (Initiator/Terminator for MVT and SVS* and Partition Activity Option for MFT and VS1).

Measure CPU usage by each protect key (Protect Key Option for all operating systems).

Display CUE measures in graphical format. These graphs will report changes from normal system operation and highlight times when certain resources are being over utilized, thus permitting more precise Analyzer studies to isolate problems (Graphics Option for all operating systems).

Measure the utilization of real memory by the load modules of the linkpack area, including measures of real memory usage, relative CPU utilization, and relative page fault activity. (Linkpack Area Usage Option for VS systems).

Additional modules may be purchased for the Extractor to collect the data required by two other Systems Measurement Software products, the Data Set Optimizer and the Total Systems Analyzer. For further information refer to the User Guide's for these two products, or contact your Boole & Babbage representative.

* All references to SVS denote VS2 Release 1 Systems.

The Extractor program collects data on hardware usage, disk head movement, transient SVC and I/O error module loading (including SVC transient area usage for MVT and excluding SVC loading for VS2 systems), device and channel queueing, ENQ/DEQ queueing, and VS measures. This data is output to an Extractor data set, which may be recorded on a magnetic tape or direct access device. The Extractor continues to sample until the time limit indicated via one of the input parameters is reached or a stop procedure is performed.

Extraction of data is controlled by means of input parameters specifying the type and frequency (sample rate) of data to be collected. Generally speaking, the user can select different sample rates for the various categories of activity being studied, thereby generating only the necessary amount of data for each type of observation.

The CUE Extractor may be run as a normal OS or VS job or as a system task. The Extractor must be the highest priority job in the system in order to collect data over all other jobs in the system. No changes to the problem programs, the operating system, or the hardware are required. When set up to run as a system task, it can be easily started and stopped by an operator command.

At the end of each logical record interval, the Extractor issues a TCLOSE for its output datafile. If this file is on a disk, this allows the system to determine the correct end of file position if the system should crash during extraction.

The CUE Analyzer produces a series of reports on system performance using data gathered by the CUE Extractor. This series of reports is organized under the generic heading CONFIGURATION USAGE REPORT which encourages the user to view the system both as an entity and as a set of related resources.

Execution of the Analyzer is controlled by the user via control cards. Reports may be selectively requested or the standard default reporting scheme may be used. In either case, the user may provide input to the Analyzer to modify report content and format. The reports may be obtained for selected time intervals within the total extraction period. The Analyzer is very flexible because the entire group of reports or any subset of the group of reports may be requested.

The reports are listed below and are described in detail in Chapter 3: The Configuration Usage Report. The Special Option reports are shown and described in Chapter 4.

CPU Utilization
CPU/Physical Channel Activity Chart
Combinations of Configuration Activity
Physical Channel Activity by Logical Channel
Logical Channel and Device Utilization
Device Activity By Volume
Direct Access Volume Activity
Direct Access Volume Head Movement Summary
Direct Access Volume Head Movement Activity
ENQ/DEQ Activity
SVC Loads
VS Measures Main Storage Utilization
VS Measures Real Storage Page Utilization
Extraction Characteristics
Extraction Cards
Linkpack Area Module Usage (MVT Special Option)
Jobpack Area Re-Entrant Module Usage (MVT Special Option)
Initiator/Terminator Task Activity (MVT and SVS Special Option)
Partition Activity (MFT and VS1 Special Option)
CPU Utilization By Protect Key (Special Option)
CPU Utilization By Initiator/Terminator (Special Option)
CUE Graphics Option (Special Option)
VS Linkpack Area Usage (Special Option)
Shared Direct Access Device Usage

The CUE Analyzer processes the data collected by the Extractor and produces a set of reports all coming under the heading CONFIGURATION USAGE REPORT. This set of reports describes in detail the demand for and utilization of the major hardware and software resources within the study system. These reports may be obtained for selected time intervals within the total extraction period. It is possible to request the entire group of reports or any subset of that group.

The reports are organized to give the user an insight into the behavior of his system and serve as a convenient trace of each bottleneck or critical device function which may be reducing the configuration performance.

The reports are listed below and are described in detail in individual sections in

CPU Utilization

CPU/Physical Channel Activity Chart

Combinations of Configuration Activity

Physical Channel Activity by Logical Channel

Logical Channel and Device Utilization

Device Activity By Volume

Direct Access Volume Activity

Direct Access Volume Head Movement Summary

Direct Access Volume Head Movement Activity

ENQ/DEQ Activity

SVC Loads

I/O Error Transient Loads

VS Measures Main Storage Utilization

VS Measures Real Storage Page Utilization

Extraction Characteristics

Extraction Control Cards

Shared Direct Access Device Usage

NOTE: The Special Options to CUE and their reports are described in Chapter 4 of the Users Guide.

PRODUCT SUMMARY - DSO

I. HISTORY AND MARKET

DSO was introduced in 1971, was modified in about 1973, and is currently being rewritten for additional function. DSO is sold as part of a CUE and DSO package. Approximately 75% of all people who have purchased CUE within the last two years have also purchased DSO.

II. FUNCTIONAL DESCRIPTION

DSO maps out 2314's, 3330's and other direct access devices. It reports to the user the physical location of the head movements and proposes a reorganization to the user for placement of the data sets on the pack to optimize the head movements.

III. PROGRAM DESCRIPTION

V2.4 5250 lines, 7 Cobol modules

V3.0 15000 lines, 11 Assembler modules

IV. SALES

The DSO sales history is included as part of the CUE sales.

V. QUALITY

VI. SPECIAL SUPPORT

Each time a new disk pack is announced by either IBM or some other manufacturer, Boole & Babbage must develop DSO suppport for that new pack. Therefore, it has been modified for such packs as the 3330 model 11 and the 3350. Support has not been timely in this area and this has led to some customer dissatisfaction. Since a customer needs DSO in order to make the best use of the new drives, late support prevents making the best use of the new acquisition.

VII. SPECIAL FEATURES

None at present.

VIII. PRICE TRENDS

DSO is sold either as a standalone product or as part of a CUE/DSO package. The DSO portion of the package has increased from $2700 to $3600 (in about 1973) and recently up to $4125. The standalone price has increased from $3600 to $5500 (in about 1975).

IX. COMPETITION AND MARKET POSITION

AT the present time there is no competition for the DSO product. However, word has it that Innovation Data Systems has a product in Beta test now that performs the reorganization for the user. Since the product is not yet announced, no information is known on this product.

X. NEAR-TERM PLANS

There is one option planned for the next release of the product and that is a Busy By Data Set Option. This option will provide the first step in the process of deciding the location of data sets between packs. Other features needed are an automatic reorganization by pack and also between packs, as well as VSAM support and PDS support.

PRODUCT SUMMARY - TSA/PPE

I. HISTORY AND MARKET

Program Performance Evaluator was developed in 1968 for the PCP/MFT Operating Systems. It was then converted to MVT, VS1 and SVS as soon as each of those operating systems became available. It was converted to MVS approximately one year after MVS became available. In 1974, sales of PPE started to lag. The reason for this was that:

1. PPE was program related, rather then system-wide CPU related.

2. PPE was hard to use because the JCL of the program had to be modified in order to measure the program.

3. With the advent of larger machines each program ran for a shorter period of time, therefore optimizing one program resulted in smaller overall savings.

4. PPE had to be sold to a different group (the Applications Group) within the site than CUE was sold (the Systems Programming Staff).

For these reasons PPE in 1974 was expanded into the Total System Analyzer product.

II. FUNCTIONAL DESCRIPTION

PPE measures a program's elapsed time and answers the question - what is causing the program to stay in the system so long? By knowing where the time in a program is spent the user then can concentrate his efforts on optimizing those particular areas.

TSA measures the entire CPU and all of its users, from programs to the operating system itself. With TSA the user can measure his entire CPU, determine which module is using the CPU for a long time period, plot the use of that particular module and obtain a histogram of the usage within the module itself (all with one extraction run).

III. PROGRAM DESCRIPTION

(See pages 6-17)

IV. SALES

PRODUCT	YEAR	REVENUE
PPE	1972	$311K
PPE	1973	279K
PPE	1974	403K
TSA/PPE	1975	649K
TSA/PPE	1976	631K
TSA/PPE	1977	874K

(Note: The sales figures available for 1972, 1973, and 1974 are a combination CUE, DSO, and PPE total sales. The above numbers were obtained using a rough estimate that 40% of the total sales were PPE sales.)

V. QUALITY

VI. SPECIAL SUPPORT

None

VII. SPECIAL OPTIONS

There are three special options for the PPE product.

1. EMA - This option allows the user to run the PPE product independently from the problem program and to monitor CICS programs.

2. DUO - This option allows the user to measure his programs running under the DUO product.

3. COBOL STATEMENT NUMBER OPTION - This option prints the statement numbers in the PPE reports, in addition to the hex addresses.

VIII. PRICE TRENDS

The price of PPE started off at $6250, was raised to $8800 and then to $9800. The combined PPE/TSA price has been $13,000 since 1974.

IX. COMPETITION & MARKET POSITION

There is only one competitor in the marketplace and that is a competitor for PPE named STROBE. There is no competition for TSA nor for the EMA Option. Therefore TSA/PPE has a very strong position in the marketplace and many users depend on the product from day-to-day.

X. NEAR-TERM PLANS

Special support must be provided in order to run PPE under the many versions of CICS. MP/AP hardware support is at least two years behind hardware availability and has been extremely difficult to develop. Not delivered yet.

INTRODUCTION

WHAT IS THE TSA MONITORING PACKAGE?

The Total System Analyzer (TSA) for OS/MVS is one of Boole & Babbage's most advanced performance measurement products. The TSA software monitor provides the capability to gather data on the CPU activity for the MVS Operating System, JES2, JES3, TSO, IMS, SVC modules, and all program modules from one central point.

WHY USE TSA?

As a system monitor, TSA provides an extremely effective method of optimizing CPU efficiency through the analysis of diagnostic reports on module activity. These reports identify system and problem program modules with high CPU usage, allow the user to locate the specific addresses of high activity within the modules, and plot any module's CPU usage as a function of time. Thus, the user can eliminate module bottlenecks, optimize high CPU usage areas in programs, reduce total CPU usage, and decrease TP system response time.

The information produced by TSA facilitates sound management level decisions concerning the cost effectiveness of present and future system components.

TSA reports on the total CPU usage by SVC modules, supervisor modules, system task modules, and problem program modules. The overall CPU usage can be broken down in finer detail by specific module and, further, by the calling job name to accurately portray not only how the CPU usage was distributed throughout the system but also which jobs were using modules of particular interest.

The usage of the CPU by SVC modules is referenced back to the calling modules while each module's usage of SVC's can also be broken down by the invoked SVC module names.

Second, histogram reports for modules of special interest or of high usage can be obtained to identify the specific instruction locations of high CPU activity.

Third, time oriented plots of CPU usage can be obtained by module or by the entire system to identify patterns in system behavior or to analyze specific time intervals when bottlenecks occur.

HOW DOES TSA WORK?

TSA for MVS consists of three program products. The TSA Extractor is a software monitor designed to collect CPU usage data throughout the entire system. No data analysis is performed by the Extractor; this minimizes the data collection overhead and avoids perturbing the system being measured.

The TSA Analyzer summarizes the Extractor data to produce the CPU usage reports and time plots described above.

Additionally, the TSA Analyzer will produce a data set containing CPU usage information for modules of special interest. This data set is read by the PPE Analyzer to produce the histogram reports.

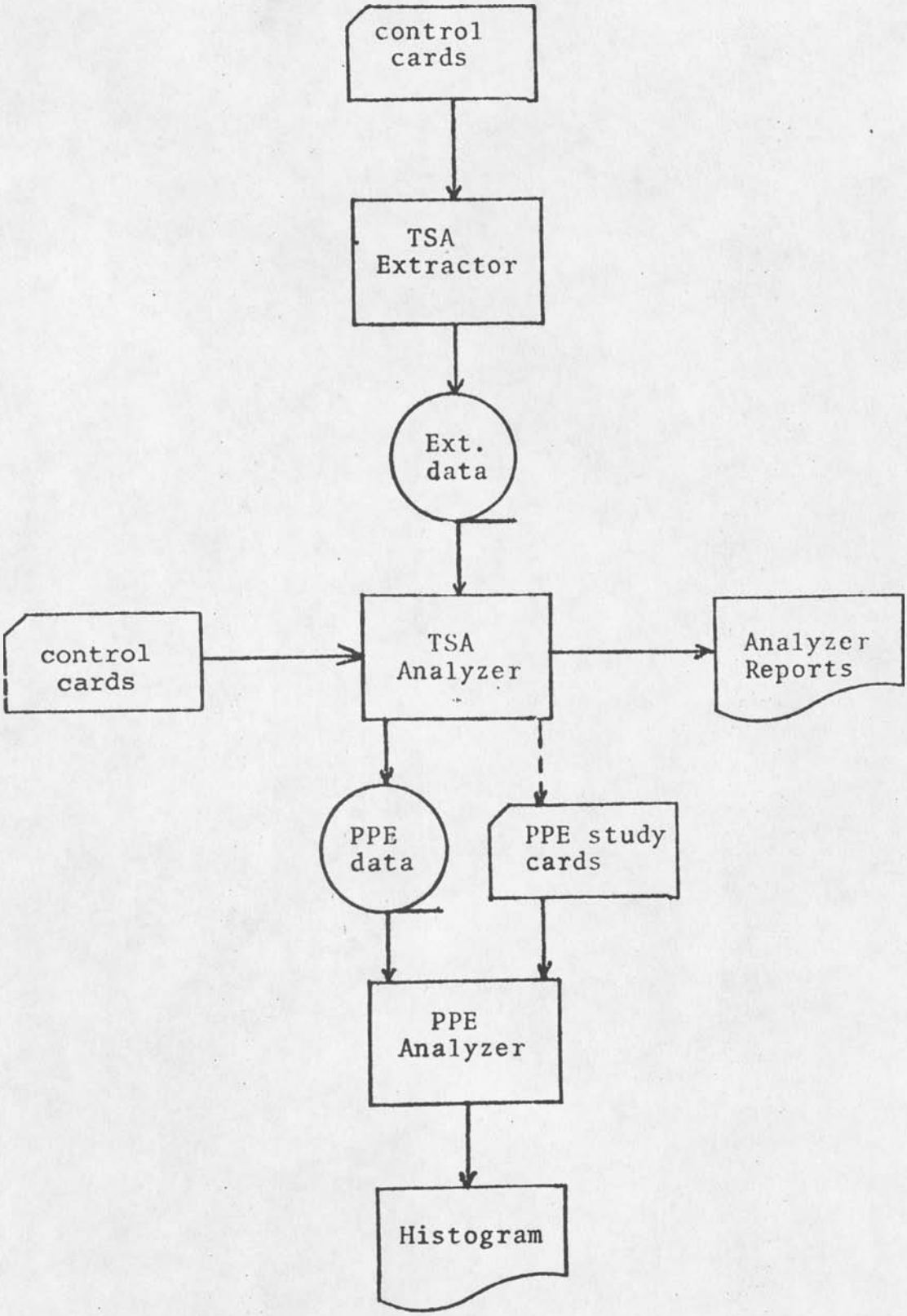
The following chapters of the TSA User Guide explain how to run the TSA monitoring package:

Chapter I - The TSA Extractor
Chapter II - The TSA Analyzer
Chapter III - The PPE Analyzer

SPECIAL EXTRACTOR CONSIDERATIONS

Boole & Babbage has provided an interface within CUE for those customers who may own both the CUE and TSA measurement products. The purpose of the interface is to enable the user to simultaneously sample configuration performance data with CUE while sampling for total system analysis data via TSA. The benefit to the user of this feature is that total data extraction overhead for CPU, memory, and I/O activity is significantly reduced. The only requirements for the user to take advantage of this feature are to include the TSA Extractor control cards along with the CUE Extractor control cards in the CUE extraction run, and second, to be sure that either the TSA modules are contained in the same library as those of CUE or that the TSA library is concatenated to the CUE library.

