

1981 FIELD SERVICE ANNUAL REPORT

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I INTRODUCTION

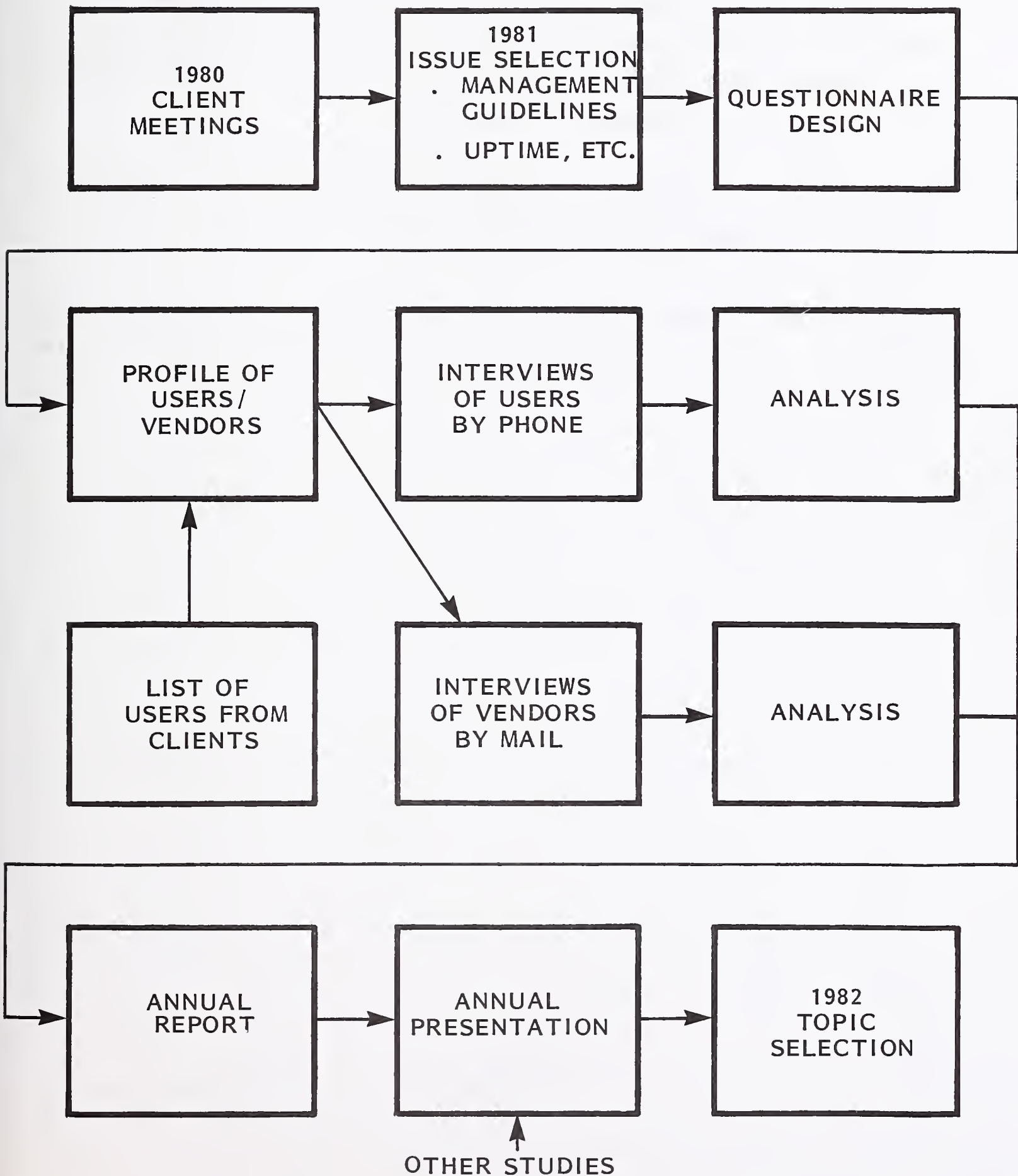
I INTRODUCTION

- This report is designed to function as a basic management and planning document for INPUT's clients in the 1981 U.S. Field Service Program. The report is based on three main sources:
 - A telephone survey of 108 users who identified and rated maintenance vendors.
 - A combination mail questionnaire/telephone follow-up campaign among 50 vendors which yielded responses from 19 U.S. vendors of field services.
 - INPUT's library of vendor and market information.
- The report provides clients with a comprehensive presentation of the current state of the user and vendor aspects of the field service sector of the industry. Elements include the following which were also treated in the 1980 Field Service Annual Report.
 - The size and growth of the market.
 - Users' perceptions of individual vendor maintenance performance.
 - Comparison of IBM performance with other vendor performance.

- The impact of maintenance on equipment selection.
 - Current levels of response and repair trends.
 - Vendor organizational trends.
 - Vendor rating of issues.
 - Vendor salary, personnel trends.
 - Analysis and comparisons with the previous year.
- In response to client requests several new elements have been added:
 - An analysis of uptime of current equipment.
 - Word processing as a specific equipment category.
 - Identification of decision-makers in the buying process.
 - User receptivity to marketing by field service.
 - Identification of vendor measurement guidelines.
 - This report continues INPUT's research and analysis in the area of field service which was initiated by INPUT's 1978 multiclient study, Maintenance Requirements for the Information Processing Industry. The methodology is presented schematically in Exhibit I-1.
 - 1980 client meetings provided guidance on issue selection.
 - To better balance the user profile and the client group, clients were given the opportunity to include lists of their users in the interview profile; seven clients used this option.

EXHIBIT I-1

METHODOLOGY USED IN THE FIELD SERVICE PROGRAM



- Annual in-house presentations are being given concurrent with the publication of this report to accomplish dual delivery of the information gathered. These presentations also function to help identify issues for the 1982 programs, thus insuring continuity.
- The vendor and user interviews were carried out in February-April 1981. A profile of respondents is presented in Appendix A. Vendor salary information is in Appendix B; definitions in Appendix C; the user questionnaire in Appendix D; and the vendor questionnaire in Appendix E.
- To allow wide distribution of the key conclusions of this study, clients are provided with additional copies of the Executive Summary.
- Inquiries and comments from clients are invited, relative both to the completed work and to work which clients want INPUT to undertake in the future.

II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

A. 1981 IN PERSPECTIVE

- For U.S. field service management, 1981 is a year of generally good news. The challenges of the 1980s are being met:
 - Users continue to show high satisfaction with the level of service being delivered.
 - Users are open to alternative methods of delivery of services: remote diagnostics and support centers, for example. These methods have potential to vendors as cost control techniques.
 - The issue of software maintenance by field engineering (FE) is reaching a critical stage in many companies and is a challenge now before field service management.
- Vendors of field service continue to experience growth in revenues, profit and status. These growth factors are putting pressures on management to run field service as a successful business; their task of running this business is the focus of this report.
- The impact of changes in the market introduced with the IBM 4300 series in 1979 is being felt. These changes include:

- Decreased emphasis on some traditional FE tasks such as preventive maintenance.
 - Increased emphasis on software maintenance as a revenue generator and as part of the total FE offering.
 - Utilization of a mix of delivery mechanisms, including support centers in place of on-site software maintenance, remote diagnostics and depot maintenance.
- Field service, as pointed out in the 1980 annual report, is growing in importance as a revenue generator in many companies.
 - Continued new installations, combined with maintenance of the installed base, have pushed FE revenues to 20% and more of total revenues in many companies.
 - Two companies in the process control sector of EDP, Measurex and Accuray, already receive approximately 50% of their revenue from FE; this is the inevitable outcome in companies with relatively stable growth and a continuing need to maintain a complex installed base with on-site maintenance.
 - Vendors are looking at techniques for saving on their major cost element - labor. They are also starting to look at methods for increasing the other side of the profit equation - that of increasing revenues through improved pricing, marketing and sales techniques.

B. 1980-1981 REVENUE GROWTH AND 1986 FORECASTS

- According to a recent INPUT survey of 23 field service vendors, most will exceed INPUT's 1980 revenue growth forecast of 15%.

- The major driving force is the increase in prices due to inflation. Typical 1980 price increases were in the 9% to 20% range, sufficient in themselves to achieve the average 15% revenue growth forecast.
- Of the 23 vendors, 18 expected a 1980-1981 growth of 20% or better.
 - . Three vendors expected 15% growth and one vendor expected only 13%.
 - . The larger vendors, those with a larger installed base, expected slower growth rates.
 - . The unweighted average growth rate of the 23 vendors was 28%.
- Because of the greater impact of large vendors who are growing at a slower rate than the average in the survey, and because the responding vendors tended to be from the more aggressive, faster growing companies, INPUT estimates that the industry is growing at an annual rate of 20%, significantly below the survey average.
- Driving the growth rate upward in addition to inflation is the continued shipment of new equipment and the increased importance of peripherals, terminals and small business computers; these carry a higher maintenance charge relative to sales price than do mainframes and minicomputers.
- Moderating the growth rate is the increased user involvement in self-maintenance and the use of depots, support centers, remote diagnostics and the introduction of more reliable equipment.
- Data is not available to allow detailed forecasts by each equipment category. However, by grouping mainframes, small business computers and minicomputers in one category, peripherals and data terminals in a second category and word processing in a third category, growth rates can be developed by

relating the rates of maintenance growth in these categories to the rates of maintenance revenue growth of the companies who participate in these categories.

- As shown in Exhibit II-1, this analysis results in a projected increase in market share for the faster growing peripherals and terminals category.
- Mainframe maintenance revenue growth is being slowed by the relatively smaller charges for new mainframe offerings, most notably the IBM 4300.
- Distributed data processing is feeding the higher terminal growth.
- Word processing is growing most rapidly, but from a relatively small base.

C. MAJOR FORCES IN THE USER ENVIRONMENT

- Most users in 1981 continue to be very satisfied with the level of maintenance being provided, as shown in Exhibit II-2.
 - For minicomputers, however, the level of highly satisfied users dropped below 50% of the survey; this lower satisfaction level is consistent with an indication that users (7% of the respondents) will replace minicomputers when maintenance falls below acceptable levels.
 - Users of peripherals and data terminals, although mostly satisfied with maintenance, showed a continued willingness to replace equipment if maintenance is unsatisfactory.
 - Compared to 1980 results, users are more satisfied with software maintenance. This is largely a result of the success of the dominant

EXHIBIT II-1

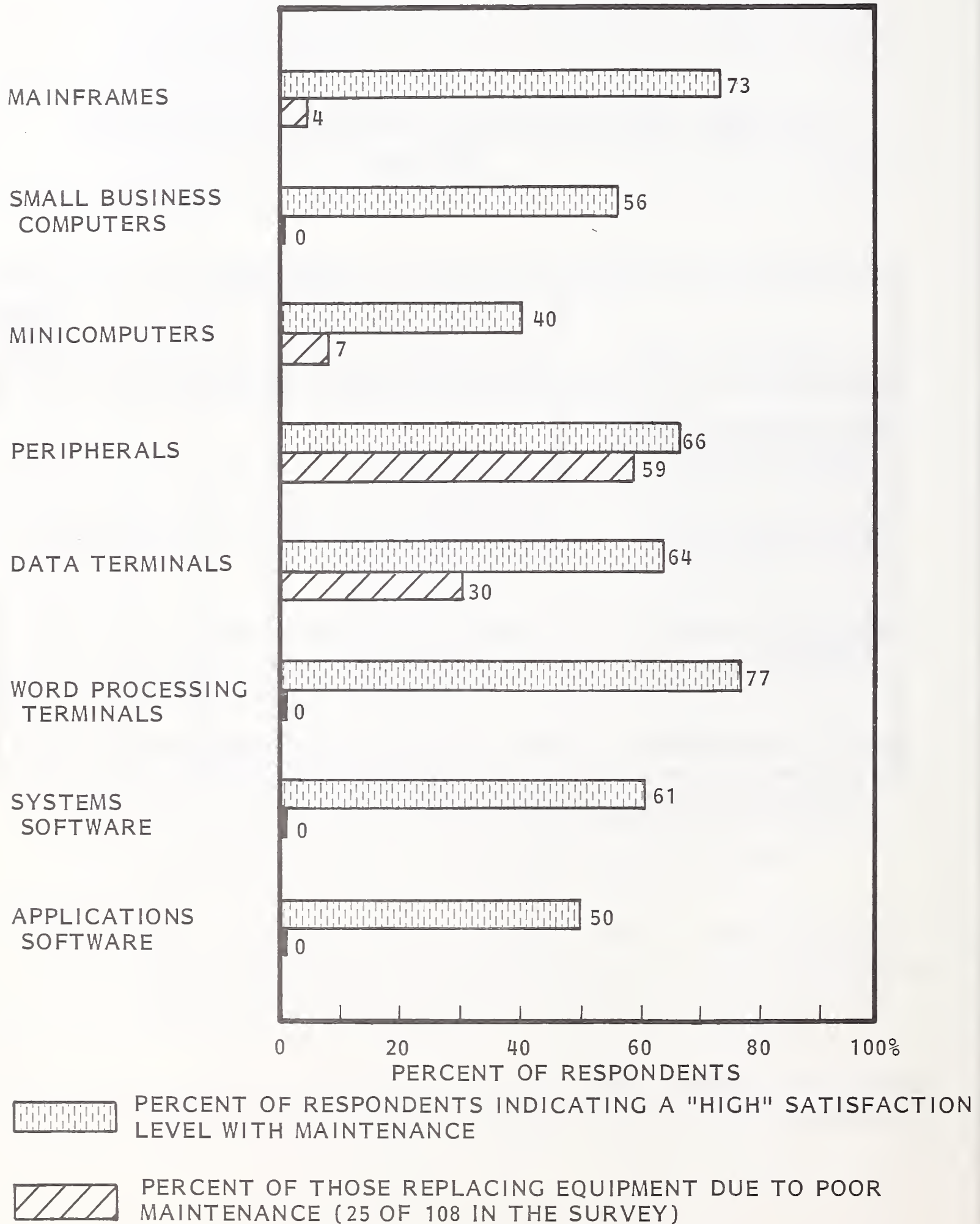
U.S. FIELD SERVICE EQUIPMENT MAINTENANCE REVENUES, 1980-1986

EQUIPMENT TYPE	\$ BILLIONS							AAGR (PER- CENT)
	1980	1981	1982	1983	1984	1985	1986	
MAINFRAMES, SMALL BUSINESS COMPUTERS, MINICOMPUTERS	\$3.1	\$3.6	\$4.2	\$4.8	\$5.6	\$6.5	\$7.6	16%
PERIPHERALS AND DATA TERMINALS	3.2	3.9	4.8	5.8	7.1	8.6	10.6	22
WORD PROCESSING TERMINALS	0.15	0.2	0.27	0.36	0.5	0.7	0.9	34
TOTAL (ROUNDED)	\$6.4	\$7.7	\$9.2	\$11.0	\$13.2	\$16.0	\$19.1	20%

AAGR = AVERAGE ANNUAL GROWTH RATE 1981-1986

EXHIBIT II-2

USER SATISFACTION LEVELS COMPARED TO EQUIPMENT REPLACED DUE TO POOR MAINTENANCE



software maintenance vendor, IBM, in supplying software maintenance from its support centers.

- Users are increasingly interested in uptime as a prime service measurement. Data gathered in the 1981 survey indicates that the following percentages among the 108 user respondents are experiencing 99% or better uptime:

-	Mainframes	-	39%
-	Small business computers	-	31%
-	Minicomputers	-	30%
-	Peripherals	-	23%
-	Data terminals	-	32%
-	Word processing terminals	-	32%
-	Applications software	-	21%
-	Systems software	-	29%

- Since an average of 20% of the respondents are experiencing 98% uptime across the equipment/software range:

- This means a total of 50% or more of the users are currently experiencing 98% or better uptime, another indicator of the high level of field service currently being delivered.
- This data use reflects the challenge which Hewlett-Packard has accepted in offering 99% uptime guarantees at a premium fee; many users perceive they are already receiving close to this level of service.

- In probing further into user satisfaction, INPUT found that 20% of respondents rated quality of maintenance more highly than equipment/software, and 39% rated equipment/software more highly than quality of maintenance.
 - Forty-one percent felt that importance of the quality of maintenance/hardware/software was a single package and rated them equally.
 - Clearly vendors of maintenance must participate aggressively in the design of hardware and software since many users typically grade the maintenance vendor more on the quality of the hardware/software than on the quality of the maintenance.
- The user attitude toward pricing of maintenance is mixed, with many users feeling captive and without options. Others, however, are becoming more analytical in evaluating pricing, and are seeking options.
 - Users were found to be very interested in receiving formal presentations from maintenance vendors on a combination of pricing alternatives, future product support plans and methods for improved communications and user productivity.

D. VENDOR PROFIT AND PERSONNEL MEASURES

- The trend to profit center organization among field engineering organizations is continuing, with 18 of 19 responding vendors either currently functioning as a profit center or intending to do so. Average profit performance of vendors is presented in Exhibit II-3.
 - Average gross profitability of responding vendors in 1980 was 16%.

EXHIBIT II-3

GROSS PROFIT MARGINS OF RESPONDING VENDORS

GROSS PROFIT CATEGORY	GROSS PROFIT MARGIN			
	1979	1980	1981	1983
FE DIVISION/DEPARTMENT				
AVERAGE RANGE NUMBER OF RESPONSES	18% 0-28% 9	16% 5-33% 10	16% 2-36% 11	19% 6-33% 11
FIELD LEVEL				
AVERAGE RANGE NUMBER OF RESPONSES	33% (5)-65% 4	34% 10-55% 5	38% 25-50% 6	42% 33-48% 6
BRANCH OFFICE LEVEL				
AVERAGE RANGE NUMBER OF RESPONSES	32% 20-44% 3	37% 31-48% 4	45% 34-50% 5	46% 35-56% 5

- The wide range in 1980 profitability, from 5% to 33% among 10 respondents, results from a combination of differences in operating results and accounting methods.
 - A finding of the 1981 survey is that vendors expect profitability to increase to 19% in 1983 in spite of inflationary pressures.
 - The increase in total profitability is expected to be reflected in increased field and branch office profits, as shown in Exhibit II-3.
- With regard to recruiting, the most significant development in 1981 is a shift in emphasis away from hardware FEs and hardware specialists; these are expected to approximately double by 1986, according to respondent vendors while software and communications specialists are expected to triple in the same timeframe.
- In terms of total FEs, the larger mainframe companies expect very little growth.
 - The minicomputer, terminal and peripheral vendors anticipate a higher short-term growth with a slackening off later in the forecast period.
- The rapid growth in FEs among small companies - some expecting a 50% and greater increase in 1981 versus 1980 - with the low growth among large mainframe companies who account for over half of the current FE force results in a net growth between these extremes. INPUT forecasts an 11% FE growth in 1980-1983, dropping off to 8% in 1984-1986. The dropoff is due largely to more reliable equipment and the growth of remote diagnostics.
- As shown in Exhibit II-4, the total effect of revenue growth combined with reduced FE growth results in the industry finally achieving \$100,000 annual revenue per territory FE by 1986.

EXHIBIT II-4

FORECASTED FIELD PERSONNEL GROWTH AND ANNUAL REVENUE PER FIELD ENGINEER, 1981-1986

YEAR	MAINTENANCE REVENUE (\$ BILLIONS)	FIELD MAINTENANCE PERSONNEL (THOUSANDS)	REVENUES PER FIELD MAINTENANCE PERSONNEL (\$ THOUSANDS)
1980	\$6.4	110	\$58
1981	7.7	123	63
1982	9.2	136	67
1983	11.0	151	73
1984	13.2	163	80
1985	16.0	176	91
1986	19.1	190	100
AAGR (PERCENT)	20%	1980-1983 11% 1983-1986 8%	

AAGR = AVERAGE ANNUAL GROWTH RATE

- INPUT feels that more creative pricing and faster automation of maintenance could bring the \$100,000 per FE rate into reality earlier than forecast.

E. RECOMMENDATIONS

- Vendors must review their prime resource - their people - in terms of 1983-1985 requirements as well as the immediate needs.
 - Survey results reveal a pressure to fill immediate requirements.
 - Products in the future will often require less on-site diagnostics and related skills.
 - Vendors must recruit now with a clear view of the career path they can offer as new products are introduced through the mid-decade.
 - Failure to recruit with a longer term view can lead to higher turnover, and in some areas, a shift to unionization.
- The interrelation of FE career path planning and new product design is one reason for accelerated FE participation in designing products for the future.
 - The profit center organization of FE also makes it essential for FE to have products which can be maintained at a profit; this means that cost efficient maintenance must be built in, and FE must contribute to product design.
 - 1981 survey results show that almost half of responding users link the quality of the product with the quality of the maintenance; a poor product will therefore burden FE with a losing situation. (In at least one company in recent months the introduction of poor quality products

resulted in FE winning veto power over future new products from a maintainability standpoint.)

- Because over 90% of major FE organizations will soon be functioning as profit centers it is essential that as part of the FE organization they develop two functions which are usually provided by the parent organization:
 - Personnel - the unique requirements of FE require FE control of the selection process.
 - Sales/marketing of maintenance - the powerful impact of sales levels on profit demands that FE management exert direct influence on the rate of revenue growth, and not be content to accept what is generated by the main sales force.
- The increased emphasis on new skills in software and communications makes FE career path planning an issue requiring top management attention.
 - Users, particularly those with critical applications, will pay a premium for skills which provide higher uptime potential; this opens the door for a new class of highly skilled, consultant-level FEs.
 - Concurrent with a need for higher skills is a need for many FEs with skills lower than the traditional FE; this results from built-in diagnostics, board swapping, and user maintenance. This split in the skill requirements between high and low is a major management challenge which must be addressed in current plans.
- FE has the opportunity to take more control of its future. Willingness to participate in sales, product design, alternative delivery mechanisms, recruiting and planning is essential.
 - Concurrent with a need for higher skills is a need for many FEs with skills lower than the traditional FE; thus results from built-in diagnos-

tics, board swapping, and user maintenance. This split in the skill requirements between high and low is a major management challenge which must be addressed in current plans.

