AN ASSESSMENT OF

MAINTENANCE RELATED SUBJECTS

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INTRODUCTION

INTRODUCTION

- This report was prepared by INPUT in response to a set of specifications set forth by Xerox Corporation in a document entitled "Subjects for INPUT Review" which was prepared in October 1979.

- The purpose of the information presented in the report is to provide Xerox with additional insight into a variety of field service related topics from the perspective of the data processing industry.

- Topics addressed herein include:

  - Service costs.

  - Technical skills requirements and availability.

  - Customer involvement in maintenance.

  - Incremental service pricing.

  - Diagnostic trends.

  - International companies (U.S. versus Western Europe).

  - Spares availability.

- Most of the information presented in this report was derived from existing research carried out by INPUT in the maintenance field. This base of information includes:

  - Multiclient studies of "Maintenance Requirements in the Information Processing Industry."

    . United States.

    . Western Europe.

  - INPUT's "Field Service Planning Information Program" a continuing information service. Recent studies issued in conjunction with the program include the following titles:

    . "IBM's Maintenance Policies."

    . "Remote Diagnostics."

    . "Instrumentation Trends."

    . "Software Maintenance."

    . "First Line Managers."

  - Interviews carried out in connection with a number of custom research projects.

- In addition, the INPUT staff talked to approximately 20 firms to obtain service cost, contract and spares data.

- Recommendations are based on the research combined with the experience and judgement of INPUT's senior staff.

- Inquiries and comments on the information presented are invited.

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

A. CONCLUSIONS

- Using the ratio of corporate revenues/number of field service employees as a measure of field service productivity shows that Xerox compares favorably with the computer industry.

  - The closest (to Xerox) DP product categories average about $250,000/employee, while the Xerox average is stated as $300,000/employee.

- INPUT believes that total service cost as a percent of revenues for the DP industry is equal to or greater than the 21-22% figure provided by Xerox, although substantial data was not available to back up this conclusion.

- Over the next three years, service costs should climb as a percent of revenues largely due to high personnel turnover rates. Beyone 1983-1984, the ratio should decrease with the more widespread use of highly reliable equipment and more efficient and less costly diagnostic and repair procedures.

- By the mid-1980s, the EDP industry will evolve to a three tiered "tech rep" structure.

- Local Field Service Technicians, whose function is to handle routine testing and maintenance functions requiring "cookbook" methods.

- Local Field Support Specialists, whose function is to deal, at the local level, with problems too difficult for the technicians to solve.

- Central Site Support Specialists, whose function is to support the field on problems that cannot be handled with local skills.

- Education, experience and other qualifications for these people will vary significantly as will pay scales and career opportunities.

- INPUT believes that, in the 1980s, Xerox will draw many of its new hires from the same population as the EDP industry. Therefore, the two will be in direct competition for new recruits.

  - Xerox may get the worst of this, because there is a perception that computer technology is more interesting than electromechanical technology.

- Xerox will be increasingly susceptible to "people piracy." This will be particularly true for managers, since field service management skills at Xerox are directly transferable to the computer industry.

- INPUT found that while the Xerox fringe benefit program is excellent, salaries appear to be at the low end of the EDP industry's wage scales. (Direct comparison was not possible because of definitional differences.)

- There are three types of service agreements in common use in the EDP industry: on-site, depot, and time and materials.

  - The work covered in these agreements includes one or more of the three basic types of maintenance services; i.e., preventive maintenance, remedial maintenance, engineering changes.

- Most firms guarantee response time in the event of a customer originated trouble call. This is, typically, two to six hours.

- There are several emerging trends that are beginning to influence the composition of service agreements:

  - Increased customer involvement in diagnostic and repair procedures.

  - The shrinking physical size of equipment which makes depot maintenance practical for a much greater number of devices.

  - Lower maintenance costs as a result of either more reliable equipment being produced, or improved diagnostic maintenance aids.

- Users will demand reduced maintenance charges for their participation. However, even though the dollars paid for maintenance per customer will decrease, the ratio of maintenance costs to hardware costs will continue to remain steady or to advance as hardware costs decline.

- The closest parallels to Xerox' reprographic systems are other office systems such as word processors, PBXs and small business computers.

  - The degree to which service requirements for these devices truly parallel Xerox' products is a function of the similarity of the customer's availability requirements.

- Although today nearly all service provided on short-term leased or rented equipment is bundled into the lease agreement, INPUT believes that within ten years, nearly all post-warranty service will be unbundled, reflecting general recognition of the "service as a product" concept by the EDP industry.

  - INPUT forecasts that U.S. expenditures for service related to information processing will reach $20 billion by 1984.

- Vendors are realizing the inherent potential for profit that can be derived from the service function.

- EDP vendors will normally provide customers with the same kind of support given to their own field service people if they want it. This includes attendance at vendors' training schools, service documentation, test equipment, etc.

- On-site spares are finding increasing acceptance, although the benefits to either customer or vendor are a function of customer size, site location, and other factors.

- Although the concept of incremental services pricing is not widely used, we are beginning to see "experiments" that clearly point to its much broader use in the future.

  - IBM has recently introduced incremental pricing for software service and some hardware services in connection with a few of its newly announced products. Since IBM sets de facto standards for service in the EDP industry, we expect to see more of the same from other firms.

- In the diagnostic area, there are several important trends:

  - Special test systems designed for off-line use are finding increasing application, particularly for peripherals such as disk drives and printers. Many are programmable and are capable of changing the diagnostics to suit a wide range of products.

  - Built-in diagnostics are becoming common for devices which have microprocessor elements. In a few cases microprocessors will be incorporated into the equipment solely for the purpose of diagnosis.

  - The use of remote diagnostics is rapidly becoming commonplace. However, since remote diagnostics are provided by vendors to diagnose

their own equipment, they are nearly worthless as a systems diagnostic tool in a multivendor environment.

- Soft failure diagnosis continues to be a number one problem. The only viable solution is to improve product engineering so that the chances of a soft failure occurrence is minimized.

B. INTERNATIONAL COMPARISONS

- In general, the U.S. and Western European environments are quite similar vis-a-vis the service function. There are, however, some significant differences:

  - European users are more "sensitive" to the service issue then are Americans.

    . INPUT found that 25% of the Europeans actually returned equipment or cancelled their dealings with a vendor specifically because of poor maintenance performance. The corresponding figure in the U.S. is less than 5%.

  - Although Europeans ranked service as a purchase criterion as high as did Americans, they rarely made an in-depth evaluation of vendors' service before making a purchase decision. Thus, the customer's perception of service (rather than the fact of the matter) is a critical sales point.

  - The concept of service as a profit generator is rarely realized in Europe, while in the U.S., an increasing number of firms in the EDP industry run service as a profit center.

- It is far more common to find European users participating in maintenance than Americans. The chief motivating factor appears to be price rather than

increased availability (as it is in the U.S.). This also reflects the higher purchase/lease ratio in Europe.

- As in the U.S., Europe is facing an acute shortage of field technicians.

  - In Europe, a service career is considered second class. Personnel are brought into their positions through apprenticeship programs similar to those used for the building trades. Pre-work academic qualifications are often minimal.

  - Although the separation rate for field service people in Europe is half that encountered in the U.S. (5% versus 10%), it is very high by European standards.

  - As a result of these and other factors, service in Europe is generally not up to the quality of that found in the U.S., although there are many exceptions to this statement.

- The spare parts shortage appears to be more intense in Europe than in the U.S. A contributing factor is that the low average quality of technicians results in many "good" parts being sent back to the factory for repair.

C. RECOMMENDATIONS

- Xerox should develop contingency plans directed at preventing "people piracy" from the EDP industry and ensuring an adequate supply of new hires in the field service function.

  - Maintenance of fringe and salary parity is essential. Xerox should consider participating in one of the EDP industry salary surveys. (The best one is put out by the Hay organization on a semi-custom basis.)

  - Career path opportunities must be visible to employees.

  - The establishment of "pre-graduation" recruiting programs designed to spot and cultivate talent before it reaches the open job market is a highly recommended way of securing qualified recruits.

- Xerox should begin to experiment with partially or fully unbundled service using incremental pricing schemes. These should not be offered to the entire customer base until proven. In other words, move cautiously.

- In conjunction with the above, depot maintenance centers should be established, particularly for portable equipment. "Loaners" can be provided to make their use more attractive to users.

- Systems aimed at increasing the user's participation in diagnosis and repair should be investigated. This is obviously a major step. Some of the implications are:

  - Products will need to be re-engineered for the unsophisticated user.

  - New documentation will have to be developed and maintained.

  - Training centers and other forms of support will have to be made readily available to customers.

  - New procedures, instrumentation and fault displays will be required.

- Maintenance contracts providing sufficient flexibility to meet individual users availability requirements should be offered. In some situations, the stocking of on-site spares should be offered, perhaps for a price.

- Xerox should study the feasibility of new diagnostic systems, including:

  - Remote diagnostics.

- Built-in diagnostic systems.

- On-site "maintenance computers."

- Soft failure rates will have to be minimized through better product design and engineering, particularly if user involvement becomes significant.

- Recognize that differences do exist between the U.S. and Europe and, within Europe, that there are significant differences between individual countries. Policies, programs, systems, etc. should have enough "built-in" variability so they can be "tuned" to address the market requirements of individual countries.

D. AREAS FOR FUTURE STUDY

- In the course of preparing this study, and, as a result of discussions with several Xerox people, INPUT has identified several areas it believes are worthy of further study. These are briefly identified in the following paragraphs. They were formulated without knowledge of any other internal or external work being conducted by Xerox.

1. SERVICE AS A PRODUCT

- In Chapter IV-A, the subject of service as a product is addressed. INPUT states unequivocally that (at least in the data processing industry) service will be a major contributor to corporate revenues and profits.

  - Xerox should dimension the revenue/profit opportunity from its own perspective.

  - If the size of the opportunity warrants further investigation, the means by which service is offered (by Xerox) as a product must be identified.

. For example, what are the tradeoffs between T&M and fixed price contracts in Xerox' context? Which should be offered and under what circumstances? Should maintenance contracts be bundled or unbundled - mandatory or optional?

- As a part of the analysis, customer willingness to participate in installation, diagnosis, and repair should be assessed.

2. SERVICE DISTRIBUTION

- New methods for distributing service are being introduced. Xerox needs to understand the implications of each method or system upon its own operations. INPUT envisions a series of cost/benefit analyses done for each approach. Examples of the kinds of things that might be examined (in random order) are:

  - On-site stocking of spares (including sale of high mortality kits).

  - Remote diagnostics.

  - User participation.

  - System support centers.

  - Regional/branch repair depots.

3. RESPONSE TIME COMMITMENTS AND ESCALATION PROCEDURES

- The necessity or relative importance of response time commitments and/or formal escalation procedures as they will impact Xerox competitive posture needs to be better understood. Questions to be addressed include:

  - Should these procedures vary by type of product or customer? If so, what type of structure is most appropriate for each product/market segment?

- What level(s) of commitment need be published?

- How important or effective are escalation procedures as a competitive tool?

- What are the customer's perceptions of escalation procedures? How much weight does he attach to them?

4. PERSONNEL ACQUISITION AND TRAINING

- In light of INPUT's earlier comments concerning the competitive environment for people and the expected shortfall of qualified personnel, Xerox should have an ongoing study program that addresses this issue.

  - Ways to enhance Xerox' competitive recruitment posture needs definition.

  - Compensation and other motivation practices need to be reviewed and changed before they prove to be inadequate.

  - Potential sources of people must be identified and evaluated from a long-term perspective.

I SERVICE COSTS

I SERVICE COSTS

A. CURRENT DATA

- Exhibit I-1 provides a compilation of comparative services costs within the information processing industry for all four categories of equipment:

  A - Large mainframes.

  B - Minicomputers.

  C - Small business computers.

  D - Terminals.

  These numbers have been used for comparative purposes with those provided by Xerox.

- Although information was not available for all service cost components, there are some comparisons that can be made.

  - As would be expected, the average revenue per employee for large mainframe companies was considerably higher than Xerox, $483,000 compared with $300,000.

EXHIBIT I-1

SERVICE COST/REVENUE RELATIONSHIPS
FOR THE INFORMATION PROCESSING INDUSTRY

COMPANY	1978-1979 REVENUES ($ MILLION)	SIZE OF FIELD SERVICE ORGANIZATION	REVENUE PER FIELD EMPLOYEE ($000)	TOTAL SERVICE COST %(REVENUE)[1]	COST OF LABOR %(REVENUE)[2]
A-1	$2,600	4,000	$ 650	9%	6%
A-2	2,800	9,700	288	21	14
A-3	2,500	4,350	574	10	7
A-4	327	750	428	14	9
WEIGHTED AVERAGE			$ 438	14%	9%
B-1	$1,800	8,000	$ 225	27%	17%
B-2	94	320	293	20	13
B-3	71	320	222	27	18
B-4	136	275	495	12	8
B-5	380	1,400	271	22	14
B-6	38	180	211	28	18
WEIGHTED AVERAGE			$ 240	25%	16%
C-1	$ 100	350	$ 285	21%	14%
C-2	61	100	610	10	6
C-3	110	600	183	33	12
WEIGHTED AVERAGE			$ 258	23%	15%
D-1	$ 87	650	$ 134	45%	29%
D-2	100	306	326	18	12
WEIGHTED AVERAGE			$ 196	31%	20%
COMPOSITE WEIGHTED AVERAGE			$ 358	17%	11%

(1) $60,000 – INCLUDES SALARY, FRINGE BENEFITS, OVERHEAD, AND TRAVEL
(2) $39,900 – INCLUDES SALARY (30,000) AND 30% FOR FRINGE BENEFITS

- However, the minis, terminals and small business computer categories which are most comparable to Xerox' line of business averaged about $250,000 per employee.

  . The fact that Xerox does considerably better probably stems from the fact that Xerox's equipment densities are higher.

- The peripherals category numbers are clearly not conclusive because of the small sample and the very wide variation between the two companies listed. However, INPUT believes that a larger sample would show peripheral vendors to be in the $300,000-$350,000/employee range.

  . While peripherals take more time to diagnose and repair than processors, they are so often present in large numbers at single sites that field engineers can be very efficient.

- Total service cost as a percent of revenue is lower for all four categories. However, the values presented in the exhibit for total service costs only account for salary, associated fringe benefits, overhead and estimated travel costs.

  . The percentage figures shown in the last two columns of Exhibit I-1 are not all one-to-one comparable, since they relate to corporate revenues, which, in some cases, include sales from non-EDP related product lines. In addition, company size and product line mix are important factors that are not separated out.

- If information had been available on parts costs and distribution costs, it is believed that total service cost as a percent of revenues for most companies would have been equal to or greater than the 21-22% provided by Xerox.

B. FUTURE TRENDS

- For at least the next three years INPUT believes that the demand for field engineering personnel within the information processing industry will increase at an AAGR (average annual growth rate) of approximately 15%.