TOTAL SYSTEM ANALYZER



THE TSA EXTRACTOR

INTRODUCTION

The TSA Extractor is a software monitor that is designed to gather data on module activity in the CPU. The Extractor may be run as a job or as a system task. The Extractor must be the highest priority job in the system in order to collect data on all other jobs in the system. No changes to system programs, problem programs, or to the hardware are required to run the Extractor.

If the Extractor is run as a system task, the operator can easily stop or start the program by an operator command. When the Extractor is run as a normal job it also can be easily stopped by an operator command.

The Extractor collects data using a statistical sampling technique. At regular intervals (specified by the user) the Extractor receives control and collects a set of information relating to CPU usage. As the TSA Extractor gathers this data, it outputs it to an Extractor data set. This data can be recorded on a magnetic tape or direct access device.

The Extractor performs the sampling function until the time limit indicated by one of the input parameters is reached or a stop procedure is performed. The input control cards specify the type and frequency (sample rate) of data to be collected.

If the user has CUE, he can use the SAMPLE TSADATA control card along with the standard control cards for CUE to obtain the necessary TSA Extractor data as part of the CUE output. This output can be processed directly by either the CUE Analyzer or the TSA Analyzer.

THE TSA ANALYZER

INTRODUCTION

The TSA Analyzer produces a series of reports on CPU usage from the data collected by the TSA Extractor. The Analyzer constructs four types of reports:

CPU Summary of CPU time and SVC time

a. in system task mode,
b. in problem program mode,
c. and in supervisor mode.

Module Summary

a. CPU time by module
b. SVC time by module
c. optional breakdown of SVC time by invoked module.

Module by JOBNAME

a. CPU time and SVC time for each module per calling job name.
b. CPU time and SVC time for each job per called module name.

Plots

a. of CPU usage by module and of general CPU time measures to determine the times when problems occur and to compare the interrelationship of one module to another, or to overall CPU measures.

b. a histogram representing CPU time usage as described in plot "a".

The user determines the type of reports to be produced by selecting specific control cards.

In addition, the TSA Analyzer will produce an output data set containing PPE Analyzer data for one or more user selected modules. The user may process this data with the PPE Analyzer to produce code execution Histograms, which graph CPU activity by relative locations within modules.

TSA WORKLOAD ANALYZER

Introduction

The TSA Workload Analyzer uses SMF data to report resource usage by programs in five categories:

1. Total number of Executions,
2. Total number of EXCP's,
3. Total CPU time,
4. Total Core/Time used,
5. Page-faults (virtual machines only).

If no control card is specified, no default values will be used in report production and all of the types of reports will be produced in full.

The TSA Workload reports identify for the user the programs which are candidates for further study and improvement. Programs which were selected for study by the user based upon TSA Analyzer reports can be examined by the criteria utilized in TSA Workload reports to gain increased knowledge of their activity. PPE can then identify the modules and their instruction sets which cause high usage.

Once identified, there are many ways to improve these high usage areas. They can be re-coded or re-designed in a more efficient manner, or these areas might not be called as often. Results have shown that very simple changes can result in major improvements in the running time of programs.

PREFACE

This text was developed as a training guide and reference manual for the Boole & Babbage Problem Program Evaluator (PPE) product. PPE is a measurement tool designed to aid programmers and performance analysts in locating code in problem programs which can be optimized.

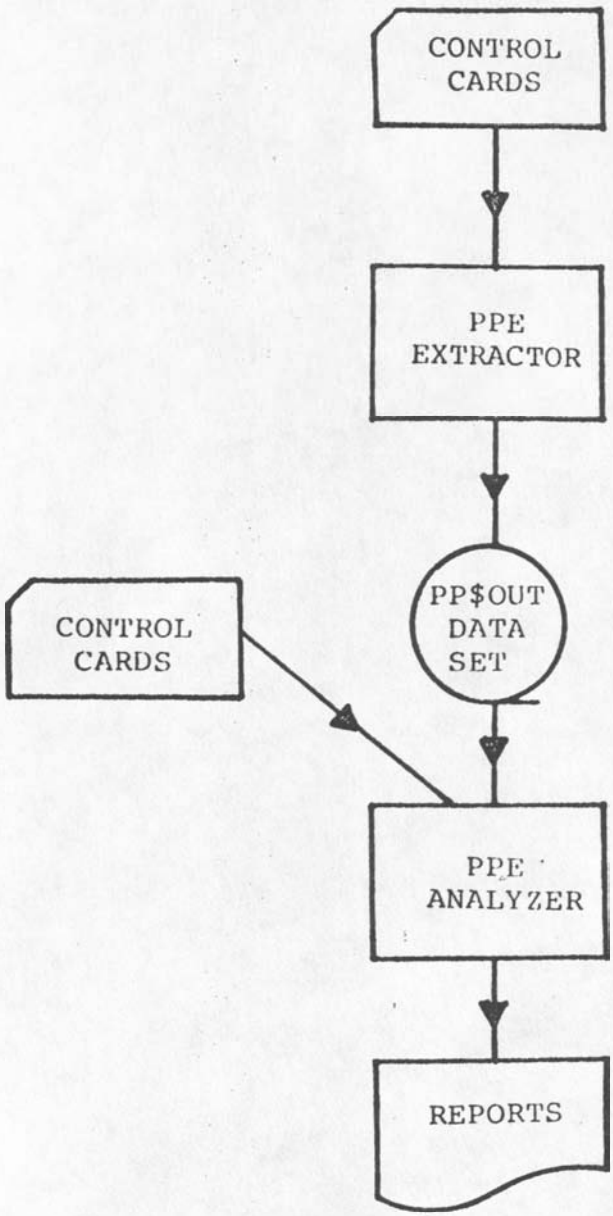
PPE consists of two programs, an Extractor and an Analyzer. The PPE Extractor collects data concerning the execution characteristics of a program. This data is obtained via a random sampling technique (see Chapter 1) while the user program executes in its normal environment. Two options are available for PPE. The Extended Module Analysis (EMA) option allows the user to study programs which execute in other regions or partitions from the Extractor (this includes programs which execute under the control of CICS). The DOS under OS (DUO) option allows the Extractor to locate programs run under the supervision of the DUO software package (a product of the University Computing Company). The DUO option is applicable only to non - MVS systems.

Chapters 1 and 2 explain the principles of PPE data extraction. Chapter 3 describes the Extractor control cards, and Chapter 4 contains the Extractor JCL and other execution information.

The PPE Analyzer processes the data collected by the Extractor and produces the diagnostic reports used to optimize a problem program. Chapter 5 gives an overview of the functions performed by the Analyzer. Chapter 6 describes the Analyzer control cards and Chapter 7 the Analyzer JCL. Chapter 8 explains the measures contained in the Analyzer reports.

The new user of PPE is encouraged to read Chapter 9 for a detailed example of how PPE may be used to perform a simple program optimization. Chapter 10 contains a catalog of the Analyzer error messages and abend codes.

The appendices give a full explanation of the Analyzer's control card syntax, which in many ways is similar to the Macro Assembler syntax, an explanation of how to optimize main storage utilization by the Analyzer, and differences between the Versions 3 and 4 Analyzers.



GENERAL FLOWCHART OF THE
PROBLEM PROGRAM EVALUATOR

AN INTRODUCTION TO PPE DATA COLLECTION

Data collection is performed by the PPE Extractor module while the user program executes in an operational environment. PPE is completely transparent to both the operating system and the user program.

Extraction of data is controlled by means of input parameters specifying what is to be measured, how it is to be measured and the type and frequency (sample rate) of data to be collected, etc. The Extractor determines the operating status of the problem program, performs an additional analysis to determine the reason for the status, and records the data.

Sampling

The PPE Extractor monitors the user's program by determining its status at periodic intervals. This technique is known as sampling and each measurement is known as a sample. The period between samples is controlled through the elapsed interval timing facility of the operating system. The interval between each sample is specified by the user as an input parameter. The content of the sample indicates the status of the problem program, defines the load module and overlay segment (if any) in which the activity was detected and includes the absolute address of the next instruction to be executed.

Once the Extractor receives control after an elapsed time interval, the Extractor samples the main task of the user's program and each subtask created by the main task. The following are the steps through which the Extractor goes when sampling the user's program.

First, the task's basic status at the time of the timer interrupt is determined. It could be one of the following four states:

ACTIVE - The task is being executed on a CPU.

WAITING - The execution of instructions has been voluntarily suspended. Usually the task has, directly or indirectly, issued a wait request until one or more ECB's (Event Control Blocks) are posted. Direct wait requests are caused by directly issuing a WAIT SVC on an ECB. Indirect waits for an ECB to be posted may be caused by page faults, requests requiring use of Program Fetch and waiting for completion of indirect I/O requests on user or system data sets. The task may also be directly or indirectly waiting for an event not associated with an ECB, such as the loading of the SVC transient area.

BLOCKED - A task is blocked if it requires a resource (e.g., a CPU or memory) which is not immediately available. This lack of availability is caused by another task using the resource.

NON-DISPATCHABLE
- A task is non-dispatchable if it is being stopped from further execution even though all required resources are available. A task is usually made non-dispatchable when continued execution of the task might affect system integrity, e.g., when the system is in error recovery or has exhausted a queue.

Once the basic status has been established, the Extractor may perform further analysis to determine the cause of the status.

ACTIVE - No further analysis: an active sample is recorded.

WAIT - Determine the cause of the WAIT state and record it.

1. DATASET WAIT - The task is awaiting completion of an I/O request. The DDNAME of the dataset that the task is waiting on and the fact that it is a Dataset Wait is recorded.

2. PAGE WAIT - The task is awaiting the completion of a page-in or page reclamation operation. It is recorded as a page wait.

3. OTHER WAIT - The task is awaiting some other event, such as loading transient SVC's, STIMER waits, waits to ENQUEUE a resource, waiting for another task to post an ECB, etc. This is recorded as OTHER WAIT.

BLOCKED - Determine the reason for blockage and record it.

1. INVOLUNTARY WAIT - Task is waiting to be executed on a CPU.

2. SUPERVISOR LOCK - This task wanted to exercise a supervisor routine which required the supervisor lock. It was unable to do so because another task is currently executing a supervisor routine which has obtained the supervisor lock.

3. DEACTIVATED - The task was deactivated or swapped out due to insufficient system resource availability.

NON-DISPATCHABLE - No further analysis: a non-dispatchable sample is recorded.

Third, if the task is waiting or active, the next instruction to be executed is determined. If the instruction is within a non-SVC routine (including access method routines), this instruction is recorded. If the instruction is within an SVC routine, the next instruction within the calling task (which is executed when the SVC is completed) is recorded.

Finally, the load module to which the instruction belongs is determined and recorded. If it is an overlay load module, the name of the segment within the load module where the instruction resides is established and recorded.

This procedure is repeated for each of the user's tasks or subtasks.

Areas Sampled

PPE samples the entire address range addressable by the task(s). This area is logically divided into four areas. The method of determining what module the instruction address is within depends on the area the instruction is in.

NOTE: For this manual, the word 'region' is used to denote partition (MFT,VS1), region (MVT,VS2/R1) and private address space (MVS).

1. If the instruction is within the task's own region, the load module contents queues for the region are searched. The primary module name is recorded (the alias or identified entry points are not recorded). For MVT and MFT with hierarchy storage the region is actually composed of two different address ranges. This is recorded by the Extractor and properly handled. If the program obtains additional areas by Rollout (MVT), these areas will not be recognized

2. If the instruction is within the resident module area of the system (the LPA for MVT or VS2/R1, the RAM for MFT or VS1, or the shared address space for MVS), the contents queue of active shared modules is searched. The module name is determined the same as for 1.

3. If the instruction is within the supervisor (nucleus), a dummy module name of @NUCLEUS will be recorded.

INTRODUCTION TO THE ANALYZER

The PPE Analyzer produces a series of reports on program performance using data gathered by the PPE Extractor. These reports help locate and identify areas of inefficiency in a program. Sources of wait and the locations which use significant amounts of CPU time are identified. These are usually areas which merit attention, for if any performance improvement can be obtained it will be there. In a well tuned program the use of CPU time is proportional to the function performed, and wait time is avoided when possible or overlapped with productive work. The PPE Analyzer has long been accepted as a valuable tool in identifying performance problems.

The Version 4 analyzer varies significantly from previous versions in two respects: 1) internal design changes have been made so that there is effectively no limit to the number of modules or data sets which may be handled in one run of the Analyzer, and location samples from any number of modules may be accumulated with no adjustment in the instruction group size (code interval); and 2) time-phased reporting is introduced through the facility for multiple report sets in one run of the Analyzer, enabling the analyst to compare program performance during various time periods and evaluate performance as a function of workload. A facility is provided to automatically generate report sets for every time INTERVAL of a specified length, providing a picture of the way performance varies with time. In addition, offsets can be reported relative to CSECT or segment origins.

Other differences between the Version 4 Analyzer and the Version 3 Analyzer are documented in . The significance of the two features mentioned is that program performance can now be easily evaluated in a data base - data communications environment where typically large numbers of program modules and I/O devices are involved, and where performance varies significantly by time of day.

The Analyzer reports are grouped in sets, and individual reports may be selectively requested or the standard default set of reports may be used. There is no effective limit to the number of report sets which may be produced in a single Analyzer run. The reports within a set are specified through control cards. These control cards are considerably different from the Version 3 Analyzer format, and give the user a wider flexibility in controlling the contents and format of a report set.

The Analyzer reports are sub-divided into summary reports and detail reports. The summary reports are activity-oriented and emphasize the various kinds of wait encountered, as well as the modules where activity occurs. The detail reports are location oriented studies of particular modules, CSECTS, or groups of code. The PPE User is now able to obtain location-oriented studies which include statement numbers from the problem program being analyzed. Each report set may have one summary report subset, and any number of detail report subsets. The titles and sub-titles may be varied from one subset to another, as well as from one set to another, in order to help the analyst identify the report output according to problem studied.

The user is thus provided with extensive flexibility in specifying the various reports, options, and format parameters, so that he may not need more than one Analyzer step to get the reports he wants. This flexibility is provided in a way that requires a minimum of control card preparation. In fact, the user does not have to use any control cards if he has no special requirements, as there is a default for every parameter and option.

Sometimes, however, it is necessary to make exploratory runs of the Analyzer because an analyst cannot foresee the type of studies necessary. A facility is provided in the Analyzer to optionally produce automatic study reports on the most active modules. Since this feature requires an additional pass of the sample data, it has not been implemented as a default option, but must be requested.

The Version 4 Analyzer provides significant new capabilities for organizing program measurement data with respect to time and unit of code.

PRODUCT SUMMARY - APO

I. HISTORY AND MARKETPLACE

Automatic Paging Optimization (APO) was introduced in June of 1976. It is sold by the SMS Division marketing force to the data processing manager or director. It has had a very slow start in the marketplace due to a number of factors. It was developed first for SVS, then VS1, and finally MVS within the last few months. Operationally it has never worked as well as it should and many times demos fail the first time. This is due to operating system dependencies and sensitivity to changes from IBM. Another reason for its slow start is that the need for a memory optimizer has not been well established in the users' minds. This is changing with the ability to measure long running systems under MVS.

II. FUNCTIONAL DESCRIPTION

APO measures the path through and time spent in CSECTS of a program and automatically restructures the program in order to reduce the working set. This then frees up memory for other programs to use and reduces paging. The end result of APO is therefore to improve throughput, reduce paging, and reduce working set for the restructured program.