- Pricing deserves higher management attention. Less than one third of respondent vendors use techniques such as value pricing and price sensitivity studies.
- FE management has an opportunity to leverage field service through aggressive marketing of current and planned offerings.
 - IBM, with an average user satisfaction level only slightly superior to the average for other vendors, enjoys a superior maintenance image, largely due to superior marketing.
 - Survey results indicate that users select the vendor with a superior image if they are dissatisfied with current maintenance vendors, thereby adding importance to the maintenance image factor.
- FE has the opportunity to take more control of its future. Willingness to participate in sales, product design, alternative delivery mechanisms, recruiting and planning is essential.

III USER ATTITUDES REGARDING FIELD SERVICE - CURRENT STATUS AND TRENDS

III USER ATTITUDES REGARDING FIELD SERVICE - CURRENT STATUS AND TRENDS

A. OBJECTIVES OF THE USER SURVEY

- The annual user survey is designed to accomplish the following:
 - Identify any shifts in user attitudes from earlier surveys.
 - Update significant issues raised in INPUT's initial project in field service, the 1978 multiclient study, Maintenance Requirements for the Information Processing Industry, 1978-1983, and the 1980 Field Service Annual Report.
 - Probe the user population to identify opportunities for vendors to increase profits through increased revenues and/or reduced costs.
 - Examine users' reactions to new issues; e.g., increased demand for uptime, shifts in buying points.
 - Expand the coverage of the program. For example, in the 1981 survey word processing equipment was added.

- Strike a balance between prior issues and new issues so that all significant issues may be readdressed in the Annual Report during three- to five-year cycles.
- During the current survey an additional objective was added - to reflect more closely in the survey the user populations of clients in the Field Service Program.
 - Clients were given the option to provide to INPUT a list of their users to be included in the profile.
 - Seven clients utilized this option, with an average of 10 users being added for each client.

B. METHODOLOGY AND USER PROFILE

- Users to be interviewed were selected from three sources.
 - Those who responded to the 1978 and 1980 surveys; these represent the majority of those interviewed and insure continuity in the basic data gathered.
 - Users supplied by clients, as mentioned above.
 - Other sources which, in INPUT's opinion, provided users who strengthened the overall survey result.
- A total of 108 users were interviewed.
 - This represents an increase of over 40% compared to the 1980 survey population.

- More important than the increase in size of the user population is an intentional shift away from emphasis on IBM users to include more non-IBM users in all equipment categories.
- Users were interviewed by telephone; qualitative as well as quantitative data was sought.
 - The questionnaire used is included in Appendix D. Those readers who want to know exactly how various questions were asked are referred to the questionnaire.
 - Interviews typically lasted between one-half and one and one-half hours.
- The distribution of user responses by equipment type is shown in Exhibit III-1.
 - The shift away from IBM is most pronounced in the terminals and peripherals areas.
 - For a detailed breakdown of respondents by industry sector, company size, equipment type, or software type, please refer to the following exhibits in Appendix A:
 - A-1 - User Respondent Profile.
 - A-2 - Large and Medium Mainframes.
 - A-3 - Small Business Computers.
 - A-4 - Minicomputers.
 - A-5 - Peripherals.
 - A-6 - Data Terminals.

EXHIBIT III-1

DISTRIBUTION OF MENTIONS OF MAINTENANCE VENDORS
BY EQUIPMENT/SOFTWARE TYPE

EQUIPMENT / SOFTWARE TYPE	PERCENT OF TOTAL USER RESPONSES								NUMBER OF MENTIONS
	IBM	HONEY- WELL	CDC	AMDAHL	HEWLETT PACKARD	DEC	TEXAS INSTRU- MENTS	OTHER	
LARGE AND MEDIUM MAINFRAMES	60%	13%	1%	5%	-	-	-	21%	83
SMALL BUSINESS COMPUTERS	31	3	-	-	-	11%	9%	46	35
MINICOMPUTERS	15	4	-	-	18	4	-	59	27
PERIPHERALS	35	7	4	-	1	-	2	51	147
DATA TERMINALS	28	3	-	-	2	1	5	61	115
WORD PROCESSING TERMINALS	31	-	-	-	-	7	7	55	26
SYSTEMS SOFTWARE	61	6	-	1	1	1	4	26	84
APPLICATIONS SOFTWARE	32	8	-	-	-	-	-	60	37

- . A-7 - Word Processing Terminals.
 - . A-8 - Systems Software.
 - . A-9 - Applications Software.
- In general, the user sample reflects the actual distribution of information equipment in the United States.
 - The banking industry sector is somewhat understated, and the services industry is overstated.
 - Large companies are dominant, with 25 of 108 responses from companies with revenues over \$1.0 billion. Ten companies had revenues less than \$99 million, with 46 respondents not categorized by revenue. The emphasis on larger companies is intentional in that a large portion of maintenance revenues flows from these users; also these users are most likely to be involved in advanced applications and are therefore better able to provide insight into future trends.
- The person interviewed was identified as being responsible for making purchase decisions regarding maintenance. Titles included:
 - Director of MIS.
 - Vice President, Computer Operations.
 - Vice President, Data Processing Planning.
 - Director, Data Processing.
 - Manager, Computer Operations.
 - Data Processing Manager.

- The trend to multivendor shops, pointed out in the 1980 Annual Report, continued. Of the 108 respondents:
 - Twelve mainframe maintenance vendors were mentioned.
 - Sixteen small business computer maintenance vendors were mentioned.
 - Twelve minicomputer maintenance vendors were mentioned.
 - Twenty-six peripheral maintenance vendors were mentioned.
 - Sixteen word processing maintenance vendors were mentioned.
 - Thirty-nine terminal maintenance vendors were mentioned.
 - Sixteen systems software maintenance vendors were mentioned.
 - Sixteen applications maintenance vendors were mentioned.
 - This total of 153 vendors accounted for 454 mentions, meaning an average of three mentions per interview.

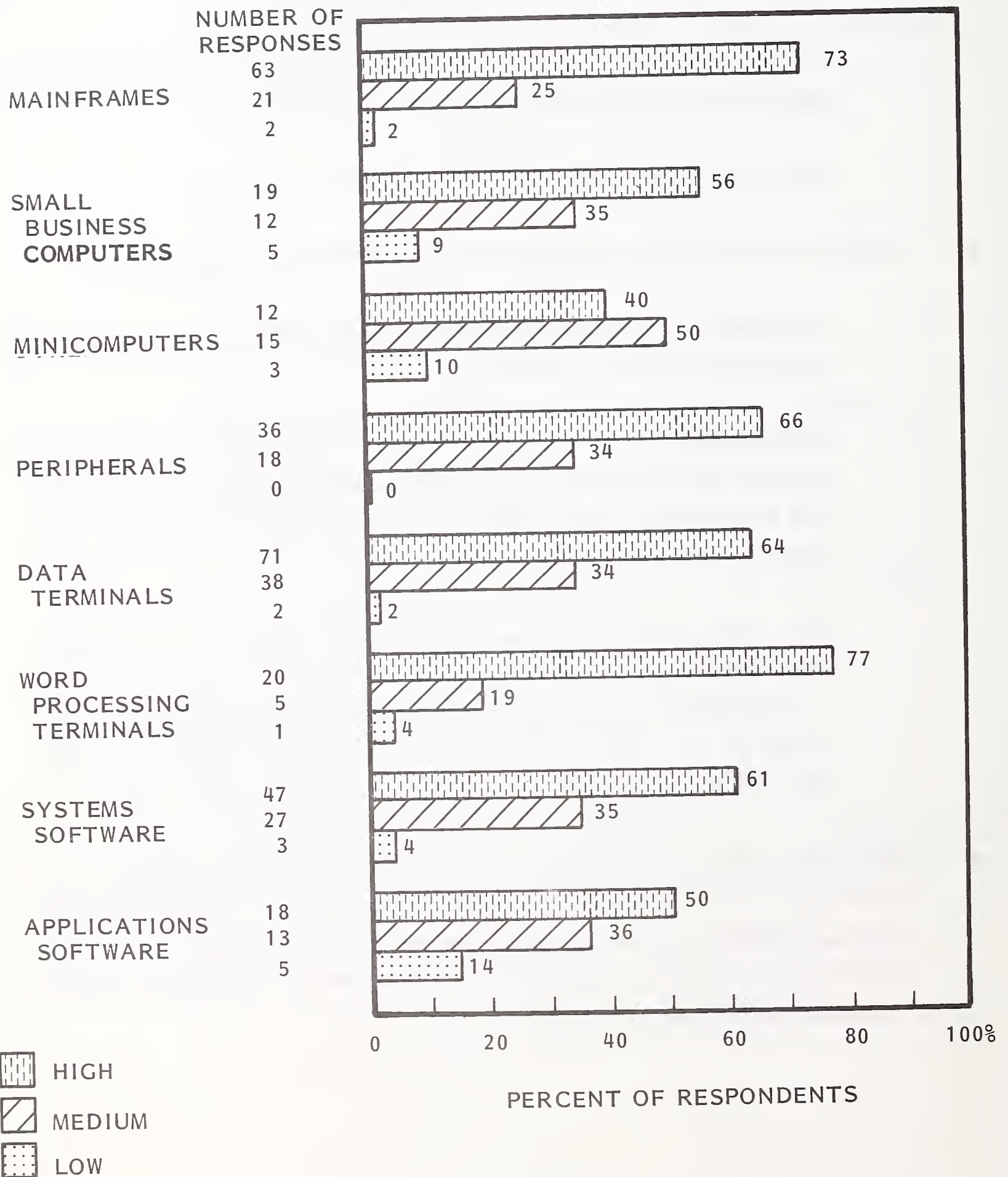
C. USER SATISFACTION WITH MAINTENANCE

- A clear understanding of current user satisfaction levels is essential for vendors, because critical decisions are made based on what is "competitive."
 - Providing a higher level of service than is necessary is expensive.
 - Providing a lower level of service, particularly in peripherals and terminals, can result in lost business.

- As shown by survey results summarized in Exhibit III-2, users in the United States are generally highly satisfied with maintenance.
 - Users were asked to rate their maintenance vendor on a scale of 0-10, with 0 = unsatisfied, and 10 = highly satisfied.
 - Responses of 0-3 were considered "low," 4-7 were considered "medium," and 8-10 were considered "high."
 - Of the 454 total mentions, 61% were "high."
- The level of satisfaction varies significantly by equipment/software type.
 - All hardware categories other than minicomputers had a majority of responses in the "high" category.
 - Word processing terminals, a new category in the 1981 survey, had the highest satisfaction level; this high satisfaction level is at least partly due to the less critical feature of word processing applications in the minds of most EDP managers.
 - The 0-2% level of responses in the "low" category for mainframes, peripherals and terminals is indicative of the success vendors are having in maintaining systems which typically are made up of these three components. These components also are normally resident at larger sites which enjoy higher field engineer availability in most cases.
- To a great extent the high level of current user satisfaction is due to the dynamics of the vendor selection process; the vendor is often selected because the user believes he will provide superior maintenance; the user's high satisfaction is partly his expression of the correctness of his selection decision
 - a type of "self-fulfilling prophecy."

EXHIBIT III-2

USER SATISFACTION WITH MAINTENANCE, 1981 USER SURVEY RESULTS



- With regard to software, the systems software vendors were rated at levels similar to mainframe vendors. The parallel is supported by comparing the percentages of respondents represented by major vendors. The following percentages represent first the percent of the time the vendor was mentioned as the mainframe maintenance vendor, and second the percent of the time the vendor was mentioned as the systems software maintenance vendor:

	<u>Mentioned As Mainframe Maintenance Vendor</u>	<u>Mentioned As Software Maintenance Vendor</u>
- IBM	60%	61%
- Univac	3%	5%
- Honeywell	13%	6%
- Amdahl	5%	1%

- In the case of Amdahl, many Amdahl users utilize IBM-supplied systems software.

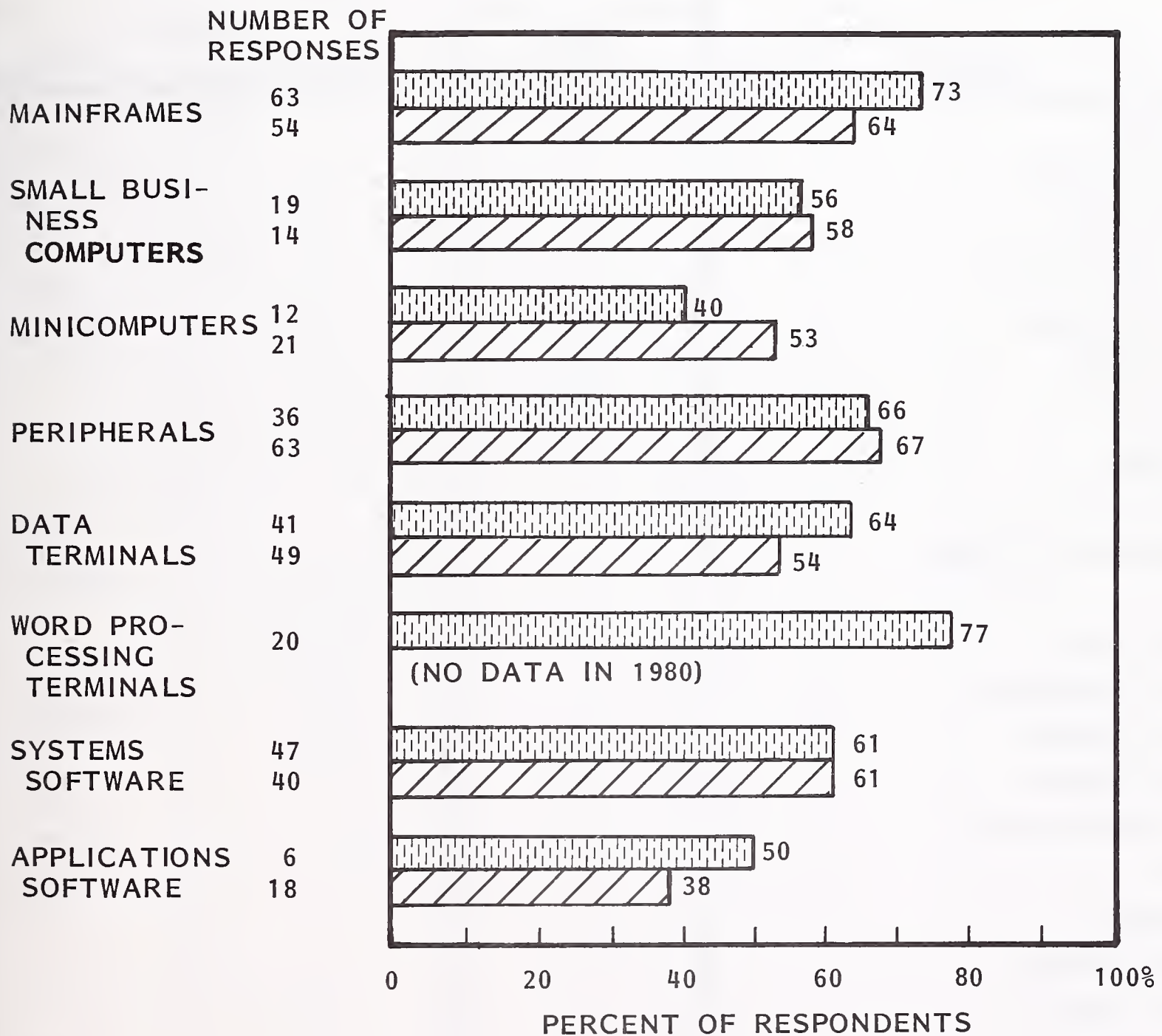
- The increasing penetration of hardware vendors into the applications software market becomes apparent by comparing the percent share of hardware vendors mentioned as the applications software maintenance vendor. In the following comparisons, the first figure represents the 1980 respondent share, and the second figure represents the 1981 respondent share:

	<u>1980</u>	<u>1981</u>
- IBM	20%	32%
- Honeywell	-	8%
- Four-Phase	-	5%
- Calma	-	21%

- Calma, a leading vendor of CAD/CAM systems, is typical of the turnkey industry in investing heavily in applications software and maintaining software in the field.
- Since the great majority of applications software is user written and user maintained, vendors who become active in applications software development and maintenance are addressing a major revenue opportunity area.
 - Challenges to recognize in applications software are the great diversity of such software, and the desire among users for non-uniform solutions.
 - The total market potential, however, exceeds the potential for hardware maintenance in that users in the U.S. now spend over \$10 billion per year on applications software maintenance according to INPUT estimates.
- Compared to 1980 survey results, respondents shifted their levels of satisfaction in some areas, as shown in Exhibit III-3. Levels of satisfaction increased significantly among users of maintenance on mainframes, data terminals and applications software.
- Levels of satisfaction decreased significantly among users of minicomputers. This was partly a result of a difference in the composition of the respondent sample. 1981 results included 28% Calma users; these users of CAD/CAM systems are very demanding, and the maintenance task is made complex by a need to maintain minicomputers, peripherals and a wide range of software.
- Results of the 1981 user survey were also tabulated by individual hardware maintenance vendors. This tabulation, presented in Exhibit III-4 further illustrates the diversity of vendors in the marketplace.

EXHIBIT III-3

COMPARISON OF USER SATISFACTION IN THE 1980 VERSUS 1981 SURVEYS



1981 RESPONDENTS WHO WERE HIGHLY SATISFIED



1980 RESPONDENTS WHO WERE HIGHLY SATISFIED

EXHIBIT III-4

USERS' RATINGS OF HARDWARE MAINTENANCE VENDORS

VENDOR	RATE		
	HIGH	MEDIUM	LOW
AMDAHL	3	-	-
BASIC/FOUR	-	1	-
BRAEGEN	-	1	-
BUNKER RAMO	1	1	-
BURROUGHS	-	1	-
CALCOMP	8	2	1
CALMA	13	5	7
COMMA	8	-	-
COMTEN	-	1	-
CUMMINS-ALLISON	-	1	-
CDC	1	5	1
DATA 100	1	-	-
DATA GENERAL	-	3	1
DATAMEDIA	1	-	-
DATAPPOINT	-	1	-
DATAPRODUCTS	2	-	-
DEC	5	3	1
DIEBOLD	1	-	-
DOCUMATION	1	4	-
DOW JONES	-	1	-
ENTREX	1	1	-
FORD	1	-	-
FOUR-PHASE	7	4	1

EXHIBIT III-4 (CONT.)

USERS' RATINGS OF HARDWARE MAINTENANCE VENDORS

VENDOR	RATE		
	HIGH	MEDIUM	LOW
GENERAL ELECTRIC	-	1	-
GENESIS ONE	1	1	-
HARRIS	2	-	-
HEWLETT-PACKARD	4	5	-
HITACHI	2	-	-
HONEYWELL	18	8	-
IBM	111	48	1
ICC	1	-	-
ICE	-	2	-
INFONET	2	-	-
INTERCOMM	-	1	-
ITEL	1	2	-
ITT	1	1	-
ITT COURIER	7	4	-
LANIER	2	-	-
LEXITRON	1	-	-
MAGNUSON	1	-	-
MEMOREX	1	5	-
NAS	12	2	-
NBI	-	1	-
NCR	-	1	1
NIXDORF	3	-	-
PERRY	1	-	-
P.T. & T.	1	-	-
PRIME	5	-	1

EXHIBIT III-4 (CONT.)

USERS' RATINGS OF HARDWARE MAINTENANCE VENDORS

VENDOR	RATE		
	HIGH	MEDIUM	LOW
PRINTRONIX	1	-	-
RADIO SHACK	-	-	1
RAYTHEON	2	3	-
SORBUS	-	1	1
STC	12	9	1
SYSTEMS INDUSTRIES	1	-	-
TANDEM	1	-	-
TCU	-	1	-
TELETYPE	3	-	-
TELEX	1	1	2
TEXAS INSTRUMENTS	11	4	-
TPM	-	1	-
TRENDA	1	1	-
TRW	6	8	-
UNIVAC	2	5	-
VERSATEC	-	-	1
WANG	1	2	-
WESTERN UNION	-	1	-
XEROX	4	1	1
TOTAL	277	155	22

- IBM, with 35% of the user ratings, improved somewhat on the ratings in the 1980 survey; in 1980, 60% of IBM's ratings were in the "high" category compared to 69% in the 1981 survey. IBM versus non-IBM responses are treated in detail in Chapter IV.
- The ratings of other vendors are mixed, with the number of mentions too small to draw individual conclusions. However, several results are of interest.
 - . The strong showings of Comma, Calcomp, Honeywell, NAS, Nixdorf, Prime and Texas Instruments are noteworthy.
 - . The mixed showings of several vendors - CDC, Hewlett-Packard and Storage Technology (STC); these vendors had a greater percentage of "high" ratings in the 1980 survey, and have a reputation for superior maintenance.
- As indicated in the overall user satisfaction results discussed earlier, software maintenance user satisfaction results parallel hardware maintenance results. This is reflected in the individual ratings shown in Exhibit III-5.
 - IBM received a "high" rating by 73% of those users mentioning IBM.
 - The difficulty in maintaining complex applications software is reflected in Calma's results.
- The question was raised by clients using the 1980 survey results, "When a user is satisfied with maintenance, is he really satisfied with the maintenance or with the equipment?" The point was that very good equipment might support poor maintenance, and vice versa. The question was addressed in the 1981 survey, and the results are presented in Exhibit III-6.