- This level of demand over the next three years will result in increased labor costs for the following reasons:

  - There will not be a sufficient availability of field engineering personnel to meet these demand levels.

  - This will force information processing companies to increase their expenditures for recruiting and training costs.

  - Salaries will increase by as much as 15% on an annual basis as companies attempt to reduce their turnover rates. However, it is expected that employee turnover will continue to be a significant problem.

  - Companies will be willing to offer significant salary increases (up to 20%) to attract field engineers to their company.

- However, beyond this three year period some significant changes will occur which will reduce this demand/availability problem.

  - The next generation of equipment in all four categories will have increased reliability and availability which will reduce the amount of service required for the equipment, the amount of spare parts that must be maintained in inventories, and the associated distribution costs. Field service organizations will reduce their reliance on field delivered diagnosis. Maintenance and regional or national remote diagnostics centers will become standard within the industry. In addition to

providing better service, these remote diagnostic centers will offer the following advantages in reducing the cost of service:

- Decrease the number of field service personnel at the various field locations. This will be particularly true for highly qualified personnel who will be located at the remote diagnostic centers. This centralized pooling of expertise will permit more effective response to maintenance problems.

- Permit the hiring of less qualified people in the field locations and reduce the costs required to train these personnel.

- The activities of these people will be directed on-line by the remote diagnostic centers. In some cases it will be possible for the remote diagnostic centers to work directly with the users in completing remote maintenance activities.

- This will negate or reduce the number of maintenance calls that will be required by field personnel.

- Therefore, it appears that the costs associated with service will continue to increase over the next three to four years and begin to reduce after that time period.

- However, INPUT expects to see service costs related to <u>software</u> maintenance continue to increase for the foreseeable future.

- Thus, the <u>total</u> cost of service as a percentage of income derived from the sale of a <u>system</u> is expected to increase.

- Xerox' projections show a continual decline in the cost of maintenance. INPUT suspects that this is based on the traditional product line and does not address the issue of maintaining reprographics products in EDP/communications systems environments, with their attendant software problems.

II TECHNICAL SKILLS REQUIREMENTS AND AVAILABILITY

II TECHNICAL SKILLS REQUIREMENTS AND AVAILABILITY

A. SERVICE PERSON OF THE FUTURE

1. SUMMARY

- By the mid 1980s, three types of people will be required to meet the service demands of the integrated computer/office/communications systems in place at that time:

  - Local Field Service Technicians, whose function is to handle routine testing and maintenance functions requiring "cookbook" methods.

  - Local Field Service Support Specialists, whose function is to diagnose problems too difficult for the technicians. He may also participate with marketing in the design and sale of service support contracts.

  - Central Site or Regional Support Specialist, whose function is to support the field on problems that cannot be handled with local skills.

- This tri-level hierarchy of people each have their own role in the service organization, and each perform different functions and interface with customers in different ways and often on different levels. Thus, the skills and training requirements are different for each level.

- Of economic necessity, some of the functional requirements of the three levels may overlap, depending on customer base, product line density, geographic dispersion of specific products, and other factors.

- The service person requirements of the future, as projected here, align closely with INPUT's prognosis of IBM's future service philosophy which is just beginning to evolve.

2. HISTORICAL PERSPECTIVE AND DRIVING FORCES

- Ten years ago, the typical new hire field service technician in the computer industry was hired with a minimum of a two-year, A.A degree in electronics or several years experience, usually military.

  - A few companies, notably IBM, hired a high percentage of four-year degree individuals with engineering backgrounds.

- With this background, technicians already had a solid grounding in electronics. They needed only to be trained on specific pieces of equipment.

- Software systems were rudimentary compared to today's products. Not only that, but most users were relatively sophisticated and could very often distinguish between a hardware and a software fault.

- By the very nature of their jobs (in the field, remote from headquarters) and the way they were managed, field service technicians were generally self-motivated loners who operated relatively independently from the rest of the company.

  - Again, IBM is a notable exception. As IBM developed its concept of account control, the field service technicians (called a C.E., customer engineer) were part of an integrated team that contained marketing, design, software, and field service elements.

- Today, the environment has changed significantly. Of necessity, the composition of the field service force has begun to change to meet the new demands. Not only are the skill requirements changing, but also the methods of delivering service must change to meet the new challenges.

- The single biggest driving force is a shortage of required skills. The traditional sources, the military and technical schools, are no longer turning out enough people to meet the demand.

- The second major driving force is the proliferation of low cost systems, with a relatively broad geographic distribution, which has changed the whole economic structure vis-a-vis field service.

  - In 1970, a $1 million system could be supported by a resident field engineer who earned $12,000 per year.

  - Today, a system with the same capacity costs $100,000, and a field service technician capable of maintaining all elements of the system earns $25,000 per year.

  - Thus, the people cost ratio for the same function has changed from 1.2% to 25% in less than ten years!

  - In addition, where once a field service technician may have had to maintain 20 systems in a metropolitan area 10 miles in diameter, today he has to cover 10 systems in a rural area of perhaps 100 miles diameter.

    . Of course the same technician may now be able to cover 50 or 100 systems in the metropolitan area. However, rural and suburban growth rates are higher than that of metropolitan areas.

- The third major driving force has to do with technological advancement.

- Equipment is becoming more reliable. MTBF has improved (for electronic equipment) by at least an order-of-magnitude in the past ten years.

- More use of communications has led to the development of remote diagnostics, use of central dispatch, the ability to create fault-fix data bases, etc.

- Equipment has become modular. Diagnosis and repair can be made at the module level, rather than at the component level, tremendously simplifying the maintenance procedures.

- Designers are beginning to design for maintenance, employing devices such as built-in diagnostics, simple back-plane wiring, easy to read fault indicators, and redundant circuitry.

3. SERVICE PERSON OF THE FUTURE REQUIREMENTS

a. Local Field Service Technician (LFST)

- LFSTs exist primarily to handle routine service functions such as:
  - "Cookbook" PM diagnostics and routines.
  - Repair at the module or unit replacement level.
  - Cleaning and burnishing of mechanical components.
- Skill and training requirements for LFSTs are relatively minimal:
  - LFSTs do not have to be versed in theory of operations.
  - LFSTs can be taught by rote.

- A high school education should be sufficient in most cases where applicants show an electro-mechanical preference.

- The appearance requirements of LFSTs will be a function of the geographic area in which they operate, the type of clientele served, and the local competition.

- Depending on function, this category will include both exempt and non-exempt employees.

- Coincident with a heavy influx of this class of employee, companies will need and want to have programs in place to detect and train individuals so that they can progress beyond this basic level if qualified and motivated.

b. Local Field Service Support Specialist (LFSS)

- LFSSs serve as backup to the LFSTs, taking charge of problems that they cannot deal with.

  - LFSSs must have a thorough grounding in theory of operations of all systems with which they will come in contact.

  - Many positions will require the equivalent of a four-year degree.

  - Most will have to comprehend software.

- LFSSs will have to receive formal training on specific products from both hardware and software standpoints.

- Most LFSSs will have to be generalists since they will have to make decisions on non-routine problems as they come up and will have to deal across a broad spectrum of products and systems.

- LFSSs are professionals in the usual sense of the word. They need to look and act like professionals.

  - LFSSs will frequently interface with marketing/sales and may asisst or actually have responsibility for the creation and sale of maintenance programs for individual customers.

- LFSSs will be exempt employees.

c. Central Site Support Specialists (CSSS)

- Central Site Support Specialists are resident at headquarters or regional locations and are responsible for dealing with problems beyond the capabilities of field personnel.

- CSSSs are specialists in every sense of the word. They have in-depth knowledge of specific products; indeed, depending on complexity, their knowledge may be limited to an individual subset of a product. For example, the central logic unit, or the operating system software package.

- CSSSs will have a variety of backgrounds, specific to their function. Some examples of these specialties are:

  - Circuit design.

  - Systems software design.

  - Test instrumentation.

  - Mechanical engineering.

  - Network design.

  - Applications programming.

- Most CSSSs will have at least the equivalent of a four-year college degree.

  - In-house training will frequently include participation in the system design, development engineering, and software development teams originally responsible for a product.

- Since CSSSs will not normally interface directly with customers, appearance requirements are secondary.

- CSSSs will be exempt employees.

B. IMPACT ON XEROX

- It seems obvious to INPUT that Xerox is drawing many of its new hires from the same population as is the EDP industry. Thus, the two are in direct competition for people.

- On the surface, it would seem that Xerox would be in no better or no worse position than any large EDP company.

  - However, it may be more difficult to recruit for the reprographics operation because of the level of technology involved in the company's products.

    . In general, prospective field service recruits perceive electronics as the leading edge technology and given a choice, it may seem a more interesting challenge than electromechanical work.

- The EDP industry has been able to do very little to deal directly with the personnel shortfall problem.

- In general, it accepts the fact that it will have to hire relatively unskilled people.

- The counter is to change the support systems rather than try to develop a broad-based educational system capable of turning out highly skilled people in numbers sufficient to carry out maintenance by traditional means.

  . The industry recognizes that these changes will negatively impact skilled employees, but most companies have not established plans to adequately address the issue.

  . IBM is an exception and is attempting to develop a long-range retraining program.

- Compliance with affirmative action programs has compounded the problem immensely.

• INPUT has learned that IBM has adopted a policy (you'll never see it on paper) of hiring one affirmative action qualified person for each other qualified person it brings into its field service organization!

  - Because of its size, Xerox is presumed to have a similar level of exposure.

• INPUT believes that Xerox will be increasingly susceptible to "people piracy" from EDP companies, particularly for experienced personnel.

  - As Xerox products increase their electronic content, the experience of the people will better fit the needs of the EDP industry.

  - Piracy may be particularly acute at management levels. There is no reason why management skills at Xerox are not directly transferable to other firms.

- In particular, the EDP industry is facing an acute shortage of first line managers. INPUT's study, "First Line Managers," November 1979, shows that the industry turnover rate for this position is now about 10% in the face of a need for 20% more managers in 1980 compared with 1979.

C. RECOMMENDATIONS

- Maintenance of salary and fringe benefit parity with the EDP industry is essential, since the majority of people in field service leave their companies for more money.

  - The Xerox fringe benefit program is excellent.

- Typical salaries in the EDP industry for field service personnel are as follows:

  - Trainees: $10,500 - $14,000, average $12,500.

  - Trained FEs: $13,000 - $24,000, average $17,000.

  - Senior FEs: $16,500 - $28,000, average $20,000.

  - Specialists: $18,000 - $35,000, average $28,000.

  - First Line Managers: $18,000 - $40,000, average $36,700.

- Correlation with Xerox's salary structure (as presented to INPUT) could not be carried out because differences in definitions preclude direct comparison. However, a cursory review of the figures provided by Xerox appear to show that their salaries tend toward the lower end of the EDP industry salary ranges.

- All Xerox employment categories were specified as non-exempt, while the last four categories of field service people for the EDP community are nearly always exempt positions.

- Even though specified as exempt, most EDP companies pay overtime and "hardship" differentials (e.g., night shifts, dangerous environments, etc.) for all categories up to the position of first line manager.

- Career path opportunity needs to be extremely visible.

  - One EDP company, admittedly an unusual case, makes all newly hired technical people spend time in the field service organization. Field service experience is a prerequisite for working in engineering or sales/marketing.

- To maximize its chances of assuring a continuing supply of people at the trainee level, Xerox should have an effective "pre-graduation" recruiting program designed to spot and cultivate talent before it gets into the open job market.

  - One way to accomplish this is to work through a selected group of technical schools by funding courses, supplying instructors, and carrying out an effective on-campus PR program.

  - The establishment of a training institute similar to the "Control Data Institute" may be effective for Xerox, perhaps done in conjunction with Xerox Learning Systems.

    . CDI trains people for the open job market, but CDI instructors are able to spot superior talent early on. Thus, Control Data Corporation gets first crack at the better people.

III CUSTOMER MAINTENANCE

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- The headings of this chapter follow the outline prescribed in the Xerox specifications.

A. TYPES OF SERVICE CONTRACTS

- Within the information processing industry, there are three types of service relationships that a customer can enter into with a vendor. Representative maintenance contracts are included in Appendix A.

- These types of service agreements are:

  - Customer Site (or on-site) Maintenance.

  - Depot Maintenance.

  - Time and Material Maintenance.

1. CUSTOMER SITE MAINTENANCE

- The vendor provides all maintenance services at the customer's location, subject to a series of terms and conditions that are discussed later in this chapter.

2. DEPOT MAINTENANCE

- This is identical to the customer site maintenance agreement except that the customer is required to deliver the faulty unit to the specified depot for repair. However, there is some variation with some vendors providing the pick-up and delivery of the faulty unit. Although this type of service relationship is limited to portable equipment, it does provide a reduction in maintenance costs of up to 20%.

- Depot maintenance is relatively new in the DP industry since it is only in recent times that there has been enough portable equipment to make it feasible.

  - The industry recognizes that depot maintenance is cost effective. More and more companies are adopting it and its use can be considered a firm industry trend.

3. TIME AND MATERIAL MAINTENANCE (T & M)

- This type of service agreement has the most open structure of all the maintenance contracts. There is no agreement between the parties on the level of maintenance provided. When the customer's unit fails, the vendor provides maintenance for a previously agreed upon hourly rate and associated parts cost. Response to customers is usually not good, since a vendor will first service those customers with fixed fee contracts while T&M customers are frequently handled on a time available basis. Vendors usually try to discourage these types of maintenance relationships because it can result in very unhappy customers, even though T & M work is generally quite profitable.

- While a few companies "hedge" their response time commitments on T&M contracts, many do not. In theory, this could cause legal responsibility problems for vendors who do make commitments and then don't live up to them.

- In practice, this rarely happens. The vendor's marketing or executive departments will usually step in to resolve conflicts before they get out of hand.

4. SERVICE CONTRACT TERMS AND CONDITIONS

- There are a number of terms and conditions that are established at the time the vendor and customer enter into a maintenance contract. A review of representative maintenance contracts indicates that they are essentially the same for all equipment categories. Where there are significant differences, they are discussed under each of the specific terms and conditions that follow:

  - Contract Term. The term of maintenance contracts within the information processing industry are on an annual basis. After the first year of a maintenance contract, either party can cancel the agreement with a 30 to 90 day written notification. As an added incentive, some hardware vendors provide free service for the first 30 days of the installation.

  - Service Hours. All vendors provide "normal" service hours. This is usually Monday through Friday, for a continuous time period of eight to twelve hours per day.

    . As a function of individual customer requirements, these "normal" service hours can be extended up to 24 hours per day, seven days a week. However, there is a premium associated with this additional maintenance coverage.

  - Response times are usually guaranteed by the hardware vendor. These vary typically from two to six hours in normal geographic operating regions. Outside these normal operating regions, response time may be a function of the amount of travel time required.

- For example, IBM's stated policy is 2 + 2, i.e., two hours to respond, two hours to repair. If the time expended exceeds these limits, then an escalation procedure is put into effect.