III. PROGRAM DESCRIPTION

MODULE STATISTICS

	ANALYZER			EXTRACTOR		
	Total	Source Stmt		Total	Source Stmt	
	Number	Total	Mean Averg.	Number	Total	Mean Averg.
VS1	48	6627	138	31	11998	387
SVS	48	6627	138	28	9269	331
MVS	55	6342	115.	32	18439	538.

See pages 6-7

IV. SALES

PRODUCT	YEAR	REVENUE
APO	1976	$40K
APO	1977	236K

V. QUALITY

EXTRACTOR AND ANAYLZER

	PPR (12/31/77 - 3/7/78)			PCR (07/02/76 - 12/8/77)		
APO	#PPR			#PCR		
VS1	5			18		
SVS	3			8		
MVS	11			7		

VI. SPECIAL SUPPORT

APO puts hooks into the operating system and is highly dependent on a program's use of the operating system. If the program uses the operating system in any non-standard fashion, APO quite likely will not work and, more importantly, could cause the system to crash. Support for MP configurations has been very difficult and still has serious problems.

VII. SPECIAL FEATURES

None

VIII. PRICE TRENDS

Each time APO was introduced for a different operating system we offered a 25% discount off the $12,000 price. All users have then purchased APO for either $9600 or $12,000.

IX. COMPETITION AND MARKET POSITION

There is absolutely no competition to APO other than spending approximately $100,000 to buy another meg of memory. We are building a new marketplace with the product, i.e. introducing the optimization of memory which has not been performed before. Some effort must therefore be performed in introducing the entire concept before the product can be sold.

X. NEAR-TERM PLANS

There are no special options to the product, however a CICS option is required for the future.

AUTOMATIC PAGING OPTIMIZATION

The procedure for optimizing your system's workload to reduce paging - related performance problems involves three steps.

1) CANDIDATE PROGRAM IDENTIFICATION - The APO Workload Analyzer profiles your system's workload to assist you in identifying the most likely candidates for program optimization. Based upon historical SMF data, the Workload Reporter produces reports of each program ordered by total paging activity. This report becomes the prioritized list of programs to be optimized in steps 2 and 3.

2) APO DATA COLLECTION - Once appropriate optimization candidates have been chosen, the actual optimization process begins. Each program is executed in its normal production environment concurrently with the APO Extractor program. The Extractor collects the inter-CSECT reference data used in step 3.

   This data is collected only once for a given module, unlike manual paging optimization products which may require several repetitions of data collection and human analysis. The APO Extractor typically incurs an average CPU overhead of up to 40% the CPU requirements of the module being studied. This overhead varies directly with the optimization potential of the module (as the number of inter-CSECT references increases, higher Extractor overheads are produced, but the likelihood of significant paging improvements also increases). The extractor needs to collect data only on one complete "cycle" of the program which may be much less than the entire program. In addition, the Extractor requires approximately 40K of virtual storage and one output data set. Otherwise, the Extractor does not impact system performance - either for the module being sampled or any other programs.

   The Extractor employs an efficient hybrid data collection technique using standard System/370 hardware. As the technique records every inter-CSECT reference, there is never a need for additional data extractions during the optimization process.

3) ACTUAL MODULE RESTRUCTURING - In the next phase, the APO Analyzer program studies the Extractor output data set, determines the optimal ordering of the module's CSECTs, and produces the appropriate set of Linkage Editor control cards. The Linkage Editor then performs the actual module restructuring, replacing the original module with the new optimized version, ready for execution.

APO includes all three of these components, providing the user with the most effective and easiest to use paging optimization system available.

SUMMARY PRODUCT - CMF REALTIME

I. HISTORY AND MARKET

CMF Realtime was introduced into the marketplace in December of 1977 as a product which the salesmen could use to sell to an MVS site that owned RMF and did not want to purchase CUE. It is the first offering in the new CMF product line.

II. FUNCTIONAL DESCRIPTION

CMF Realtime is a Realtime product which is an extension to the Realtime measures given by RMF. It requires RMF in order to run. It provides trending capabilities which no other Realtime product provides. Realtime runs on a 3270 under TSO giving the user 1) System measurement variable measures, 2) Graphic display of measures (dynamically updated), 3) Historic presentation of same and 4) Trending presentations.

III. PROGRAM DESCRIPTION

50K lines. Many modules

IV. SALES

To the present time we have had one sale for $5625. Sales are impacted by: 1) The necessity of having RMF, 2) Realtime not linked to other products until CMF is available, and 3) small $ sales for the salesman.

V. QUALITY

Not enough exposure to comment. Only a few bugs to date. Two bugs in 4 months.

VI. SPECIAL SUPPORT

If RMF changes, then changes must also be made in CMF Realtime.

VII. SPECIAL FEATURES

None

VIII. PRICE TREND

The price of CMF Realtime is $7500, but during the first two months it was sold at an introductory price of $5625.

IX. COMPETITION AND MARKET POSITION

CMF Realtime is running into competition from a product named OMEGAMON sold by Candle Corporation. This product has one major feature, that of exception reporting. The product also allows the user to modify his operating system based on measures reported by the product. CMF Realtime is a measurement tool only and gives no facilities to modify the operating system, nor does it measure any job related data.

X. NEAR-TERM PLANS

PRODUCT SUMMARY - CMF

I. HISTORY AND MARKET

The CMF product was conceived in an increasingly difficult CUE environment. Several factors led to its conception:

1) Maintenance problems with CUE.

2) The corresponding lag in new development of CUE features.

3) CUE's design was not appropriate for the growing MVS UP/MP/AP market.

4) Competition had caught up with CUE.

A design conference was held in December 1976, to which a number of concerned and knowledgeable current Boole & Babbage customers were invited. The objective of the conference was to determine features and direction for the new CUE replacement product. It was decided to concentrate on the MVS marketplace first and the POR for CMF was completed in April 1977 and the ERS in May 1977. Coding began immediately and then terminated when IBM announced enhancements to a competitive measurement product, RMF II, in the MVS marketplace. At this point it was decided to develop the online display portion of CMF (Realtime) as quickly as possible in response. Realtime would run off RMF II data

initially and then be switched over to run off CMF data when the CMF Extractor was completed.

Realtime was developed successfully and released from Beta test in a very short time (5 months), and presented to the marketplace in December 1977. Sales have been minimal due to unexpected competition such as OMEGAMON. Work was then resumed on the CMF Extractor and is currently in progress with entry to Beta test scheduled for June 1978.

Design of a VS1 version began in December 1977 and a POR was completed by March 1978. The ERS is currently in progress.

Concurrent with the CMF Extractor development, the CMF Analyzer began in August 1977. Recognizing the length of time before the CMF Extractors would be ready, it was decided to produce an analyzer which could be run off CUE data as well, to allow non-MVS CUE users (in particular) some enhancement in the interim. To speed development in this area, the existing CPA structure and command service function were used.

The marketplace for the family of CMF products is the same as that for CUE except that it is not planned to introduce CMF (except as an analyzer enhancement) to non-VS systems.

II. FUNCTIONAL DESCRIPTION

CMF (Comprehensive Management Facility) is a family of programs designed to measure and report the hardware/software activity of an MVS system.

Currently, CMF consists of three major programs:

1. The CMF Extractor
2. The CMF Analyzer
3. CMF-REALTIME (separately purchased option)

The Extractor measures selected hardware/software activities in the system. The data is accumulated in CSA work areas and is periodically written to SMF (or a user-specified data set). The Analyzer produces all of its reports from the data written to SMF by the Extractor. REALTIME gives on-line displays of the system status. The information displayed is obtained from the Extractor's CSA work areas and by reading the SMF file (for long-term data).

The scope and number of CMF programs will grow as time goes on.

III. PROGRAM DESCRIPTION

Module breakdown of CMF/MVS

	EXTRACTOR	REALTIME
# of modules with <100 lines of code	28	14
# of modules with 100-500 lines of code	19	29
# of modules with 500-1000 lines of code	9	5
# of modules with >1000 lines of code	5	70
	61	52
	113	

Macro breakdown of CMF/MVS

# of macros with <100 lines of code	105	30
# of macros with 100-500 lines of code	12	8
	117	38
	155	
	268	

Of the modules, 155 are in the form of macros called by other modules, and the remaining 113 modules are functionally divided into global routines and sampler routines. Each sampler routine consists of four functional units:

1) Control Card cracker

2) DIE sampler

3) SRB sampler

4) Record formatter

All future sampling options to be developed for CMF will be written in a common format and will use common services such as UCCP and the extractor output writer.

	EXTRACTOR	REALTIME
How many people in the company know the product?	4	4

Module Breakdown of CMF Analyzer

# Modules with <100 lines of Code	10
# Modules with 100-500 lines of Code	20
# Modules with 500-1000 lines of Code	70
# Modules with >1000 lines of Code	10

Dynamic Demand Module Loading - No composite links.

Common Routines for -
- Command Cracking
- Data Management
- Printing
- Abend Error Recovery
- Control Block Creation & Chaining

	ANALYZER
How many people in the company know the product?	5

IV. SALES - Not yet available for sale.

V. QUALITY - Not yet applicable.

VI. SPECIAL SUPPORT

CMF, like its predecessor CUE, is very dependent on the internals of the operating system. Therefore, CMF is sensitive to new releases of the operating systems, any modifications to the operating system, and any new devices being announced by IBM or other vendors.

With the introduction of RMF, and particularly RMF II under MVS, CMF will be able to take advantage of more stable internal measurement interfaces which IBM must now maintain for RMF. This will tend to make a large portion of the CMF product more stable than its predecessor.

VII. SPECIAL FEATURES

Options will be offered with CMF as with CUE in the past. The precise packaging of these options is not clear at this time, but will include those which were available under CUE where appropriate to MVS and the RMF competition.

Specifically, Realtime, Linkpack, and Graphics will be offered. RESOLVE, DSO, and TSA may also run off the base CMF extractor in the future.

VIII. PRICE TREND - Not yet available for marketing.

IX. COMPETITION AND MARKET POSITION

CMF/MVS's main competition is RMF II which rents for $250/month from IBM.

CMF/VS1's main competition is VS1PT at the same price.

X. NEAR-TERM PLANS

Computer Accounting System (CAS)

I. History & Market

The CAS product was purchased from Imperial Chemical Limited of England in March 1972. Initially, the product, which was written in PL/1, had to be modified to "Americanize" the reports and headings and documentation had to be written. The first sale occurred around June 1972.

There were a great many problems with the original product and sales were poor until Fiscal '76 when the rewrite of the product was essentially complete.

The major portion of the rewrite occurred between 1973 and December 1975 when the system was converted to COBOL and ALC, one function at a time, and new features were added to the product.

In 1976 and 1977, rate determination was rewritten in Assembler and Prorate was added to the product.

Sales rose significantly in Fiscal '76 and '77.

Up to September 1977, eight people had worked on the product, mostly two at a time. None of these original people are on the project today and only one remains in Boole & Babbage.

II. Functional Description

The market for CAS is the IBM OS/VS computer sites. Practically all of thse sites have some need to report utilization cost, but not all need the sophisticated methods used by CAS. The larger (158 and above) installations have more need for thse methods and thus are the major market for CAS.

III. Program Description

Please see pages 12-20 of this appendix for a detailed description of the structure of this program.

CAS MODULES - ASSEMBLER

Lines of Code	Servaids	Edit	Accounting	Online
<100	0	4	2	5
100-499	2	11	8	4
500-999	0	3	0	1
1000-1999	0	4	2	3
≥2000	1	0	0	0

CAS MODULES - COBOL

Lines of Code	Servaids	Edit	Accounting	Online
<100	0	0	0	0
100-499	0	0	3	0
500-999	0	0	5	0
1000-1999	0	0	3	0
≥2000	1	1	1	0

CAS Code

	Modules	Lines
Assembler	40	20594
Macro & Copy Code	30	10277
	70	30871
Cobol	14	16366
Cobol Copy Code	8	659
	22	17025
Total	92	47896

CAS Supports

OS/MFT	The same code is
MVT	sent for each
VS1	operating system. We do
SVS	not maintain separate
MVS	code for each operating system.

The entire edit subsystem is shared with the CPA/FMR product. CAS/CPA are usually sold together. Since both products need edited SMF data, the one subsystem is used. If only CPA is sold, the edit subsystem is shipped with it.

IV. Sales - CAS/CPA

Fiscal Year	
1972 CAS/CPA	76,682
1973 CAS/CPA	160,630
1974 CAS/CPA	137,890
1975 CAS/CPA	65,525
1976 CAS/CPA	176,050
1977 CAS/CPA	379,240
78 1st Qtr.	249,310
	$1,245,327.

132 Sites

V. Quality Information

PCR's By Subsystem

YEAR	SERVAIDS	EDIT	ACCOUNTING	ONLINE	OTHER	TOTAL
74	3	15	22	9	12	61
75	7	11	19	8	2	47
76	8	19	32	20	7	86
77	3	15	13	3	2	36
Totals	21	60	86	40	23	230

VI. Special Support

CAS has a User Guide and an Installation Manual. There are tools for the sales people in the form of presentations (foils) and hand-outs, but no training aids for the technical people.

The Performance Engineers are trained to give technical presentations to the customer. These are normally scheduled shortly after the customer receives the product but the training is sometimes delayed due to problems in scheduling, either on the PE or customer side.

VII. Special Features

Rate Determination - Computes rates to be charged for each element of the Computer Resources to fully recover the cost of the resources. User inputs the cost of each resource (e.g. CPU, Disk, etc.). PGM reads SMF data and accumulates the totals for each resource, then divides cost by totals to get rate.

Prorate & Surcharge - Surcharge allows a flat charge to be levied for the use of a resource, e.g. $2.00 for each use of Syncsort. Prorate allows the cost

of running a job to be charged to more than one account #. The cost is split according to percentages supplied by the user.

VIII. Price Trends

The original price of CAS was $6,000. This included the basic package plus CASSTATS which was replaced by CPA in December '75.

In mid 1974 the price was raised to $7,500 but online could be removed for a credit of $1,500. In 1977 online was made a standard part of the product and the price was kept at $7,500.

IX. Competition & Market Position

The major competitors are:

- Johnson Systems

  Value Computer Systems

  Lower cost but less sophisticated

  Pace - more sophisticated and higher cost

  In-house systems - usually less sophisticated but more tailored to the installation.

  SARA - Boeing Computer Services - new - uses software physics

X. Near Term Plans

1. Modify system to accept CICS & IMS input data so that all costing can be done in one place. Many calls from field about this and competition offers it.

2. Rewrite online to remove macro code. (Internal change only)

3. Allow online to validate account codes and reject jobs with bad account codes.

4. Allow different rates to be charged for different machines in online and batch.

5. Break OS and VS versions apart and modify reports to emphasize VS Resources.

6. Modify detail billing to report on four sections: Batch, Online Systems (TSO), Transaction Based Systems (CICS & IMS), and Offline Charges. Summary could then report on these four.

7. Allow production of invoices in summary after #1 & #6 are implemented.

8. Modify year-to-date file and report to produce history of usage in dollars by account # by month for at least a year.

Introduction

The Boole & Babbage CAS/CPA program product is a computer accounting and performance reporting system for use in IBM OS and VS environments. The CAS (Computer Accounting System) component performs computer job and step accounting and produces a variety of related accounting reports. The CPA (Computer Performance Analysis) component addresses the performance reporting functions of CAS/CPA.

The operation of CAS is described in this User Guide, while CPA is discussed in a separate manual, the CPA User Guide.

CAS consists of four major subsystems, each of which executes a distinct function in job and step accounting:

1) CAS/SERVAIDS assists the user in constructing a reasonable rate structure based on actual machine usage and machine costs. SERVAIDS is described in chapter 1.