EXHIBIT III-5

USERS' RATINGS OF SOFTWARE MAINTENANCE VENDORS

VENDOR	RATING		
	HIGH	MEDIUM	LOW
AMDAHL	1	-	-
CALMA	-	11	4
CINCOM	-	1	-
COMMA	2	-	-
COMPUTER ASSOCIATE	2	-	-
DEC	-	1	-
EQUIMATIC	-	-	1
FLORIDA	1	-	-
FLOR SFW	2	-	-
FOUR PHASE	2	1	-
HEWLETT-PACKARD	-	1	-
HONEYWELL	5	5	-
IBI	1	-	-
IBM	43	14	2
KRANZLEY	1	-	-
MSA	1	-	-
NAS	1	1	-
PRIME	1	-	-
SOFTWARE PURSUITS	1	-	-
SYNCOM	1	-	-
TEXAS INSTRUMENTS	1	2	-
UCC	-	-	1
UNIVAC	1	1	-
TOTAL	67	38	8

EXHIBIT III-6

USERS' RATINGS OF QUALITY OF MAINTENANCE VERSUS HARDWARE/SOFTWARE

TYPE OF EQUIPMENT	NUMBER OF RESPONDENTS	AVERAGE RATING QUALITY OF MAINTENANCE	AVERAGE RATING QUALITY OF HARDWARE/ SOFTWARE	PERCENT OF RESPONDENTS RATING MAINTENANCE BETTER THAN HARDWARE/ SOFTWARE	PERCENT OF RESPONDENTS RATING HARDWARE/ SOFTWARE BETTER THAN MAINTENANCE	PERCENT OF RESPONDENTS RATING HARDWARE/ SOFTWARE SAME AS MAINTENANCE
MAINFRAMES	101	8.0	8.0	20%	38%	42%
SMALL BUSINESS COMPUTERS	34	6.6	7.7	15	59	26
MINICOMPUTERS	30	6.7	7.3	20	36	44
PERIPHERALS	146	7.0	7.5	24	30	46
DATA TERMINALS	111	7.4	8.0	14	42	44
WORD PROCESSING TERMINALS	26	7.75	8.5	15	42	43
SYSTEMS SOFT- WARE	78	7.76	8.4	22	26	52
APPLICATIONS SOFTWARE	33	7.0	8.0	18	42	40
TOTAL	559	7.3	7.9	20%	39%	41%

RATING: 0 = UNSATISFIED, 10 = VERY SATISFIED

- The quality of maintenance versus hardware/software were rated within 10% of each other, 7.3 for maintenance and 7.9 for hardware/software where 0 = poor and 10 = excellent.
 - Almost half the respondents rated the two elements on a par.
 - Small business computers received the most critical rating from a maintenance standpoint, a reflection partly of the wide dispersion of this equipment, and the difficulty in providing a quick response. A similar rating was given to terminals for the same reasons.
- The message to vendors in Exhibit III-6 is an important one. Users intermix their satisfaction level based on their total satisfaction with hardware/software and the maintenance delivered.
- Maintenance vendors cannot afford to play a passive role in new hardware/software development.
 - The ultimate satisfaction of the user is as dependent on the performance of the hardware/software as it is on the quality of the maintenance delivered.
 - Users are primarily interested in performance, not in the separate issues.

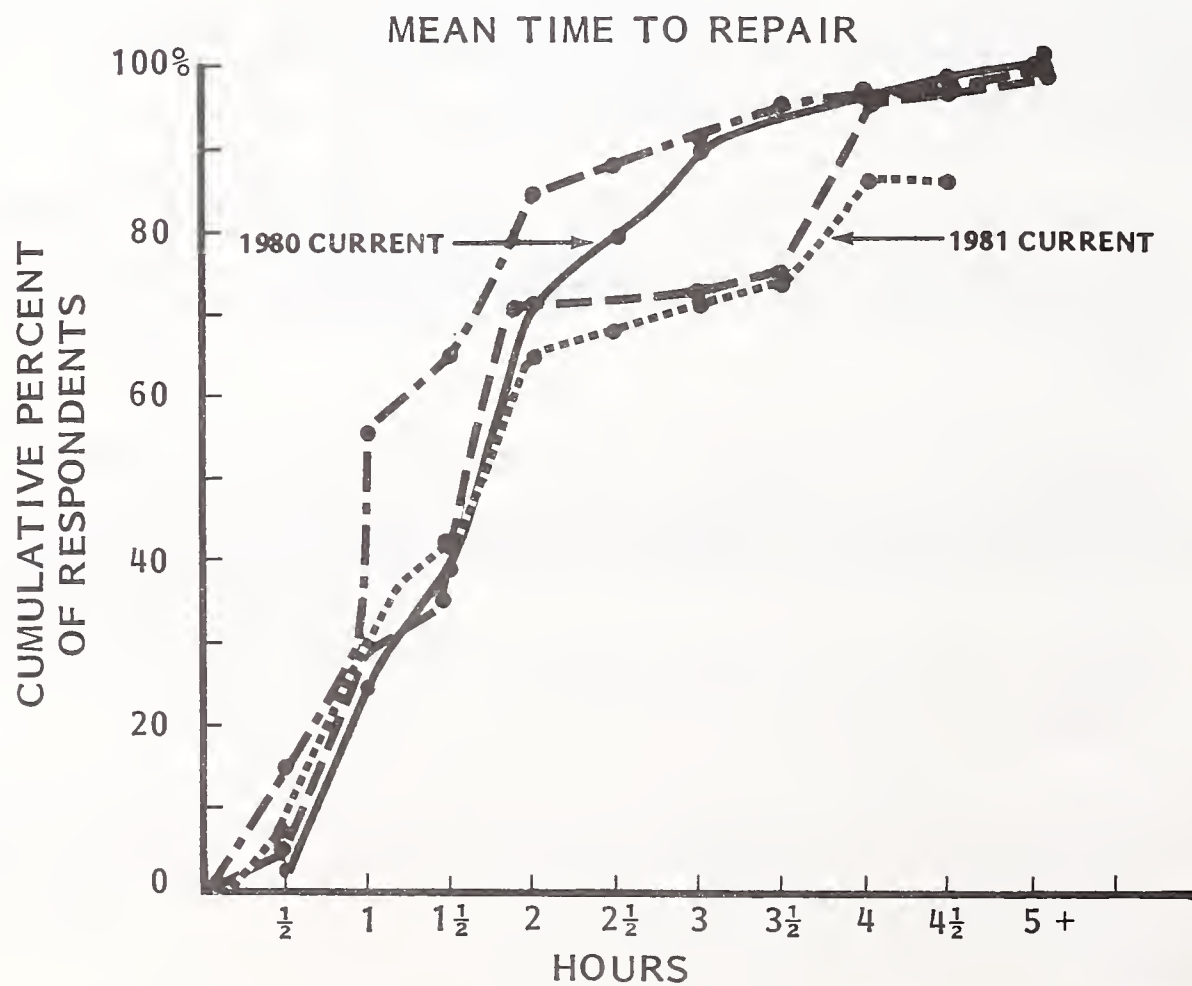
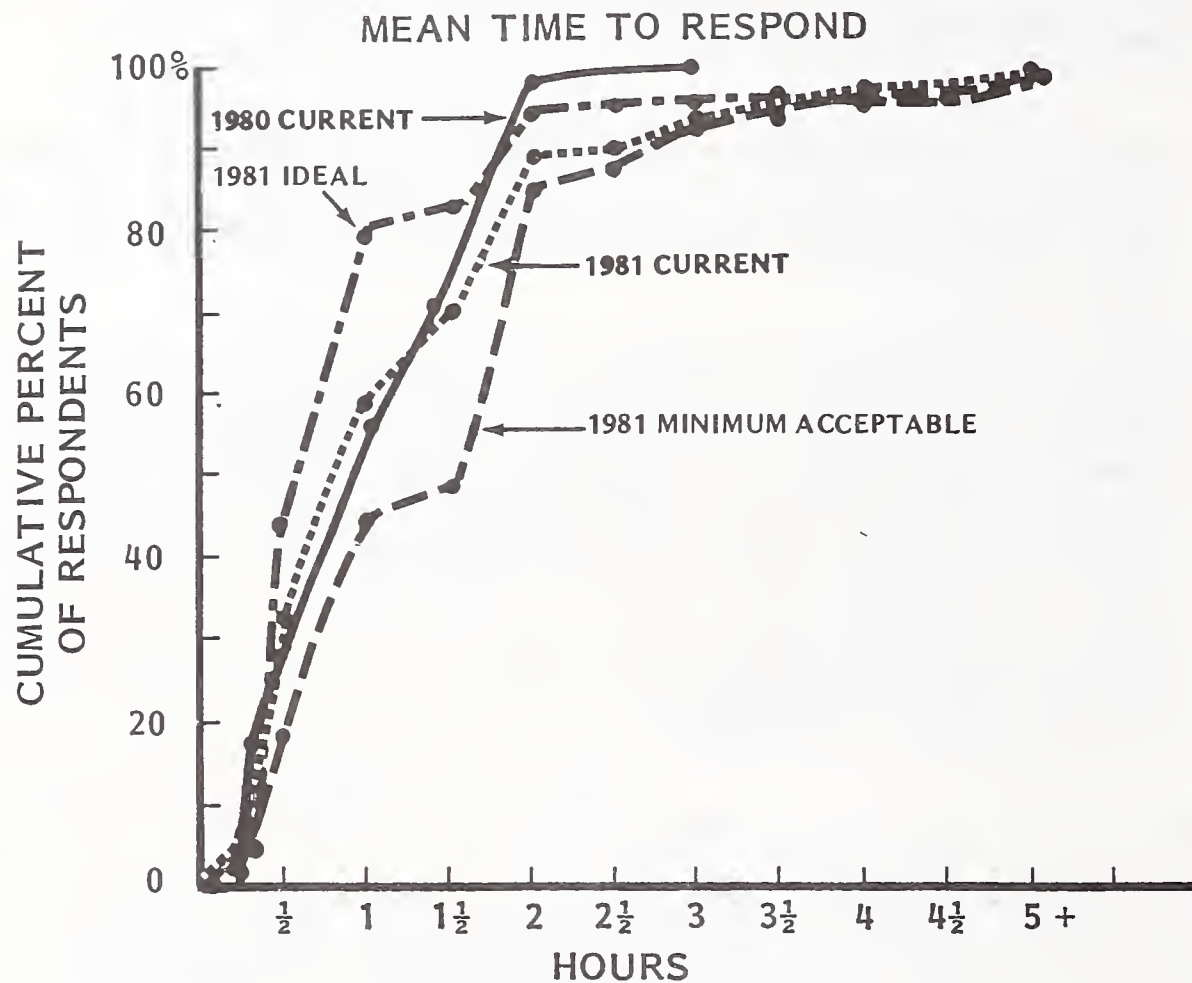
D. CURRENT USER PERCEPTIONS OF MEAN TIME TO RESPOND AND MEAN TIME TO REPAIR

- Much of the expense involved in field service operations is the result of the cost of staffing to provide a certain mean time to respond and mean time to repair.

- Vendors need to know the current competitive levels in order to design their own offerings.
 - Also of interest beyond current competitive levels are the levels which users consider ideal, and those which they consider the minimum acceptable.
 - Exhibits III-7 through III-14 provide this information; the exhibits are based primarily on the 1981 survey with comparisons made to the 1980 survey to detect trends. The 1980/1981 comparisons are shown by the solid lines (1980 actual service level received) and the dotted lines (1981 actual service level received); the other lines are 1981 ideal and minimum levels respectively.
- Exhibits III-7 through III-14 display the user response data in a cumulative format. This is consistent with the way most managers view the subject, "Thirty percent of the users expect a response time of two hours or less, etc." This format avoids the disadvantages of averages such as, "The average response time is three hours"; this type of presentation does not reveal the variability and spread of the responses.
 - In the charts, each point on the graph represents the percentage of respondents who experience response or repair in the indicated time or less.
 - Response time is measured by the time elapsed from placement of the call by the user, until the arrival time of the field engineer.
 - Repair time is the time required on-site to resolve the problem, measured from the time of arrival of the field engineer.
 - The user responses are compared to vendor responses in Chapter V. In Chapter IV, user responses are segregated into IBM users and non-IBM users to provide a measure of the similarities and differences between the two.

EXHIBIT III-7

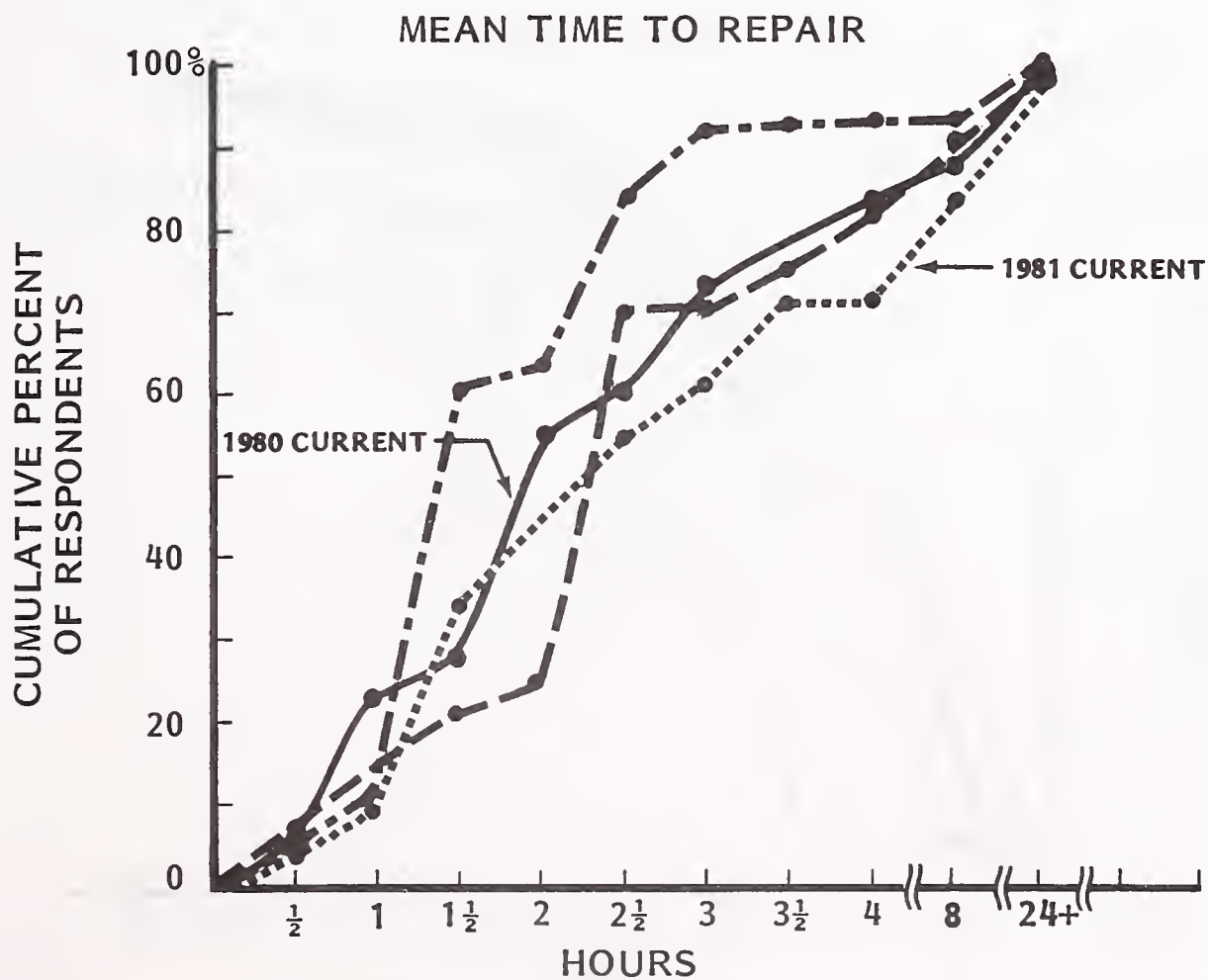
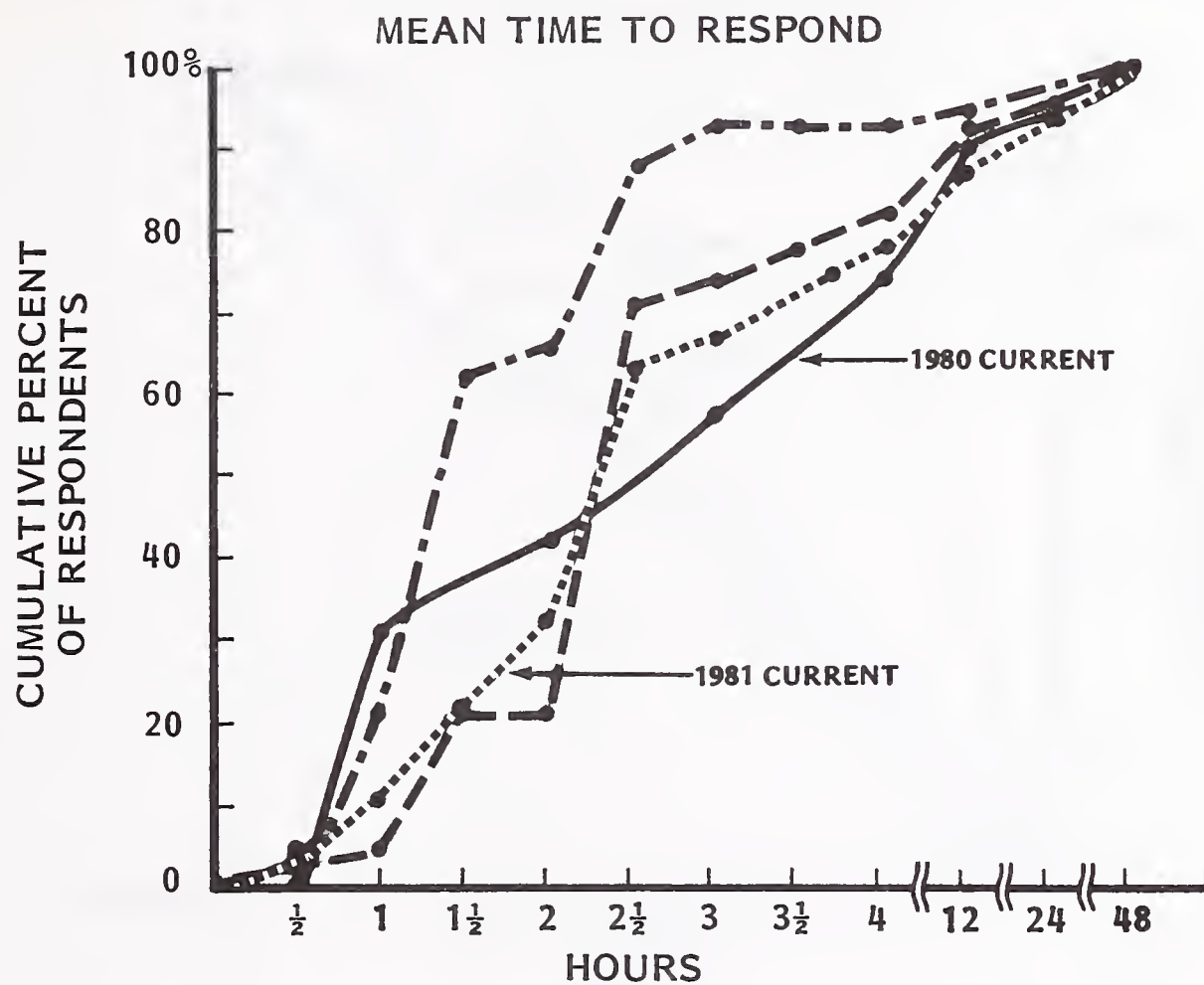
MAINFRAMES, MEANTIME TO RESPOND AND REPAIR: MINIMUM ACCEPTABLE, CURRENT AND IDEAL - USER RESPONSES