- The handling of response time commitments is the source of one of the industry's biggest customer problems. Customers believe that when a vendor quotes, "two hours to respond," the service-person should be on-site within two hours from the time the trouble call is placed. Vendors often interpret (at their convenience) the same terms to mean that a serviceperson will call the customer back within two hours.

- Maintenance Service. There are three types of maintenance service provided by hardware vendors under service contracts. These are:

  - Preventive Maintenance (PM). This includes maintenance activities aimed at reducing product failure and extending product life through regularly scheduled inspection and testing. PM is usually performed during calls scheduled specifically for that purpose. However, most vendors try to double up by performing PM during a trouble call. There is considerable customer pressure on vendors to reduce the amount of PM performed.

  - Remedial Maintenance. This includes maintenance activities for the diagnosis and correction of a product which is malfunctioning.

  - Engineering Changes. During the life of a product, the hardware vendor may install improvements to the product. These engineering changes are normally installed during a preventive or remedial maintenance call.

- Service Limitations. There are a series of conditions usually imposed on the customer by the hardware vendor that include the following:

  . Equipment Modification. If the customer makes any modification to the equipment that causes it to operate outside the specifications, the service contract is voided.

  . Equipment Movement. Customers may not physically relocate equipment within a facility without the previous agreement of the hardware vendor.

  . Equipment Interface. Customers may not interface vendor supplied equipment with other vendors' equipment unless there has been a prior agreement that such an interface will not adversely affect the vendor's equipment.

  . Operating Environment. Customers are required to provide the proper physical environment for the vendor equipment. This includes temperature and humidity ranges and, in some cases, electrical supply limitations.

  . Billing Procedures. Service contracts are usually billed monthly in advance.

5. FUTURE TRENDS IN SERVICE CONTRACTS

- With the introduction of some of the expected changes in maintenance activities, such as increased use of remote diagnostics, user involvement in maintenance, and increased reliability, INPUT believes that there will be some important changes in service contracts.

  - Although there exists almost a de facto industry standard for service contracts, INPUT believes that vendors will be forced to provide much more flexibility in the service contracts, both in types of products

supported and the type of customer. This will be particularly true when there is heavy user involvement in the diagnosis and maintenance. INPUT believes users will demand reduced maintenance charges for their participation.

- The cost of maintenance to the user will be significantly reduced, but in many cases will increase in proportion to hardware costs. This can already be seen in the new terminal product offerings of IBM. The full effect of this will continue to increase in intensity as more and more products of increased reliability are introduced.

  . However, cost reductions will not keep pace with MTBF improvements.

B. USER PARTICIPATION IN MAINTENANCE

- This subject is covered in Chapter IV.

C. XEROX PARALLELS

- In terms of reprographics service, the closest parallels to Xerox are:
  - Word processing systems.
  - PBX systems.
  - Small business computers.
- The degree to which these systems truly parallel the Xerox situation has to do with the customer's availability requirements.

- At INPUT, for example, the word processors and copiers are equally critical to the conduct of the company's business. From the company's standpoint, availability requirements are identical.

- In order to develop a frame of reference, Xerox should develop a matrix whose parameters are customer size and industry sector. Each matrix element can then be ranked in terms of all information processing availability needs. The result will be a structured presentation of comparable systems which will point out where Xerox should establish its study priorities.

  - Although this is not a trivial exercise, the basic data should be available in-house.

D. USER PARTICIPATION IN INSTALLATIONS

- This topic is covered in Chapter IV.

E. SERVICE OPTIONS ON LEASED EQUIPMENT

- The usual policy today is to bundle service into the lease or rental agreement.

  - Operating (full pay out) leases are frequently treated as purchases. However, some companies (like Itel) bundle both the financing and the maintenance into a single package.

- Most suppliers insist on maintenance provisions for equipment leased or rented for less than three year terms.

  - Since the vendor expects that the equipment will be returned, he must of necessity insure that the system will be well cared for.

- Service specifications on rented or leased systems generally provide for minimum coverage usually specified in terms of: 1) hours per day service will be available, and 2) meantime to respond.

  - Riders are provided, allowing for increased shift coverage or faster response time based on customer requirements.

- For equipment that experiences relatively low failure rates (such as terminals), some companies are offering unbundled leases.

  - Today, however, these are "non-standard" agreements, negotiated individually with the customer.

- Another unbundled situation frequently occurs with large clients who have a large number of similar devices to be maintained.

  - For example, a customer with 100 terminals might negotiate a financial package on each device and a separate maintenance agreement covering all of his units.

  - Some large users have their own maintenance organizations. Originally established to service purchased equipment, they have obtained permission from vendors to use their own force to service some leased equipment.

F. CUSTOMER SERVICE ASSISTS

- The EDP industry provides customers with the same kind of support that is given to their own field service people.

  - Customers can attend the supplier's training schools, usually for a fee, but sometimes for free.

- Service manuals are provided at nominal prices.

  . NOTE: IBM is withdrawing all highly detailed documentation from the field.

- Special test equipment can be purchased from the supplier.

- Customers can avail themselves of remote diagnostics, system support centers, etc.

- On-site spares ("care packs" in Xerox' terminology) are finding increasing acceptance.

  - Vendors sometimes supply them for free as a matter of convenience. The decision to do so is a matter of the economics of an individual site.

    . The replenishment process is handled in the same way as it would be for a branch office.

  - As noted in INPUT's study, the sale of spares "high mortality kits" is finding increasing acceptance.

    . Acceptance is a function of the sales strategy.

    . Replenishment is handled either on an automatic re-order basis or individually based on the recommendations of field service.

- INPUT was not able to quantify the benefits of on-site stocking to any degree because the desirability of doing so is a function of several factors, including:

  - Customer size.

  - Site location.

- Ratio of spares/installed base value.

- Obviously, selling spares directly to customers places them in the product category rather than the inventory category. Book inventories are thus diminished.

  - Selling spares can create problems when a company is production-bound. Because purchasers get first crack at the parts, field service may be left short.

G. LOCAL SERVICE CENTERS

- The benefits of depot maintenance are extremely significant to all industry participants.

  - Depots are better equipped, in terms of both people and test equipment.

  - Some maintenance or diagnostic operations can be totally automated, substantially cutting costs and MTTR.

  - Maintenance procedures can be carried out in an environment that can be controlled much better than the field.

  - Human interface problems are minimized.

- Unfortunately, depot maintenance is limited to equipment that can easily be transported to and from the depot.

  - In addition, because equipment can be damaged or delayed in transit, the value of depot maintenance can be subject to uncontrolled problems.

- However, most companies report that the advantages of depot maintenance significantly outweigh the disadvantages.

- IBM is stressing the availability of depot maintenance for many of their recently announced product lines.

  - Maintenance for their new ASCI terminal is restricted to depot maintenance. No other options are available.

IV INCREMENTAL SERVICE PRICING

IV INCREMENTAL SERVICE PRICING

- INPUT was asked to comment on the extent to which incremental service pricing is gaining in acceptance. In order to place this issue in perspective, an understanding of the "Service as a Product" concept and its applicability to the computer industry is reviewed in Section A.

- The following sections contain comments on where the industry is today, where its heading, and the effects of unbundling service on lease agreements.

A. SERVICE AS A PRODUCT

I. SUMMARY

- Within the information processing industry, which includes computers, office systems, and communications, there is a growing trend toward the treatment of service as a product.

- There are several underlying reasons for this shift in thinking. Three of the more important ones are:

  - Diminution of hardware costs due to technological and manufacturing advances are beginning to limit the margins that can be achieved through the sale of hardware. As hardware prices will ultimately

decrease faster than the market is growing, suppliers must look for new avenues to obtain profit.

- A growing buyer perception that service, not hardware, is the primary item that distinguishes one hardware vendor from another.

- The costs of labor and of maintaining and distributing spares inventories are rising very rapidly. This situation tends to highlight the importance of obtaining an adequate return on investment for service functions.

2. HISTORICAL PERSPECTIVE AND DRIVING FORCES

- The concept of service as a product is not new. Indeed, it has been well accepted by the consumer marketplace in mature industries for a very long time.

  - Sears, Roebuck & Company, for example, has clearly demonstrated the success of the concept. Its service and spare parts division are among the firm's most profitable operations.

  - General Electric has established service divisions for both consumer and industrial products.

- The information processing industry has been dominated for many years by IBM (computers), Xerox (office products), and AT&T (communications). All of these firms have traditionally taken a "bundled" approach to service and, as such, have established de facto standards and umbrellas under which the rest of the industry believed it had to operate.

- Led by IBM, who is gradually separating service from hardware, the industry is beginning to wake up to the fact that the old (perceived) constraints are in the process of being removed.

- At most firms, the maintenance function has traditionally been regarded by senior management as a "necessary evil." Service usually has been included as a unit of the marketing or sales organization and, from an accounting standpoint, is treated as a cost center.

- The service function has begun to account for an increasing percentage of corporate dollars. As this fact of life is recognized by senior management, the role of the service function has changed.

  - In many companies, service now has a reporting line equal to that of other functional departments, such as marketing or engineering.

  - The service organization is now a P&L center in many firms.

- In the past, the typical maintenance organization was wholly devoted to the testing and repair of equipment, usually on-site. Maintenance organizations are now changing their character.

  - The software support function frequently cannot be separated from the hardware maintenance function.

  - The new economics, dictated by low cost, widely distributed (geographically) systems, precludes on-site repair in many cases.

- Maintenance organizations in the information processing industry, particularly at the computer site, have been staffed by highly skilled technicians and engineers - people competent to make independent diagnoses and on-the-spot decisions. The supply of these kinds of people today has shrunk significantly, relative to the demand.

  - Service organizations have to adapt to this change by developing new methodologies to cope with the service requirements.

- R&D costs that will be increased to develop the new methodologies will be substantial and must be recovered.

- In many sectors of contemporary American business, there is a growing recognition of the potential opportunities inherent in the service as a product concept:

  - GM's "Mr. Goodwrench" compaign has been extremely successful.

  - The federal government has given increasing recognition of the concept by purchasing more and more service (as a product) from the private sector. This has spawned new companies specializing in service and has given increased recognition of the concept to established hardware vendors looking for a bigger "piece of the action."

- As computer/communications systems become more complex and more important to the everyday conduct of an institution's business, the sensitivity to "down systems" becomes greatly enhanced. An increasing number of users cannot tolerate the loss of the use of a system for any extended period. In this situation, service becomes an imperative that can be justified at nearly any price.

3. OPPORTUNITIES

- In 1979, service in the U.S. EDP industry alone will account for approximately $5.5 billion of expenditures by users. Add to that the tab for office products and communications service (excluding the military) and the bill approaches nearly $10 billion.

  - Assuming a 15% AAGR, users will spend $20 billion in 1984!

- In 1970, the annual cost of maintaining an average computer system ran about 5% of the purchase price. Today, ratios of 15% are not uncommon. This means that over an average system life of, say, seven years, users' expendi-

tures for service will exceed the price of the hardware. If constant margins as a percent of revenue are maintained, clearly the profit opportunity for service may, in fact, exceed that of the sale of hardware.

- As equipment becomes more inherently reliable, the absolute value of the cost of service will decrease. However, it is not likely, nor necessary, that they decrease in direct proportion to the reliability of the device or system.

  - As an example, consider IBM's strategy with respect to its 327X series of CRT terminals:

    . Maintenance on the 3275 terminal sold for (on average) $40/month.

    . Maintenance on the new 3278 terminal is priced at (on average) $16/month.

    . The 3278 is at least an order of magnitude more reliable than the 3275.

- With the growing recognition (by users) of the importance of service, there is increasing acceptance of the concept of user participation in the service function. This is creating new opportunities. Suppliers are beginning to sell:

  . Training.

  . Instrumentation.

  . Access to support centers.

  . Documentation.

  . Spare parts.

. Redundant equipment.

B. PRESENT ACCEPTANCE OF INCREMENTAL PRICING

- As shown in INPUT's earlier studies of maintenance requirements, users prefer fixed-fee maintenance contracts over T&M by about a 20:1 ratio.

- However, most customers really think in terms of system availability. What they really want is a contract that fits their needs. The form of the contract itself is relatively incidental.

  - In other words, the contractural form is a sales problem, in the sense that it is up to the vendor to work with the customer to devise a maintenance program to meet his needs.

- It should be clearly understood that, in the EDP community, IBM sets the standards for service against which nearly all the other companies design their service programs, policies, and pricing.

  - IBM has recently introduced incremental pricing for software service and some hardware maintenance services, using both T&M and fixed-fee contractural vehicles.

  - Thus, we can expect to see more of the same from the rest of the industry after IBM has "educated" the user community to accept these polices.

- Pricing increments on IBM's fixed-fee contracts are normally stated in terms of:

  - Number of hours/day coverage is available.

- Number of days/week coverage is available.

- Shift coverage.

- Response time.

- Software support on IBM's new lines (4300, 8100 and presumably "H" Series) are strictly time and materials, charged off at rates varying from $60 to $85 per hour - a negative incentive.

  - However, IBM provides free access to system support centers as an alternative.

- These IBM policies cited are new and should, at this juncture, be considered as experiments. Doubtless they will be subject to some modification in the near future.

- Most other companies offer customers a choice of T&M or fixed-fee contracts for equipment maintenance.

  - Systems software maintenance is generally provided free, regardless of whether a system is purchased or leased.

  - This policy can be expected to change as the software is "burned in."

- Only the very large companies with extensive field service organizations can afford to offer much variability in their service offerings.

C. UNBUNDLING

- INPUT believes that, within ten years, nearly all service beyond warranty will be unbundled regardless of whether or not a system is leased or rented.

- The lease or rental contract may insist on a minimum level of maintenance.

- The preceding comment applies to systems whose application is generally under the direct control of the customer.

- An exception is the turnkey system that may be sold on a pay-per-transaction basis. In this case, the maintenance charges will rarely be visable to the user.

  - For example, a stock brokerage quotation system might be priced on a per inquiry basis.

  - This example is similar to the Xerox policy of charging on a per copy basis.

- In summary, INPUT believes that Xerox should begin to experiment with incremental maintenance pricing. As IBM has set the standards in the EDP industry, so has Xerox established them in the reprographics industry. It is largely up to Xerox to change them.

D. THIRD PARTY MAINTENANCE (TPM)

- Unbundling presumably opens the door to providers of TPM. However, history has shown that TPM is successful only when the vendors want it to be.

  - In the IBM environment, TPM exists primarily on older product lines which IBM does not want to maintain itself, or in multivendor installations where the customer prefers dealing with a single maintenance vendor. In nearly all cases, the customer would prefer to obtain service from IBM, if he could get it.

- TPM firms are almost wholly dependent on the hardware suppliers for training, documentation and spare parts.

  - The EDP industry has shown no inclination to develop an "aftermarket" support system like that found in the automobile industry. Until it does, TPM companies will continue to exist only at the discretion of equipment suppliers.