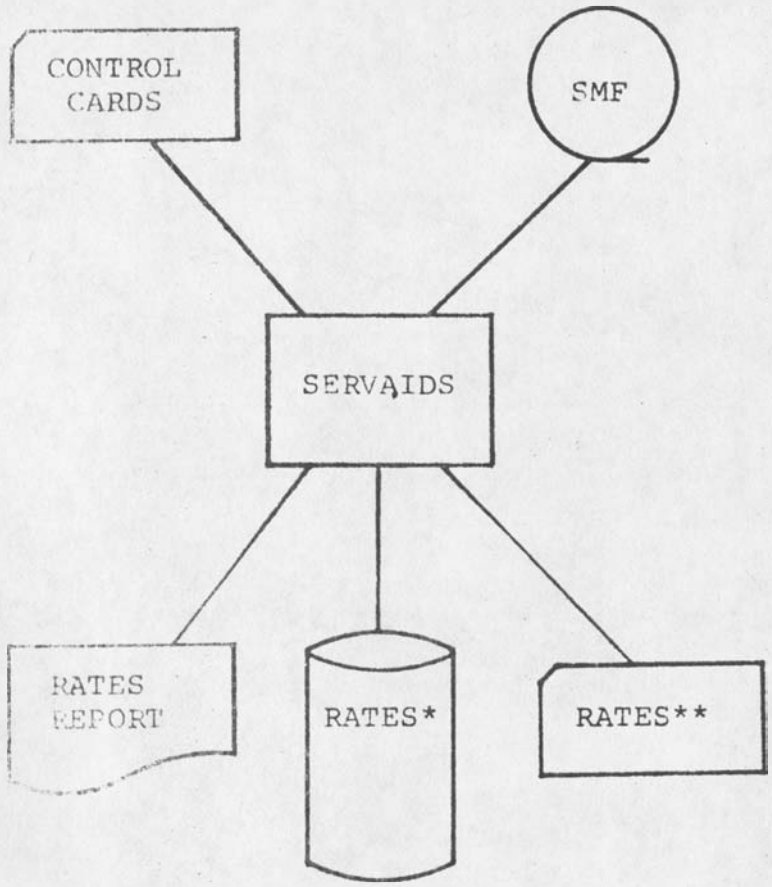
2) CAS/EDIT validates SMF data and produces output data sets for CAS/ACCOUNTING and/or CPA. CAS/EDIT is described in chapter 2.

3) CAS/ACCOUNTING processes the Accounts data set from CAS/EDIT, and produces all the financial reports except the step-end and job-end reports produced by CAS/ONLINE. CAS/ACCOUNTING is discussed in chapter 3.

4) CAS/ONLINE is an optional feature of CAS which collects additional accounting information not available in standard SMF data. ONLINE also produces reports which detail step and job charges in each user's JCL listing. ONLINE is discussed in chapter 4.

The installation procedures for the first three subsystems listed above are contained in chapter 5. Chapter 4 contains the installation procedures for CAS/ONLINE. CAS maintenance information can be found in chapter 6.

RATE DETERMINATION SUBSYSTEM



* Suitable for input to CAS/ACCOUNTING

** IEFACTRT and DEVCHRG card images, suitable for input to CAS/ACCOUNTING and/or CAS/ONLINE

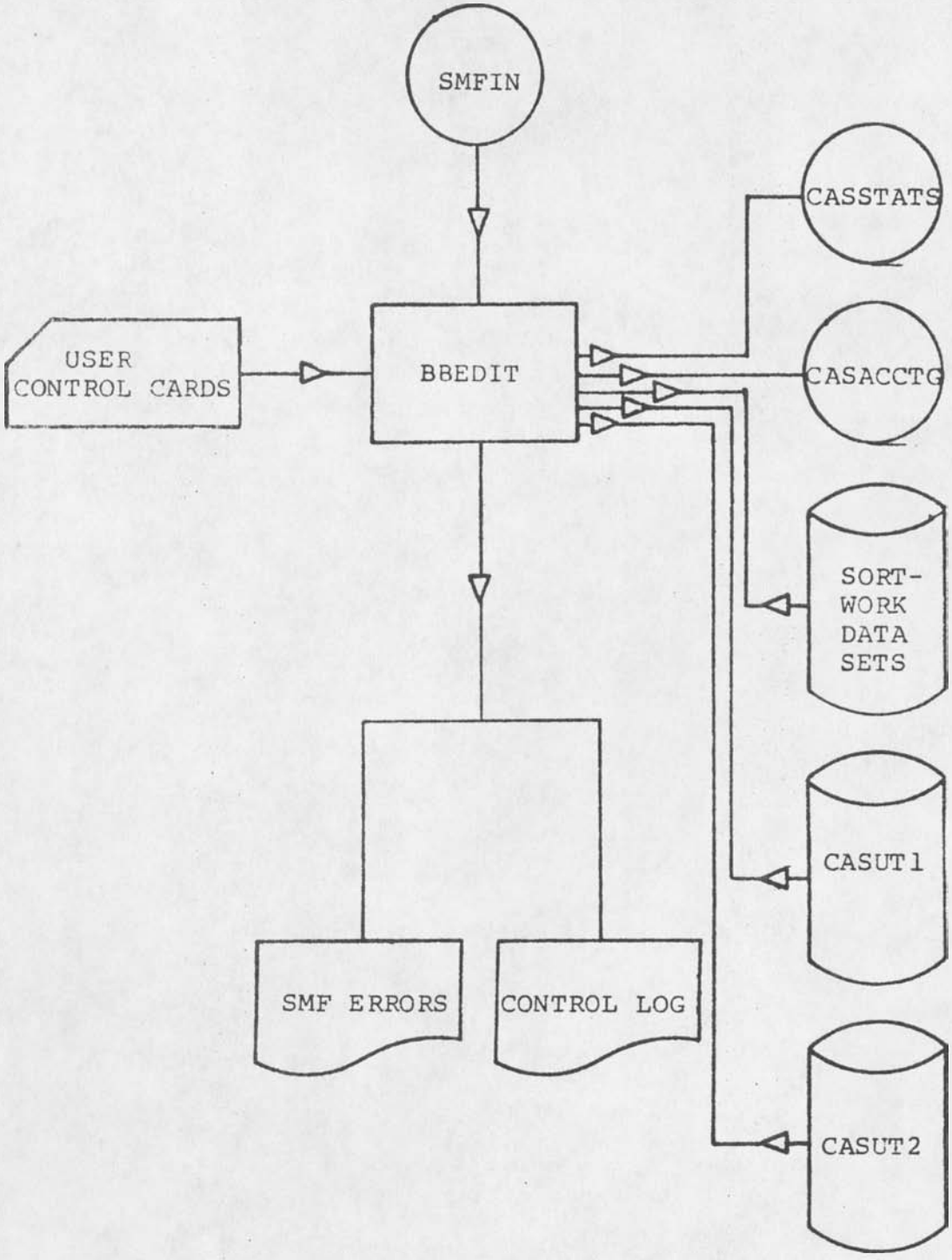
THE CAS/SERVAIDS SUB-SYSTEM

INTRODUCTION

The CAS/SERVAIDS subsystem is designed to allow a CAS customer to determine approximate rate values for various computer resources. These rates can then be used in the generation of IEFACTRT if online job and step accounting is desired or as input to the CAS/ACCOUNTING subsystem if offline accounting is preferred

The CAS/SERVAIDS subsystem uses SMF data as input to collect usage information on such items as CPU time, EXCP counts and main storage usage. This information will be the basis for the user's accounting algorithm. The actual usage and the cost of each chargeable resource (as supplied by the user) is used to derive the calculated rates.

EDIT SUBSYSTEM



THE EDIT SUB-SYSTEM

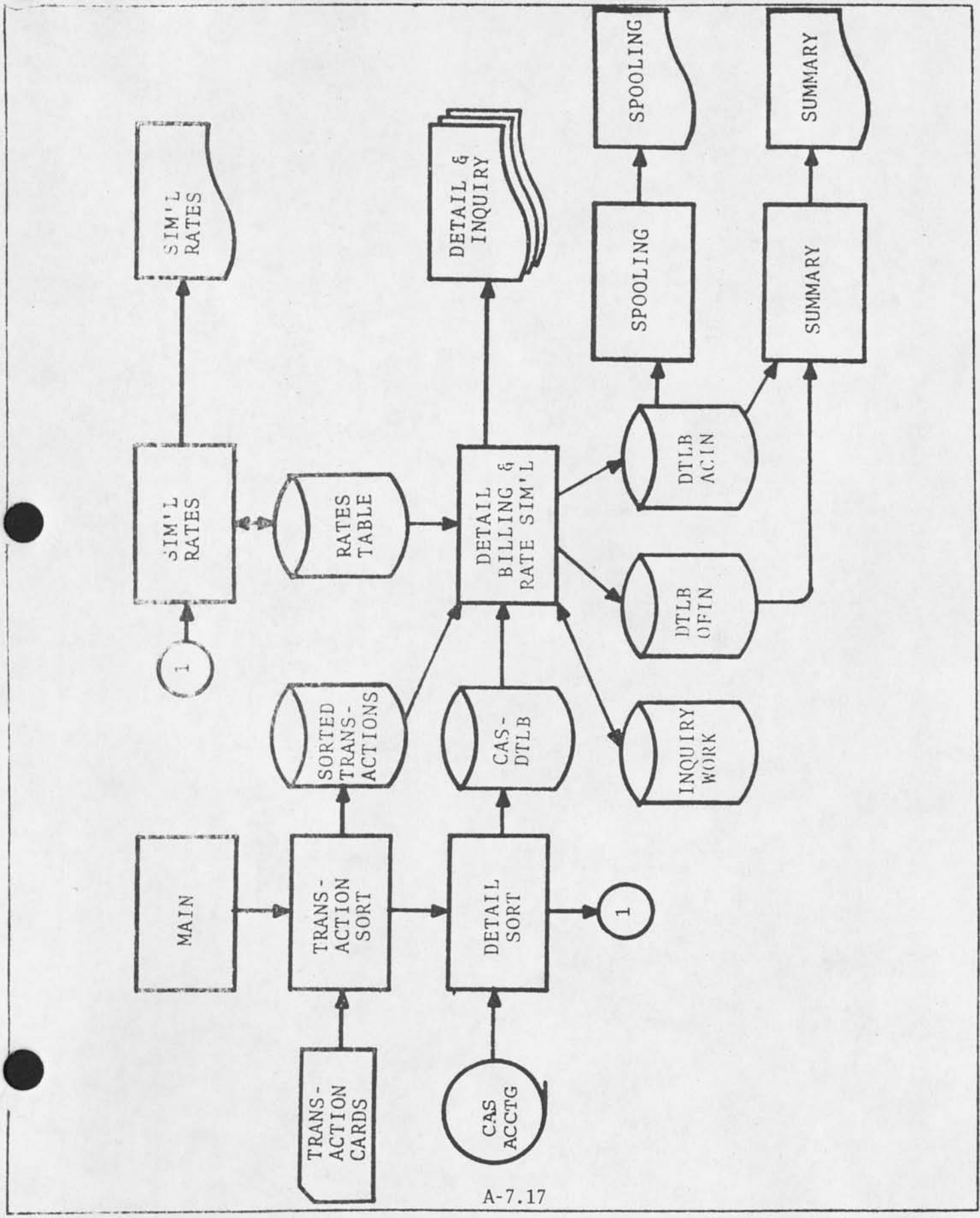
INTRODUCTION

The EDIT system processes the raw SMF data produced by the System Management Facilities of the operating system, extracts job accounting information and creates two output data sets: the CASACCTG data set which will be used as input to the CAS/ACCOUNTING system and the CASSTATS data set which will be used as input to the CAS/STATISTICS or the CPA system.

The primary functions of EDIT are as follows:

- Edit the raw SMF input records for validity, document any errors in a report and reject any records in error.
- Eliminate any duplicate records which may be present (perhaps caused by twice dumping the MANX or MANY data set).
- Insure that an End of Day record is present for each IPL and vice versa; generate IPL and End of Day records that may be missing.
- Insure that all the step-end and job-end data for each job is present; document any incomplete jobs in a report and reject them.
- Generate the Accounts Data Set (CASACCTG) consisting of four record types including:
  1) Accounting records for each step or TSO session processed.
  2) Accounting records for each job or TSO logoff processed.
- Generate the Statistics Data Set (CASSTATS) consisting of all valid SMF data. This data set can then be used as the installation's SMF data base.
- Provide exit facilities for user routines to perform such functions as:
  1) Substitute a user routine to extract the job accounting information in place of the routine provided by EDIT.
  2) Extract portions of the validated SMF data and create additional files which can be used as input to user written analysis programs.
  3) Repair any modifications the user has made to the standard SMF format.

ACCOUNTING SUBSYSTEM



THE ACCOUNTING SUBSYSTEM

INTRODUCTION

The Accounting System processes the Accounts data set produced by EDIT. It provides a flexible and modular billing system to charge for computer resources used.

The primary functions of the Accounting System are to:

- Produce a Summary Billing Report for management which re-caps all the dollar charges for user-defined account levels.
- Produce a Detail Billing Report which shows all the dollar charges for each step or job within an account.
- Produce a Spooling Report giving detailed analysis of all spooling charges, including a breakdown of SYSIN, SYSOUT, and SYSPUNCH.
- Provide an Inquiry capability to obtain a Detail Billing Report on selected accounts or jobs which itemizes all the dollar charges on a step level.

In addition, the Accounting System has three optional features which extend its capabilities:

- Rate/Offline Charges (Optional)

  This feature allows the user to incorporate the charges for computer related services such as keypunching and programming services into all levels of the accounting reports.

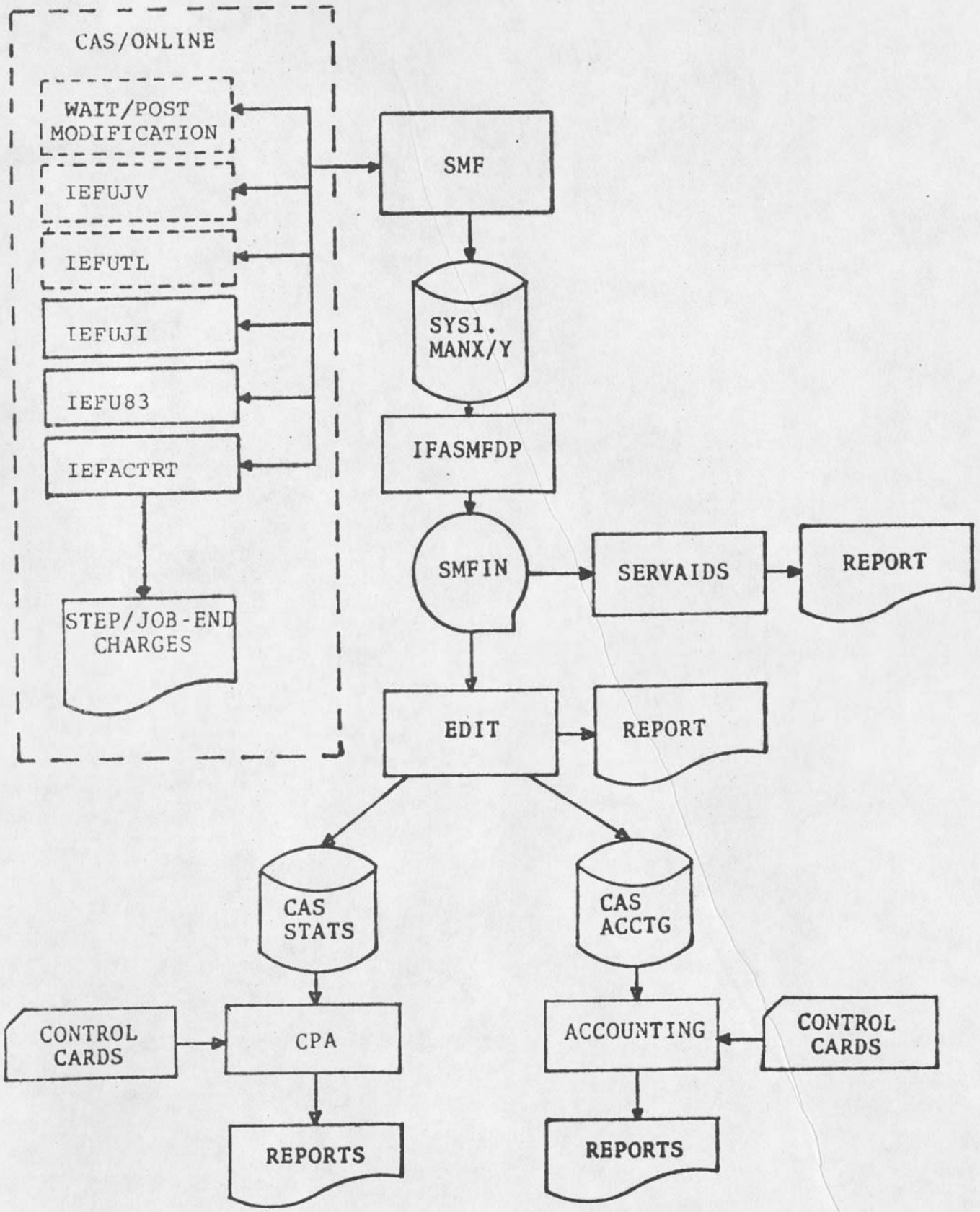
- Year-to-Date/Budget (Optional)

  This feature allows the user to accumulate the year-to-date costs for each job and each user defined account level. This information allows the user to track his current month and year-to-date actual charges against the budget.