1981 SURVEY: - - - IDEAL CURRENT - - - MINIMUM ACCEPTABLE
1980 SURVEY: - - - - - CURRENT

EXHIBIT III-8

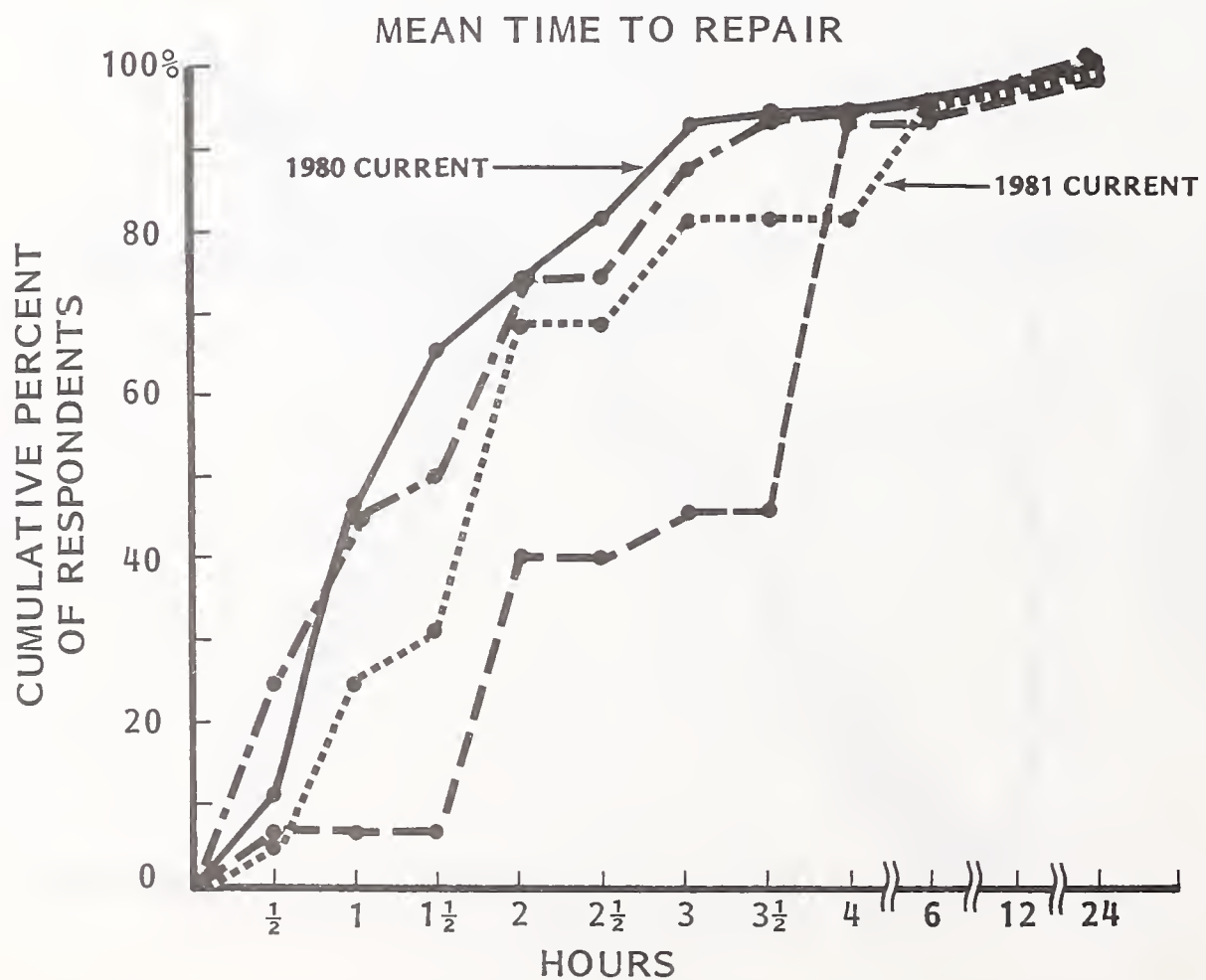
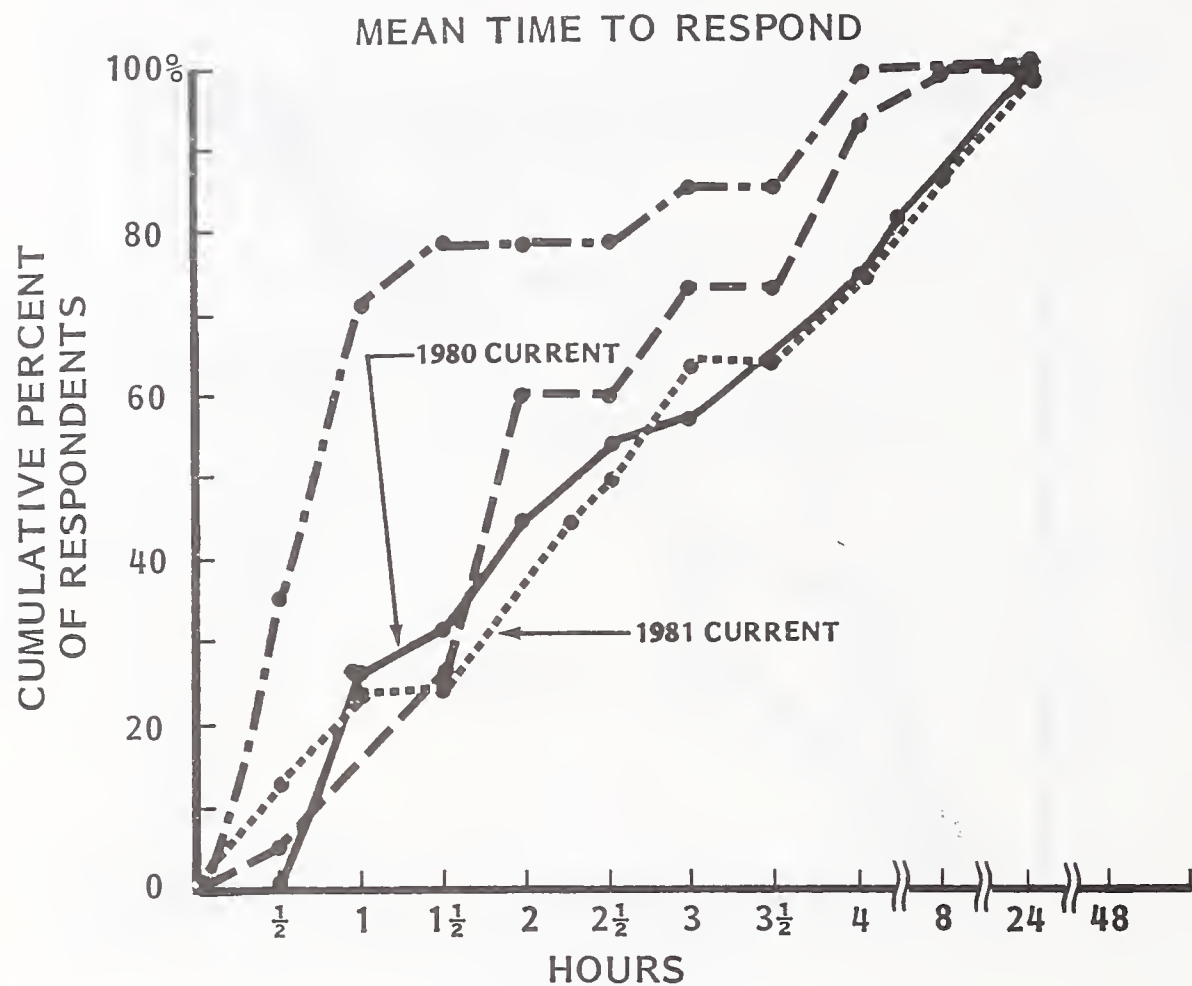
SMALL BUSINESS COMPUTERS, MEAN TIME TO RESPOND AND REPAIR: MINIMUM ACCEPTABLE, CURRENT AND IDEAL - USER RESPONSES



1981 SURVEY: --- IDEAL CURRENT --- MINIMUM
1980 SURVEY: --- CURRENT --- ACCEPTABLE

EXHIBIT III-9

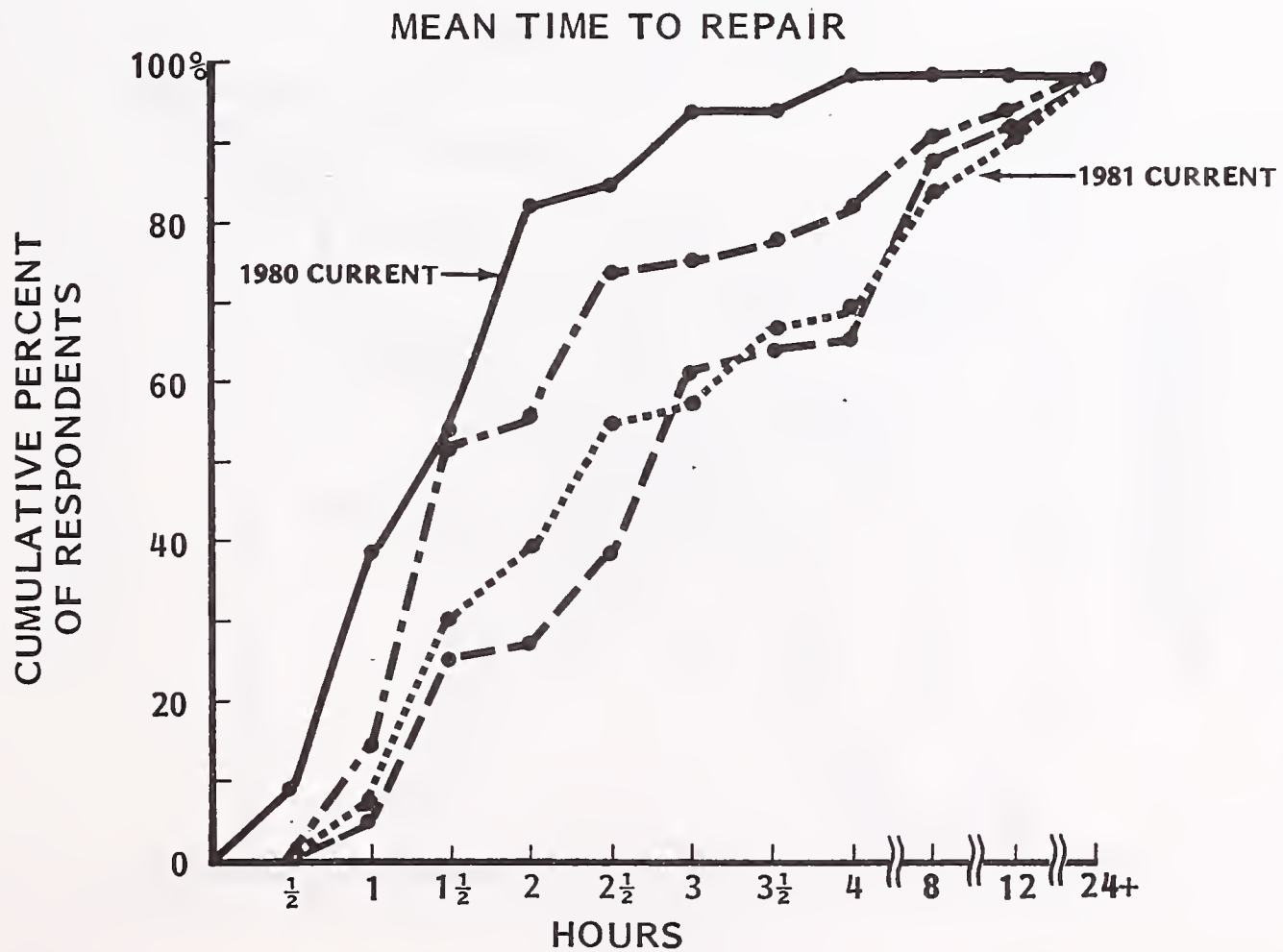
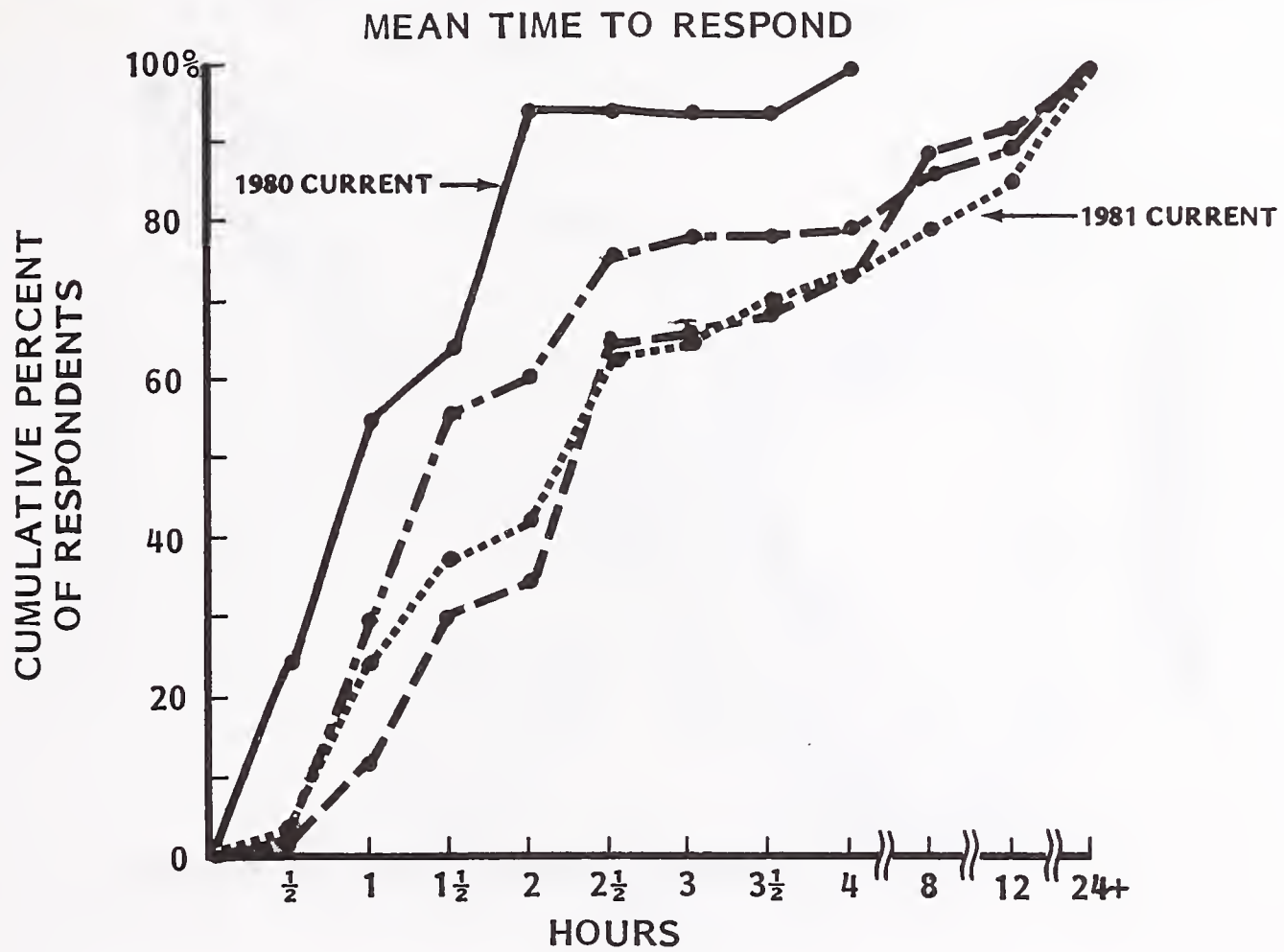
MINICOMPUTERS, MEAN TIME TO RESPOND AND REPAIR: MINIMUM ACCEPTABLE, CURRENT AND IDEAL - USER RESPONSES



1981 SURVEY: --- IDEAL CURRENT --- MINIMUM
1980 SURVEY: --- CURRENT --- ACCEPTABLE

EXHIBIT III-10

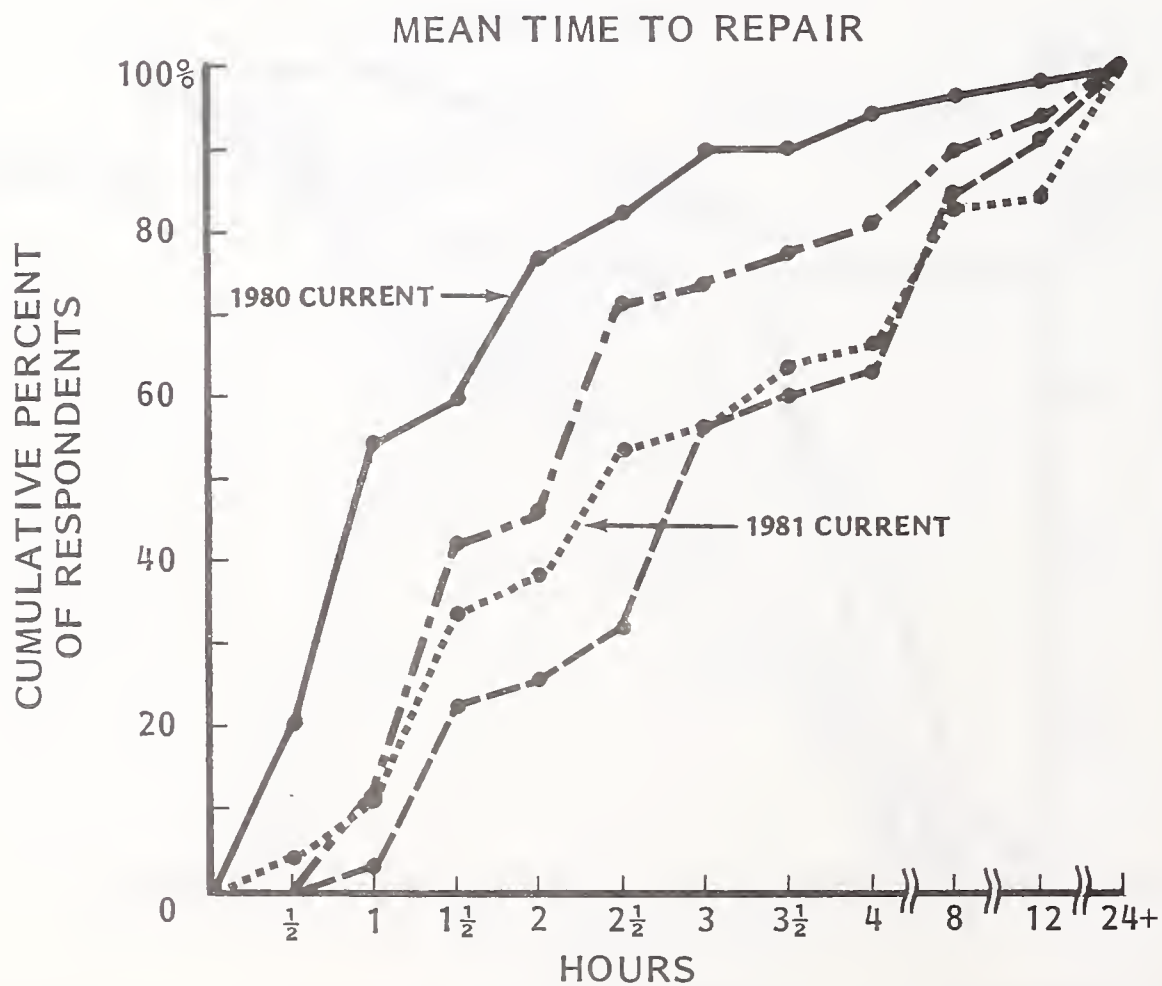
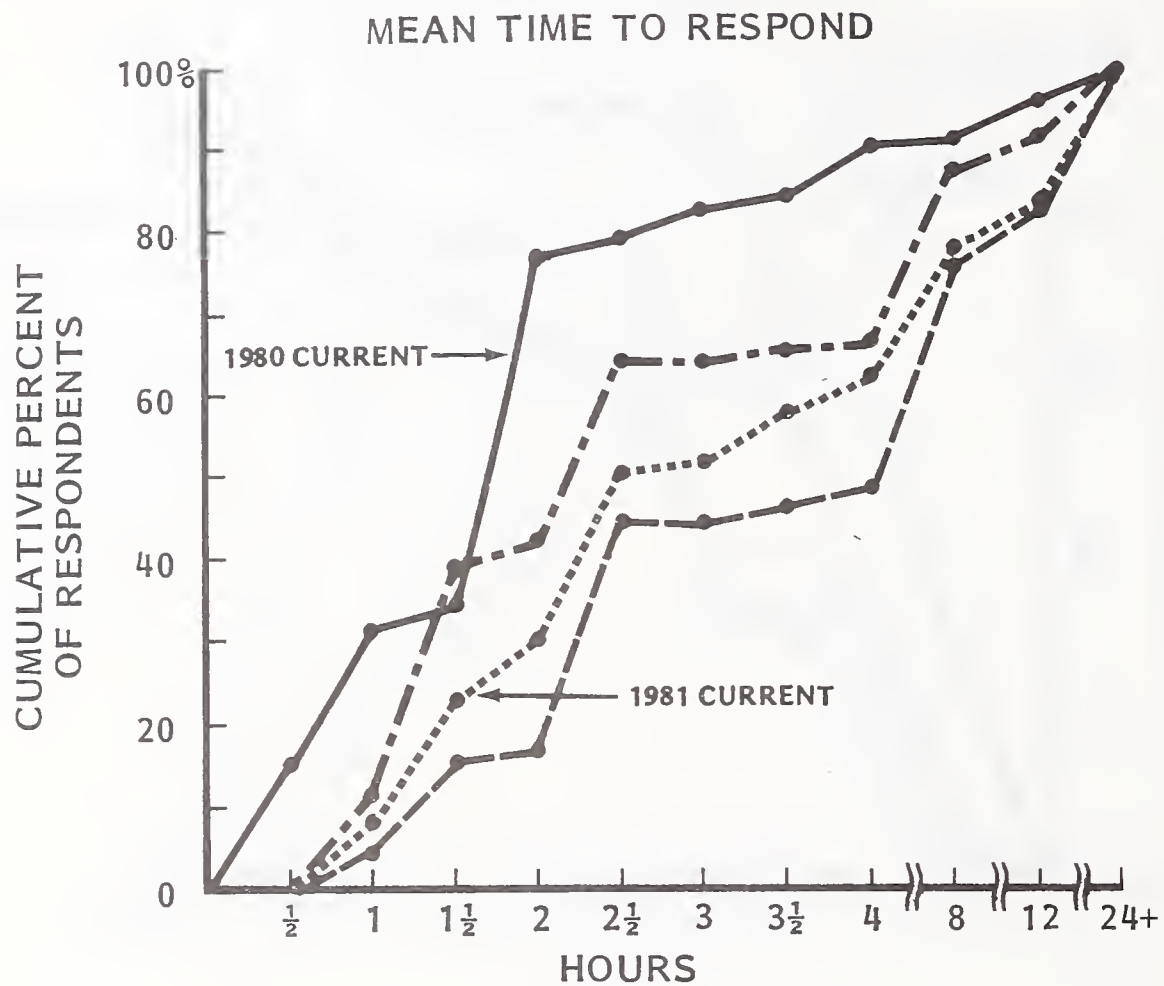
PERIPHERALS, MEAN TIME TO RESPOND AND REPAIR: MINIMUM ACCEPTABLE, CURRENT AND IDEAL - USER RESPONSES