V DIAGNOSTICS

V DIAGNOSTICS

- The objective of this chapter is to review certain EDP industry trends regarding diagnostic systems and approaches.

- The results and conclusions presented are based largely on data obtained from other INPUT studies, including:

  - Field Service Brief #2: "Remote Diagnostics."
  - Field Service Brief #3: "Instrumentation Trends."

- The chapter follows the outline format provided by Xerox in the project specifications.

A. DIAGNOSTIC TEST AND INSTRUMENTATION TRENDS

1. SPECIAL TEST SETS

- Special test sets, also know as off-line testers and exercisers, are finding increasing application in the peripherals area, particularly for equipment that have electromechanical elements, such as disk drives and printers.

- Most major companies make special purpose testers designed specifically for their own products, although there are a few commercially available exercisers from companies such as Wilson Laboratories.

- Off-line testers may be totally self-contained external units, or they may operate in conjunction with internal (usually microprocessor based) functions designed into the unit under test.

- The long term trend is towards providing more built-in diagnostics. However, diagnostic functions will be more or less limited to what can be accomplished through the pure application of electronics.

  - For the foreseeable future, it will, in most cases, be too expensive to provide the high precision sensors on electromechanical equipment that would permit complete fault diagnosis.

- The trend is to develop versatile off-line testers that have to be carried to the site. That is, the device needs to be capable of diagnosing a range of products, usually within a single product line. However, to accomplish this:

  - Testers are being developed that are, in effect, "programmable" in the sense that the diagnostics can be changed to suit the piece of equipment under test.

  - Test routines can be implemented in PROMS which can be loaded by cassette or floppy disk.

- Nearly all equipment will have at least rudimentary diagnostics in the form of go/no go logic tests of certain functions which are monitored on built-in displays.

2. BUILT-IN DIAGNOSTICS

- If a device includes a microprocessor element, it will ultimately use its internal logic and processing power to perform at least some diagnostics internally.
  - Of course, in order for any built-in diagnostic to work, the system must be at least partially functional.
  - Therefore, built-in diagnostics have limitations that force companies to have external systems available as well.
- Systems designed with a high degree of redundant circuitry are potential candidates for the inclusion of relatively sophisticated built-in diagnostic facilities.

3. REMOTE DIAGNOSTICS

- There is no question that the move to remote diagnostics is rapidly becoming a major industry trend.
- However, remote diagnostics have some important limitations:
  - They are nearly worthless as a system diagnostic tool in a multi-vendor installation.
  - Their use is confined to testing at the "module" level.
  - The device to be tested must be equipped for communications.

4. TECHNICIAN - LOADED DIAGNOSTICS

- As noted in Section I, technicians who work on peripherals (notably disk and tape drives) are already beginning to be equipped with "loadable" off-line testers. These testers, however, are limited, special-purpose devices.

- There are a number of experiments being initiated today (primarily by vendors of small business computers and word processing systems) that concern the development of a "maintenance computer."

  - These are "general-purpose" microprocessor based programmable devices designed to be carried to the site.

  - The units are equipped with cassette or floppy disk drives. The technician carries several cassettes or floppies with him containing either specific customer configuration data and/or different test routines.

- It is too early to state with certainty that the use of these devices will be a definite trend. However, the early signs are generally encouraging.

5. TRADE-OFFS IN APPROACH

- The economic trade-offs between different diagnostic methods obviously have to be analyzed in the context of the type of equipment to be serviced, the vendor's entire product line, the density of installations, the degree to which customer cooperation can be elicited, the size of the customer, and how critical a device failure is to the customer's operations.

- However, we can make a few statements about the future:

  - Remote diagnostics will be the first-line diagnostic procedure used by terminal and mainframe vendors.

- All devices will be equipped with at least some built-in diagnostic aids, many of which can be used or run by customers.

- Non-portable peripherals which have a high electromechanical content will be diagnosed by special purpose testers designed specifically for the products they test. Most will be developed and supplied by the equipment vendors themselves.

- We will see increasing use of microprocessors, both in equipment and in test equipment. Much equipment will have micros built-in specifically for diagnostic purposes.

- In some cases, redundant hard-wired main logic will perform the same function.

B. SERVICING MICROPROCESSOR BASED PRODUCTS

- This issue was partially addressed in the preceding section in the context of the EDP industry.

- This section addresses the question in the context of such products as cash registers, sewing machines and other high-volume products that have a high electromechanical content.

- The trend is to use the microprocessor(s) as a status monitoring and diagnostic tool.

  - Some devices are equipped with a harness jack, premitting the technician to "tap" into the microprocessor and have it run certain diagnostic functions for him. The Volkswagen "Rabbit" is a notable example.

- Most devices that fall into this category are portable. Diagnosis and repairs are done primarily "on the bench" at repair centers where stationary test systems can be employed.

- In terms of servicing the microprocessor or "electronics" portion of the device itself, on-site repair will be limited to "board-swapping."

C. FIELD SERVICE DOCUMENTATION

- The most interesting change in field service documentation policy is one recently put into effect by IBM.

  - On its newest systems, its field service people no longer carry detailed logic diagrams, test program source code, or other highly detailed documentation. Only functional diagnoses and procedures documents are actually carried by the individual.

  - Detailed documents are retained at system support centers. Access to these documents is handled either by phone or via terminal. (The serviceman does not carry the terminal - the customer has to have this facility.)

  - It should be noted that IBM has instituted this policy to prevent detailed documents from falling into competitor's hands, rather than from any attempt to reduce the amount of material to be physically handled by the service person.

- INPUT has not found any other new approaches addressing the documentation problem.

- Fiche is used by several companies.

- Fiche suppliers continue to improve portable fiche-reader systems.

D. DIAGNOSING SOFT FAILURES

- Soft failure diagnosis continues to be a number one problem in the EDP industry.

- The best way of dealing with the problem is to better engineer the products themselves to reduce the possibility of soft failures.

  - In electronics, the use of redundant circuits is the best approach to the problem.

  - In the mechanical portions of a system, closer machining tolerances help reduce the soft failure rate.

  - Whenever feasible, electromechanical components are replaced with electronics.

- Miniaturization and board standardization is helping to some extent. The field serviceman can carry more boards with him and through board swapping, frequently isolate a soft failure very quickly.

  - With board standardization, only one or a very few boards need be handled.

E. DIAGNOSTIC TRAINING

- INPUT was asked to determine if there was any trend distinguishing the training of field service personnel in theory of operations vis-a-vis fault isolation using structured documentation.

- In Chapter II, INPUT's conclusions concerning the three levels of service that would evolve in the DP industry were discussed. The logical conclusions based on this triple-tiered structure are that:

  - Local service technicians will be capable only of following structured methods and procedures.

  - The other two levels will have to be skilled technicians, well versed in operations theory.

F. MULTI-VENDOR ENVIRONMENTS

- The number of multi-vendor installations, particularly at medium and large size companies, will increase substantially over the next few years, in large part due to IBM's inability to produce enough to meet their own market demands.

- There are two significant trends that relate to the handling of service in multi-vendor environments:

  - Increasing use of self-test and specialized off-line test instrumentation.

  - The inclusion of microprocessors at the interface adapters, permitting the constant monitoring of input/output signals while the devices are functioning on-line.

- The increasing use of communications has, in many cases, brought the carriers (AT&T, et al) into the picture creating a de facto multi-vendor environment even though all the equipment residing at the customer's site may come from one vendor.

- Because AT&T perceives itself as an EDP/office system competitor in the future, very little has been done or is being done by either the EDP industry companies or AT&T to resolve the DP/communications interface service problem.

- Should IBM be successful in obtaining control over alternative communications sources such as SBS, we would expect to see extensive diagnostics encompassing all elements in a network.

G. IMPACT OF AVAILABLE SKILLS ON TRAINING IN THE 1980s

- This issue has been addressed in Chapter II and Section E of this chapter. To summarize:

  - Local field technician training will focus on the teaching of cookbook diagnostic procedures.

  - This kind of training will be supplemented by increased focus on human communications skills.

    Note: Reference INPUT's November 1979 study, "First Line Managers."

H. CUSTOMER PARTICIPATION IN PRE-SERVICE CALL DIAGNOSTICS

- As pointed out in INPUT's earlier studies, most customers are willing to assist in any phase of the maintenance process, provided they have an adequate incentive to do so.

  - Incentives are either increased availability (better "up-time") or a price break.

- This will be an accelerating trend as more and more companies are developing ways to increase user involvement. IBM is a leader, and since it sets most service standards for the entire EDP industry, it will "educate" future generations of users to feel comfortable with its service policies. Examples are:

  - The 8100 comes with a do-it-yourself installation kit which can save the customer hundreds of dollars.

  - The new ASCI terminals are designed to be user-diagnosed by simple go/no go tests. If a test fails, the customer must return the entire unit to a depot for repair. No other options are available.

  - A remote diagnostic system for 327X series terminals can be run by users as well as service personnel.

- The "tolerance" level of customer's involvement in maintenance procedures has not been calibrated by INPUT (or anyone else we know of). However, we can expect to see present limits increased significantly as participation becomes a more frequent occurrence over time.

- In early 1980, INPUT will be conducting an in-depth study of user involvement in maintenance as part of the "Field Service Planning Information Program." Clients of the service have almost unanimously identified this issue as one of the most important for the mid 1980s.

VI INTERNATIONAL COMPARISONS

VI INTERNATIONAL COMPARISONS

- The purpose of this chapter is to highlight some of the differences between the DP maintenance environment in Western Europe and that of the United States.

- The information presented was derived principally from INPUT's earlier "Maintenance Requirement Of The Information Processing Industry" studies, supplemented by more recent information derived from the "Field Service Planning Information Program" and other custom research projects.

- It is noted that most of the comments in this chapter are framed in a "Pan-European" context. Europe is, of course, a number of different country markets, each with its own unique characteristics. For details by country, the reader should refer to INPUT's study "Maintenance Requirements of the European Information Processing Industry" published in July 1979.

A. THE IMPORTANCE OF MAINTENANCE

- As is the case in the U.S., maintenance and reliability are the top ranked criteria for equipment selection, rating well ahead of such things as price/performance ratios, vendor image, software support, and other prominently mentioned factors.

- However, European users appear to be far more sensitive to this issue than U.S. users. This is especially true of the Nordic countries (Germany, Holland, etc.).

  . Of the representative user sample interviewed by INPUT, fully 25% stated that they had actually terminated doing business with a vendor specifically because of poor maintenance performance.

  . The corresponding figure in the U.S. is less than 5%.

- Thus, system availability ("up-time") is a key factor in Europe and can be considered a gating item to sales growth.

- Because of the importance attached to maintenance, most U.S. users tend to scrutinize proposed service offerings in the procurement evaluation phase.

  - In sharp contrast, European users rarely carry out in-depth comparisons of maintenance facilities between vendors.

    . They tend to believe the information supplied to them by the vendors.

    . Therefore, the customer's perception of the service offering is more important than the vendor's own performance criteria.

- European equipment vendors admit that revenues attributable to maintenance comprise from 15-30% of their total income.

  - This range is, on average, slightly higher than that experienced in the U.S. - about 10-25%.

- However, the value of maintenance as a profit generator is rarely realized in Europe; while in the U.S., 50% of the EDP industry vendors run the maintenance function as a profit center.

- The shift to a profit center operation is a major trend in the U.S. By 1984, nearly all U.S. companies will be looking at maintenance as a significant profit making product.

B. EUROPEAN USER ATTITUDES

- Exhibit VI-1 compares the U.S. and European views of several important field maintenance characteristics. The data for this chart derives from a question asked of users (in both the U.S. and Europe) in which the interview subject was asked to rate the importance of each of the five maintenance characteristics listed in the exhibit. Examination of this chart leads to some interesting comparisons:

  - Although both the U.S. and Europe users attached the most importance to "mean time to respond," the U.S. users clearly place more stress on it than the Europeans.

  - U.S. users rated "mean time to repair" equally high, inferring that, in the U.S., people are more cognizant of the total "down time" experienced than are the Europeans.

  - Preventive maintenance was important to 50% of the Americans, while only 20% of the Europeans considered it critical. In Europe, it is apparently quite common to "run it until it breaks."

  - In both regions, the cost of maintenance rated relatively low - 33% for the U.S. versus 17% for the Europeans. This is a significant finding, because it points out that vendors can raise maintenance prices without much fear of a negative reaction - providing, of course, that the service quality is there to support the price.

EXHIBIT VI-1

RATINGS OF THE IMPORTANCE OF
FIELD MAINTENANCE CHARACTERISTICS

MAINTENANCE CHARACTERISTIC	PERCENT OF USERS RATING CHARACTERISTIC AS "CRITICAL"	
	UNITED STATES	EUROPE
MEAN TIME TO RESPOND	96%	61%
MEAN TIME TO REPAIR	94	51
PREVENTIVE MAINTENANCE	48	19
MAINTENANCE EXPENSE	33	17
ACCOUNT CONTROL	38	14

- The concept of "account control" was ranked nearly three times as high by U.S. users - 38% versus 14%. However, 86% of the large U.S. users rated it critical. The close interlocking relationships that develop between U.S. users and their vendors appears to be far less evident in Europe.

- There are some significant differences between attitudes within Western European countries.

  - Exhibit VI-2, compares mean time to respond (the most highly ranked characteristic) between the U.S., the U.K. and Germany.

C. USER INVOLVEMENT WITH MAINTENANCE

- There is a relatively new trend towards increasing the user's participation in the maintenance process encompassing installation, diagnosis, and repair. INPUT's U.S. study, done in 1978, showed that about 33% of the users were willing to increase their participation, given the right incentives.

  - Helped along by IBM, DEC, and a few other vendors, the concept is finding increasing acceptance in the U.S.