- Prorate Accounting and Cost Amortization (Optional)

  This feature allows the CAS user to distribute (prorate) the costs of computer resources among multiple end-users according to criteria established by the data center. With cost amortization, the cost of software can be amortized based on "expected" use, with a fixed charge for each use of software; and the cost of software can be amortized by adding a job (or jobstep) surcharge based on a percentage of the job cost.

CAS / ONLINE OPTION



ONLINE SUPPORT

The purpose of the Online Option is to:

- Increase user awareness of resource usage and cost by printing step and job accounting information on MSGCLASS output.
- Improve the accuracy of charging information by capturing voluntary wait time for OS and SVS or transaction active time for MVS.
- Allow the collection of volume mount information.
- Improve SMF data validity by preventing use of the TIME=1440 parameter to bypass accounting.
- Prevent SMF data from being lost when a job or step terminates because it exceeds the wait time limit.

The objectives are accomplished by:

- Using the IEFACTRT SMF exit to print charges on MSGCLASS output and attach additional information to the end of SMF type 4 and 5 records (type 34 and 35 for TSO option).
- Extending the capabilities of the OS and SVS Wait/Post Routine to capture voluntary wait time.
- Addition of a routine to capture volume mount information.
- Inclusion of IEFUJV and IEFUTL (SMF exit routines) to ensure improved data validity.

Two additional options are available with the Online Option:

- The TSO Option provides online accounting capabilities for TSO users. In particular, this option allows charges for TSO resources (connect time, TPUTS, and TGETS) to be calculated online. Accounting messages are written on MSGCLASS output by IEFACTRT for the TSO user to retrieve. All other computer resource charges supported by CAS/ONLINE are included in the TSO charging algorithm.
- The OS HASP Option provides accurate accounting for all HASP spooling.

This chapter will explain in detail the installation and usage of each feature of the Online Option.

CPA/FMR

I. History and Market

CPA was developed in 1975 as a replacement to the CAS Stats portion of CAS. CPA incorporated the new data management sub system (DMSS) to handle the large volumes of data needed for the reports and was designed to be a very structured system.

FMR was developed in 1976 as an add on to CPA to allow trending of SMF measures over time.

II. Functional Description

CPA/FMR reports a series of data items available through SMF data. The data is presented by shift (Jobload statistics), or ranked in some order (Resource utilization, number of occurences, etc.).

The major purpose is to provide a macro view of the system's operation.

FMR extends the CPA measures over time. CPA can report (at most) only on the time period of the input data; FMR includes a data base which stores the data from past month's runs. This allows trending over a much greater time period.

III. PROGRAM DESCRIPTION

Lines of Code	80,000
# of Modules	120
Language	Assembler
Environments supported	All OS systems

(See pages 3-8)

IV. SALES

See CAS Sales - the figures for CAS/CPA/FMR are reported together

V. QUALITY

	1975	1
PCR's	1976	40
	1977	28

VI. SPECIAL SUPPORT

CPA/FMR now has two User Guides, one devoted to each system and an installation Guide. There are also sales brochures and foil presentations for the salesmen.

The Performance Engineers can give technical presentations on the use of the system and the analysis of the reports.

CPA/FMR are usually sold through a demo.

VII. SPECIAL FEATURES

None

VIII. PRICE TRENDS

CPA/FMR has not changed in price significantly since introduction. It is priced to sell with CAS in the following manner:

Any one of CAS/CPA/FMR	$ 7,500
Any two of CAS/CPA/FMR	12,000
All three	15,500

IX. COMPETITION, MARKET POSITION

The major competitor to CPA/FMR is Plan IV by Capex. There are reports included with some of the other accounting packages which provide some of the information in CPA. These cannot be considered serious competitors.

X. NEAR-TERM PLANS

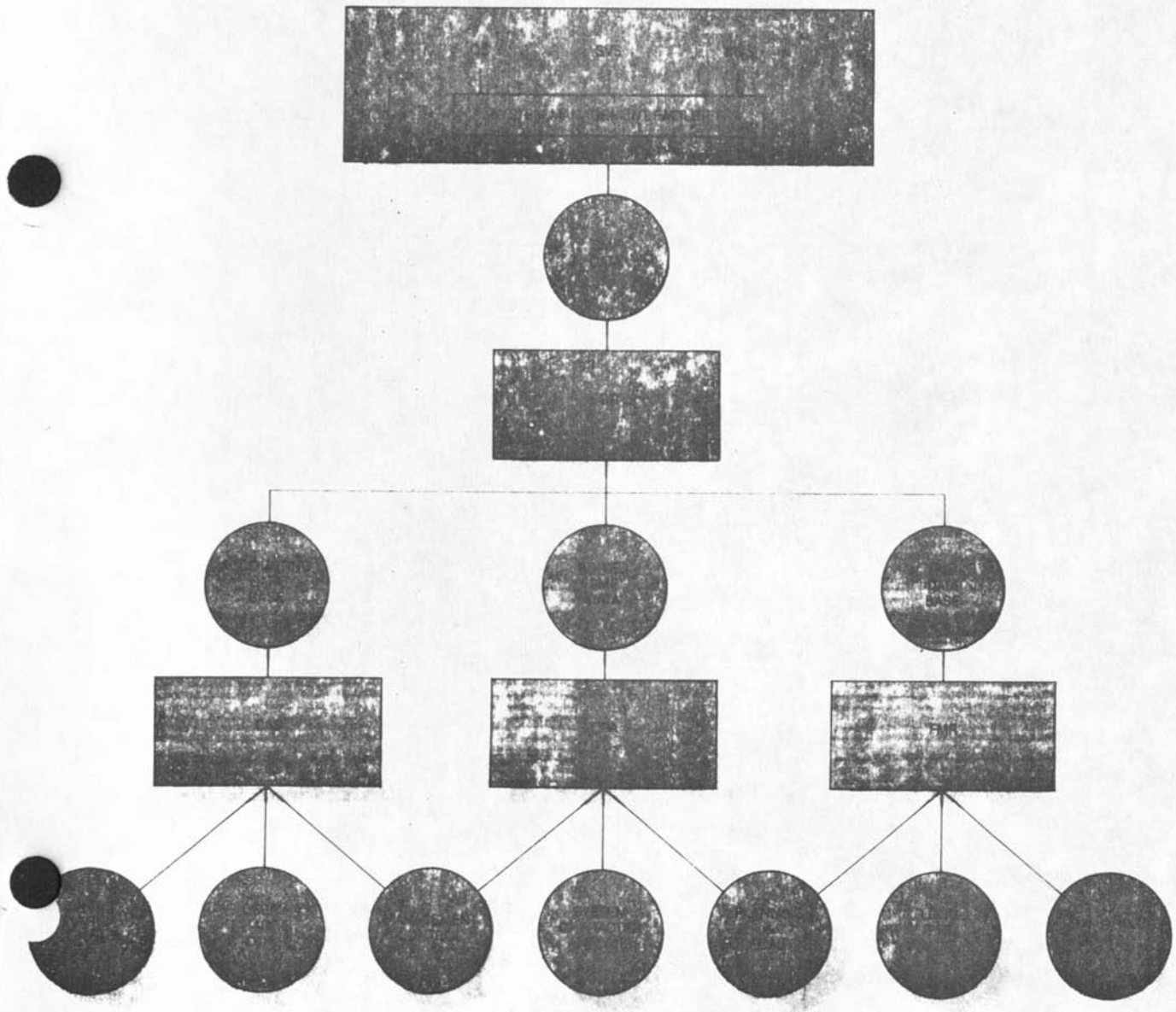
The project team is now working on producing the analyzer for CMF and there are no plans for development work on CPA/FMR.

Management control

CAS/CPA/FMR is structured as three major subsystems: The Computer Accounting System, Computer Performance Analysis and Facility Management Reporting.

The raw SMF data is processed by a high performance edit, which provides complete and accurate data to these subsystems. In addition, by using the Data Management Subsystem (DMSS), it develops a highly efficient historical data base which can be used to develop long-range capacity planning, equipment justification, operations evaluation, performance variations and other key long-term reports.

The following schematic illustrates the CAS/CPA/FMR system flow and operating system interface:



Total resource accounting

Complete accounting means more than just being able to charge users for services rendered.

Before you can gain control over the situation that exists today, you must know the character of your user workload and system performance.

The CPA component of the system provides short-term performance analysis. This includes:

- Hardware–usage statistics of CPU, main storage, tape and DASD devices, paging and swapping.
- Operations–IPL frequency, device configuration, performance statistics.
- Workload–job load and job statistics, turnaround analysis, device allocation requirements.
- Programs–resource consumption, abends, run frequencies.

In the TSO performance statistics illustration above, the user receives a report by job of how his system is being consumed.

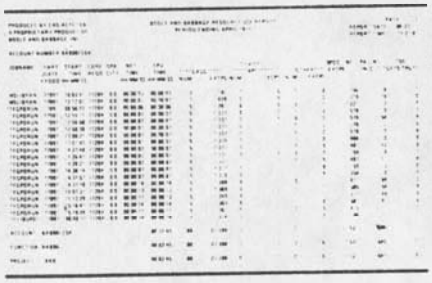
The FMR component develops a comprehensive data base which provides a variety of long-range planning capabilities including:

- Capacity planning–trend of increase in system workload
- Equipment justification–CPU usage, core wait
- Operations Evaluation–IPLs, system idle periods, abend trends
- Performance Variations–increase/decrease in paging, IPLs, abends, uptime, jobs executed
- Operations profile–"average day," hour by hour system activity, CPU usage, etc. for scheduling

In the profile of idle time above, the manager receives information on how to improve operations efficiency by leveling out slack periods.

The CAS component associates a cost with the performance of work for users. It lets you distribute and charge back this cost to users. Its accounting system includes:

- **Rates**
  automatically determined based upon resource usage and costs
- **Users**
  are made directly aware of the day-to-day cost of resource consumption
- **Chargeback**
  to user defined cost centers equitably distributes among your users the cost of operation
- **Overheads**
  and non-system charges are input off-line and equitably distributed and included in the user's billing and reports
- **Budgets**
  with expenditures clearly stated, users can improve performance against their cost center budgets
- **Reports**
  of user cost summaries, distribution, usage, etc.
- **Inquiry**
  into details of user or job charges



The resource usage report shows by job how your system is being consumed.

The common denominator of all accounting is the dollar.

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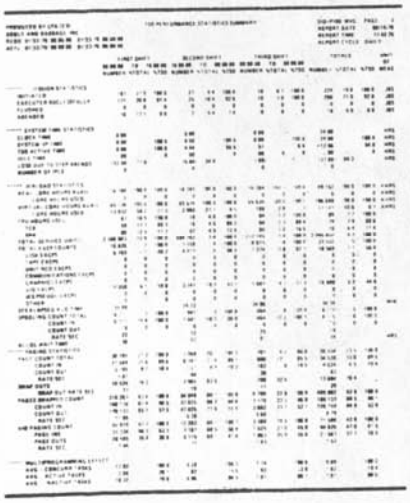

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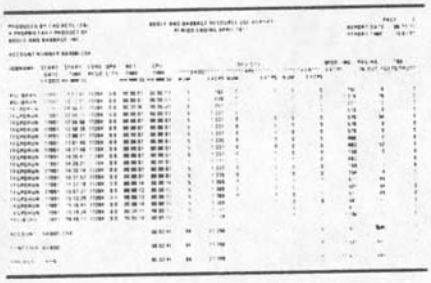


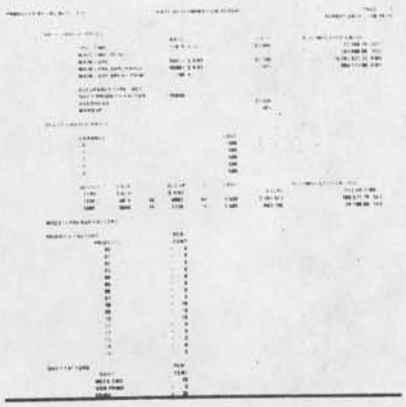
The resource usage report shows by job how your system is being consumed.

The common denominator of all accounting is the dollar.

Planning & forecasting

CAS/CPA/FMR provides complete management and financial control, performance evaluation as well as planning and forecasting information to the organization using OS, SVS or MVS, based upon system management facilities (SMF) data.

Data center operations and management can benefit fror the following CAS/CPA/ FMR features:



Rate Determination

A service aid subsystem which, based upon your workload history and your IBM bill, proposes a set of rates which will equitably recover your cost of operation. These costs will be distributed among your users. The rate structure is comprehensive yet flexible and will allow for overhead costs (such as air conditioning) and a profit margin.

On-Line Billing

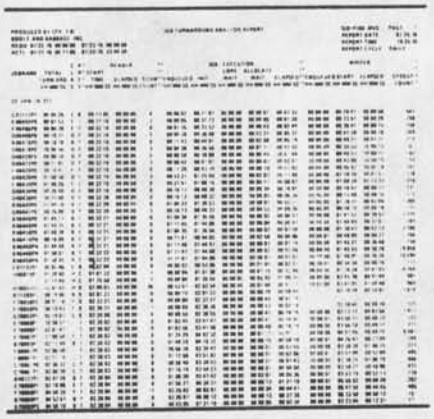
A facility which displays, directly upon the user's job output, the charges and resource usage and rates associated with the running of a particular job. The charges are presented in readily understood categories and are highly equitable due to the NET TIME measurement ability of CAS.

Budget Reporting

Each user of your system can have, for the current period and year-to-date, his expenditures reported against his predefined budget.

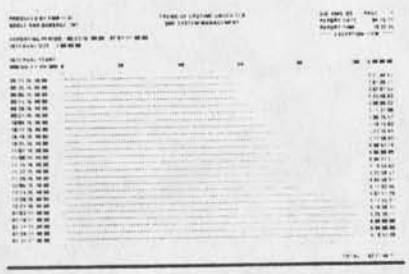
Utilization Analysis

The profile plots in combination with the tabular reports of CPA present key information from which you can readily discern the level of utilization of the various resources of your system. This information can be an invaluable aid to thorough operations management and informed equipment justification.



Service Analysis

The user service level of your operation is presented both as job turnaround and as shift and class structure summaries. Reports are available for specific jobs, time periods, class, priority and/or service level.