1981 SURVEY: - - - IDEAL CURRENT - . - MINIMUM
1980 SURVEY: - - - CURRENT - - - ACCEPTABLE

EXHIBIT III-11

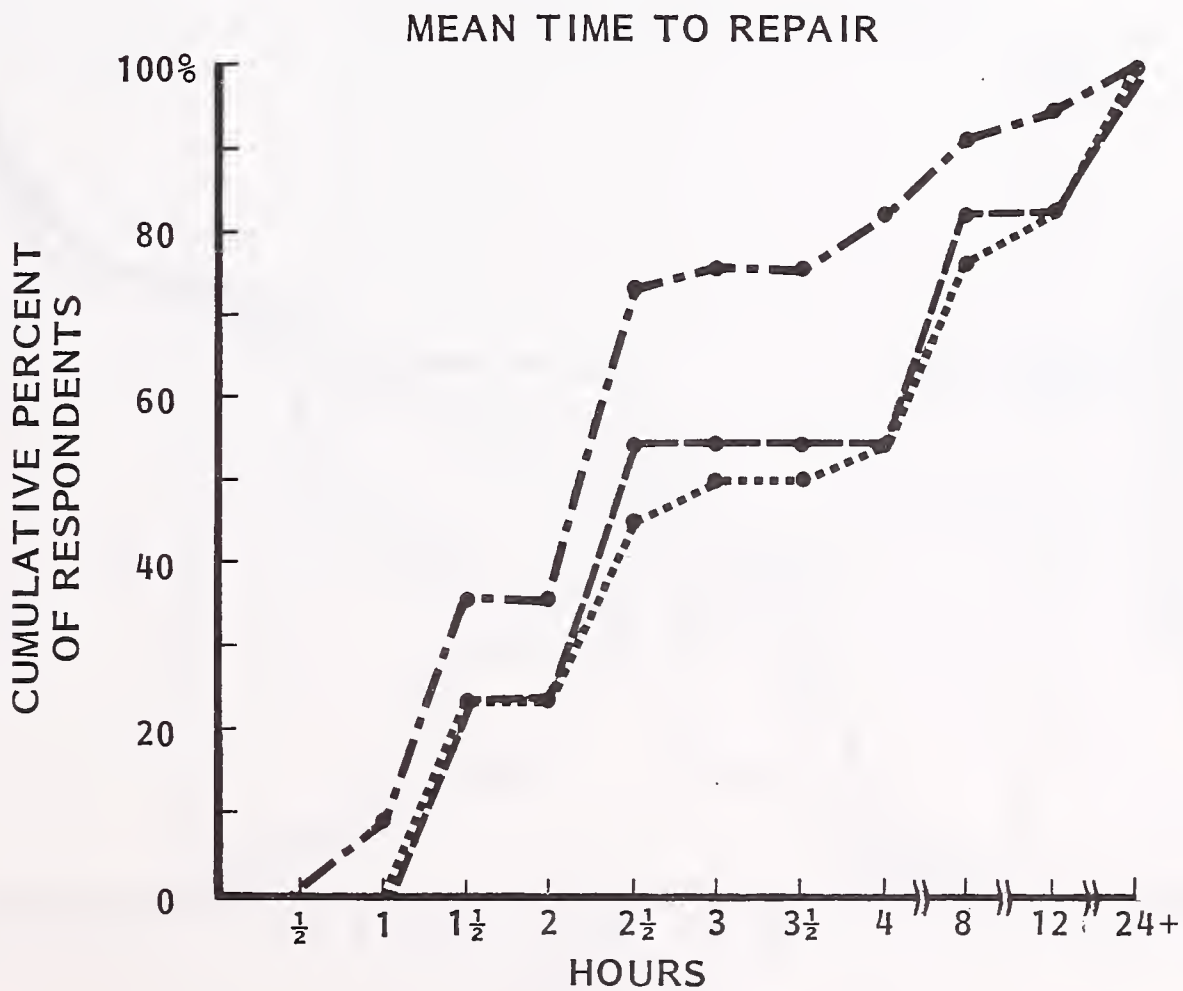
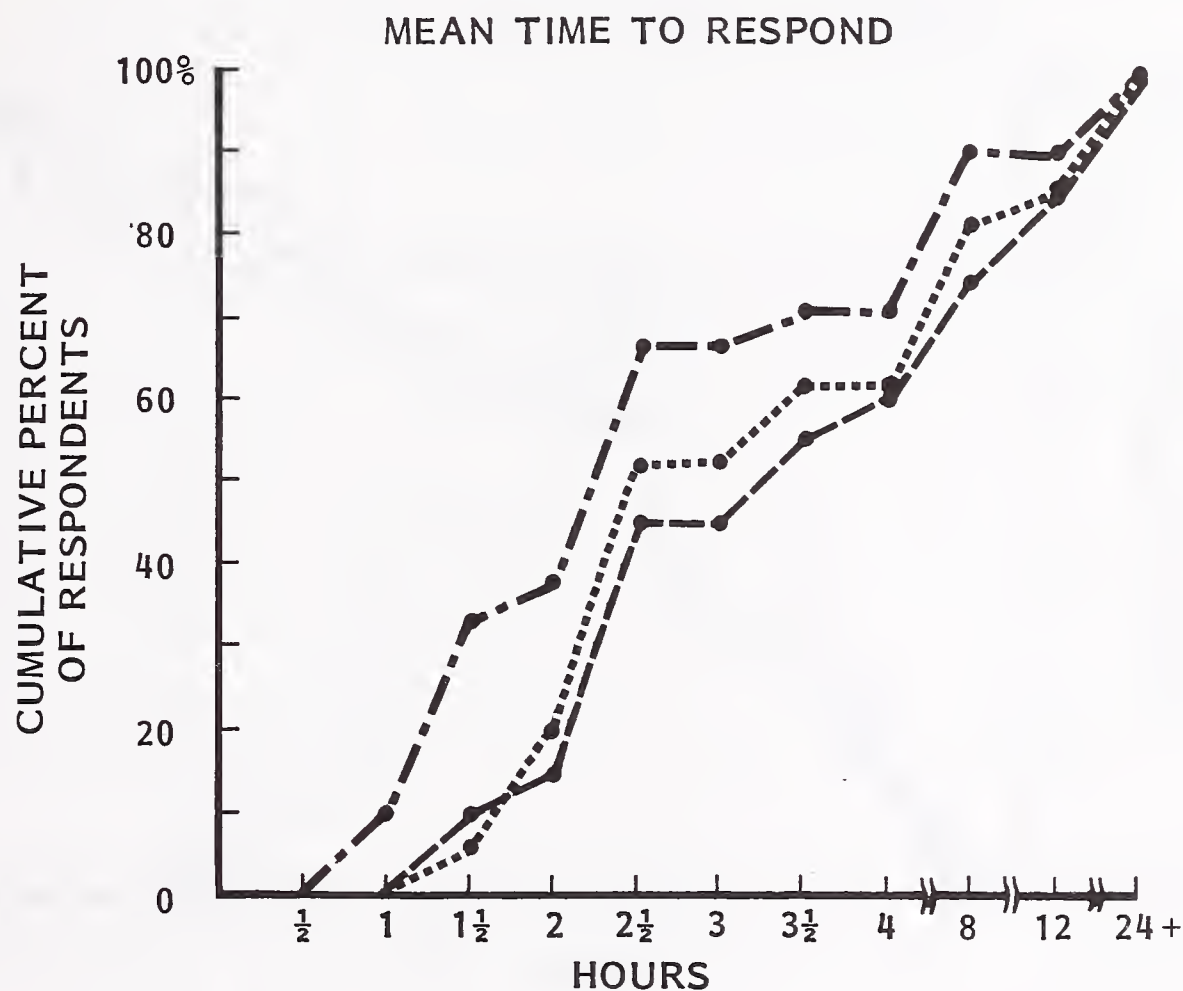
DATA TERMINALS, MEAN TIME TO RESPOND AND REPAIR:
MINIMUM ACCEPTABLE, CURRENT AND IDEAL - USER RESPONSES



1981 SURVEY: - - - IDEAL CURRENT - - - MINIMUM
1980 SURVEY: ——— CURRENT ——— ACCEPTABLE

EXHIBIT III-12

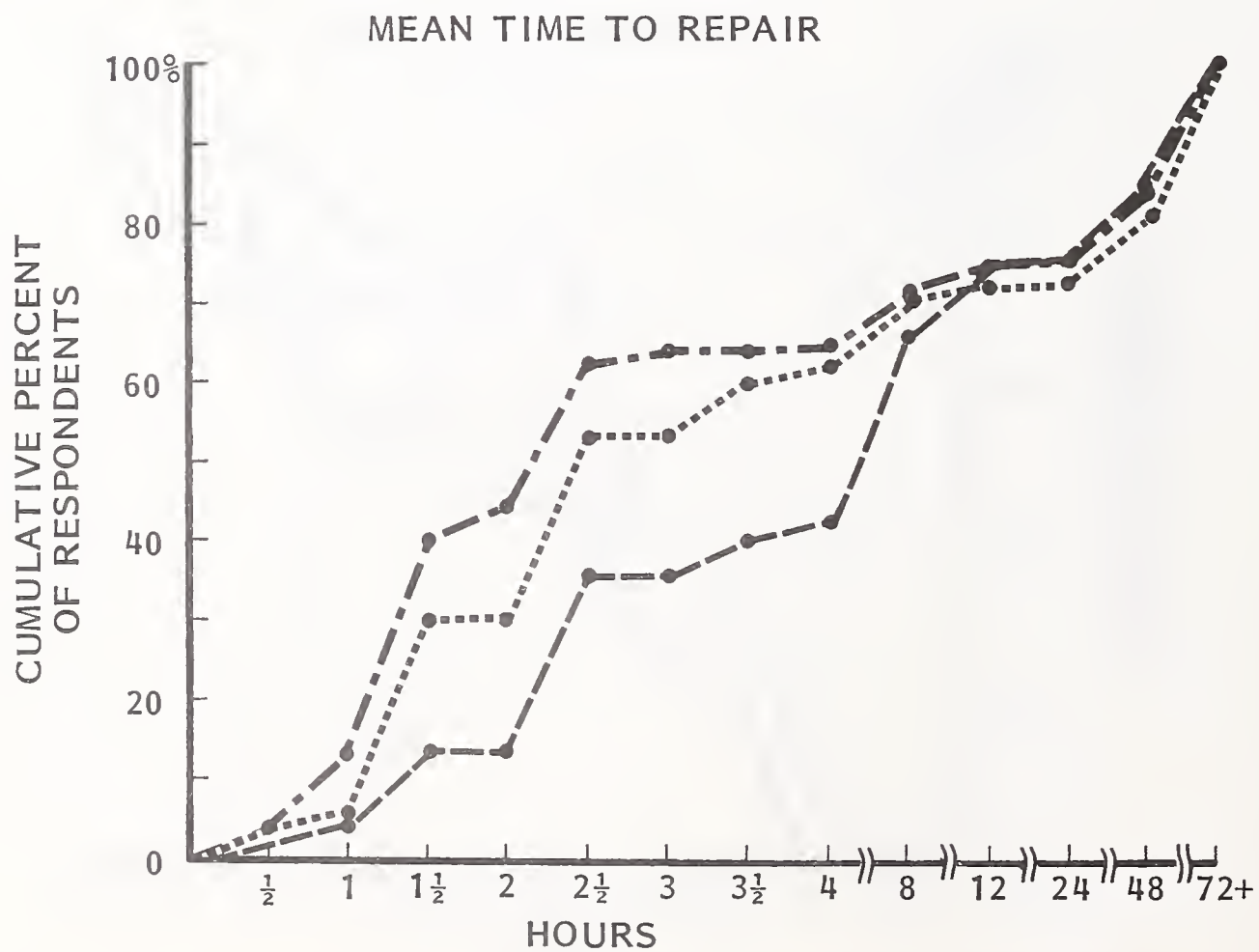
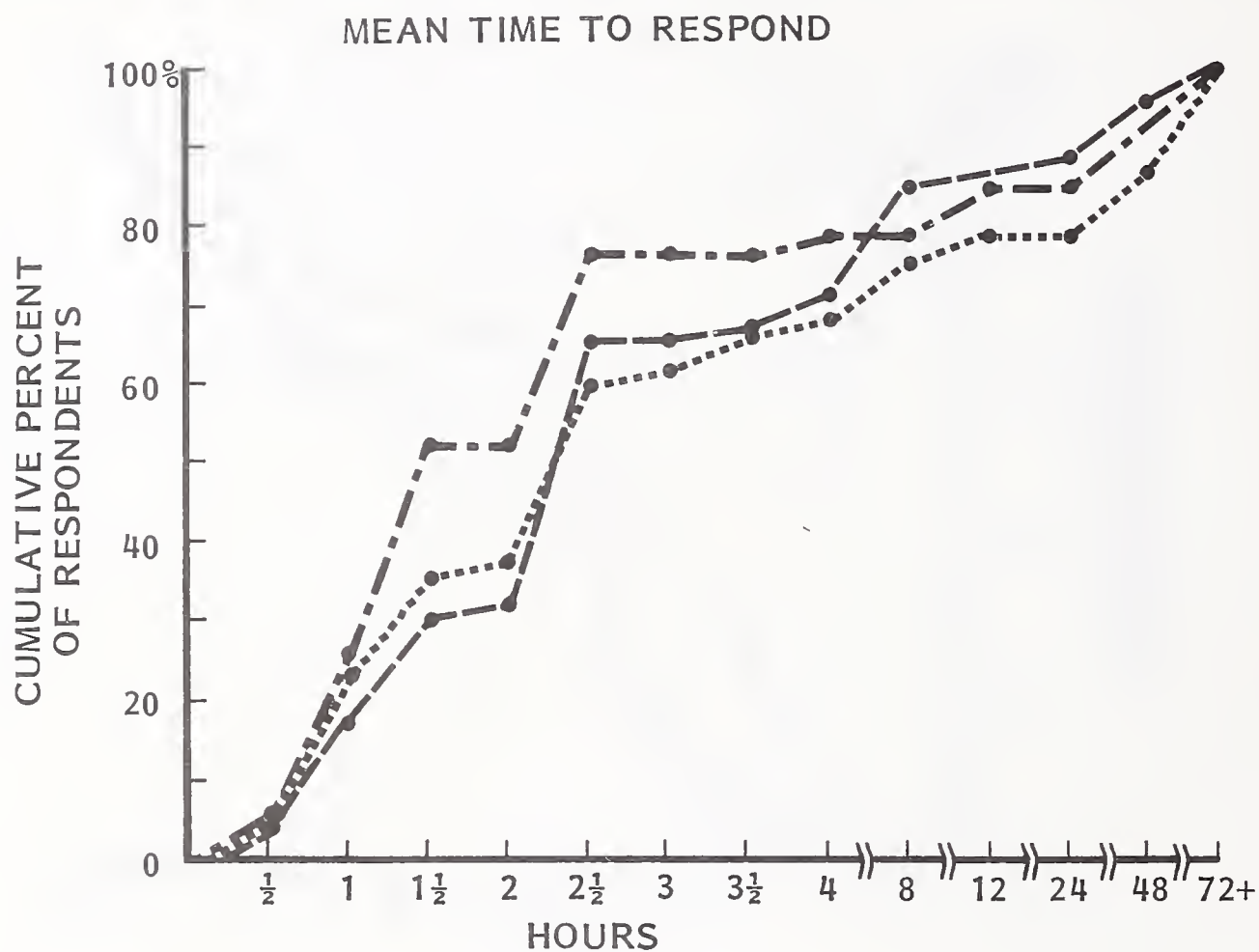
WORD PROCESSING TERMINALS, MEAN TIME TO RESPOND AND REPAIR: MINIMUM ACCEPTABLE, CURRENT AND IDEAL - USER RESPONSES



1981 SURVEY: — — — IDEAL CURRENT — — — MINIMUM ACCEPTABLE

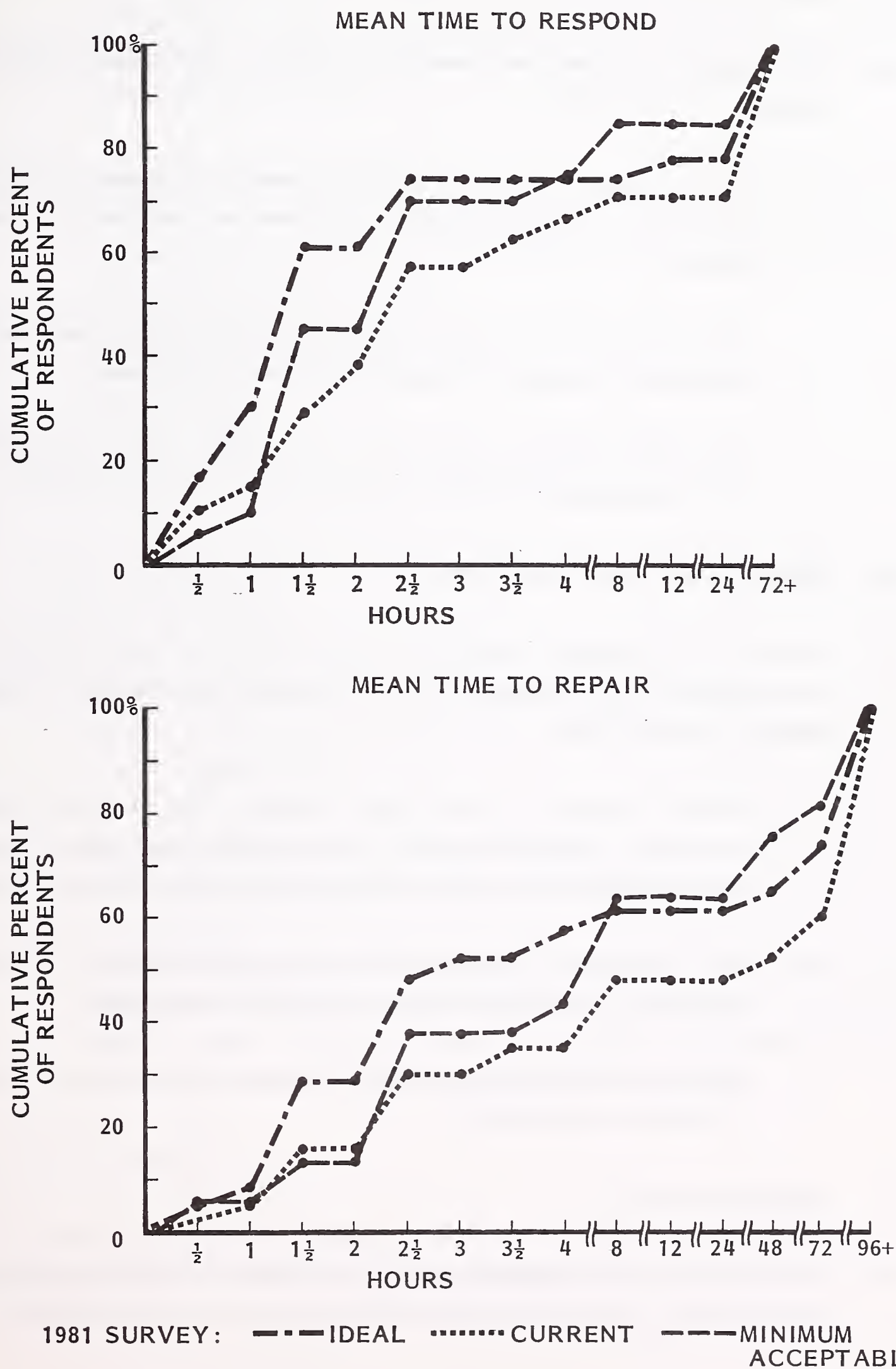
EXHIBIT III-13

SYSTEMS SOFTWARE, MEAN TIME TO RESPOND AND REPAIR:
MINIMUM ACCEPTABLE, CURRENT AND IDEAL - USER RESPONSES



1981 SURVEY: — — — IDEAL CURRENT — — — MINIMUM ACCEPTABLE

APPLICATIONS SOFTWARE, MEAN TIME TO RESPOND AND REPAIR:
MINIMUM ACCEPTABLE, CURRENT AND IDEAL - USER RESPONSES



I. MAINFRAMES

- The responses of users who identified mainframe maintenance vendors are presented in Exhibit III-7.
 - Seventy percent to eighty percent of users require repair and response within two and one-half hours, and they are receiving this level of service.
 - The main problem is on the repair side, where 30% of respondents felt the repair time was in excess of the minimum acceptable.
 - The 1981 results are quite similar to the 1980 results, an indication of the relative stability of the mainframe sector.

2. SMALL BUSINESS COMPUTERS

- Users of small business computers do not demand, nor do they receive, the same level of repair/response times as do users of the larger mainframes, as shown in Exhibit III-8.
 - Seventy percent of users liked a response time of three hours as a minimum. Seventy percent are receiving two and one-half hours or less. This is an improvement of one hour over the 1980 survey response.
 - The repair profile is very similar between the 1980 and 1981 surveys. Most users continue to expect repair in three hours or less.
 - Some users feel they are currently receiving less than the minimum acceptable service levels.

3. MINICOMPUTERS

- In the case of minicomputers, some users also feel they are receiving less than the minimum acceptable service levels, particularly in response time.

- As shown in Exhibit III-9, approximately 20% of the users feel they are not getting the minimum level for either repair or response. This is undoubtedly reflected in the low satisfaction levels among minicomputers described earlier.
- Compared to 1980 survey results, the minicomputer curves more closely resemble the small business computer curves; this is at least partly due to the increasing amount of software being placed on minis, making the maintenance task more complex.
- The 1981 survey results indicate a growing unhappiness among minicomputer users.

4. PERIPHERALS

- Peripheral users continue to receive service which approximates their stringent expectations.
 - As shown in Exhibit III-10, the spread between minimum, current and ideal is quite narrow, and the current service delivered is generally in the acceptable range.
 - The ease of replacement of peripherals gives a user an option should a peripheral vendor stray too far from the acceptable levels.
 - 1980 peripheral users had a higher actual service level; this is due largely to a difference in the makeup of the 1981 sample. In 1981, a broader range of peripheral users was surveyed, and many of these peripherals were less demanding segments of the market.

5. DATA TERMINALS

- The data terminal results shown in Exhibit III-11 show that approximately half the respondents are receiving response and repair time of two hours or better.