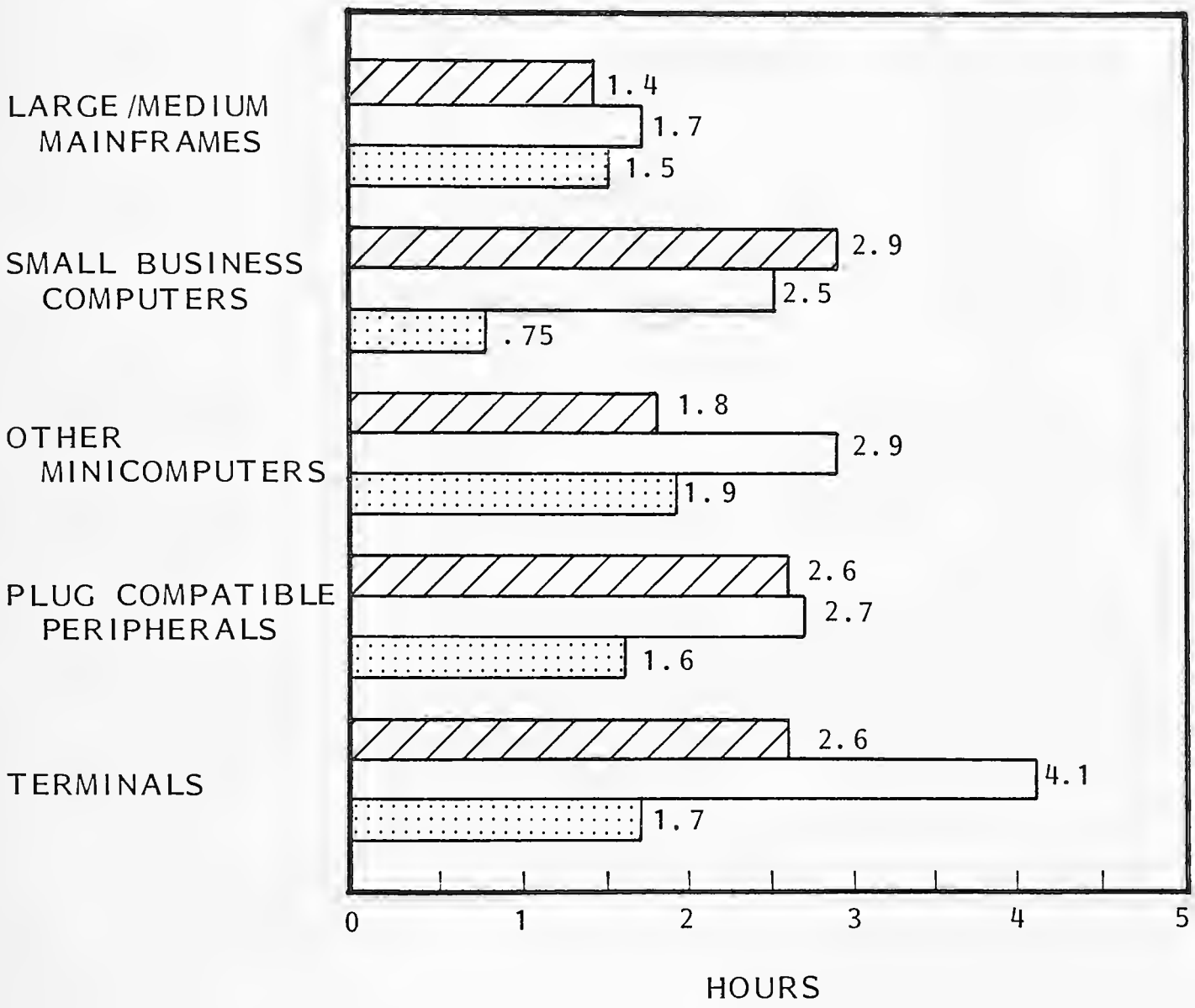
- In Europe, INPUT found that it was quite commonplace for vendors to encourage users to install and diagnose their own systems.

  - As a result, acceptance of the concept is today higher in Europe than in the U.S.

    . INPUT found a high percentage of instances where users performed cooperative testing, stocked spares on-site, and took over a major share of the preventive maintenance load.

EXHIBIT VI-2

USERS' MINIMUM ACCEPTABLE MEAN
TIME TO RESPOND BY CLASS OF EQUIPMENT



- One interesting difference, however, was that, in the U.S., users were motivated to participate based primarily on achieving higher up time, whereas, in Europe, they wanted a price break.

D. PRICING CONSIDERATIONS

- European users interviewed in early 1979 anticipated maintenance price increases in 1980 ranging from 3.5-7.0%.

  - U.S. users expectations are considerably more than that. In fact, they are tied to the inflation rate.

- As in the U.S., competitive maintenance pricing in Europe is usually not an issue, although third party firms must generally be at least 20% under the manufacturer's going rates to compete at all.

- As noted earlier, European users were more sensitive to the down time issue than Americans. However, when asked what premiums they would be willing to pay to obtain significant improvements, the Europeans said 3.0-8.0%, while the Americans said 7.5-15.0%!

  - The Europeans are either tougher negotiators or are unwilling to "put their money where their mouths are."

E. PERSONNEL CONSIDERATIONS

- Europe is facing an acute shortage of field engineers. This shortage is likely to be even more serious than in the U.S., which is undergoing tough times in this department at present.

- In Europe, field service is perceived by both management and employees as a second-class career.

  - Most European field engineers are developed in "tradesman" fashion through a high school to apprentice system.

  - There are very few people in field service who have the equivalent to the U.S. 4-year degree.

  - Vendors do not perceive any significant changes in the system, at least over the next few years, as shown in Exhibit VI-3.

- The average separation rate for field service people in Europe is 4.9%, about half that experienced in the U.S., as shown in Exhibit VI-4. However, that is a high figure by most European standards. (Again, there are significant country differences.)

F. SPARES CONSIDERATIONS

- Movement of spare parts is a much bigger headache in Europe than it is in the U.S.

  - When parts are shipped across national borders, customs delays are encountered and tariffs are imposed.

  - Most vendors warehouse spares at bonded facilities, the most common of which are located at Schipol Airport in Amsterdam.

- The spares shortage appears to be far more intense in Europe than in the U.S.

EXHIBIT VI-3

VENDOR PERCEIVED SOURCES
OF FIELD ENGINEERS IN EUROPE

SOURCE	1978 RATING*	1982 RATING*	COMMENTS
HIRE AND TRAIN YOURSELF	477	487	"THE ONLY SOURCE FOR LARGE NUMBERS"
RECRUIT FROM COMPETITION	248	90	"FOR SMALL NUMBERS; NOT ALWAYS A SUCCESS"
RECRUIT FROM OTHER INDUSTRIES	190	135	"DIFFICULT TO FIND"
ARMED FORCES PERSONNEL	130	95	"GREAT IF YOU CAN GET THEM"
RECRUIT FROM WITHIN COMPANY	60	80	"VERY RARE"
TRADE SCHOOLS	80	80	"WE SPONSOR TRADE SCHOOL ATTENDANCE"
OTHER	20	20	"UNIVERSITY TRAINEES; BUT VERY HARD TO GET"

* NUMBERS REFLECT COMPOSITE SCORES AND ARE MEANINGFUL ONLY IN RELATION TO ONE ANOTHER

EXHIBIT VI-4

1978 NEW HIRES AND SEPARATIONS
OF FIELD ENGINEERS AS A PERCENTAGE
OF 1977 TOTAL FIELD ENGINEERS

TYPE OF VENDOR	NUMBER OF FIELD ENGINEERS 1977	NEW HIRES		SEPARATIONS	
		NUMBER IN 1978	PERCENT OF 1977 BASE	NUMBER IN 1978	PERCENT OF 1977 BASE
MAINFRAMES	5,768	749	13.0%	231	4.0%
SMALL BUSINESS MINICOMPUTERS	562	146	26.0	58	10.3
TERMINALS	527	90	17.1	37	7.0
THIRD PARTY MAINTENANCE	98	22	22.5	11	11.2
OTHER	225	43	19.1	14	6.2
ALL VENDORS COMBINED, EUROPE	7,180	1,050	14.6%	351	4.9%
ALL VENDORS COMBINED, U.S.	18,711	3,946	21.1%	1,902	10.2%

- One of the major contributing factors to this shortage is that the low average quality of field service technicians often results in many "good" parts being sent back to the factory or repair depot for repair.

G. CONTRACT CONSIDERATIONS

- Standard fixed-fee maintenance contracts are much preferred over T&M contracts, as illustrated in Exhibit VI-5. As in the U.S., these normally include provision for regularly scheduled preventive maintenance calls.

- Both European and U.S. users like the concept of a maintenance service contract "tailored to meet their individual needs."

H. THIRD PARTY MAINTENANCE (TPM)

- As in the U.S., Europeans generally want to have their maintenance supplied by the equipment vendors themselves.

  - However, within Europe there are significant differences in degree from country to country.

    . In Germany, for example, third party maintenance is unlikely to be considered, while in the U.K., TPM is becoming respectable.

- In general, TPM is gradually becoming a more viable alternative in Europe as the equipment suppliers' performance begins to degrade from the lack of qualified service personnel.

- Users' preferences for maintenance vendors are compared in Exhibit VI-6.

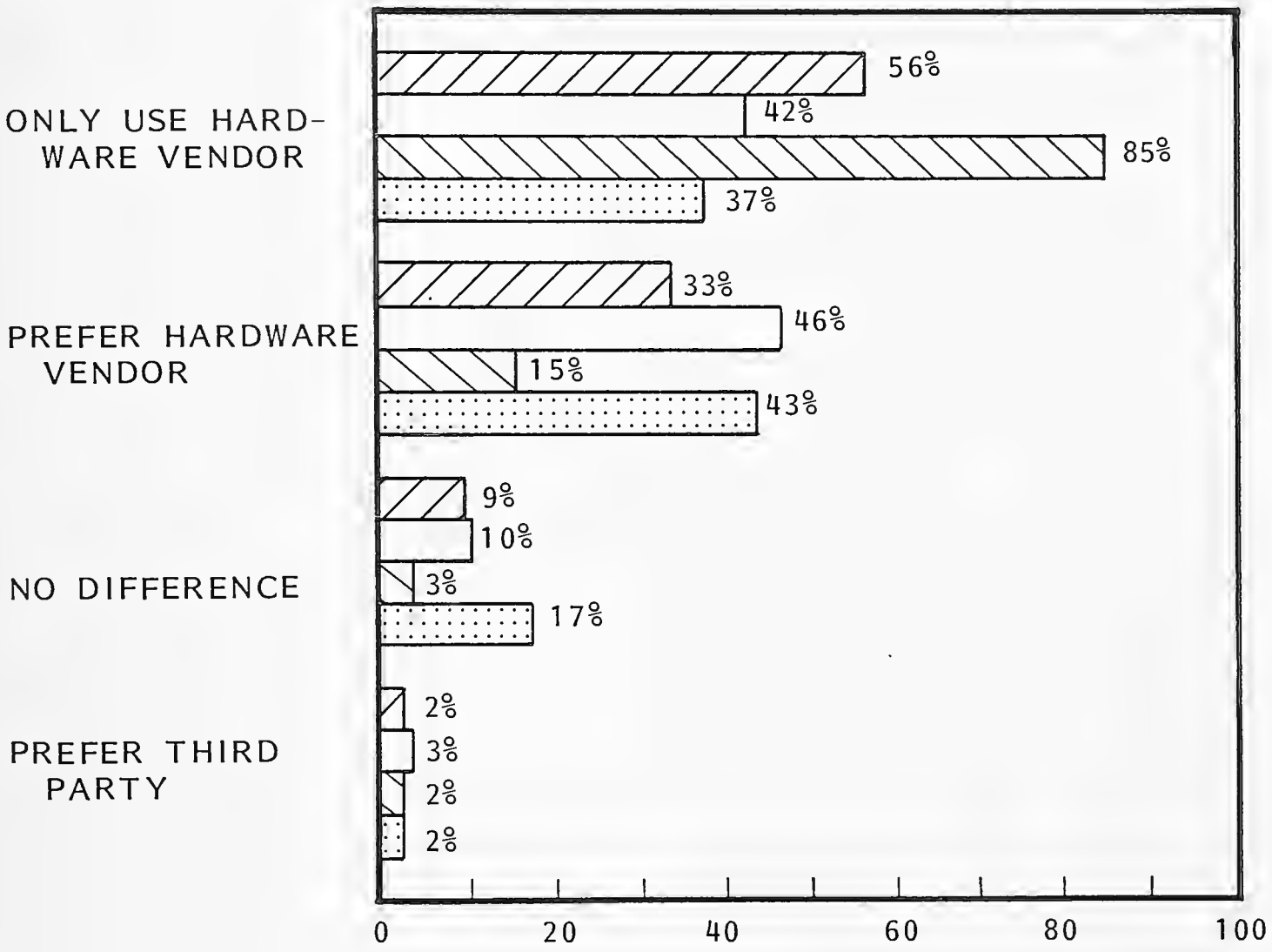
EXHIBIT VI-5

MAINTENANCE SERVICE CONTRACTS:
USER PREFERENCE FOR
TIME AND MATERIALS VERSUS FIXED FEE

USER SIZE CATEGORY	PREFERENCE			
	TIME AND MATERIALS		FIXED-FEE	
	EUROPE (PERCENT)	U.S. (PERCENT)	EUROPE (PERCENT)	U.S. (PERCENT)
VERY LARGE >$950 MILLION	8%	-	92%	100%
LARGE $350-950 MILLION	2	-	98	100
MEDIUM $100-349 MILLION	1	6%	99	94
SMALL <$100 MILLION	5	4	95	96

EXHIBIT VI-6

USERS' PREFERENCE FOR
MAINTENANCE VENDOR



VII SPARES AVAILABILITY

- INPUT was not able to obtain much in the way of hard data concerning the availability of spares inventories carried by the field service people or located at the branch.

- Surprisingly, most field service executives when queried about this, did not seem to have a firm handle on the figures, although most of them said that the information was available to be "dug" out.

- Executives said that parts lists for dispersed locations are made up based on a targeted call completion. The targets from 10 of the companies interviewed by INPUT are given in Exhibit VII-1.

  - The numbers refer to calls wherein a problem is found, rather than all calls made by a service person. As pointed out in INPUT's early study, for example, "no fault found" calls alone averaged 10% of total calls.

  - Nearly all the executives pointed out that the numbers "don't mean a damn thing" since there is a general shortage of spare parts throughout the industry.

- The exhibit shows that all companies planned that parts would be available to complete at least nine out of ten calls.

EXHIBIT VII-1

SPARES COMPLEMENT
AT FIELD LOCATIONS:
TARGET CALL COMPLETION RATE

COMPANY I.D.	NUMBER OF FIELD ENGINEER'S IN U.S.	TARGET CALL COMPLETION RATE (U.S.) (PERCENT)
C-3	450	95%
D-2	306	90
B-5	1,400	95
A-1	2,000	99
B-1	6,000	97
A-3	3,350	90
B-2	320	95
A-4	750	92
D-1	625	90
A-2	5,890	90

APPENDIX: SAMPLE SERVICE AGREEMENTS

HEWLETT hp PACKARD

CUSTOMER SUPPORT SERVICES AGREEMENT

AGREEMENT BETWEEN _____
AND HEWLETT-PACKARD COMPANY

AGREEMENT NO. _____
COMMENCEMENT DATE _____
REVISION DATE _____

1. STATEMENT OF AGREEMENT

Hewlett-Packard shall support the products specified on Exhibit B throughout the term of this Agreement. Customer support performed under this Agreement will consist of the services specifically described in Exhibit A.

2. ELIGIBILITY

Only Hewlett-Packard products which are in normal operating condition and which are currently at Hewlett-Packard's specified revision levels are eligible for coverage under this agreement. If, in Hewlett-Packard's opinion, maintenance of any product is required to return it to normal operating condition or to bring any product to the specified revision level, Hewlett-Packard will offer to perform such work at standard service rates prior to placing the product on this agreement.

3. RESPONSE TIME

The response time is specified on Exhibit A. Hewlett-Packard shall respond to a request for support services within the specified response time. Availability of Hewlett-Packard personnel and telephone answering service is limited to the specified periods of coverage.