Trend and Profile Analysis

FMR, drawing from its historical data base, provides trend variations of an item over a long period of time. In this way, management is able to quickly determine the cause and effect relationship between various items. It also provides you with a graphic presentation of daily activity over time. The period can be a month, a year or any period in between.

Exception Reporting

Significant changes in your day-to-day operation may be occasional exceptions or may be indicative of long-range changes which should be considered. Once you establish your significant change parameters, FMR automatically graphs trends of key indicators to correlate cause and effect.

Who benefits from CAS/CPA/FMR?

Data Center Management

- By having the information needed for installation management of the operation of the computer system
- By having the tools required to control the operation
- By having available information to assist on both short and long-range management of the data center
- By having documented justification for decisions and defense of system performance

Software Support

- By knowing the short and long-range statistical characteristics of usage of the elements within your system including devices, channels, main storage and other system resources

Scheduling

- By knowing when peaks of resource demand exist and when capacity exists to do more work, thus improving the ability to balance workload

Users

- By directly knowing the cost, and therefore the impact, of the work they are submitting
- By having a greater understanding of data processing through your increased ability to communicate your performance of his workload

Cost Accounting

- By knowing the cost of operation and its distribution
- By having a flexible "menu" of charging options allowing you to account in accordance with your company's philosophy

Planning and Forecasting

- By knowing the profile of your past system and today's so you are in a better position to plan for the future

FACILITY MANAGEMENT REPORTING (FMR)

Facility Management Reporting (FMR) is a long term management reporting tool which will assist Data Processing Management in evaluating past performance of the computer center, and in planning for the future. FMR's reporting capabilities are based upon a historical file which can contain data from any time period for which SMF data has been gathered. FMR is designed to help management set objectives and measure performance against these objectives; it can also provide objective documentation necessary for new equipment justification.

The Facility Management Reporting system consists of the following major components:

FMR Historical Data Base — This data is the basis for all reports provided by FMR. It contains one record for every 30 minutes of elapsed time; each record contains 50 fields for recording various types of system activity. Thirty-two of these fields currently contain information. In a multiple CPU environment, multiple historical data bases can be maintained.

Long Term Trend Graphs — Report the variation of an item over a long period of time, for example, number of jobs run by day for the past three months, CPU time used by week for the past 2 years, or number of IPL's by day for the past several months. FMR will produce a trend graph of any item in the historical data base. It will also provide a trend graph of two, three or four items side by side on the same page for easy correlation of cause and effect relationship between various items. These two, three or four-up plots are the same ones which are automatically produced if related items are contained in the significant change specifications. These trend graphs may be for any period of time contained in the historical data base, and may be broken down to 30 minute intervals.

Profile Reports — It is often desirable to see what an average day looks like, or an average week, or an average month, etc. From the historical data base, FMR can produce a plot of an "average" day, taking the data from many days and averaging it together so that the graphic picture of daily activity actually represents a composite of all activity over time. The period on which this average day is based is specified by the user and can be a month, a year or any other time period. It could also be the average Friday, or average five day week, or at any time interval the user desires.

Significant Change Reports — This is a form of exception reporting. The user may specify for each element in the historical data base what he considers a significant change. This threshold may vary from item to item, and may vary for positive or negative change factors. For example, an increase of 10% in average CPU time might be considered significant whereas a decrease of 5% would be considered significant. Or, the change may be expressed as an absolute amount, for example, 10 IPL's more or 5 IPL's less. To run the significant change analysis the user may choose any two periods to be compared, for example, this month and last month, or this week and last week, or this January and last January. If any item exceeds the user specification of significant change between the two periods, trend graphs covering those periods may automatically be produced for those items. Exceeding the threshold of any item may also trigger the correlation analysis described below.

Correlation Analysis — When the user defines significant change as discussed above, he may also identify up to three additional items in the historical data base which he considers to be related to the item being analyzed. If a significant change has occurred, trend graphs on these one, two, or three related items are also automatically produced alongside the graph of the exception item.

Calendar Reports — Calendars are probably the most easily read and quickly analyzed form of report available. They enable quick recognition of holidays, weekends, and activity patterns by day and by week. The report may begin on any day of the month, and may plot up to four items from the historical data base. It can include up to six weeks, and be made to include only those days of the week desired by the user.

CONTROL/IMS & CONTROL/IMS REALTIME

I. HISTORY AND MARKET

CONTROL/IMS was purchased from Morino Associates in 1975. Since then, the product has been modified extensively, especially the internals which were rewritten.

The REALTIME portion of the product was developed in 1977 in order to make time dependent information available to the systems programmer and the master terminal operator.

CONTROL/IMS addresses the market for costing the use of IMS with some performance information thrown in. The REALTIME product is directly aimed at the IMS performance tuning market.

II. FUNCTIONAL DESCRIPTION

CONTROL/IMS consists of two parts, an internals portion which is linked into the IMS Control Region and gathers additional data over that normally present on the Log Tape, and the Externals portion consisting of a series of COBOL and assembler programs which analyze the data output from the internals and certain IMS Records.

The REALTIME product runs entirely in the Control Region but uses a standard MFS Exit interface. Both products can be

affected by IBM changes to the control region code through new Releases and PTF changes.

III. PROGRAM DESCRIPTION

CONTROL IMS

Internals (AME)

Lines of Code	16,000
# of Modules	56
Language	Assembler
Environments supported	All OS.

Externals

Lines of Code	25,000
# of Modules	71
Language	COBOL and Assembler
Environments supported	All OS.

Realtime

Lines of code	19,000
# of Modules	31
Language	Assembler
Environments supported	IMS 1.1.3 & 1.1.4 in MVS only

(See pages 5-7)

IV. SALES

CONTROL/IMS

1975	$ 92,500
1976	$460,000
1977	$479,000

CONTROL/IMS Realtime is a new product and there have been no sales yet.

V. QUALITY

PCR's (CONTROL/IMS)

1975	1
1976	49
1977	50

VI. SPECIAL SUPPORT

CONTROL/IMS is normally not Demo'ed because the product must be put into the control region and run for at least a day to collect data. Most prospects are not willing to do this.

The sales presentation is, therefore, more involved and elaborate, seeking to demonstrate the features and advantages of the product without an actual run on the prospect's machine.

Realtime is also not Demo'ed because of the need to put the product into the Control Region of IMS.

There are several manuals for C/IMS: An installation guide, a system introduction, a system administrators guide, and PRS & TAS technical specifications.

Realtime has a Users Guide and a pocket guide.

VII. SPECIAL FEATURES

None

VIII. PRICE TRENDS

CONTROL/IMS sells for $17,000. This price has not changed since Boole and Babbage obtained the product.

Realtime is being offered for $7,500 to C/IMS customers and $9,000 to non-C/IMS customers.

IX. COMPETITION, MARKET POSITION

There are no other products which gather additional data within the IMS system.

The main competitors are IMS maps by MacAuto and the IMS add-on portion of Johnson's and Value Accounting's Systems.

IBM has recently announced an IMS accounting package which runs entirely off of Log Data.

X. NEAR-TERM PLANS

The plans right now are to reduce the amount of problems presently outstanding against the product. If the sale to S. W. Bell goes through we will provide additional measures of response time as well as an alternate method of defining response time.

Realtime has two additional phases defined. These will allow the product to measure changes in data measures over a short period of time instead of from the initialization of IMS.

CONTROL/IMS provides performance evaluation, planning and forecasting, and financial and management control information to the organization using the Information Management System (IMS). CONTROL/IMS is designed for the Data Communication (incl. message processing and batch message processing) environment of IMS. IMS installations can benefit from the following CONTROL/IMS features:

ADDITIONAL MEASUREMENT DATA

Meaningful performance and accounting analysis is feasible due to the additional measurement data collected by the CONTROL/IMS measurement interface to IMS. This interface is established with minimal impact on system performance, and provides data that is not collected by the standard IMS log or monitor functions.

PERFORMANCE EVALUATION

System tuning of IMS is greatly facilitated by the performance evaluation data provided, allowing the installation to improve IMS performance and/or reduce its cost of operation.

PLANNING AND FORECASTING

Planning and forecasting are made practical with the system's method of graphically presenting trends, growth patterns, and saturation levels.

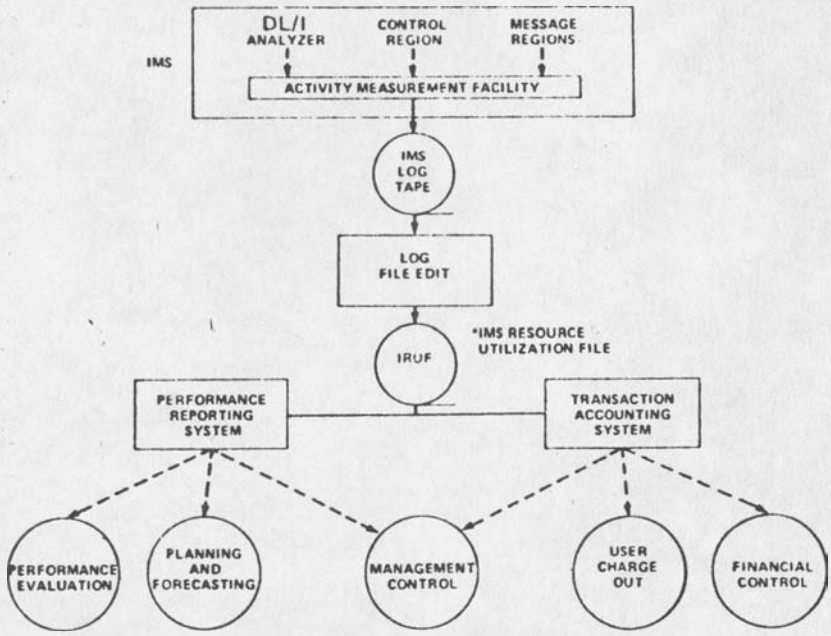
FINANCIAL CONTROL

Standard cost accounting for the utilization of IMS not only provides the IMS administrator and management with a clear and concise statement of their "cost of operation," but also establishes an accurate, equitable, and easy-to-understand method for user charge-out.

MANAGEMENT CONTROL

The IMS administrator and data center management are provided with the information necessary to exert effective management control over their IMS expenditures and service responsibilities to users. This is made possible through the continual operation of the CONTROL/IMS measurement facility, the summarization of this measured data into a manageable data base, and the generation of concise reports on cost, system activity, and usage trends. These usage trends address both the immediate and long-term analysis requirements of an installation.

CONTROL/IMS is structured into three major subsystems: the Activity Measurement Facility, the Performance Reporting System, and the Transaction Accounting System. The following schematic illustrates the CONTROL/IMS system flow and IMS interface:



ACTIVITY MEASUREMENT FACILITY (AMF)

The Activity Measurement Facility directly interfaces to IMS. It is designed to extract performance and accounting information and to associate the information with the responsible program or transaction. AMF monitors many different IMS activities including:

- DL/I Activity for each referenced DBD (ISAM, OSAM, VSAM)
- Program Scheduling Activity
- Terminal Activity for each LTERM
- CPU Utilization for a transaction in both the CTL Region, MSG Regions, and BATCH MSG regions.
- Message Queue Activity
- Memory Utilization

It is important to realize that message processing *and* batch message activity is comprehensively measured by AMF.

When a transaction or program completes processing the collected activity information is recorded via the standard IMS log function. Two types of AMF records are generated:

- Program Activity Record
- Transaction Activity Record

It is important to note that AMF was designed to minimize added system overhead. Typically, only one program activity record and one transaction activity record are generated for each transaction processed. This allows AMF to collect performance and activity data on a continuous basis without sacrificing system performance or integrity.

PERFORMANCE REPORTING SYSTEM (PRS)

The Performance Reporting System is an offline analysis system that allows the user to understand the execution characteristics of IMS and to control, plan, and optimize system performance. The PRS and, in fact, all of the offline components of CONTROL/IMS, process a common data set called the IMS Resource Utilization File (IRUF).

The IRUF, which contains statistical information about transactions, terminals and programs, is created from the Standard IMS log tape. It is formatted to facilitate processing by higher level languages (e.g., COBOL) and report generaters so the user can easily write his own programs to perform special analysis and generate custom reports. It can also be summarized, enabling efficient Long Term Reporting.

Standard Reports

Any number of standard PRS reports can be generated from the IMS Resource Utilization File, including:

- Region Utilization Report - summary information on the activity of each message region and detailed patterns of message region processing activity.
- Terminal Report - summary of all the activity for each LTERM.
- Data Base Report - summary of all data base activity by DBDNAME.
- Program Report - summary of the activity of each program.

Graphic Analysis

When collecting performance and accounting data for a system as complex as IMS, the system administrator has the immediate problem of how to manipulate a vast quantity of data to produce meaningful results. Furthermore, the goals of short-range analysis (e.g., data for one day) are totally different from the objectives established for long-range analysis (e.g., data for three months). To help the system administrator manipulate and understand the collected information, a graphic analysis facility has been included as an integral part of CONTROL/IMS. This facility can be used for both short and long-range analysis.

Short-range graphical reports provide the information necessary for rapid analysis of activity patterns over a specific period of time. Such analysis allows the system administrator to pinpoint unusual levels of system activity and to identify possible causes for these levels. A simple visual correlation between the average transaction response time plot and

all of the other activity plots enables the user to understand the causes of bad response time and when these periods occur. This same correlation allows the system administrator to determine whether IMS is functioning "normally."

Long-range graphical analysis provides the system administrator and management with the information necessary to understand growth rates of individual applications and total IMS activity; to forecast saturation levels as activity tends to exceed the configuration's capacity; and to identify usage trends that will have a degrading impact on system responsiveness.

General Retrieval/Selection

The last major component of the Performance Reporting System is the file selection utility. This utility enables the user to extract records from the IMS Resource Utilization File based upon user-specified selection criteria. The selected records may be printed and/or written to a work data set for subsequent evaluation by the standard report programs or by user-written programs. When this component is coupled with the CONTROL/IMS graphics facility and standard performance and accounting reports, it provides the user with a powerful data retrieval and analysis system.

TRANSACTION ACCOUNTING SYSTEM (TAS)

The Transaction Accounting System provides the user with two essential financial capabilities – cost accounting to control cost of operation, and a user charge-out facility to distribute the expense of IMS processing to the responsible users. As input, TAS uses the IMS Resource Utilization File, the common data set maintained by CONTROL/IMS.

Standard Cost Accounting

The TAS cost accounting facilities provide the IMS administrator and data center management with the necessary cost distribution reports by cost center, resource pool, and/or user to insure internal cost control.

User Charge-Out

TAS provides the user with a range of charge-out options, allowing the user to choose those options that are consistent with his specific accounting philosophy. The design of TAS ensures the operation of a charge-out system that will be simple to administer and efficient to operate.

The complete charge-out results of any accounting period are stored in a charged-out data set created in the Transaction Accounting System. This file of information contains summarized costs and resource usage statistics by transaction and user. The structure of this file makes it easily accessible and available for interface to installation accounting systems (e.g., VS Job Accounting System), or to cost control systems (e.g., expense analysis by chart of account).

SUMMARY

The Transaction Accounting System produces concise, accurate, equitable, and easy-to-understand charges for IMS usage. The basic charge-out reporting facility provides for summarized charge-out reports by transaction within user. The Transaction Accounting System provides the user with a comprehensive and flexible cost control capability.

RESOLVE

I. HISTORY & MARKET

RESOLVE was originally developed as ASSIST by Advanced Software Techniques (AST) of San Francisco. AST had sold about 50 copies before B & B acquisition of the product in mid 1976.

RESOLVE is the product around which the Operations Division was formed. It was (along with its competitors) a pioneer into a new market for online real-time diagnosis of operational OS problems (e.g. ENQ conflicts).