- The dispersed nature of terminals is reflected in the fact that 30% would be satisfied with a four-hour response/repair performance; users recognize the difficulty in fast response in more remote locations.
- Compared to 1980 results, the 1981 survey reveals a significantly longer repair time; this reflects the greater complexity of newer terminals, both in terms of hardware capability and software.
- The very long response and repair times being experienced by 20% of terminal users is an opportunity for alternative delivery systems for maintenance, including remote diagnostics and depot maintenance.

6. WORD PROCESSING TERMINALS

- Word processing terminal results, gathered for the first time in 1981, are presented in Exhibit III-12.
- The response time is quite similar to that for small business computers. This is consistent with the fact that some word processing equipment is dual function word and data processing, and must compete in both markets.
- Repair time for word processing equipment is significantly longer, however, with almost half the respondents reporting repair times of four hours or longer. This is partly a result of the rapid growth of this segment, and the existence of many new field engineers in the word processing area.

7. SYSTEMS AND APPLICATIONS SOFTWARE

- The longer response/repair times experienced for software are shown in Exhibits III-13 and III-14.

- For systems software, as shown in Exhibit III-13, only 50% of users report a repair time of two and one-half hours or less. Times of over four days are reported.
 - For applications software, the repair time is even more extended, with 50% of the users experiencing repair time of eight hours or more.
 - In light of these software experiences, the success of support centers with their offer of faster response and repair times is understandable.
- Having tracked the user experience and expectations regarding maintenance levels, INPUT asked users to indicate the premium they were willing to pay to go from the "current" to the "ideal" level of maintenance, as shown in the preceding exhibits. Results are tabulated in Exhibit III-15.
 - A small percentage of small business computer users would be willing to pay an average of 43% more; this is indicative of the growing importance of small business computers in some installations, and the users' increased dependence on these computers.
 - The results in Exhibit III-15 must be viewed with caution in that users are hesitant to tell an interviewer that they are willing to pay more; for this reason, the percentage of increase is likely understated.
 - In light of the above comment, a comparison with the 1980 survey is particularly significant. Those users willing to pay more indicate a growing (from a 1980 average of 14% to a 1981 average of 18%) amount they would be willing to pay in premiums for improved maintenance service levels.

8. USER COMMENTS

- User comments regarding level of satisfaction with maintenance add insight into the often subjective nature of the ratings:

EXHIBIT III-15

USERS' WILLINGNESS TO PAY MORE FOR IDEAL MAINTENANCE

CATEGORY	WILLING		NOT WILLING		AMOUNT WILLING TO PAY	
	NUMBER	PERCENT PREMIUM	NUMBER	PERCENT PREMIUM	AVERAGE	RANGE
MAINFRAMES	14	20%	53	80%	15%	5- 25%
SMALL BUSINESS COMPUTERS	3	8	34	92	43	10-100
MINICOMPUTERS	3	17	15	83	15	10- 20
PERIPHERALS	12	14	75	86	15	5- 25
WORD PROCESSING TERMINALS	1	5	18	95	10	10
DATA TERMINALS	6	8	69	92	13	10- 20
TOTAL	39	13%	264	87%	18%	5-100%
RESULTS OF 1980 SURVEY	38	16	204	84	14	5- 25

- An IBM user: "GSD and DPD are worlds apart in the systems and service they provide." (He rated GSD a 6 and DPD a 9 on a scale where 0 = poor and 10 = excellent.)
- A sympathetic terminal user: "One problem is that they are distributed in many small locations, therefore a poor response in some locations. Also, they have new hardware so the FEs aren't as well trained as they will be in the future." (He rated a 7.5.)
- Several respondents mentioned high-speed printers as being particularly troublesome.
- An IBM system software user: "We don't use any local support. We use the system support center in Chicago, and I rate that very high." (He rated a 9+.)
- A Hitachi user: "Have had Hitachi since last June and have yet to call with a problem." (He rated a 9.5, a tribute to the reliability of the Japanese produced mainframe.)
- IBM, as the most prevalent vendor, sometimes gets caught in the crossfire.
 - . One user with an IBM mainframe and a plug compatible memory attributed his problems to the memory. He rated IBM an 8 and the memory maintenance at 3.
 - . Another user had just replaced IBM with Hewlett-Packard. Interestingly, Sorbus was the maintenance vendor on the IBM equipment and was thought to be "excellent"; the user felt the problem was with the IBM equipment itself.
- The long-suffering user of a package from a software company: "They lost their entire staff of commercial loan programmers. There was

almost a year with no answer to our problems. It is improving now."
(He rated a 3.)

- A user of plug-compatible disks and tapes: "They don't replace read-write heads until we have trouble. They should replace them on a regular preventive cycle." (He rated the vendor a 6.)
- A user of word processing equipment purchased from Radio Shack: "Of the two times we required maintenance, it took 14 days to get repaired!" (He rated the vendor a 3.)
- Minicomputer vendors generally received the most negative comments. Two examples:
 - . "Poor maintenance over the years, poor response, unqualified engineers." (A 2 rating.)
 - . "Poor repair time, poor communications, less than professional." (A 4 rating.)
- A user of an applications software package from a software house was particularly upset: "I can't get them to come out and fix anything. When they get someone here they don't know what they are doing. As a matter of fact I spent \$3,500 to get someone else to fix one of their problems."
- Are things getting better or worse? It depends on who you talk to (a conclusion also reached in the 1980 survey). Two IBM users in the 1981 survey:
 - . "IBM has improved."
 - . "IBM has a lot of prima donnas who don't want to get their hands dirty. I believe it's because of their past hiring freeze. They

don't have enough new blood willing to work. Our systems programmers have to tell IBM how to fix their own problems." This particular user was most upset over systems software maintenance, which he rated a 3, while he rated hardware maintenance a 9.

- The user ratings certainly are colored by personal prejudices, or simply by whether or not the user is having a bad day. Looking at the total of approximately 500 mentions, however, the total survey profile is a revealing picture of the current state of user satisfaction in the United States.

E. USER EXPERIENCE WITH UPTIME

- In the 1981 user survey, the issue of uptime was addressed for the first time.
 - It is generally felt that user expectations regarding uptime are increasing.
 - There is a need to quantify this expectation.
- It is essential to analyze uptime by equipment type, because some parts of a system can go down without making the total system inoperative.
 - For critical applications, some users build redundant systems, or redundant parts of systems; i.e., dual printers.
 - The success of Tandem Computers is built on the concept of redundant systems. Other vendors are expected to offer systems patterned on the Tandem approach of building a very long mean time between failures.

- For a more detailed analysis of the issue of applications criticality and uptime, see INPUT's recent report, Users' Perceptions of Critical Maintenance, issued in June 1981.
- Results of the 1981 survey regarding uptime are shown in Exhibit III-16. A number of revealing data points warrant mention.
 - The 95% uptime which many vendors consider today's norm is actually being met and exceeded by 75% of the pieces of equipment and software represented in the sample.
 - For 39% of the mainframes in the sample, the users report uptime of 99% and better; this is particularly interesting when related to H-P's recent announcement of a 99% guaranteed uptime offer.
 - A significant number of users feel that they are already averaging this level of uptime on mainframes.
 - A critical element in any offering is the vendor's definition of uptime, and the number of elements covered in the guarantee commitment.
 - H-P's offering is discussed in more detail in Chapter VI on vendor activities.
- Small business computer users report uptimes comparable to mainframes, with the exception of the over 99% category.
 - The difference between user satisfaction with maintenance of small business computers versus the lower satisfaction level with minicomputer maintenance shown earlier is undoubtedly a reflection of the lower uptime figures shown for minicomputers.

PERCENT OF UPTIME

NUMBER OF MENTIONS TYPE OF EQUIPMENT	GREATER THAN 99%		99%		98%		95-97%		90-94%		80-89%		60-79%		BELOW 60%	
	NUM-BER	PER-CENT	NUM-BER	PER-CENT	NUM-BER	PER-CENT	NUM-BER	PER-CENT	NUM-BER	PER-CENT	NUM-BER	PER-CENT	NUM-BER	PER-CENT	NUM-BER	PER-CENT
MAINFRAMES-86	12	14%	21	25%	19	22%	19	23%	10	11%	3	3%	2	2%	0	0%
SMALL BUSINESS -32	1	3	9	28	7	22	7	22	2	6	4	13	1	3	1	3
MINIS - 27	1	4	7	26	5	18	4	14	6	22	2	8	2	8	2	8
PERIPHERALS -134	3	2	28	21	15	11	46	35	17	13	14	10	8	6	3	2
DATA TERMINALS - 106	8	8	25	24	25	23	19	18	21	20	5	5	2	2	-	-
WORD PROCESSING -23	1	5	6	27	5	23	7	31	1	5	2	9	-	-	-	-
APPLICATIONS SOFTWARE - 24	1	4	4	17	5	21	9	38	2	8	1	4	2	8	-	-
SYSTEMS SOFTWARE - 66	4	6	15	23	21	32	16	26	6	9	2	3	2	3	-	-
TOTAL-498	31	6%	115	23%	102	20%	127	26%	65	13%	33	7%	19	4%	6	1%

- All these figures must be related to the number of shifts per week during which the particular piece of equipment or software is operated. This is presented in schematic form in Exhibit III-17.
 - Peripherals, which include printers as well as disk and tape, have the lowest average uptime, and the percentage uptime drops as the shift usage increases.
 - Mainframes tend to cluster at the high usage end of the spectrum.
 - Small business computers, minis and terminals all show similar usage/uptime patterns, with a greater incidence of low-shift usage than mainframes.
 - Any vendors considering uptime guarantees must consider current user experience with similar equipment.
 - Individual user responses have been graphed versus number of shifts per equipment type and are presented in Appendix A, Exhibits A-11 through A-18. These graphically show the range and diversity of user experience on the uptime issue as summarized in Exhibit III-17.
- There is a definite trend to a higher number of shifts per week covered by maintenance as evidenced by the maintenance coverage requirements charted in Exhibit III-18.
- After a period of stability between the 1978 and 1980 surveys, 1981 respondents showed a marked increase in number of shifts, particularly in those running parts of a second shift (6-15 shifts per week).
 - A portion of the change between the 1980 and the 1981 results is due to the inclusion in the 1981 sample of more large data centers; these will tend to have more on-line applications and tend toward multishift operation.

EXHIBIT III-17

DISTRIBUTION OF UPTIME VERSUS
NUMBER OF SHIFTS BY EQUIPMENT TYPE

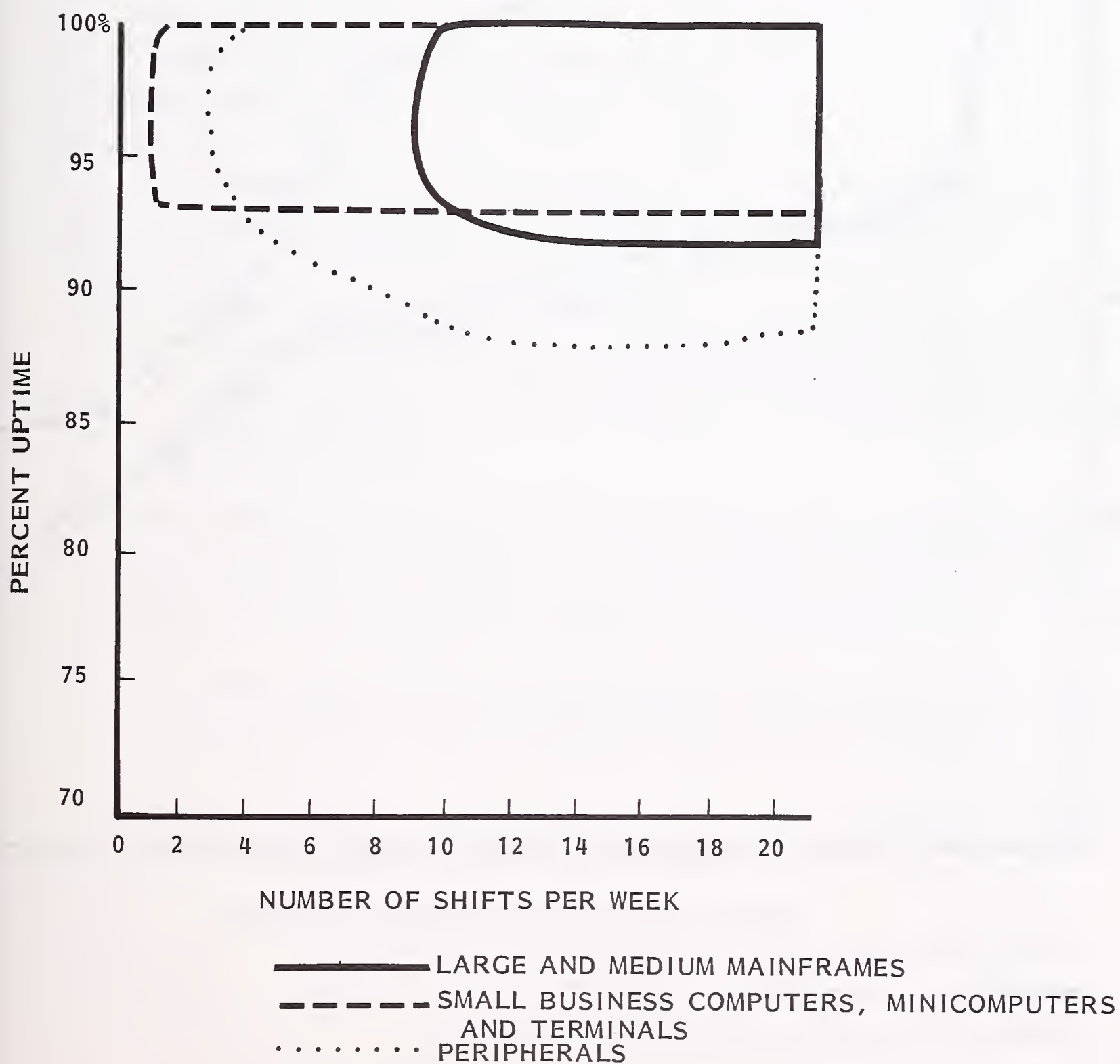
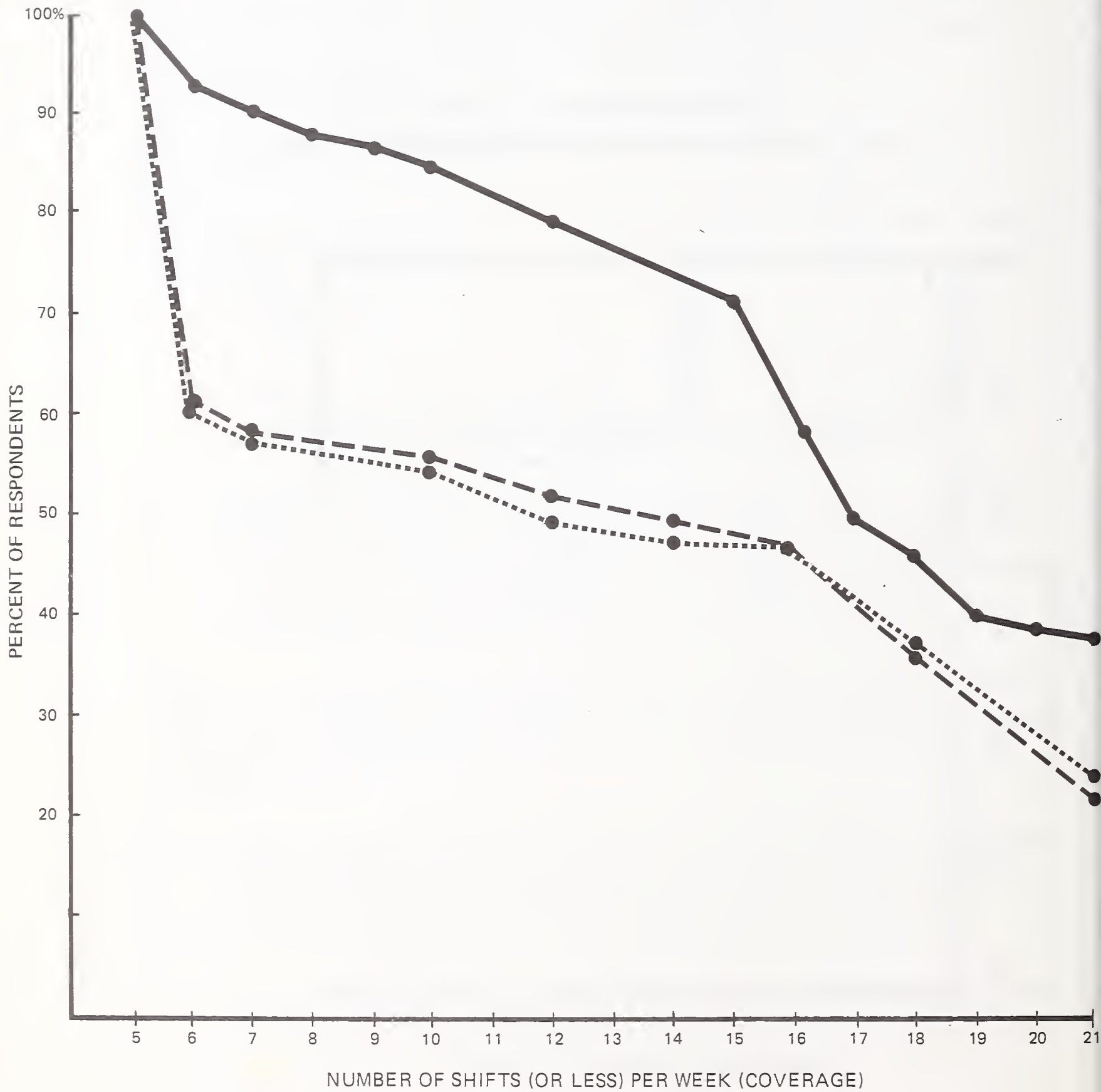


EXHIBIT III-18

CUMULATIVE MAINTENANCE COVERAGE REQUIREMENTS, 1978, 1980, 1981



— 1981 - - - 1980 1978

NUMBER OF RESPONDENTS: 1981 (107), 1980 (76), 1978 (133)

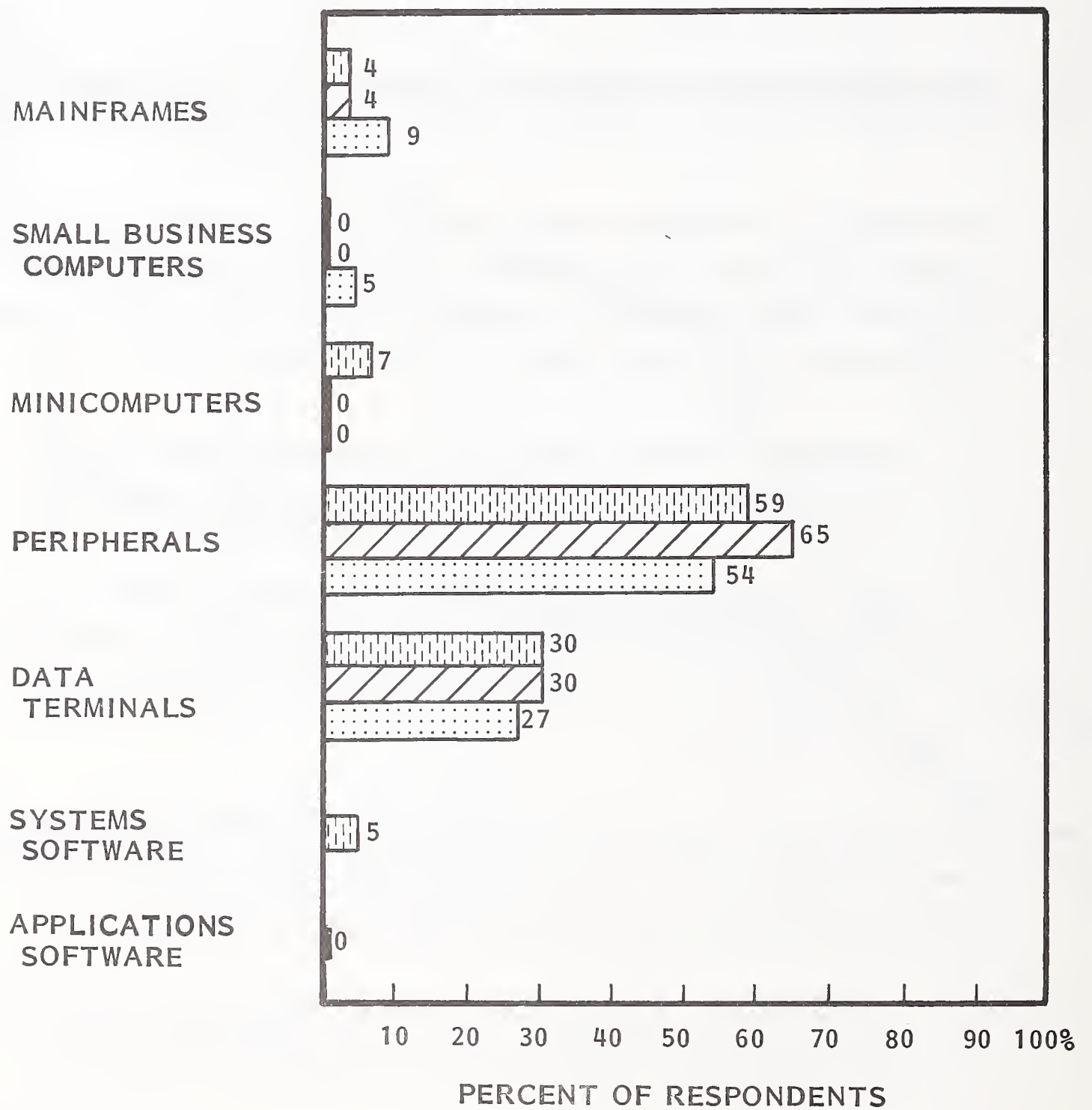
- However, even with the above qualification the move toward multi-shift operation is significant; over 40% of the respondents had 19 and more shifts per week of operation, out of a total potential of 21 shifts. This is up from 20% in 1978-1980.