4. PERIODS OF COVERAGE

The periods of coverage for products covered by this Agreement are specified on Exhibit A. The Customer may request a change in the specified periods of coverage at any time. Such change is subject to written approval by Hewlett-Packard.

Legal (national) holidays, and Hewlett-Packard approved holidays, are excluded from the standard periods of coverage.

5. TERM OF AGREEMENT

The initial term of this Agreement shall be one (1) year beginning on the date stated in Exhibit A. The Agreement shall be automatically renewed from year to year commencing with the expiration of the initial term hereof on the same terms and conditions herein set forth. The charges shall be subject to change upon renewal as further set forth in paragraph a. under CHARGES.

6. CONDITIONS OF SERVICE

Hewlett-Packard shall be under no obligation to furnish support services under this Agreement should repair be required because of (1) improper use; (2) natural disasters such as flood or earthquake; (3) strikes, riots, or acts of war or nuclear disaster; (4) repairs, maintenance, modifications, or relocation and reinstallation made by other than Hewlett-Packard personnel or without Hewlett-Packard's supervision and approval; (5) unusual shock or electrical damage, accident fire or water damage, neglect, air conditioning failure, humidity control failure, damage during transportation by Customer, or causes other than ordinary use; and (6) refusal to maintain HP's site specifications. If support services are required as a result of the causes stated above such service shall be provided at Hewlett-Packard's standard service rates for labor, travel, and material in effect at the time of service.

7. EXCLUSIONS

Hewlett-Packard's support services do not include (1) operating supplies and consumables, (2) refinishing the products or furnishing materials for that purpose, (3) electrical work external to the products, (4) maintenance of accessories, attachments or products not specified on Exhibit B, and (5) any other services not specifically described in Exhibit A.

8. RELOCATION OF PRODUCTS

a. The Customer shall give Hewlett-Packard sixty (60) days' written notice prior to any relocation of products requiring on-site support services.

b. Products moved to a location within the contiguous United States shall continue to be serviced under this Agreement. The response time and charges will be adjusted to reflect the new location.

c. Products moved outside the contiguous United States shall continue to be serviced under this Agreement at the option of Hewlett-Packard. The service to be provided and charges for such service shall be subject to mutual agreement.

d. Hewlett-Packard shall, at Customer's expense, and risk of loss or damage, supervise the dismantling and packing of the products, and shall inspect and reinstall the products at the new location. The Customer shall furnish all labor and materials for the dismantling, packing, and placement of the products in the new location.

e. The Customer shall be responsible for any loss or damage to the products in transit.

9. CHARGES

a. The charges specified are those currently in effect. These charges may be changed by Hewlett-Packard upon each annual renewal of this Agreement provided that Hewlett-Packard has notified Customer of the proposed increase at least thirty (30) days prior to the expiration of the term.

b. Charges for services performed outside the specified periods of coverage and for services not covered by this Agreement will be invoiced separately at Hewlett-Packard's standard service rates.

c. Unless otherwise stated all charges are exclusive of federal, state, or local taxes, now or hereafter enacted, which apply to the charges, the agreement, the services rendered, or the parts supplied. Such taxes, when applicable, will appear as separate additional items on the Hewlett-Packard invoice.

d. When requested by Customer that Hewlett-Packard incur commerical travel and per diem expenses because of extended travel not included in the coverage, these expenses will be passed on to the Customer.

REV. NO.R8-79
9320-4077

10. INVOICING

Invoicing for maintenance charges will be as indicated on Exhibit C. Invoicing for other charges as described in the paragraph CHARGES will be made as incurred. Terms are net thirty (30) days from date of invoice (N-30).

11. MODIFICATION

Hewlett-Packard may, at its option, and at no additional charge to the Customer, make modifications to improve the operation and/or reliability of the products.

12. ADDITIONS/DELETIONS

The Customer with Hewlett-Packard's concurrence may add or delete compatible Hewlett-Packard products to this Agreement at any time. Any addition shall be subject to the terms and conditions stated herein. The charge shall be adjusted accordingly.

13. NOTICES

Any notices required to be given under this Agreement shall be given in writing at the address of each party, herein set forth, or at such other address as either party may substitute by notice to the other.

14. EXHIBITS

The exhibits checked below shall be attached to and are hereby made part of this Agreement.

_____ Exhibit A — Specifications & Charges

_____ Exhibit B — Product List

_____ Exhibit C — Invoicing Schedule

_____ Exhibit D — _____

_____ Exhibit ( ) — _____

_____ Exhibit ( ) — _____

15. GENERAL

a. Neither party shall assign this Agreement without prior written consent of both parties.

b. For hardware products, warranty provided hereunder shall be limited to the correction of any defective services by restoring the products to good operating condition. For software products, warranty provided hereunder shall be limited to providing the software support services selected by Customer. NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HEWLETT-PACKARD SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

c. This Agreement shall be governed by the laws of the State of California.

d. This Agreement and attached exhibits represent the entire understanding of the parties. The terms and conditions of this Agreement and attached exhibits supersede all other terms and conditions contained on any acknowledgement form, order, or other document issued by either the Customer or Hewlett-Packard.

e. Hewlett-Packard reserves the right to withhold without liability and with five (5) days prior notice the services selected by the Customer above, if the Customer is delinquent in payment for such services or other services performed by Hewlett-Packard on the products listed in Exhibit B.

f. Customer may terminate this Agreement upon thirty (30) days written notice to Hewlett-Packard, and Hewlett-Packard may terminate this Agreement or offer a new Agreement upon ninety (90) days written notice prior to the anniversary date of this Agreement.

AGREED TO THIS

_____ day of _____,19___

_____

By _____

Title _____

ACCEPTED THIS

_____ day of _____,19___

HEWLETT-PACKARD COMPANY _____

Telephone Number

_____

Address of designated service office

_____

By _____

Title _____

Printed in U.S.A.

BASIC SERVICE AGREEMENT

TERMS AND CONDITIONS

1. TERM

This Agreement is effective from the commencement date and shall continue until terminated by either party upon ninety (90) days prior written notice of the annual Agreement anniversary date.

2. ELIGIBILITY FOR SERVICE AGREEMENT

A. Digital-supplied equipment is eligible for inclusion under this Agreement immediately upon Digital installation or expiration of on-site warranty or existing Digital on-site service agreement.

B. Digital-supplied equipment not eligible for inclusion under 2.A. above shall be subject to inspection by Digital to determine if it is in good operating condition. Any repairs, adjustments or Field Engineering Change Orders (FCO's) then deemed necessary by Digital shall be made at Digital's per call rates and terms then in effect prior to commencement of maintenance service.

C. Service under this Agreement is contingent upon conformity with Digital's currently applicable minimum equipment configuration requirements. Digital's acceptance of this Agreement for the equipment as listed herein confirms the satisfaction of this requirement.

3. SERVICE RESPONSIBILITIES OF DIGITAL

A. For the charges stated herein, Digital shall maintain the equipment in good operating condition and furnish on-call maintenance service during the Call Window defined in Clause 6 and noted on the face of this Agreement. In fulfillment of the above, Digital shall:

1. Provide scheduled preventive maintenance (PM) based on the specific needs of the equipment as determined by Digital and normally between the hours of 8:00 AM to 5:00 PM Monday through Friday, or within extensions to the Call Window as mutually agreed upon.
2. Provide unscheduled, on-call remedial maintenance as required during the Call Window following Customer notification that the equipment is inoperative.
3. Provide maintenance materials, tools, documentation, Site Management Guide, diagnostics and test equipment necessary for the maintenance services described herein; such items at all times to remain the exclusive property of Digital.

B. Digital will provide and bear the costs of labor (during the Call Window) and parts under this Agreement for maintaining the specified equipment in good operating condition, when such labor and parts are required because of normal wear and tear.

C. Maintenance will include replacement of parts deemed necessary by Digital. All parts will be furnished on an exchange basis and will be new standard parts or parts of equal quality, exchanged parts removed from the system become the property of Digital.

D. Digital will install, at its option, Field Engineering Change Orders (FCO's) on the Digital-supplied equipment covered by this Agreement. The installation shall be at no charge if done concurrent with preventive maintenance or at another time within the Call Window as mutually agreed upon.

E. At the end of twelve (12) months of maintenance service or anytime thereafter, if individual item(s) cannot, in Digital's opinion be properly or economically repaired on-site due to excessive wear or deterioration, Digital may supply the Customer with a quote for reconditioning at Digital's product repair center or other factory repair location. If the Customer does not elect to have the equipment reconditioned, or if reconditioning is impractical due to equipment age or availability of replacement parts, Digital may withdraw such item(s) from this Agreement upon one hundred and eighty (180) days prior written notice.

F. If a system is maintained for which Digital Diagnosis Center (DDC) service is being provided (as specified on the face of this Agreement) the following applies:

Digital will typically respond to remedial maintenance requests received during the Call Window within fifteen (15) minutes, except for causes beyond Digital's control. This response will consist of telephone-initiated diagnostic procedures for all service requests in which, at the sole discretion of Digital, DDC service will aid in problem resolution.

4. SERVICE LIMITATIONS

A. If maintenance service is requested because of causes other than normal wear and tear, the service will be provided at Digital's per call rates and terms then in effect.

B. The following are examples of causes other than normal wear and tear: unauthorized attempts by other than Digital personnel to repair, maintain or modify the equipment; catastrophe; failure of equipment not maintained by Digital or of non-Digital-supplied removable rotating storage media; fault or negligence of Customer, operator error, improper use or misuse of the equipment; causes external to the equipment such as, but not limited to, transportation or fluctuations of humidity or temperature.

C. Maintenance service does not include (1) operating supplies or accessories, cleaning supplies necessary for Customer preventive maintenance, paint, or refinishing the equipment or furnishing materials for this purpose; (2)electrical work external to the machines or maintenance of accessories, alterations, attachments or other devices not furnished by Digital unless specifically noted herein.

5. RESPONSIBILITIES OF CUSTOMER

A. The Customer shall notify Digital immediately of equipment failure and allow Digital full and free access to the equipment. Waiver of liability or other restrictions shall not be imposed as a site access requirement. Also, the Customer will allow Digital to use necessary machines, communications facilities, features and other equipment (except as normally supplied by Digital) at no charge.

B. Throughout the term of this Agreement, Customer shall maintain site conditions within the common environmental range of all system devices (and media) covered hereunder, as specified by Digital prior to the agreement commencement date.

C. Customer's representative shall be on the premises during Digital's performance of maintenance services.

D. If a system is maintained for which Digital Diagnosis Center (DDC) service is being provided, the Customer shall provide and bear the costs of Digital-specified modems and/or data sets. These devices will be connected to a dedicated direct distance dialing (voice-grade) telephone line for use only by Digital in effecting its diagnostic procedures.

E. To facilitate Digital's performance of maintenance services, the Customer agrees to provide reasonable facilities such as, but not limited to, secure storage space, a designated work area with adequate heat and light, and access to a local telephone line; these facilities are to be provided upon request and at no charge to Digital.

6. PERIOD OF SERVICE AVAILABILITY

A. The "Call Window" is defined as the time within which the Customer may notify Digital that the equipment covered under this Agreement is inoperative, and within which Digital will perform the services described in Clause 3. All equipment shall have the same Call Window, which is specified on the face of this Agreement and excludes locally observed Digital holidays, unless otherwise stated.

B. Customer may request an extension to the Call Window beyond the basic coverage of 8 AM to 5 PM Monday through Friday. Such extensions may result in twelve (12), sixteen (16), or twenty-four (24) hours of coverage per day, Monday through Friday; and include eight (8), twelve (12), sixteen (16) or twenty-four (24) hours per day Saturday, and/or Sunday, and/or holidays. The Call Window on Monday through Friday shall be the same each day, and the Call Window on Saturday and Sunday shall be the same on all Saturdays and/or Sundays. The Call Window shall begin at 8 AM daily and shall consist of consecutive hours selected.

C. If accepted, modifications to the Call Window shall be confirmed in writing by Digital prior to the effective date and shall be listed in this Agreement by addendum.

7. CHARGES

A. Monthly charges will be invoiced one (1) month in advance. Charges for a partial month's service will be prorated on a thirty (30) day month.

B. Charges for maintenance service resulting from Customer-requested Digital performance outside the Call Window, or for reasons other than normal wear and tear, will be invoiced after completion of the call at Digital's per call rates and terms then in effect.

C. Payment of all charges is due on the first day of the service period for which the Digital invoice is rendered.

D. On-call maintenance is subject to a monthly travel charge if indicated on the face of this Agreement. The applicable charge shall be the prevailing rate for commercial customers.

E. Digital may change monthly charges on the anniversary date of this Agreement by giving ninety (90) days prior written notice. The changes shall not exceed Digital's published charges of maintenance service on the effective date of the adjustment. The charges for equipment added to this Agreement will be the current published rate at the time the equipment is added.

F. In addition to the charges due under this Agreement, the Customer agrees to pay or reimburse Digital any taxes or charges resulting from this Agreement which are levied by a taxing authority, except for taxes based upon Digital's net income.

8. MOVEMENT OF EQUIPMENT

A. To permit continuity of service under this Agreement, the Customer shall give Digital at least thirty (30) days prior written notice of its intent to move the equipment listed herein. Equipment moved to a new location within the continental United States is subject to applicable mileage charges (if any) at the new location. Equipment moved outside the continental United States may be eligible for continued service under Digital's local terms and conditions then in effect for like equipment in the territory or country or reinstallation.

B. Digital personnel shall supervise the dismantling and packing/unpacking of the equipment and shall inspect and reinstall the equipment at the new location, and charge the Customer for all such labor and materials provided at its then current rates and terms. The monthly charges shall be suspended when the system is dismantled and reinstated on the day following equipment reinstallation and acceptance by Digital at the new location.

C. Digital shall be under no obiligation to fumish continued service (preventive or remedial) under this Agreement if the equipment is moved from its location of initial installation and/or reinstalled without the prior written approval of Digital.

9. LIMITATION OF LIABILITY AND WARRANTY

A. Digital's liability to the Customer (whether in contract or tort, including negligence) for damages of any nature shall not exceed the total charges paid or payable during one year under this Agreement.

B. No action, (whether in contract or tort, including negligence) arising out of the performance of services under this Agreement may be brought by either party more than eighteen (18) months after cause of action except that an action for non-payment may be brought within eighteen (18) months of the date of the last payment.

C. In no event will Digital be liable for any loss of data, lost profits or any special, indirect or consequential damages.

D. DIGITAL DISCLAIMS ALL WARRANTIES (INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE).

10. GENERAL

A. If either party neglects or fails to perform any of its obligations under this Agreement, and such failure continues for a period of twenty (20) days after written notice thereof, the other party shall have the right to terminate this Agreement.

B. The terms and conditions of this Agreement prevail over the terms and conditions of any order submitted by the Customer for maintenance services under this Agreement. If the Customer revises the order document number, the Customer will provide sixty (60)days prior written notice to Digital.