II. FUNCTIONAL DESCRIPTION

RESOLVE is an extension of the IBM provided facilities to "look inside" of OS and determine the status of particular jobs, devices, system components, etc. It also contains action services which will allow correction of diagnosed problems. RESOLVE'S main benefit is to diagnose and correct these real-time problems which might otherwise require an IPL or cause sluggish system performance. It also provides services to more efficiently accomplish routine operational functions, manage the execution of particular jobs and gauge overall systems performance.

III. PROGRAM DESCRIPTION

Lines of code 32,000

# of modules. 217

Language . . . . . Assembler

Environments supported. . . All OS environments

(Code is well structured)

IV. SALES

1975 - 1976 AST	Total 50 copies
1977 B & B	$500,000/ 50 sales
1978 to date	$300,000/ 25 sales

V. QUALITY

The product has operated reliably but has gone through periods of minor incorrect data presentation. During parts of 1977, RESOLVE did not correctly operate in an AP or MP system. This was corrected in Release 2.2 in August 1977. The product now supports MVS.

Problems reported: 123/year

Phone calls: 1440/year

VI. SPECIAL SUPPORT

A RESOLVE Pocket Reference Guide was implemented in 1977. This was very well received by the users and is a valuable sales aide.

The salesmen often conduct operator introduction and training classes. A more formal class, given by technical persons, would be a helpful addition.

VII. SPECIAL FEATURES

The User Interface Option gives to the user, for an additional $2500, the ability to add his own RESOLVE SERVICES. This feature consists of documentation, macro source code and a library of contributed services written by other users. However, this library is currently empty. A 1978 goal is to make this a viable product feature by gathering a collection of valuable user services.

VIII. PRICE TRENDS

RESOLVE is priced separately for MVS and non-MVS and by CPU on site. It is also available on a 90 day cancellable monthly rental. We have recently raised the price and concurrently offered a stripped down non-MVS version for only $5,000 (versus $8200) in order to be competitive with LOOK from ADR in the VS/1 marketplace. We currently need added product function in order to continue to support our more expensive price relative to competition. (currently up to $21,600 for an MVS site)

IX. COMPETITION, MARKET POSITION

RESOLVE is the high priced alternative in a very competitive market. A differentiation is being made between two types

of online system information display products. One for Operational Problem Solving (RESOLVE, LOOK from ADR) and one for System Performance Monitoring and Tuning (CMF, RMF-II from IBM, OMEGAMON from Candle Service Corp.). However this differentiation is not well established in the marketplace. This causes RESOLVE to have a very large number of competitors, among them CMF-Realtime from the SMS division.

RESOLVE has been the leading operational product and also had considerable appeal for system programming persons. This position is however being rapidly eroded by competitive product enhancement and RESOLVE is falling behind.

Our competitive position is especially weak in VS/1 due to specific product shortcomings. B & B does not yet have sufficient engineering expertise in this potentially lucrative market.

X. NEAR-TERM PLANS

A release is planned to provide general service additions and a generalized innovation interface including support of usage from ROSCOE (an ADR sold TSO type product). Many other additions are defined but insufficient staff exists currently for development. In the long run RESOLVE and CMF-REALTIME may need to be combined in order to remain competitive.

SECURE

I. HISTORY & MARKET

Originally called Data Access Security (DAS), this product was developed for one customer on contract by Tesseract Inc. of San Francisco. During 1975-1977 Tesseract sold approximately 35 copies of DAS averaging about $6,000 per copy. Most sales were made without face-to-face customer contact. B & B purchased the product, renamed it SECURE, repackaged and introduced it at $10,500 in November 1977. December sales were 6, January was 3.

II. FUNCTIONAL DESCRIPTION

Secure is a Data Access Security System based upon the standard password facility provided as part of OS. However it provides a practical solution to controlling use of information and is not easily circumvented. It also provides audit trails of access activity.

III. PROGRAM DESCRIPTION

Lines of code - 12,300

Modules - 19

(Also 83 IBM module superzaps)

Environments - All OS environments (MFT -> MVS)

All assembler.

IV. SALES

1975 - 1977 as DAS by Tesseract

35 sales, $200K

Nov 1977 - date

9 sales, $90K

V. QUALITY

- Insufficient history to comment
- Modifies OS and can stop a user from running, therefore good support is essential
- Concern - There is currently no way to test this product at B & B.

VI. SPECIAL SUPPORT

None except for critical need for good customer support because of possible user dependence upon SECURE to run production.

VII. SPECIAL FEATURES

None

VIII. PRICE TRENDS

Product is currently introductory priced at very low level in order to quickly build a customer base. A significant price increase is expected in 1978.

IX. COMPETITION, MARKET POSITION

Only signficant competition is Resource Access Control Facility (RACF) offered by IBM. Secure is significantly less expensive since RACF rents/CPU/year for the Secure purchase price. However, SECURE offers considerably less function, is based on a less comprehensive and sophisticated protection philosophy, and modifies OS.

X. NEAR-TERM PLANS

Specific improvements planned:

We have not yet made the planning decision about long-term product direction - either to keep selling the "practical" alternative or to upgrade to a "full function" security system.

Our original business planning allowed for the total loss of the MVS marketplace to IBM and the product was justified on a VS1, MVT, SVS only market.

Short-range plans include adding:

- VSAM support
- SMP format for distribution
- A way to reduce mods to OS, and thereby remove sales objections and reduce maintenance requirements.

MAIL ORDER PRODUCTS

--- DFP and DISKPLAY

These two low cost programs are described in available sales literature.

DFP is a diagnostic program that lets users interpret all internal tables in the event of an abnormal ending to any program. It operates under MFT, MVT, VS1 and SVS.

DISKPLAY is described on page 1 of this Appendix.

DISKPLAY

SECTION 1: INTRODUCTION

DISKPLAY produces a group of easy to read reports mapping the volume of a disk. The first report lists all the data sets on the disk by name. The second report graphically displays the hierarchy of a disk (disk, cylinder, track and data set). Most importantly, the disk is displayed showing both free and used space for each data set. This enables the user to easily add new data sets to the free space or to release the unused space within the data set. Also, the number of defective tracks on each pack is given to spot further problems on the disk.

SECTION 2: REPORTS

There are two main reports produced by DISKPLAY which can be repeated on as many pages as necessary. The first report lists all the data sets by name on a disk in the order in which they reside. Each data set is given an alphanumeric character as its "ID". This character is what is graphically displayed on the second report. It locates the data set. Other detailed information is given for each data set; i.e., name, date of creation and date of expiration, type of file organization (ISAM, SEQ, etc.), type of extent encountered, beginning and ending addresses, etc. A more detailed description of this report is given later in this section as well as an example of the report.

The second report is the actual graphic display of the disk as a whole showing cylinders, tracks and data sets. The report readily shows the user the actual location of both free and used space on a data set. A final feature of this report is a listing of any defective tracks on this volume; (this data may appear on a separate page). A more detailed explanation as well as an example of this report appears later in this section.

Report 1

The following is a detailed explanation of this report. See section A of Figure 1.

- The VTOC is located on the pack and read sequentially.
- The files shown on the pack are sorted into the order in which they reside on the pack before they are listed.

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BOOLE & BABBAGE, INC.

BALANCE SHEET

September 30, 1977 and 1976

ASSETS

	1977	1976
Current assets:		
Cash in banks and savings accounts	$1,140,520	$ 114,220
Marketable securities, at cost which approximates market	-	694,437
Accounts receivable (Note 2)	1,084,827	638,535
Lease contracts receivable (Notes 1 and 3)	328,841	219,439
Prepaid expenses	5,729	4,181
Total current assets	2,559,917	1,670,812
Lease contracts receivable due after one year (Notes 1 and 3)	373,445	172,404
Equipment and leasehold improvements, net of accumulated depreciation and amortization of $61,863 in 1977 and $34,869 in 1976 (Note 1)	195,067	90,184
Other assets:		
Purchased computer software, net of accumulated amortization of $163,914 in 1977 and $82,747 in 1976 (Note 1)	47,096	128,263
Other	15,623	7,160
	$3,191,148	$2,068,823

LIABILITIES AND STOCKHOLDERS' EQUITY

	1977	1976
Current liabilities:		
Accounts payable	$ 126,500	$ 35,299
Accrued liabilities	226,973	116,413
Profit incentive bonus due within one year (Note 5)	103,077	76,093
Contracts payable due within one year	7,734	97,200
Income taxes payable (Notes 1 and 4)	256,615	-
Deferred taxes on income (Note 4)	521,000	211,000
Total current liabilities	1,241,899	536,005
Profit incentive bonus due after one year (Note 5)	91,970	69,867
Contracts payable due after one year	10,068	7,504
Stockholders' equity (Note 7):		
Common stock, $.10 stated value; authorized 1,000,000 shares, issued and outstanding 707,849 shares (710,768 shares in 1976)	70,785	71,077
Capital in excess of stated value	996,030	1,001,576
Retained earnings	780,396	382,794
Total stockholders' equity	1,847,211	1,455,447
	$3,191,148	$2,068,823

See accompanying notes.

BOOLE & BABBAGE, INC.

STATEMENT OF INCOME

Years ended September 30, 1977 and 1976

	1977	1976
Sales (Note 1)	$5,740,343	$3,778,903
Costs and expenses (Note 1):		
Service department	37,449	101,929
Marketing	1,980,095	1,383,276
Engineering, research and development	1,424,720	751,644
General and administrative	908,829	567,300
Interest, net	(145,339)	(76,199)
Provision for profit incentive bonus (Note 5)	131,563	100,989
	4,337,317	2,828,939
Income before provision for taxes on income and extraordinary item	1,403,026	949,964
Provision for taxes on income (Notes 1 and 4)	723,000	464,000
Income before extraordinary item	680,026	485,964
Extraordinary item - reduction in federal income tax arising from the utilization of net operating loss carryover and the deduction of prior years' accounting losses (Note 4)	-	45,000
Net income	$ 680,026	$ 530,964
Earnings per share (Note 1):		
Income before extraordinary item	$.94	$.68
Extraordinary item	-	.06
Net income	$.94	$.74

See accompanying notes.

BOOLE & BABBAGE, INC.

PROFIT AND LOSS FORECAST

FISCAL 1978 ($000)

	1977			1978									
	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	TOTAL FY '78
SALES:													
PPE/TSA	34.0	72.0	61.0	70.0	73.0	84.0	74.0	82.0	84.0	78.0	81.0	90.0	883.0
CUE/DSO	103.0	91.0	98.0	108.0	103.0	111.0	82.0	91.0	71.0	80.0	93.0	110.0	1,141.0
CMF & REALTIME	-----	----	15.0	18.0	21.0	28.0	17.0	36.0	40.0	50.0	31.0	35.0	291.0
OPTIONS	6.0	6.0	6.0	7.0	8.0	6.0	6.0	7.0	6.0	6.0	5.0	6.0	75.0
APO	15.0	20.0	25.0	27.0	25.0	27.0	23.0	23.0	24.0	26.0	24.0	28.0	287.0
CAS/CPA/FMR	20.0	61.0	32.0	31.0	35.0	41.0	20.0	41.0	24.0	37.0	40.0	53.0	435.0
CIMS/REALTIME	23.0	30.0	35.0	43.0	50.0	61.0	42.0	54.0	46.0	65.0	64.0	67.0	580.0
RESOLVE	45.0	50.0	52.0	45.0	53.0	60.0	55.0	55.0	60.0	60.0	55.0	60.0	650.0
RESOLVE RENT	12.0	13.0	16.0	18.0	20.0	23.0	25.0	27.0	30.0	32.0	35.0	37.0	288.0
DAS	-----	----	----	10.0	25.0	25.0	25.0	25.0	30.0	35.0	30.0	45.0	250.0
MAIL	7.0	4.0	3.0	4.0	7.0	6.0	5.0	7.0	8.0	6.0	7.0	8.0	72.0
TOTAL NEW PRODUCT SALES	265.0	347.0	343.0	381.0	420.0	472.0	374.0	448.0	423.0	475.0	465.0	539.0	4,952.0
MAINTENANCE & USE	123.0	84.0	181.0	94.0	78.0	114.0	137.0	89.0	56.0	110.0	159.0	166.0	1,391.0
STUDIES	-----	-----	3.0	-----	-----	2.0	-----	-----	3.0	-----	-----	2.0	10.0
ROYALTIES	91.0	75.0	60.0	51.0	55.0	73.0	80.0	73.0	78.0	60.0	50.0	65.0	811.0
TOTAL REVENUES	479.0	506.0	587.0	526.0	553.0	661.0	591.0	610.0	560.0	645.0	674.0	772.0	7,164.0
LESS: COMMISSIONS	33.0	31.0	36.0	44.0	38.0	55.0	35.0	37.0	37.0	45.0	40.0	56.0	487.0
ROYALTIES	15.0	17.0	19.0	19.0	20.0	21.0	23.0	25.0	22.0	25.0	30.0	31.0	267.0
NET CONTRIBUTION	431.0	458.0	532.0	463.0	495.0	585.0	533.0	548.0	501.0	575.0	604.0	685.0	6,410.0
EXPENSES:													
SERVICES	1.0	2.0	2.0	1.0	2.0	-----	-----	-----	-----	-----	-----	-----	8.0
MARKETING	141.0	156.0	148.0	161.0	190.0	168.0	216.0	180.0	182.0	176.0	177.0	171.0	2,066.0
SOFTWARE ENG.	169.0	184.0	178.0	175.0	177.0	172.0	168.0	172.0	169.0	167.0	174.0	168.0	2,073.0
HARDWARE ENG.	1.0	11.0	7.0	7.0	7.0	9.0	9.0	11.0	11.0	11.0	11.0	11.0	106.0
G & A	87.0	92.0	93.0	95.0	95.0	94.0	96.0	96.0	96.0	97.0	94.0	93.0	1,128.0
TOTAL EXPENSE	399.0	445.0	428.0	439.0	471.0	443.0	489.0	459.0	458.0	451.0	456.0	443.0	5,381.0
NET OPERATING PROFIT	32.0	13.0	104.0	24.0	24.0	142.0	44.0	89.0	43.0	124.0	148.0	242.0	1,029.0
OTHER INCOME	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	16.0	16.0	181.0
PROFIT BEFORE PROFIT PLAN	46.0	28.0	119.0	39.0	39.0	157.0	59.0	104.0	58.0	139.0	164.0	258.0	1,210.0
PROV.FOR PROFIT PLAN	4.0	4.0	8.0	5.0	5.0	8.0	8.0	9.0	9.0	9.0	10.0	14.0	93.0
PROFIT BEFORE TAXES	42.0	24.0	111.0	34.0	34.0	149.0	51.0	95.0	49.0	130.0	154.0	244.0	1,117.0
STATE/FEDERAL TAXES	12.0	9.0	58.0	18.0	18.0	78.0	27.0	50.0	26.0	69.0	81.0	129.0	575.0
NET PROFIT	30.0	15.0	53.0	16.0	16.0	71.0	24.0	45.0	23.0	61.0	73.0	115.0	542.0

BOOLE & BABBAGE, INC.