F. REPLACEMENT OF EQUIPMENT/SOFTWARE DUE TO POOR MAINTENANCE

- As shown also in earlier surveys, users interviewed in 1981 do make replacements of equipment when maintenance falls below acceptable levels. Even though the 1981 sample differs somewhat from the 1980 sample, the amount of replacement is very similar, as shown in Exhibit III-19.
 - Peripherals and terminals again lead in replacement with the respondent replacement rate approximating 60% and 30% respectively.
 - The replacement rate, of course, does not apply to the total installed base, but means that 60%, etc., of the respondents had replaced one or more units in that equipment category over the past two years due to poor maintenance.
- The consistency in replacement rate over the period 1978-1981 indicates that there is a portion of the installed base which remains vulnerable due to the wrong match between equipment, application and often, people.
 - The increase in the rate of minicomputer replacement, from 0% in 1978 and 1980 to 7% in 1981 may be due to several factors including:
 - . Use of minicomputers in more critical applications where traditional minicomputer maintenance is inadequate.
 - . The availability of more plug compatible minicomputer replacements.

EXHIBIT III-19

EQUIPMENT REPLACED DUE TO POOR MAINTENANCE,
BY TYPE, 1978-1981



-  - 1981 (25 OF 108 USERS QUESTIONED)
-  - 1980 (22 OF 76 USERS QUESTIONED)
-  - 1978 (27 OF 93 USERS QUESTIONED)

- While the sample of minicomputer user respondents is quite small the fact that the user satisfaction level discussed earlier is down and the replacement rate is up, is a significant indication of a decline in average satisfaction among minicomputer users.
- Mainframes, small business computers and software continue to be resistant to replacement, a reflection of user hesitancy to make any change once they have invested in software; any change in mainframes may affect overall software compatibility.
- User comments regarding reasons for replacement reveal a mix of dissatisfaction with the equipment and/or the maintenance.
 - "I don't think the local people were qualified to repair the disks . . . the tape drives I don't think anybody could maintain. Bad tape hardware."
 - "IBM used to come in for maintenance but they never did much. Percent uptime was only about 63%. It's substantially improved by Comma."
 - "Comma had unqualified personnel maintaining machines."
 - "The problem with third-party is if they run into a problem that they can't solve, generally they don't have a bank of experts to call in like IBM does. If we had IBM in the first place we could have put pressure on them to bring in the experts. They replaced a system that was outdated."
 - "One problem took more than one year to repair. They sold so much equipment that they forgot about small users like us." (A minicomputer user.)
 - "Poor response due to location of FEs. It took 60 miles of driving to get here." (Replaced non-IBM terminals with IBM.)

- "We were too small to matter very much." (A word processing user.)
- "Lack of talent. I think they are growing too fast. No continuity. On software problems they have to fly someone in to fix it. They don't have local software support."
- "We changed due to poor equipment, not maintenance."
- "Poor response time, repair time, lack of parts. They lost some of their key people and replaced them with trainees."
- "Poor equipment reliability and the vendor could not maintain it."
- "Had problems with supplies only. We changed supplies vendors and got rid of a lot of hardware problems."
- As shown in Exhibit III-20, 27 of 108 users made replacement during the past two years. While the majority of users interviewed had not made replacements and were basically satisfied with the combination of equipment and maintenance offering, a significant additional number either considered replacement, or are considering it.
 - "Close to it. I was about to pull the tape drives out 6-9 months ago, but now they're working beautifully."
 - "We were contemplating it but feel TRW is now strengthened since their arrangement with Fujitsu."
 - "I want to get rid of the printer due to poor service but can't because we own it. I wish I could throw it out the door."
 - "I feel like I am a training ground. Our people know more about what's going on than they do."

EXHIBIT III-20

IDENTITY OF VENDORS REPLACED
DUE TO POOR MAINTENANCE

VENDOR	NUMBER OF UNITS REPLACED	EQUIPMENT REPLACED	REPLACED BY
BRAEGEN	1	PERIPHERAL	STC
BURROUGHS	2	MAINFRAME, TERMINAL	IBM
CAMBRIDGE	1	MEMORY	IBM
CENTURY	1	PERIPHERAL	CALMA
COMPUTERVISION	1	MINICOMPUTER	CALMA
DEC	1	MINICOMPUTER	PRIME
HARRIS	1	TERMINAL	IBM
HONEYWELL	1	PERIPHERAL	HONEYWELL
IBM	1	TERMINAL	IBM
INTELL	1	MEMORY	IBM
ITEL	4	PERIPHERAL	MEMOREX, STC
ITT COURIER	1	TERMINAL	IBM
LITTON	1	TERMINAL	DIGITAL EQUIPMENT
MEMOREX	1	PERIPHERAL	STC
NCR	1	TERMINAL	IBM
STC	1	PERIPHERAL	STC
SYCOR	5	PERIPHERAL, PRIN- TERS, TERMINALS	IBM, TEXAS INSTRUMENTS
TEXAS INSTRUMENTS	1	TERMINAL	TEXAS INSTRUMENTS
XEROX	1	PRINTER	IBM
TOTAL	27	-----	-----

NUMBER OF RESPONDENTS: 25

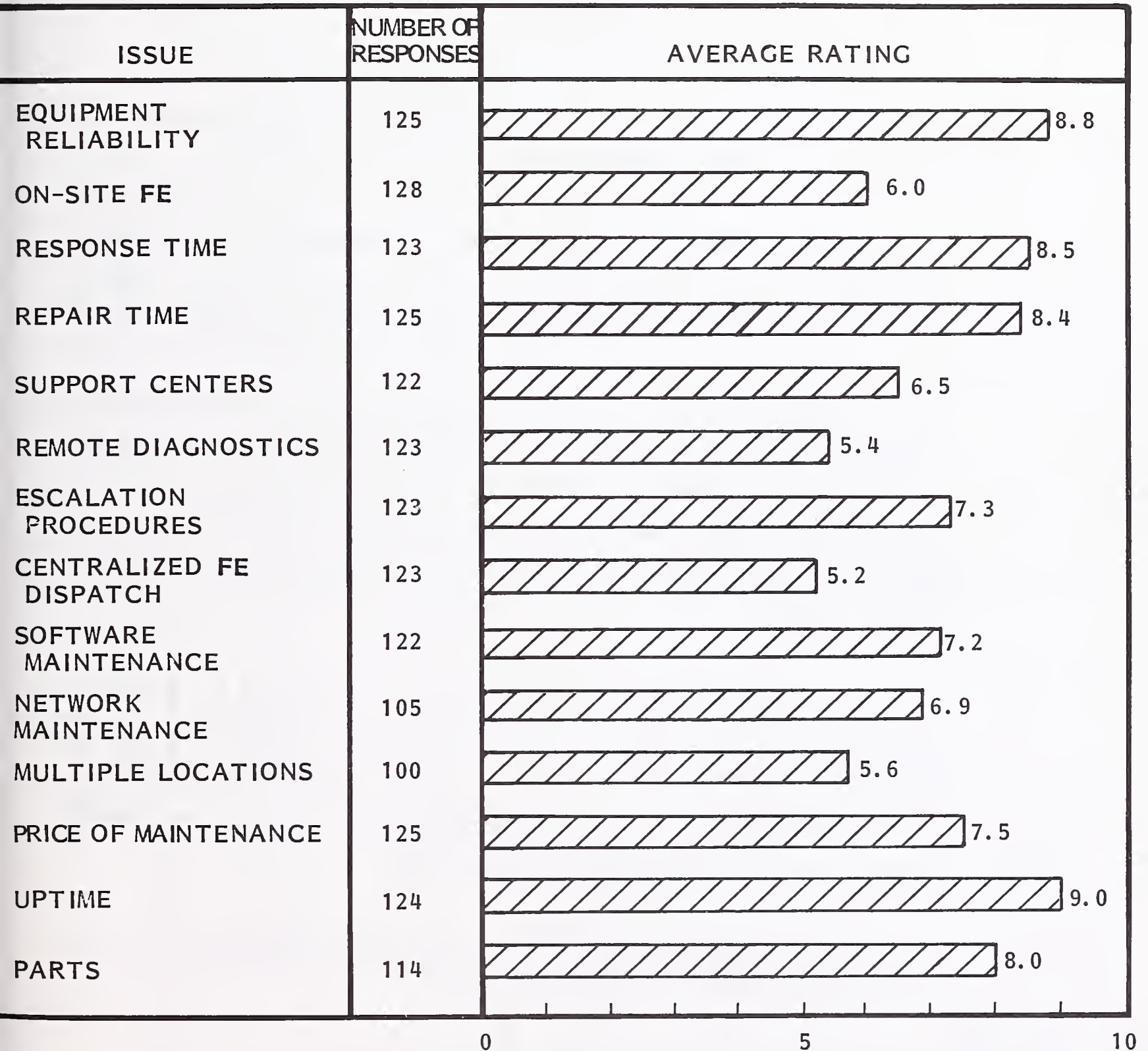
- Still, with all the complaints, the majority is satisfied; as one user summarized it, "We are happy."

G. USER RECEPTIVITY TO MARKETING OF FIELD SERVICES

- Usually the fastest way to increase field service profits is to increase revenues; the alternative, that of reducing costs, typically takes longer, and has some irreducible limits. To provide insight into means of increasing revenues several questions were added to the 1981 survey to determine the users' receptivity to various vendor marketing strategies.
- Exhibit III-21 tabulates user ratings of a range of maintenance related issues. Users were asked to use a scale of 0 = not important, 10 = very important.
 - The highest rating is given to uptime. This reinforces the importance of the uptime analysis earlier in this chapter.
 - The next four issues in terms of high rating - equipment reliability, response time, repair time and parts - are also uptime related; this gives further weight to the viability of a vendor emphasizing increased uptime in a revenue-generating campaign.
 - The price of maintenance rates fifth in the list of 14 issues presented to users.
 - Other INPUT research reveals that price is relatively less important in installations with critical applications.
 - In many installations, however, price is a major factor.
 - The relatively low rating of remote diagnostics reinforces earlier INPUT findings: remote diagnostics are being driven mainly by the

EXHIBIT III-21

USERS' RATINGS OF MAINTENANCE RELATED ISSUES



RATING: 0 = UNIMPORTANT
10 = VERY IMPORTANT

desire of vendors to reduce labor costs, not by user demand. Vendors desiring to market remote diagnostics would do well to tie it to increased uptime as a prime user benefit.

- Centralized FE dispatch is rated lowest by users. Many users view this issue as primarily to the benefit of the vendor and therefore not a prime benefit in the users' point of view.
- Users were also asked to comment on what level of price increase would lead them to consider doing their own maintenance.
 - Previous INPUT research revealed that user willingness to do maintenance was centered mainly on terminals and very few users are willing to do their own maintenance on mainframes or minicomputers.
 - With the above factor in mind (i.e., doing "own maintenance" does not necessarily mean doing all maintenance, but rather is often restricted to terminals and other simpler devices) the user attitude responses were grouped according to the amount of price increase which would lead the user to consider doing his own maintenance. Results are presented in Exhibit III-22.
 - User willingness to pay more is undoubtedly understated for a reason verbalized by one user, "I really should say another 10% (price increase). I don't want the vendors to know that we really wouldn't consider doing our own maintenance unless the cost was very much higher. I run the risk of vendors raising rates!"
 - Most users would not consider doing their own maintenance at any anticipated increase. Typical comments:
 - "Wouldn't consider it under any circumstances."

IMPACT OF INCREASES IN MAINTENANCE PRICING ON USER WILLINGNESS TO DO OWN MAINTENANCE

AVERAGE RANGE OF RATINGS															
ISSUE	AVER- AGE	RANGE	AVER- AGE	RANGE	AVER- AGE	RANGE	AVER- AGE	RANGE	AVER- AGE	RANGE	AVER- AGE	RANGE			
EQUIPMENT RELIABILITY ON-SITE FE RESPONSE TIME REPAIR TIME SUPPORT CENTERS REMOTE DIAGNOSTICS ESCALATION PROCEDURES CENTRAL FE DISPATCH SOFTWARE MAINTENANCE NETWORK MAINTENANCE MULTIPLE LOCATIONS PRICE OF MAINTENANCE UPTIME PARTS	8.8	6-10	9.5	9-10	9.75	9-10	9.3	9-10	9.8	9-10	9.5	9-10			
	6.0	0-10	8.0	7-9	9.0	7-10	5.0	0-9	4.3	0-10	5.6	0-10			
	8.5	7-10	8.5	7-10	9.25	9-10	9.0	9	8.8	8-10	9.5	9-10			
	8.4	4-10	9.5	9-10	9.0	8-10	9.0	8-9.5	6.2	0-10	8.5	5-10			
	6.5	0-10	6.0	5-7	8.75	7-10	8.0	5-9	7.2	0-10	8.5	7-10			
	6.4	0-10	6.5	5-8	4.5	0-7	7.0	5-8	4.4	0-10	5.75	0-10			
	7.3	0-10	8.0	7-9	9.75	9-10	7.7	5-8.5	7.0	3-10	7.5	5-9			
	5.0	0-10	7.5	6-9	5.5	0-9	7.0	5-8.5	5.6	3-6	6.0	2-8			
	7.0	0-10	7.5	7-8	6.5	0-10	8.0	7-9	8.6	7-10	7.75	5-10			
	7.0	0-10	6.5	3-10	6.5	0-10	7.0	2-10	4.3	0-8	9.5	9-10			
NUMBER OF RESPONSES	5.6	0-10	6.5	3-10	8.25	7-10	4.8	2-9	6.4	0-10	8.5	7-10			
	7.5	0-10	8.5	7-10	8.25	6-10	6.4	3-9	6.8	7-9	7.0	5-9			
	9.0	8-10	10.0	10	9.75	9-10	9.3	9-10	9.8	9-10	9.25	9-10			
	8.0	6-10	7.0	6-8	9.6	9-10	8.0	5-10	9.6	9-10	8.5	8-9			
AVERAGE PERCENT OVER CURRENT MAINTENANCE COSTS USER WOULD CONSIDER DOING OWN MAINTENANCE	60	-	2	-	4	-	5	-	6	-	4	-	1	-	OVER 100%

0 = UNIMPORTANT
10 = VERY IMPORTANT

- . "Perhaps we would consider it on a very simple piece of equipment . . . but we feel maintenance is best left to the expert."
 - . "We can't take the risk. This is a hospital and lives may depend on our system being up."
 - . "Never. It's too difficult in terms of training personnel."
 - . "We cannot get the parts."
 - . Not worth the effort. We don't have the people."
- Some users are developing an in-house capability; i.e., "We could probably do our own maintenance on the IBM equipment. We have someone employed now who could handle it."
 - The resistance to self-maintenance is diminishing, according to INPUT research done in 1980. In the current survey, the following user indicated this trend, "I think we will participate more in the future. We will do partial maintenance, that is, maintenance from manufacturer's instructions. They keep telling us that there will more customer participation. Sounds good to us."
 - The earlier finding that terminals are the most likely candidates for early user self-maintenance was reinforced by a number of comments similar to the following, "We could consider terminals, but not CPUs or peripherals. Too much staffing up and training is required. We don't need the same amount with terminals"; or, "We may do it with terminals because they have a lower priority. We would order another terminal and steal the parts."

- The relationship between a desire for higher uptime and a willingness to pay more for maintenance is also apparent from Exhibit III-22. The average rating for uptime is lowest among those who would resist any increase, although the difference is not great.
- Evidently many users, 60 out of the 108 included in this survey, are of a mind to resist any price increase.

H. USER GUIDELINES REGARDING PRICING

- Users were asked, "What guidelines do you use to evaluate the cost of maintenance?" A wide range of responses was received; some use a fairly analytic approach, and others accept passively whatever the vendor offers. A sample of responses follows:
 - "We look at the amount of downtime and multiply it by the hourly wage of those using the system to arrive at dollars lost and compare this to the cost of maintenance." This same user said it would take a 50% price increase before he would consider doing his own maintenance.
 - "On contracts we look at downtime versus support. We also evaluate competitive pricing."
 - "Not sure. We pay the price."
 - "We don't have too much to say. It's only been recently that some people have made it competitive. We would reduce those costs but not at the expense of the reliability of the system."
 - "We don't. We've got the machines, we need the maintenance. We pay for the maintenance. We go to the vendors who sell us the machines." This user would not consider self-maintenance.

- "We make a comparative analysis between equipment, service provided, and expense."
- "We do a comparison with other vendors. Quality, price to a degree, and recommendations from other users. We actually talk to other users."
- "With Sorbus we just compared rates between IBM and Sorbus - better service was assumed."
- "I prefer manufacturers. There are always little things he would do that a third party could not do."
- "I'm interested in knowing if they have local parts, local personnel, on-site personnel . . . and then we look at price. Price would be down low on the priority list."
- "We're looking at third-party. We're looking for a 10-15% savings."
- "We compare one vendor to another. We compare cost of the equipment itself with the cost of the maintenance, and see whether it's realistic."
- "The amount of profit lost by a store or department due to the system being down."
- "We write out the specifications of what we need - then we consider the lowest one that meets these requirements that has a decent escalation procedure and parts availability. Then we consider cost."
- "We are on a lease with IBM so it's a requirement to have a maintenance package. On Honeywell we use their maintenance package because it's less expensive than going through independent maintenance."

- "No evaluation."
 - "None, really."
 - "We accept what is provided by the vendor."
 - "No formal guidelines. We use local IBM support. We're not in a major metropolitan area. We're hooked into IBM."
 - "None. We have no recourse. We're hooked into one vendor."
 - "We weigh the cost of maintenance and equipment against pure base price."
 - "I really don't know. I've used Itel and Comma so long I just have not looked into it. Maybe it's about time I do!"
- The decision-maker for the selection of maintenance services is tied closely in the mind of the user to the decision-maker on key hardware/software selection. Therefore the vendor's maintenance strategy must be communicated to this decision-maker; users identified a range of decision-makers from the operations manager up to the chairman of the board, as shown in Exhibit III-23.
 - In companies or institutions where the computer capability was key to survival, the purchasing decision was at a higher level.
 - Computer services companies tended to place these decisions at the president/chairman level.
 - The larger companies, who have typically developed more advanced systems, tend to place the decision-maker at a high level. Of the responding companies with over \$1 billion in annual sales, 70% identified the decision-maker at the vice president/director level and above.

EXHIBIT III-23

IDENTITY OF DECISION-MAKER BY SIZE OF COMPANY

NUMBER OF RESPONSES											
SIZE OF COMPANY TITLE	> \$1 BILLION		\$500-999 MILLION		\$100-499 MILLION		<\$99 MILLION		NO INFORMATION ON RESPONDENT REVENUE		TOTAL
	DECISION-MAKER		DECISION-MAKER		DECISION-MAKER		DECISION-MAKER		DECISION-MAKER		
	PRIMARY	SECON-DARY	PRIMARY	SECON-DARY	PRIMARY	SECON-DARY	PRIMARY	SECON-DARY	PRIMARY	SECON-DARY	
PRESIDENT / CHAIRMAN	1	-	-	-	-	-	3	2	6	2	14
VICE PRESIDENT (NON DP)	3	-	1	-	2	-	1	3	9	3	22
VICE PRESIDENT(DP)	7	2	2	2	2	1	1	1	4	2	24
ASSISTANT VICE PRESIDENT/DI-RECTOR (NON DP)	3	2	-	-	1	1	1	-	7	4	19
ASSISTANT VICE PRESIDENT/DI-RECTOR (DP)	3	5	2	0	7	1	1	-	6	3	28
MANAGER (NON DP)	4	2	-	1	-	2	-	1	2	9	21
MANAGER (DP)	2	4	3	4	2	7	4	1	6	11	44
SPECIALTY MAN-AGER (NON DP)	-	2	-	-	2	3	-	1	3	7	18
SPECIALTY MAN-AGER (DP)	1	6	-	2	-	1	-	2	4	6	22

- Smaller companies also place the decision at high levels. This means that a vendor must be able to attract the attention of this high-level executive if the vendor wants to impact long-term maintenance purchase decisions.
- The fact that, as shown in Exhibit III-23, no single title category represented even one quarter of the responses, means that often multiple contacts must be made at a user location.
 - . Decisions on mainframes may involve higher level participation than decisions on peripherals.
 - . Presentations by field services to groups within a user organization will often be an appropriate marketing vehicle, to ensure that multiple buying viewpoints are present.
- Of the 108 users interviewed only four anticipated a change in the identity of the decision-maker in the coming years; these saw either that the decision point would move higher in the organization, or that decisions regarding word processing equipment would come under data processing.
- During the interviews an attempt was made to identify the decision-maker by equipment type.
 - Almost all respondents indicated that all decisions regarding equipment/software selection are made at the same level.
 - Twelve respondents identified a separate group as the decision-maker for word processing terminals. Those identified were: purchasing agent, user department, vice president of finance, controller, acting chief of office automation, administrative section and director of corporate communications.

- Four respondents did indicate a higher decision level for mainframes than for peripherals and terminals.
- Having been asked about issues and decision-makers, users were then asked to rate their levels of interest in topics which a field service vendor might develop in a presentation to the decision-makers. Responses are presented in Exhibit III-24.
- Two-thirds of the respondents indicated they would be interested in a management level presentation.
- Of the five potential topics for such a presentation, four rated between 7.9 and 8.1 on a scale where 0 = no interest and 10 = high interest.
 - Only "methods for handling multiple sites" rated lower.
 - This indicates that distributed processing and its impact are still in the future for most sites; a vendor would normally do well to focus a presentation on local issues.
- Exhibit III-24 is structured to allow comparison of responses of IBM and non-IBM users:
 - IBM users tend to be more interested in future product plans.
 - Non-IBM users tend to be more interested in the near-term issues of vendor/user communications and productivity.
 - Differences between the two user groups are slight, however, with the similarities being more dominant.
- In summary, the characteristics of the users in the 1981 survey are:
 - They are generally satisfied with the maintenance they are receiving.