C. This Agreement supersedes all prior service agreements and understandings between the parties with respect to any equipment covered under this Agreement, and may not be changed or terminated orally.

D. It is expressly understood that if either party, on any occasion, fails to perform any term of this Agreement, and the other party does not enforce that term, the failure to enforce on that occasion shall not prevent enforcement on any other occasion.

E. Neither party shall assign this Agreement unless consented to by both parties.

F. This Agreement will be governed by the laws of the Commonwealth of Massachusetts.

PRIME COMPUTER
SCHEDULE B

MAINTENANCE TERMS AND CONDITIONS

1. REGULAR SERVICE HOURS. For purpose of this Schedule, "Regular Service Hours" will be between the hours of 8:00 A.M. and 5:00 P.M., Monday through Friday, excluding PRIME holidays.

2. EFFECTIVE DATE AND TERM. This Schedule will be effective on the date signed by PRIME and will be for a term of one year commencing on the date of Acceptance of the equipment covered hereby unless an alternative commencement date is specified. Maintenance service may be terminated at the expiration of the one-year term and at any time thereafter by either party upon ninety (90) days prior written notice, but will continue to be effective in the absence of such notice.

Upon commencement of the term, PRIME's obligation to Customer under any prior agreement for maintenance service for the equipment covered by this Schedule will cease and neither Customer nor PRIME will have any further obligation to the other in connection with the prior agreement except for payment by Customer for charges incurred thereunder.

3. CHARGES. The Monthly Maintenance charges are those shown on the face hereof and are applicable to those Customers with equipment located within one hundred (100) miles of a PRIME service center. Charges for remote service will be by special quote. It is agreed that if after the effective date of this Schedule, there is an increase in PRIME's published commercial maintenance charges and PRIME gives Customer ninety (90) days written notice of such increase, then PRIME, one year after the effective date of this Schedule and at any time thereafter, may implement such increase.

Monthly Maintenance charges for new systems that include central processor units shall be waived for the initial sixty (60) days of this Agreement when the commencement date for the term of this Agreement is contemporaneous with the Acceptance Date of such systems. This waiver by PRIME shall include all equipment ordered for delivery with such systems but shall not be applicable to equipment add-ons and/or upgrades ordered under PRIME's then prevailing upgrade policy.

The Monthly Maintenance Charge and any additional monthly charges will be invoiced in advance on the first day of each month commencing with the date equipment maintenance service is provided and will be payable by Customer within thirty (30) days from date of invoice.

Customer will pay, or reimburse PRIME, for all taxes imposed on Customer or PRIME arising out of this Schedule, except for tax based on PRIME's net income.

Any other charges will be invoiced to Customer as incurred and will be due and payable upon receipt of invoice.

4. UPGRADES. Customer shall pay PRIME's applicable Maintenance Charges for upgraded equipment obtained pursuant to PRIME's then prevailing upgrade policy from date of Acceptance of such equipment even if the equipment traded-in was subject to a waiver of Maintenance Charges at the time of trade-in. This upgrade policy shall be applicable in all instances where the traded-in equipment was covered under this Agreement.

5. MAINTENANCE SERVICE. PRIME will make all necessary adjustments and repairs to keep the equipment in good operating condition during Regular Service Hours, and in accordance with PRIME's policies then in effect. PRIME representatives will have full access to the equipment in order to effect necessary adjustments and repairs PRIME will determine the preventive maintenance service required for the equipment. All remedial maintenance service will be provided during Regular Service Hours after notification that the equipment is inoperative and PRIME will be responsible to the remedial maintenance needs of the Customer Customer will provide adequate storage space for spare parts, test equipment and adequate working space, heat, light, ventilation, electric current and outlets for use by PRIME's maintenance representatives.

Customer agrees not to move, or permit to be moved, the equipment covered by this Schedule, without PRIME's prior written consent

All spare parts until incorporated in the equipment, all test and maintenance equipment, tools and maintenance documentation will remain the property of PRIME and may be removed by PRIME at any time.

Replacement parts will be installed on an exchange basis at no additional charge to Customer when such replacement is effected on Customer's premises by PRIME's maintenance representatives. Parts removed on an exchange basis become the property of PRIME.

Maintenance service does not include replacing platens, providing supplies, accessories or refinishing of the equipment; nor maintenance of accessories, attachments, machines or other devices not provided by PRIME; nor making specification changes or performing services connected with relocation, installation or deinstallation of equipment; nor adding or removing accessories, attachments or other devices Any maintenance resulting from other than normal operation of the equipment including Customer's fault or misuse of the equipment or Customer's failure to provide the necessary facilities or specified operating supplies or to meet PRIME's site specifications will be invoiced to Customer as an additional charge.

6. ALTERATIONS AND ADDITIONS. PRIME will not be responsible to Customer for loss of use of the equipment or for any other liabilities arising from alterations, additions, adjustments or repairs which are made to the equipment by other than authorized representatives of PRIME. If, in the opinion of PRIME, any such alterations, additions, adjustment or repair adversely affects PRIME's ability to render maintenance service to the equipment, PRIME reserves the right to terminate this Schedule upon thirty (30) days prior written notice to Customer.

7. INDEMNIFICATION. Customer will indemnify and hold harmless PRIME from any loss, claim or damage to persons or property, other than the equipment, arising out of this Schedule or Customer's possession or use of the equipment and services provided which indemnity will survive the termination of this Schedule, provided that such loss, claim or damage was not caused solely by the fault of PRIME.

8. GENERAL. If PRIME or Customer is in default under this Schedule and such default continues for thirty (30) days after written notice by the other party, this Schedule may be terminated by such other party. In the event of default by Customer, it is agreed that Customer will pay PRIME all costs and expenses including reasonable attorney's fees incurred by PRIME in exercising any of its rights or remedies. No delay or failure of PRIME to exercise any right or remedy will operate as a waiver thereof

Customer may not assign any of its rights under the contract formed by this Schedule.

PRIME will not be liable for any failure or delay in performance due in whole or in part to any cause beyond PRIME's control. In no event will PRIME be liable for any indirect, special or consequential damages arising out of this Schedule or the use of any services provided in this Schedule.

This Schedule may be amended only by an instrument in writing executed by Customer and PRIME.

THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, NOT SPECIFIED HEREIN RESPECTING THIS SCHEDULE AND THE SERVICES PROVIDED.

_____
CUSTOMER'S INITIALS

UNIVAC

MAINTENANCE SERVICE AGREEMENT

Mini-Computer Operations

(TO BE COMPLETED IF OTHER THAN ABOVE)

AGREEMENT NUMBER

y Rand Corporation, acting through its Sperry Univac Division (hereinafter called "Sperry Univac"), upon its acceptance here- means of signature in the Acceptance block of this Agreement, shall furnish to the Customer, subject to the Terms and litions hereinafter stated, Maintenance Service with respect to the Equipment listed below.

IPMENT SCHEDULE

TYPE NUMBER	GROUP	SERIAL NUMBER AND DESCRIPTION	NO. OF UNITS	BASE MONTHLY MAINTENANCE CHARGE	
				UNIT	EXTENDED

TOTAL ▶

MAINTENANCE SERVICE	FROM	TO
ICIPAL PERIOD OF AINTENANCE		
TIONAL SCHEDULED EXTENDEC PM (GROUP & EQUIPMENT)		

TIONAL MONTHLY CHARGE FOR EXTENDED PPM $ ______

DEFINITIONS

The following terms shall have the meanings set forth below whenever they are used in this Agreement including the preceding page:

(a) "Documentation" shall mean the then current standard visually readable materials published by Sperry Univac for Customer use with the Equipment.

(b) "Equipment" shall mean all of the items listed on the Equipment Schedule of this Agreement as modified by any supplemental Equipment Schedule.

(c) "Site" shall mean the room or rooms within which each unit of Equipment is to be installed, at the address designated on the preceding page.

TERM OF AGREEMENT

(a) This Agreement shall become effective on the date it is accepted by Sperry Univac. It shall continue in effect for an initial term of one (1) year from the date specified in Section 5 (b) for commencement of Monthly Maintenance Charges for the last unit of Equipment installed under this Agreement. This Agreement shall continue in effect thereafter until terminated or cancelled in accordance with the provisions of Section 8.

(b) In addition to the services described herein, any other item furnished or service performed by Sperry Univac for the Customer in furtherance of this Agreement, although not specifically identified in it, shall nonetheless be covered by this Agreement.

REMOVAL AND RELOCATION OF EQUIPMENT

Sperry Univac shall not be obligated to provide maintenance service, under this Agreement, at any location other than the Site designated herein. If the Customer wishes to relocate any unit (s) of Equipment, he shall give timely notice to Sperry Univac and the relocation and maintenance, if any, of such Equipment shall be subject to agreement between authorized representatives of the parties.

EQUIPMENT MAINTENANCE SERVICE

(a) Sperry Univac shall provide preventive and remedial maintenance service to maintain the Equipment in satisfactory operating condition. Preventive maintenance shall be performed during the Principal Period of Maintenance (herein referred to as "PPM") except that in the case of Equipment designated in the Equipment Schedule as Group (A), preventive maintenance may be performed at such times as may be agreed upon by authorized representatives of the parties. Sperry Univac shall determine the frequency and the duration of preventive maintenance.

(b) Payment of the Base Monthly Maintenance Charges shall entitle the Customer to on-call remedial maintenance service during the PPM, which shall consist of the same consecutive nine (9) hour period per day as identified on the face of this Agreement, between the hours of 7 a.m. and 6 p.m., five (5) days per week, Monday through Friday, excluding holidays. In addition, PPM shall be deemed to include any agreed period of scheduled extended maintenance service availability.

(c) For such Equipment as is designated as Group (A) in the Equipment Schedule, Sperry Univac, upon thirty (30) days prior written request by the Customer, will extend the period of scheduled on-call maintenance availability. The periods included in any such extended period of maintenance shall be consecutive, of uniform duration and shall immediately precede and/or follow the PPM as scheduled for the same day. Additional charges and other terms applicable to the extended period of maintenance shall be in accordance with Sperry Univac's standard published charges and terms in effect at the time such extended period of maintenance is scheduled.

(d) Upon thirty (30) days prior written request by the Customer any extended period of maintenance scheduled thereunder may be modified subject to appropriate adjustments in accordance with Sperry Univac's standard published rates in effect at the time.

(e) With the exception of Group (C) or (D) Equipment, where remedial maintenance service is commenced during the PPM and is continued beyond the PPM, no additional charge shall be made until the time worked after the PPM exceeds the time worked immediately preceding the end of the PPM.

(f) Where Equipment designated as Group (B) or (C) in the Equipment Schedule is installed at a location which is more than 25 miles beyond the city limits in which a Sperry Univac Maintenance Service Office is located, the Customer shall be charged at the applicable Sperry Univac standard hourly rates for the time of Sperry Univac's personnel in traveling in excess of the 25 mile limit to and from such location.

(g) Where the Equipment is designated as Group (D) in the Equipment Schedule a Monthly Travel Zone Charge at Sperry Univac's prevailing zone rates shall be charged for each unit of Equipment located more than 15 miles beyond Sperry Univac's nearest established point of maintenance service.

(h) Except as otherwise expressly provided in paragraphs (e) and (f) of this Section 4, the furnishing by Sperry Univac of any remedial maintenance service outside of the PPM shall be subject to Sperry Univac's standard published charges and terms then in effect applicable to the Equipment serviced.

(i) The Customer shall provide, at its expense, for use of Sperry Univac's maintenance personnel, and reasonably accessible to the Equipment, adequate and secure working and storage space and facilities as may be needed by Sperry Univac in order to provide maintenance service of the Equipment. Replaced parts shall become the property of Sperry Univac.

(j) The Customer shall be responsible for the use, care and cleaning of the Equipment in accordance with instructions furnished by Sperry Univac. When a need arises for maintenance service the Customer shall notify Sperry Univac's maintenance personnel immediately, allow full access to the Equipment and release the Equipment to Sperry Univac for maintenance service.

(k) By written agreement between authorized representatives of the parties, Equipment may be added to the Equipment Schedule subject to appropriate adjustments in accordance with Sperry Univac's standard published charges and other terms in effect at the time.

5. CHARGES

(a) The Customer shall pay the Base Monthly Maintenance Charges, as well as all other charges provided in this Agreement, within thirty days after date of invoice. The Monthly Maintenance Charges shall be invoiced monthly in advance. All other charges under this Agreement shall be invoiced by Sperry Univac, at its option, as incurred or at a later date.

(b) Maintenance Charges for the Equipment, and for Group (D) Equipment any applicable Travel Zone Charges, shall commence on the date such Equipment is installed and ready for use, or on the effective date of this Agreement, whichever event occurs later.

(c) The charges do not include, and the Customer assumes the cost of: (1) supplies; (2) painting or refinishing the Equipment; (3) installation or movement of any unit of Equipment or part thereof; (4) repair of damage to the Equipment, including replacement of parts, resulting from the fault of the Customer or from causes reasonably within the Customer's control; and (5) replacement of parts due to total degradation of these parts due to wear.

(d) The charges do not include any federal, state, county, local or other taxes howsoever designated and whether levied or based upon such charges, this Agreement, the Equipment or its use, or any service or parts supplied hereunder. Any taxes or amounts in lieu thereof and interest thereon paid or payable at any time by Sperry Univac, exclusive of personal property taxes and taxes based on net income, shall be borne by the Customer.

(e) All charges relative to any unit are subject to change by Sperry Univac, on thirty (30) days prior written notice to the Customer, effective at the end of one year from the date of commencement of such charges for each such unit of Equipment, and at any time thereafter.

(f) When any unit (s) of Equipment is installed for a fraction of a calendar month, the charges for each day shall be computed at the rate of 1/30th of the monthly charges for such unit (s).

6. WARRANTY

(a) Sperry Univac warrants that under normal use and service, all Equipment which is continuously the subject of a Sperry Univac Maintenance Service Agreement after the date of its installation shall remain in satisfactory operating condition except for those parts which totally degrade due to wear.

(b) Sperry Univac's sole and exclusive obligation under this warranty shall be to repair any unit of Equipment which is repairable, and, during the first year after the ready for use date of the Equipment, shall be at its option to refurbish, overhaul, or rebuild any unit of Equipment that (1) has been promptly reported by the Customer to Sperry Univac as defective in material or workmanship; and, (2) upon investigation by Sperry Univac, shall be determined by Sperry Univac to have been defective.