BALANCE SHEET AS OF

September 30, 1978

ASSETS		LIABILITIES	
CURRENT ASSETS:		CURRENT LIABILITIES:	
Cash	$ 25,000	Accounts Payable - Trade	$ 150,000
Marketable Securities	1,300,000	Accrued Commissions & Royalties	95,000
Accounts Receivable Trade Net	925,000	Accrued Expenses	90,000
Notes Receivable	6,000	Contracts Payable-Short Term	7,100
Employee Advances	2,500	Profit Incentive Plan-One Year	46,500
Lease Receivables	800,000	State Income Tax Payable	125,000
Prepaid Income Taxes	488,000	Federal Income Tax Payable	600,000
Prepaid Expenses	42,500	Deferred Taxes	350,000
Inventory	38,000		
Total Current Assets	3,627,000	Total Current Liabilities	1,463,600
EQUIPMENT & INTANGIBLES:		LONG TERM LIABILITIES	
Fixed Assets	321,000	Contract Payable	7,000
Depreciation Reserve-Fixed Assets	< 100,259 >	Profit Incentive Plan	175,000
Computer Software	341,000	Total Long Term Liabilities	182,000
Depreciation Reserve-Software	< 275,567 >		
Total	286,174	EQUITY:	
		Capital Stock	72,000
		Capital Surplus	1,010,000
		Retained Earnings	
		-Prior Years	1,093,000
		-Current Years	585,000
		Dividends	<492,426>
		Total Equity	2,267,574
TOTAL ASSETS	3,913,174	TOTAL LIABILITIES & EQUITY	3,913,174

/ml

BOOLE & BABBAGE, INC.
BUDGET RECAP - FY'78

EXPENSES	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	TOTAL
Payroll	152097	168385	178748	185682	189255	191631	194523	199615	200505	200807	202153	202848	2,266,249
Payroll Taxes	5350	6105	6287	16265	16334	16698	15601	12837	10917	10302	9829	9199	135,724
Group Insurance	6785	6885	6985	7085	7185	7285	7385	7385	7385	7485	7485	7485	86,820
Workman's Comp. Ins.	320	320	320	430	430	430	430	530	530	530	530	530	5,330
Rent	12028	12028	12028	12425	13210	13210	13210	13210	13610	13610	13610	13610	155,789
Utilities	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	19,200
Building Maintenance	600	600	600	600	600	600	600	600	600	600	600	600	7,200
Equipment Maintenance	1775	1775	1775	1775	1775	1775	1775	1775	1775	1775	1775	1775	21,300
Telephone	17877	18377	19002	20202	21452	21402	21902	21902	22052	22552	22552	22552	251,824
Insurance - General	370	370	370	370	370	370	370	370	370	370	370	370	4,440
Property Tax	620	620	620	620	620	620	620	620	620	1000	1000	1000	8,580
Leasehold Improvements	85	85	85	85	85	85	85	85	85	85	85	85	1,020
Depreciation - All	3150	3200	3225	3300	3300	3300	3300	3300	3300	3300	3300	3300	39,275
Travel	38326	53739	43526	46226	49906	53856	57081	53332	49522	45953	52813	47283	591,563
Postage	2674	3674	2774	2824	3924	2934	2944	3944	2944	2944	3944	2952	38,476
Operating Supplies	12643	12643	14143	14173	12898	12898	12898	12898	12898	12898	12898	12898	156,786
Stationery & Office	3542	3542	3552	3557	3757	3782	3782	3782	3782	3782	3782	3782	44,424
Printing	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	30,000
Equipment Lease	8168	8168	8168	8168	8168	8168	8418	8418	8603	8603	8603	8603	100,256
Professional Services	11000	11000	11000	6000	6000	6000	6000	6000	6000	6000	6000	6000	87,000
Computer Usage	35458	37708	39142	41600	42203	39608	39609	40208	40309	40908	41009	41610	479,372
Other Outside Services	4219	4219	4219	4544	4844	4869	4869	4869	4969	5069	5169	5169	57,028
Dues, Subscriptions	1595	1295	1095	1065	1215	1065	1115	1065	1165	5565	1065	1115	18,420
Employee Education	7825	12175	10525	9960	7691	3510	9005	4010	3510	4210	3010	2010	77,441
Employee Recruitment	32914	23855	11996	6512	16406	4496	9496	9496	4996	1996	1996	1996	126,155
Employee Relocation	4500	5000	3000			2000	3000		3000		2000	2000	24,500
Freight	1325	1325	1325	1325	1325	1325	1325	1325	1325	1325	1325	1325	15,900
Other Taxes	100	100	100	100	100	100	100	100	100	100	100	100	1,200
Employee Welfare	1000	1000	2000	1000	1000	1000	1000	1000	1000	1000	1000	1000	13,000
Charitable Contributions	165	165	165	165	165	165	165	165	165	165	165	165	1,980
Advertising	16192	19192	16192	16192	19192	16192	16192	18792	16192	16192	19592	16192	206,304
Exhibits & Shows		1100	1200	1700	10100		15000	1800	9400	5000	600		45,900
Sales Awards & Prizes	3875		1000	3500	3000	1000	14000	500	-0-	2000	4700	5100	38,675
Interest Expense	150	150	150	150	150	150	150	150	150	150	150	150	1,800
Amortization-Software	7417	10417	10417	10417	10417	10417	10417	10417	10417	10417	7417	7417	116,004
	398245	433317	419834	432117	461177	435041	480467	448600	446296	440793	444727	434321	5,274,935

Effective: February 28, 1978

BOOLE & BABBAGE, INC.

BOARD OF DIRECTORS

F. P. Johnson, Jr. Chairman

B. T. Coleman
W. C. Edwards
D. Katch
T. J. O'Rourke
C. H. Reynolds

President

B. T. Coleman

Effective: February 28, 1978

Approved: B. T. Coleman
B. T. Coleman

PRESIDENT

B. T. Coleman

- **Hardware Engineering** — C. D. Warner, Vice President
- **Planning & Administration** — B. T. Coleman
- **Marketing** — R. C. Coolidge, Vice President
- **Software Engineering** — T. M. Hoger, Vice President

Effective: February 28, 1978

Approved: R. C. Coolidge
R. C. Coolidge

MARKETING

R. C. Coolidge, Vice President

Operations Division

J.E. Zipp, Nat. Marketing Manager

Sales
P.W. Gleason
R.J. Germscheid
M.R. Reagan
R.T. Spurr
G.S. Spieler
W.H. Rogers, Jr.
R. Russo

Headquarters

International

Computer Program Products
(SMS Products-Europe)

SLIGOS (France)

IP Computer Consultants Pty.,Ltd.
(Australia/New Zealand)

Advanced Technology Ltd.
(Israel)

Bror Anderson AB
(Scandinavia)
SYNTAX (Italy)

CGS Products
(RESOLVE-Europe)

Tokyo Systems Labs, Inc.
(Japan)

CAP, Pty., Ltd.
(South Africa)

Services

SMS Division

D.S. Crow, Nat. Marketing Manager

Sales
G. G. Bakelaar
J. L. Baker
W. L. Baker
G. W. Goodwin
J. H. Jackson
T. H. Politowski
L. W. Rocque
B. A. Ruks
R. G. Rackley

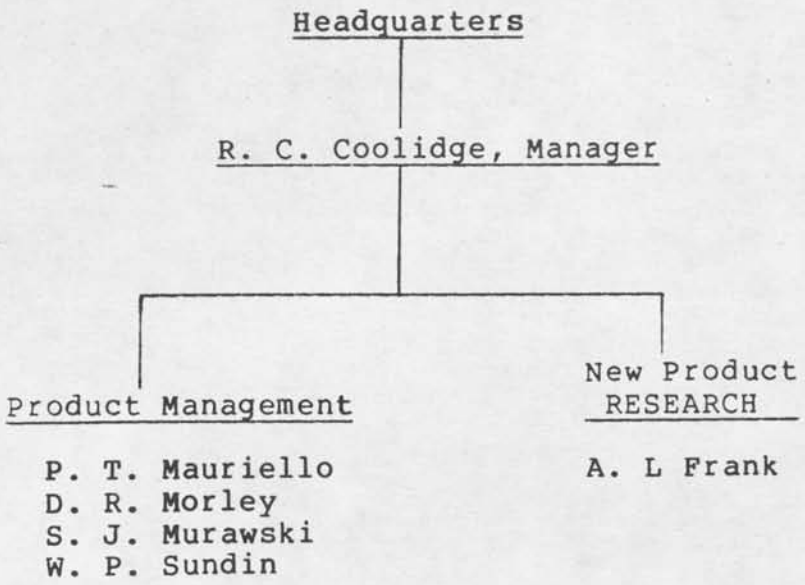
Technical Support

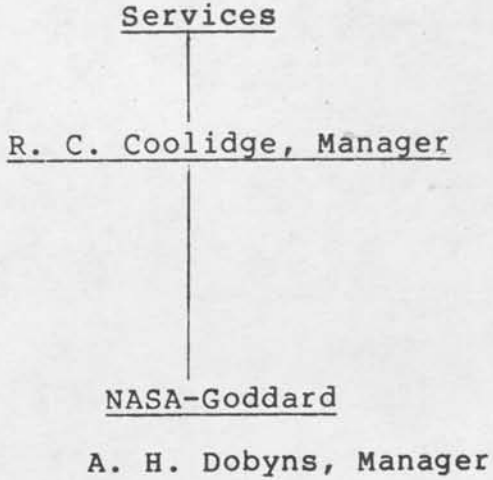
M.P. Brennnan, Nat. Tech. Manager

L. B. Clapp
A. L. Kleinecke
J. C. Lafferty
C. M Sabo
L. R. Scroggins
M. A. Tyrrel

Effective: February 28, 1978

Approved: R. C. Coolidge
R. C. Coolidge

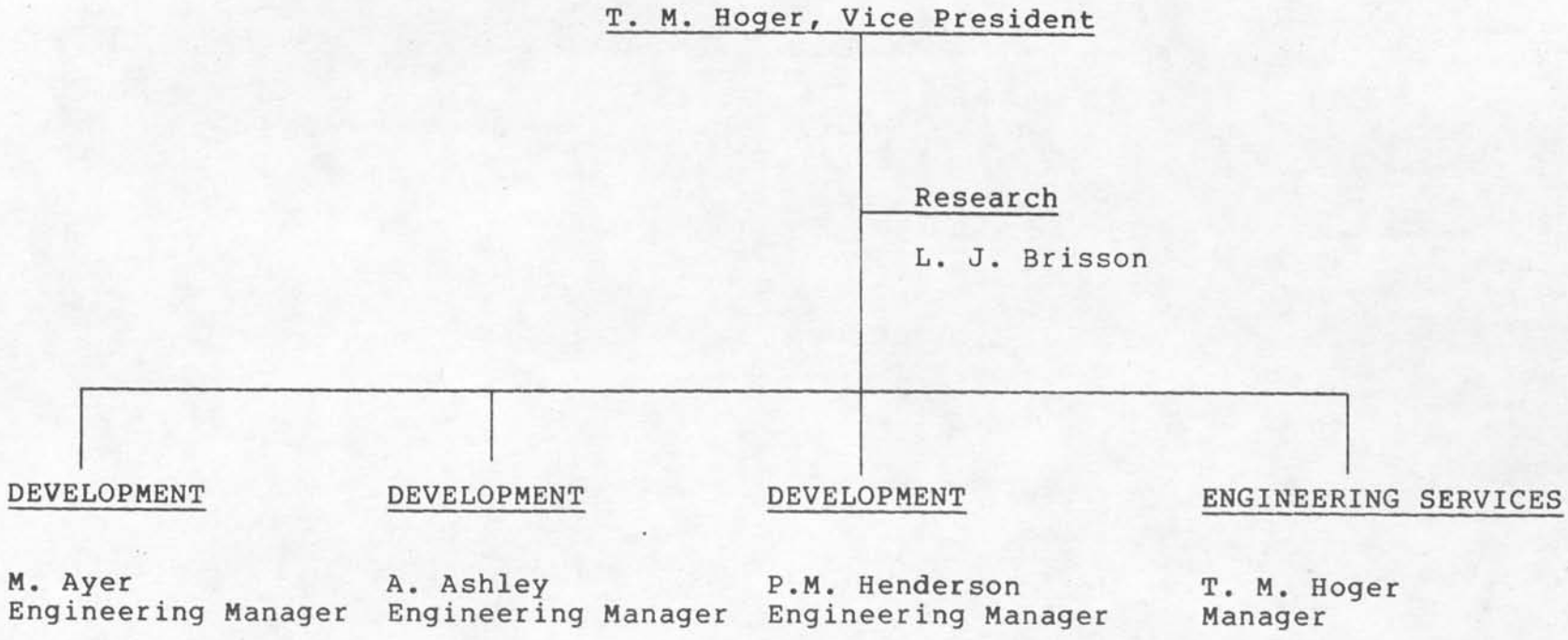




Effective: February 28, 1978

Approval: T. M. Hoger
T. M. Hoger

SOFTWARE ENGINEERING



Effective: February 28, 1978

Approved: T. M. Hoger
T. M. Hoger

SOFTWARE ENGINEERING

T. M. Hoger, Vice President

DEVELOPMENT

M. Ayer, Engineering Manager

CMF/VS1 EXTRACTOR PROJECT

M. Challenger, Proj. Leader
R. Britton

M. James

CMF/MVS EXTRACTOR PROJECT

E. Bank, Proj. Leader
W. Bauman
A. Whitman
K. Williams

CMF ANALYZER PROJECT

M. Withrow, Proj. Mgr.
T. Southworth
D. Wertheim
C. Wilkins
T. Smith

Effective: February 28, 1978

Approval: T. M. Hoger
T. M. Hoger

SOFTWARE ENGINEERING

T. M. Hoger, Vice President

DEVELOPMENT

A. Ashley, Engineering Manager

TSA/PPE PROJECT

W. Overstreet, Proj Mgr.
T. Fuller
N. Jones
J. Lockhart

DSO PROJECT

S. D. Hunsaker
T. Marshall

OPERATIONS DIVISION PROJECT

S. Mesch, Proj. Mgr.
M. Andrews
J. Calder
C. Stanley
D. Tootill

Effective: February 28, 1978

Approved: T. M. Hoger
T. M. Hoger

SOFTWARE ENGINEERING

T. M. Hoger, Vice President

DEVELOPMENT

M. Henderson, Engineering Manager

CAS/CPA PROJECT

T. Butler, Proj. Mgr.
M. Chen
J. Close
P. Munson
J. Tyler

DB/DC PROJECT

E. Roman, Proj. Mgr.
J. Quenet
H. Scofield

ENGINEERING TECHNICAL SUPPORT

K. Ballard, Proj. Mgr.
R. Boyd
D. McFarland
D. Weiner

Effective: February 28, 1978

Approved: T. M. Hoger
T. M. Hoger

T. M. Hoger, Vice President

SOFTWARE ENGINEERING SERVICES

T. M. Hoger, Manager

TECHNICAL SYSTEMS SUPPORT

B. M. Clay, Manager

CUSTOMER SERVICE

A. Findley
D. Hefner
J. Jensen
S. Scofield

PRODUCT DISTRIBUTION

C. Schneider
K. Frye

PRODUCT VALIDATION

J. Jett

DOCUMENTATION

J. A. Biles, Manager
C. W. Helsing
V. C. Soder
D. W. Monar
H. Schorr

Effective: February 28, 1978

Approved: C. D. Warner
C. D. Warner

HARDWARE ENGINEERING

C. D. Warner, Vice President

R. L. Allardyce, Manager, Special Project
(Consultant)

Bruce Palmer

Effective: February 28, 1978

Approved: B. T. Coleman

B. T. Coleman

PLANNING & ADMINISTRATION

B. T. Coleman, Manager

Accounting

M.J. Heber, Manager
P.G. McIntyre

Exec. Secretary
D.A. Skelton

Corporate Secretary
Personnel Manager

E.H. Goss

Headquarters Secretaries

B.J. Atherton (Part Time)
G.A. Ausman (Part Time)
M.C. Buonocore
L.I. Chaffee
L.M. Emmenegger
M. Haniotis
J.R. Knight (Part Time)
M.J. Lattanzio
M.L. Lewis
A.H. Moreno
N.J. Roey
M.F. Tom

Administrative Services

J.R. Moriarty, Manager
R.E. Alvis
F.W. Bolm
E.H. Macken (Part Time)
N.J. McIlrath
A. Rubio
C.M. Ryan (Part Time)
R.F. Patzer
D.L. Sink
P.A. Taylor (Part Time)
D.M. Thompson