7. ALTERATIONS AND ATTACHMENTS

If the Customer uses non-Sperry Univac attachments, features or devices on the Equipment or makes alterations to the Equipment; (1) Sperry Univac shall be relieved of the obligation(s) specified elsewhere in this Agreement, including without limitation, the obligation which may be incurred under the provisions of Section 6, caused by or resulting directly or indirectly from such alterations or attachments; (2) Sperry Univac shall not be liable for any performance degradation of the Equipment caused by or resulting directly or indirectly from such alterations or attachments; (3) Sperry Univac will not be responsible for the cost or effort to modify any Documentation affected directly or indirectly by such alterations or attachments; (4) The Customers shall pay Sperry

nivac for any increase in the cost or effort related to maintenance ervice for the Equipment, caused by or resulting directly or ndirectly from such alterations or attachments; (5) Sperry Univac hall not be responsible for any injury to persons or damage to roperty, real or personal, caused by or resulting directly or ndirectly from such alterations or attachments.

NCELLATION AND TERMINATION

a) Either party may, upon thirty (30) days prior written notice, ancel Maintenance Service on any unit of Equipment twelve (12) nonths after the date of commencement of Maintenance Charges or such unit or at any time thereafter. This Agreement shall erminate upon cancellation of Maintenance Service as to all units of quipment.

b) Sperry Univac may elect, without prejudice to any other rights or emedies, to cancel this Agreement; (1) if the Customer, upon ten ays prior written notice, has failed to make payments due ereunder or has failed to perform any other substantial obligation o be performed by the Customer under this Agreement; or (2) if a etition in Bankruptcy has been filed by or against the Customer, or ne Customer has made an assignment for the benefit of creditors, or receiver has been appointed or applied for by the Customer.

IMITATION OF LIABILITY

a) EXCEPT AS HEREIN EXPRESSLY STATED, THERE ARE NO /ARRANTIES, EXPRESS OR IMPLIED, BY OPERATION OF LAW R OTHERWISE, OF THE SERVICES AND PARTS AND OCUMENTATION PROVIDED IN CONNECTION WITH SUCH ERVICES UNDER THIS AGREEMENT. SPERRY UNIVAC ISCLAIMS ANY IMPLIED WARRANTY OF MERCHANTABILITY R FITNESS FOR PARTICULAR PURPOSE. IN NO EVENT SHALL PERRY UNIVAC BE LIABLE FOR ANY INCIDENTAL, INDIRECT, PECIAL OR CONSEQUENTIAL DAMAGES IN CONNECTION /ITH OR ARISING OUT OF THIS AGREEMENT OR THE XISTENCE, FURNISHING, FUNCTIONING OR THE USTOMER'S USE OF ANY PART, DOCUMENTATION OR ERVICES PROVIDED FOR IN THIS AGREEMENT. THE USTOMER'S SOLE AND EXCLUSIVE REMEDY FOR LIABILITY F ANY KIND, INCLUDING NEGLIGENCE WITH RESPECT TO HE PARTS, DOCUMENTATION AND SERVICES FURNISHED NDER THIS AGREEMENT, SHALL BE LIMITED TO THE REMEDY ROVIDED IN SECTION 6 OF THIS AGREEMENT.

(b) THE CUSTOMER FURTHER AGREES THAT SPERRY UNIVAC SHALL NOT BE LIABLE FOR: (1) ANY LOSS OF USE, REVENUE OR PROFIT; (2) ANY CLAIM, DEMAND OR ACTION AGAINST THE CUSTOMER BY ANY THIRD PARTY.

10. GENERAL PROVISIONS

(a) Title to all Documentation shall remain with Sperry Univac. All devices, accessories, Documentation and updates thereto, furnished by Sperry Univac, except for those replacement parts that are incorporated into the Equipment, or those purchased by the Customer, or consumed in Maintenance Service, shall be returned to Sperry Univac upon termination of this Agreement.

(b) Neither party shall be liable or deemed to be in default for any delay or failure in performance under this Agreement or interruption of service resulting directly or indirectly from acts of God, civil or military authority, acts of public enemy, war, riots, civil disturbances, insurrections, accidents, fire, explosions, earthquakes, floods, the elements, strikes, labor disputes, shortages of suitable parts, materials, labor or transportation, or any other causes beyond the reasonable control of such party.

(c) The Customer shall not assign or otherwise transfer its rights or obligations under this Agreement, except with the written consent of Sperry Univac and any prohibited assignment shall be null and void. Sperry Univac shall have the right to assign all or part of the payments under this Agreement, subject to the Customer's rights hereunder.

(d) This Agreement shall be governed by the local laws of the Commonwealth of Pennsylvania.

(e) This Agreement constitutes the entire agreement between the parties with respect to the subject matter hereof and shall supersede all previous proposals, both oral and written, negotiations, representations, commitments, writings, agreements, and all other communications between the parties. It may not be released, discharged, changed or modified except by an instrument in writing signed by a duly authorized representative of each of the parties. The terms of this Agreement shall prevail notwithstanding any variances with the terms and conditions of any order submitted by the Customer.

(f) No action, regardless of form, arising out of transactions occurring under or contemplated under this Agreement may be brought by either party more than two (2) years after the cause of action has accrued.

EPTANCE

RY UNIVAC DIVISION OF SPERRY RAND CORPORATION. PTANCE BY (TYPE NAME)	CUSTOMER ACCEPTANCE BY (TYPE NAME)
URE DATE	SIGNATURE DATE
	TITLE

MEMOREX MAINTENANCE AGREEMENT

EMOREX CORPORATION
n Tomas at Central Expressway
nta Clara, California 95052

SALES BRANCH OFFICE NO.	SERVICE BRANCH OFFICE NO.	CUSTOMER NO.	AGREEMENT NO.

ɔREX SALES BRANCH OFFICE ADDRESS

CUSTOMER NAME & ADDRESS

OMER ACKNOWLEDGES THAT HE HAS READ THIS AGREE-T, UNDERSTANDS IT AND AGREES TO ALL TERMS AND DITIONS STATED HEREIN.

MER: ______

AUTHORIZED SIGNATURE

NAME (TYPE OR PRINT)

TITLE

DATE

ED BY: ______

SALES BRANCH OFFICE NAME/NUMBER

SALES BRANCH OFFICE MANAGER'S SIGNATURE

MANAGER'S NAME (TYPE OR PRINT)

DATE

MEMOREX
FIELD - BY: ______

SALES BRANCH OFFICE NAME/NUMBER

BY ______

SALESMAN'S SIGNATURE

SALESMAN'S NAME (TYPE OR PRINT)

ON ______

DATE

BY ______

FIELD SUPPORT BRANCH OFFICE NAME/NUMBER

BY ______

FIELD SUPPORT MANAGER'S SIGNATURE

FIELD SUPPORT MANAGER'S NAME (TYPE OR PRINT)

ON ______

DATE

ACCEPTED BY: ______

MAINTENANCE BILLING AUTHORIZED SIGNATURE

BY ______

NAME (TYPE OR PRINT)

TITLE

ON ______

DATE

ɛx Corporation by its acceptance of this Maintenance Agreement (the "Agreement") to provide and the Customer agrees to purchase on the following terms and condi- aintenance service for the Memorex data processing equipment and programming s shown on the "Equipment and Programming Products List" attached hereto as A and incorporated herein by reference and for additional equipment and products ich such service is ordered from time to time by the Customer, subject to written ation by Memorex.

reement shall be deemed accepted and requests for additional coverage shall be l confirmed when signed at Memorex headquarters by an authorized agent of the nance Billing Office.

ALIFICATION FOR MAINTENANCE SERVICE

condition precedent to this Agreement that equipment covered qualifies by its condi- r maintenance service. The determination as to qualification will be made solely by morex Field Support Representative based upon Field Support inspection. Inspec- d qualification will not be necessary in the case of leased equipment or of purchas- pment at the expiration of the Service Warranty period.

ce is needed to bring the equipment up to Memorex maintenance agreement stand- Memorex will so notify Customer in writing. Unless Customer informs Memorex in within 15 days of the date of such notice that it does not want this service to be ned, Memorex shall proceed with the required service. Customer will be billed at nd material rates for the effort needed to bring this equipment up to maintenance ent standards.

MS OF AGREEMENT

reement is effective from the date on which it is accepted by Memorex and shall in force until terminated by the Customer upon one month's prior written notice Memorex upon three months' prior written notice. Individual machines may be awn from this Agreement by the Customer upon one month's written notice, or by ex upon three months' written notice.

3. MAINTENANCE SERVICE

Memorex agrees to provide maintenance service availability during the selected periods to keep the machines in good working order while they are located at the agreed location within the United States. The agreed location is indicated in the "Equipment and Programming Products List" attached hereto as Exhibit A. Maintenance service includes scheduled preventive maintenance based upon the specific needs of the individual machines as determined by Memorex, and unscheduled, on-call remedial maintenance. Maintenance will include lubrication, adjustments and replacement of parts deemed necessary by Memorex. Extraordinary maintenance service which involves extensive reconditioning and upgrading of equipment is not covered by this Agreement. The determination of whether a maintenance request involves extraordinary service will be made solely by Memorex.

Parts will be furnished, at no additional charge, on an exchange basis regardless of when installed by Memorex and will be new or equivalent to new in performance when used in these machines. Replaced parts become the property of Memorex.
Customer agrees to furnish Memorex full and free access to the equipment to provide service thereon.

4. PERIODS OF MAINTENANCE SERVICE AVAILABILITY

Customer has selected the period(s) of maintenance service availability shown on the "Equipment and Programming Products List" which is attached hereto as Exhibit A. The selected period(s) of maintenance service availability may be changed by Customer by giving Memorex 30 days prior written notice, subject to written confirmation by Memorex. Memorex holidays are (regardless of individual state, city, local or company observance) those days that are celebrated by the Federal Government in observance of the following holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. This Agreement does not provide maintenance coverage on holidays. Work performed on a holiday is chargeable at Memorex's applicable hourly rates and terms then in effect.

BRANCH OFFICE COPY

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MAINTENANCE SERVICE CHARGES

...er agrees to pay maintenance service charges for the periods of service selected ... on the "Equipment and Programming Products List" which is attached hereto as ... A. If Customer requests maintenance to be performed at a time outside the selected ... of maintenance service availability, the service will be furnished at Memorex's ... hourly rates and terms then in effect.

...nance charges for a machine will commence on the stated effective service com... day (Monday through Friday) following the last day on the serv... warranty period, whichever is later.

...ly charges will be invoiced in advance and will be payable within thirty days after ... Charges for a partial month's service will be prorated based on a ... day month.

...shall be added to any charges under this Agreement amounts equal to any taxes, ... levied or based on such charges or on the services rendered or parts ... pursuant hereto, including but not limited to state and local privilege or excise ... revenue, and any taxes or amounts in lieu thereof paid or payable ... in respect of the foregoing, exclusive, however, of taxes based on net in...

...E HOUR MINIMUM CHARGE FOR LABOR

...er agrees to pay for services performed during any period not covered by this ... or otherwise. For purposes of determining the amount of such charges, a ... period consisting of one hour immediately following any period of coverage will be ... If a service call starts during a period not covered or ends outside a covered ... or the ... period, the Customer will be charged for labor for the time not cover... for a one hour minimum, whichever is larger, plus the appropriate travel charge.

...AVEL CHARGES

... assigned to the zone shown on the "Equipment and Programming Products ... attached hereto as Exhibit A. Travel charges are billed according to this ... unless Customer has entered into a Maintenance Travel Contract. If ... Customer's units are covered by a Maintenance Travel Contract, Customer ... for travel for each service call involving a unit not covered by the Main... Contract no matter which unit the service call was originally placed for.

...SPONSE TIME

...is no guarantee regarding response time to a service call from a customer. Memo... will make every effort to respond within the same work day.

...CLUSIONS

...nance service does not include:

...ctrical work external to the machines or maintenance of accessories, alterations, ... other devices not furnished by Memorex;

...pair of damage or increase in service time caused by: accident, transportation, ... alterations, which shall include, but not be limited to, any deviation ... circuit ... structural machine design as provided by Memorex, installation or re... of Memorex features or any other modification, whenever any of the foregoing ... performed by other than Memorex;

...pair of damage or increase in service time resulting from failure to provide a suit... environment with all facilities prescribed by the appropriate Memo... Installation Manual – Physical Planning (including but not limited to failure of or ... to provide adequate electrical power, air conditioning, including humidity ... use of supplies or materials not meeting Memorex specifications for ... installation;

(d) Repair of damage or increase in service time ... machines for other than the data processing purposes for which designed;

(e) Furnishing platens, supplies or accessories; painting or refinishing the machines or furnishing material therefor; making specification changes or performing services connected with relocation of machines; or adding or removing accessories, attachments or other devices; and

(f) Service which is impractical for Memorex to render because of alterations in the machines or their connection by mechanical or electrical means to another machine or device.

If persons other than Memorex representatives shall perform maintenance or repair of a machine, and as a result further repair by Memorex is required, such further repairs will be made at Memorex's applicable time and material rates and terms then in effect. If such additional repair is required, Memorex may withdraw the machine from this Agreement upon written notice following any repetition of the need for additional repair of such machine caused by non-Memorex maintenance activity.
Memorex is not responsible for failure to render service due to causes beyond its control.

10. OTHER MAINTENANCE SERVICE

Memorex may provide maintenance outside the scope of this Agreement. Such service will be furnished at Memorex's applicable time and material rates and terms then in effect.

11. ENGINEERING CHANGES – INSTALLATION AND CONTROL

Engineering changes determined applicable by Memorex will be controlled and installed by Memorex on equipment covered by this Agreement.

12. LIMITATION OF LIABILITY

Customer agrees that Memorex will not be liable for any consequential damages, even if Memorex has been advised of the possibilty of such damages.
No action arising under this Agreement may be brought by either party more than one year after the cause of action has accrued, except that an action for nonpayment may be brought within one year of the date of last payment.

13. MODIFICATION

The terms of this Agreement, including but not limited to the monthly charges, period of maintenance service availability offered, and extended coverage period percentages, are subject to change by Memorex upon three months' written notice to Customer. Customer may exercise his right to terminate; otherwise, such modification shall be come effective on the date stated.

14. ASSIGNMENT

Customer shall not assign, transfer or pledge this Agreement without the prior written consent of Memorex. The consent of Memorex to any of the foregoing applies only to the instance in which it is expressly given, and shall not be deemed a consent to any subsequent like act by Customer or any other person.

Subject to the foregoing, this Agreement inures to the benefit of, and is binding upon the successors and assigns of the parties hereto.
Memorex may assign or transfer this Agreement either in whole or in part without notice to Customer.

15. REPRESENTATION OF AUTHORITY

The equipment covered by this Agreement is the property of Memorex or a subsidiary thereof or Customer represents that he is the owner of the machines for which he shall order maintenance service, or if not the owner that he is the user and has authority from the owner to order such service.

16. GOVERNING LAW

The interpretation, performance, and enforcement of this Agreement shall be governed by the laws of the State of California.

17. EXCLUSIVE AGREEMENT

This Agreement constitutes the complete and exclusive statement of the agreement superseding all oral or written communications and any prior agreements between the parties relating to its subject matter. The terms of this Agreement shall prevail notwithstanding any variance with the terms of any present or future order from the Customer for maintenance services. The term "this Agreement" as used herein includes any future written amendments, modifications or supplements made in accordance herewith.