EXHIBIT III-24

USER INTEREST IN VENDOR PRESENTATION TOPICS

TOPICS		USER RESPONSES				
		n=	AVERAGE	NUMBER OF 10s	NUMBER OF 0s	NUMBER OF N/A
1. METHODS FOR HANDLING MULTIPLE SITES	IBM	33	5.7	5	6	18
	NON-IBM	37	4.8	4	11	25
	ALL	70	5.2	9	17	43
2. VENDOR FUTURE PRODUCT PLANS	IBM	36	8.3	10	0	15
	NON-IBM	40	7.8	10	1	23
	ALL	76	8.1	20	1	38
3. PRICING ALTERNATIVE	IBM	36	8.0	6	0	15
	NON-IBM	40	8.2	12	0	23
	ALL	76	8.1	18	0	38
4. METHODS FOR IMPROVING VENDOR/USER COMMUNICATION	IBM	36	7.3	4	0	15
	NON-IBM	40	8.4	11	0	23
	ALL	76	7.9	15	0	38
5. METHODS FOR IMPROVING PRODUCTIVITY	IBM	36	7.8	6	1	15
	NON-IBM	40	8.4	13	2	23
	ALL	76	8.1	19	3	38

KEY: 10 = HIGH INTEREST, 0 = NO INTEREST

- They will replace equipment, particularly peripherals and terminals, if maintenance falls below acceptable levels.
- They will not generally admit to being willing to pay more for maintenance, but most have no intention of picking up the maintenance task themselves.
- Uptime and reliability are prime issues from a user viewpoint, particularly in critical applications.
- User satisfaction is often more a function of the equipment than the maintenance.
- There is a trend toward multishift operations.
- The decision-maker regarding maintenance in most user organizations is remaining constant, with very little shifting evident.
- Most users are interested in hearing a field service vendor's story and an opportunity exists for vendors to present this story to its user base.

IV RESPONSES OF IBM USERS COMPARED TO
NON-IBM USERS

IV RESPONSES OF IBM USERS COMPARED TO NON-IBM USERS

A. IMPORTANCE OF IBM USER COMPARISONS

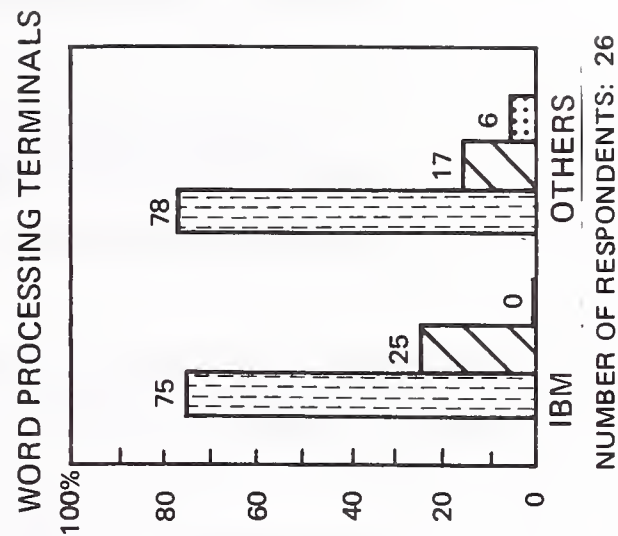
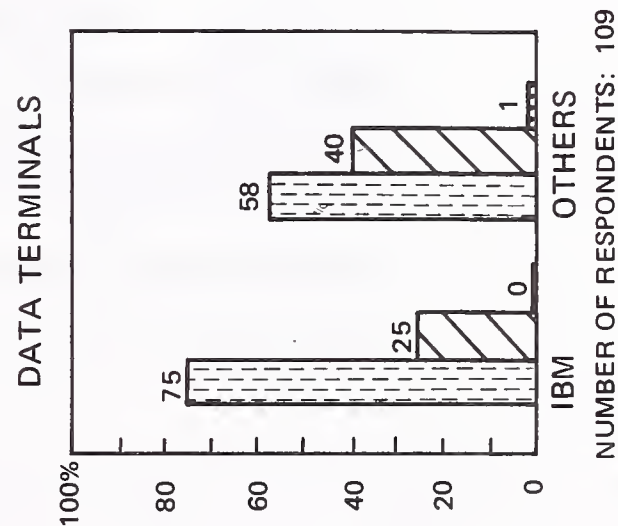
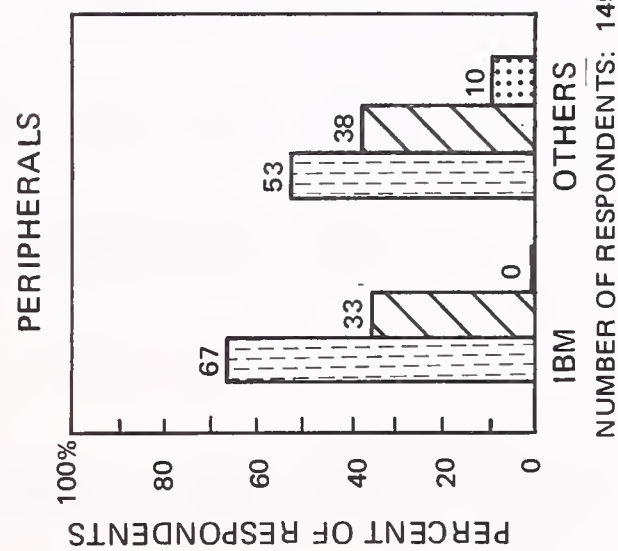
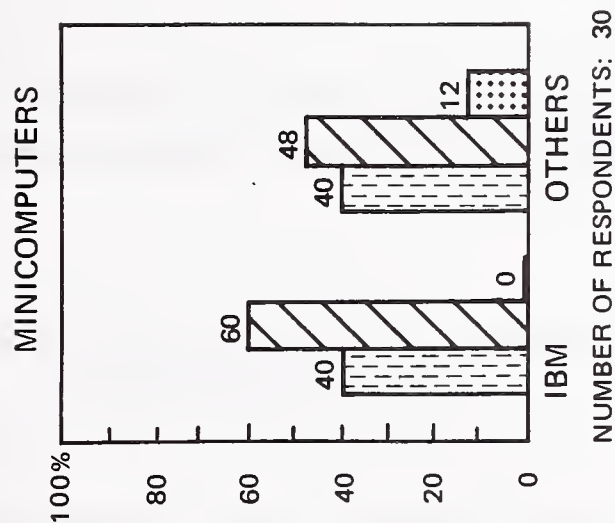
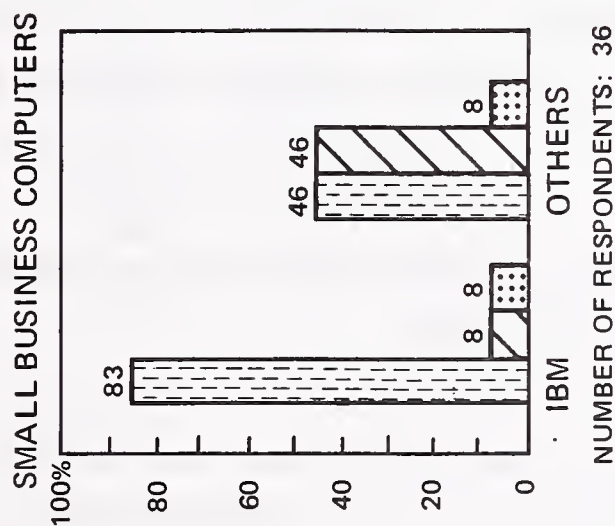
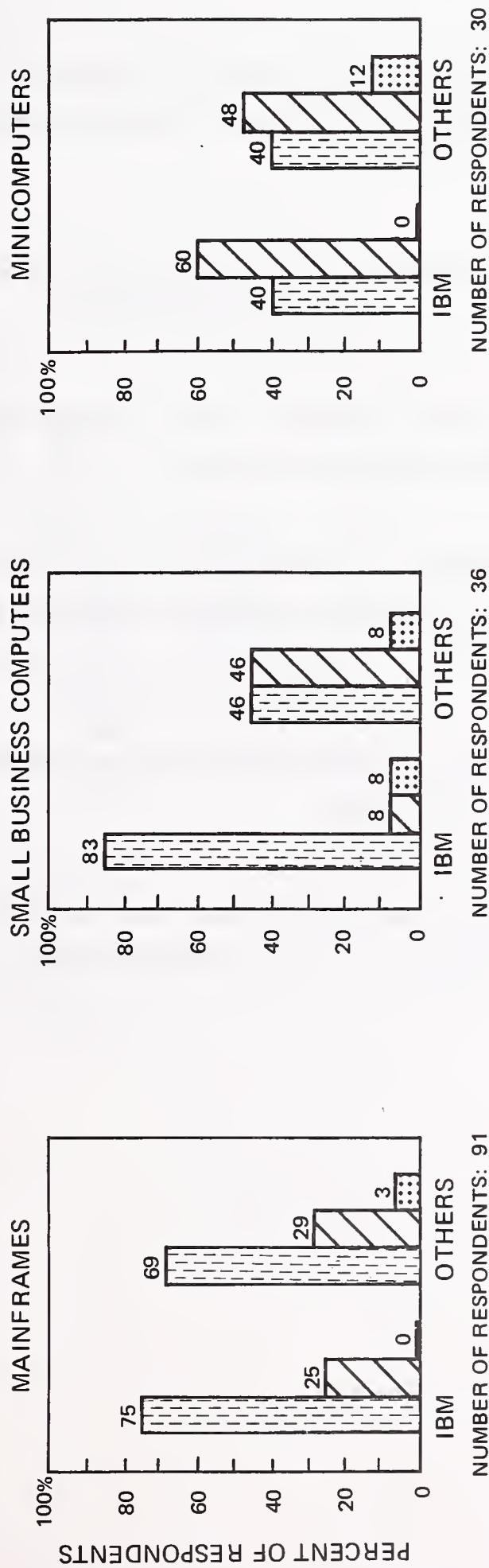
- From a market share standpoint, IBM is the dominant vendor. Beyond sheer size, however, IBM is important to all other vendors because:
 - In recent years IBM has been particularly innovative in field service. Examples include the withdrawal of preventive maintenance on the IBM 4300 series, the introduction of depot maintenance on the IBM 3101 Display Terminal, and the unbundling of software maintenance.
 - As the trend toward total systems (data, text, graphics) continues, IBM impacts other vendors who previously had thought they could carve a niche away from this competitor.
 - For many vendors, IBM creates markets; the plug compatible equipment marketplace is an example.
- In this chapter, the same survey results which were presented in total in Chapter III are split between IBM and non-IBM.
 - Readers wanting data on the makeup of respondents for individual equipment types are referred to Appendix A, Exhibits A-19 through A-24.

- Since respondents mentioned an average of four (not necessarily different in that the same vendor may maintain more than one equipment type in an installation) maintenance vendors for their range of equipment types, many users were in fact exposed to other vendors as well as IBM. The great majority of users were using more than a single maintenance vendor, and their responses are therefore comparable.

B. IBM USERS ARE SLIGHTLY MORE SATISFIED

- In the 1981 survey, as stated earlier, a deliberate effort has been made to expand the types of users interviewed beyond the dominant EDP manager type. As a result, the 1981 survey better represents the total marketplace.
- As shown in Exhibit IV-1, IBM users tend to have equivalent satisfaction levels to non-IBM users in some hardware categories, and to be more satisfied in others.
 - IBM mainframe users expressed no "low" satisfaction levels; other users tended to be slightly less satisfied but with an essentially equivalent profile.
 - IBM small business computer users showed the largest incremental satisfaction, with almost double the proportion of "high" satisfaction compared to other users. It is noteworthy that the only "low" rating from IBM equipment users came in this category.
 - The main difference between IBM minicomputer maintenance users and other users is in the higher level of "medium" ratings. Obviously IBM minicomputer users share the same general dissatisfaction noted earlier for many minicomputer users.

USER SATISFACTION WITH HARDWARE MAINTENANCE, IBM AND OTHERS

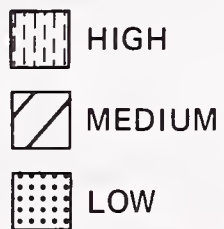
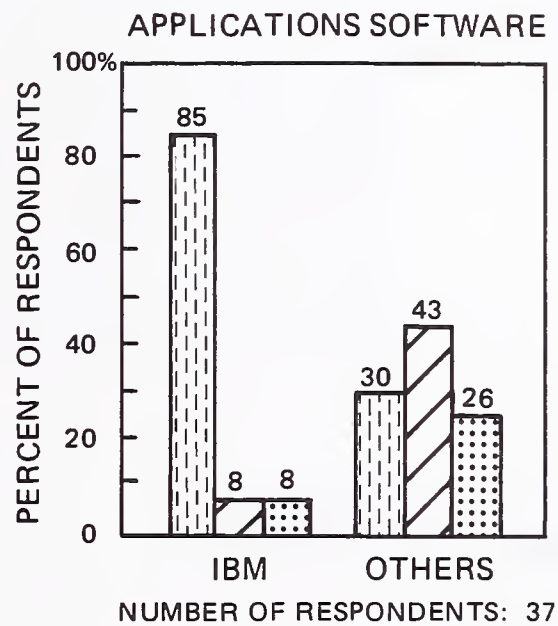
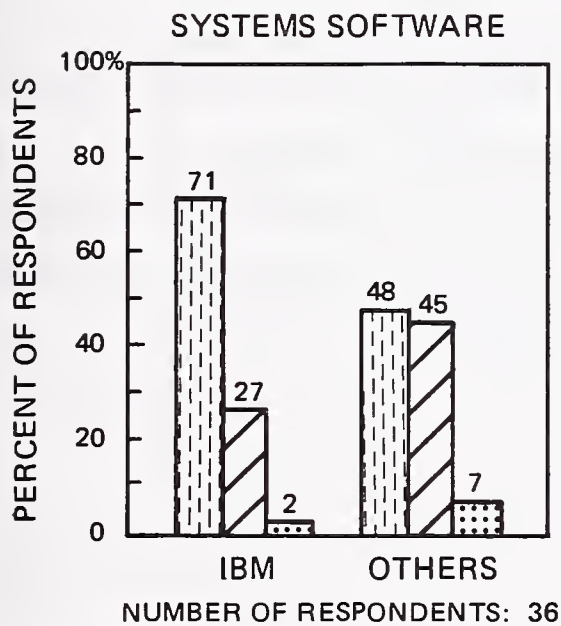


HIGH 8, 9, 10
 MEDIUM 4 - 7
 LOW 0 - 3

- With peripherals and terminals, IBM's users again appear to be marginally more satisfied than other users.
- In the word processing category, other users are marginally more satisfied in terms of "high" satisfaction, but this is offset by some "low" satisfaction respondents.
- In the software categories shown in Exhibit IV-2, the higher level of satisfaction of IBM users is prominent.
 - The satisfaction level of systems software users among the IBM respondents is approximately 50% above other users.
 - In the case of applications software, the IBM maintenance user is very satisfied in contrast to other users who show less than one-third in the "high" satisfaction category.
 - This advantage in software will be a strong competitive edge for IBM as software grows in importance in the 1980s.
- Clients wanting to review the detailed differences in repair and response times for IBM and non-IBM users are referred to the following exhibits in the appendix:
 - A-19 - Mainframes.
 - A-20 - Small Business Machines.
 - A-21 - Minicomputers.
 - A-22 - Peripherals.
 - A-23 - Data Terminals.
 - A-24 - Word Processing Terminals.

EXHIBIT IV-2

USER SATISFACTION WITH SOFTWARE MAINTENANCE, IBM AND OTHERS



- The major conclusions which can be drawn from these exhibits are:
 - . The response and repair times of IBM and "others" are essentially the same, with IBM slightly superior in some categories and behind in others.
 - . The "ideal" and minimum expectations of IBM and "others" are close to the same.
 - . The higher satisfaction level of IBM users stems from something other than performance or expectation. Largely, it is from the superior job IBM does in marketing its maintenance capability. Users believe they are receiving superior maintenance because they are sold the idea that it is superior.

C. UPTIME COMPARISONS

- The relationship between user satisfaction and uptime is revealed in the data presented in Exhibit IV-3.
 - In the data terminals and software categories IBM users reported a higher uptime, paralleling their higher satisfaction level.
 - In the small business computers category, where IBM users were also found to be more satisfied, the uptime profile is more mixed; more IBM machines reported the highest, and some of the lowest, ratings; IBM user satisfaction in this category may well be more a result of satisfaction with software rather than hardware.

EXHIBIT IV-3

IBM VERSUS NON-IBM UPTIME REPORTED BY RESPONDENTS

TYPE OF EQUIPMENT	NO. OF MENTIONS	UPTIME REPORTED AS A PERCENT OF MENTIONS IN THE EQUIPMENT CATEGORY							
		99%	99%	98%	95-97%	90-94%	80-89%	60-69%	60%
MAINFRAMES									
IBM	50	14%	24%	24%	20%	14%	2%	2%	—
NON-IBM	36	14	25	19	25	8	6	4	—
SMALL BUSINESS COMPUTERS									
IBM	11	0	18	36	27	0	0	9	10
NON-IBM	21	5	33	14	19	10	19	0	0
MINICOMPUTERS									
IBM	4	0	25	50	0	25	—	—	—
NON-IBM	23	49	26	13	17	22	9	9	—
PERIPHERALS									
IBM	48	2	31	15	37	6	4	2	1
NON-IBM	86	2	15	9	32	16	14	8	3
DATA TERMINALS									
IBM	30	3	33	27	27	7	0	3	0
NON-IBM	76	9	20	22	15	25	7	2	0
WORD PROCESSING TERMINALS									
IBM	7	0	14	57	29	0	0	0	0
NON-IBM	15	7	33	7	33	7	13	0	0
APPLICATIONS SOFTWARE									
IBM	9	11	11	34	33	0	0	11	0
NON-IBM	15	0	20	13	40	13	7	7	0
SYSTEMS SOFTWARE									
IBM	40	2	25	45	17	7	2	2	0
NON-IBM	26	6	23	32	24	9	3	3	0

- To determine if there is a basic difference between IBM users and non-IBM users regarding the basic maintenance issues explored in Chapter III, responses were segregated, and the results are presented in Exhibit IV-4.
 - In the overall, the two groups are remarkably alike with almost identical ratings of on-site FEs, escalation procedures, central dispatch, multiple locations, uptime, and parts.
 - The most significant difference is the higher importance of price in the view of non-IBM users; this is largely a reflection of a superior job done by IBM in selling the non-price aspects of field service.
 - In the other categories, non-IBM users tend to give a slightly higher overall rating to the particular issue than their non-IBM compatriots; as with the previous point, this may reflect IBM's marketing, which may bring about a more positive group of users.
- On balance, the IBM and non-IBM users are very similar, with IBM enjoying a slight overall edge in user satisfaction at the moment.

EXHIBIT IV-4

USERS' RATINGS OF MAINTENANCE RELATED ISSUES, IBM VERSUS NON-IBM

ISSUE	NUMBER OF RESPONSES	AVERAGE RATING	NUMBER OF 0s	NUMBER OF 10s	NUMBER OF N/A
EQUIPMENT RELIABILITY					
IBM	54	8.2	0	22	0
NON-IBM	71	9.4	0	41	3
TOTAL	125	8.8	0	63	3
ON-SITE FIELD ENGINEERING					
IBM	54	6.0	5	13	0
NON-IBM	74	6.1	7	21	0
TOTAL	128	6.0	12	34	0
RESPONSE TIME					
IBM	52	8.0	0	11	2
NON-IBM	71	9.0	0	29	3
TOTAL	123	8.5	0	40	5
REPAIR TIME					
IBM	54	8.0	0	14	0
NON-IBM	71	8.7	0	26	3
TOTAL	125	8.35	0	40	3
SUPPORT CENTERS					
IBM	52	6.0	2	7	2
NON-IBM	70	7.0	3	15	4
TOTAL	122	6.5	5	22	6
REMOTE DIAGNOSTICS					
IBM	52	5.0	5	3	2
NON-IBM	71	6.4	5	10	3
TOTAL	123	5.7	10	13	5
ESCALATION PROCEDURES					
IBM	52	7.5	3	16	2
NON-IBM	71	7.2	3	19	3
TOTAL	123	7.3	6	35	5
CENTRAL FE DISPATCH					
IBM	52	5.2	3	3	3
NON-IBM	71	5.2	4	10	3
TOTAL	123	5.2	7	13	6
SOFTWARE MAINTENANCE					
IBM	53	6.8	3	9	1
NON-IBM	69	7.6	2	15	5
TOTAL	122	7.2	5	24	6
NETWORK MAINTENANCE					
IBM	47	6.5	3	11	7
NON-IBM	58	7.3	3	15	16
TOTAL	105	6.9	6	26	23
MULTIPLE LOCATIONS					
IBM	47	5.5	7	5	7
NON-IBM	53	5.8	5	14	21
TOTAL	100	5.6	12	19	28
PRICE OF MAINTENANCE					
IBM	54	6.1	1	5	0
NON-IBM	71	8.9	0	21	3
TOTAL	125	7.5	1	26	3
UPTIME					
IBM	53	8.86	0	26	1
NON-IBM	71	9.0	0	40	3
TOTAL	124	8.97	0	66	4
PARTS					
IBM	50	8.0	0	15	4
NON-IBM	64	8.1	0	27	10
TOTAL	114	8.0	0	42	14
TOTAL					
IBM	730	6.82	32	160	31
NON-IBM	956	7.55	32	332	77
TOTAL	1,686	7.18	64	492	108

0 = UNIMPORTANT
10 = VERY IMPORTANT

V FIELD SERVICE VENDOR STATUS AND FORECAST -
RESULTS OF THE 1981 SURVEY

V FIELD SERVICE VENDOR STATUS AND FORECAST - RESULTS OF THE 1981 SURVEY

A. METHODOLOGY

- Questionnaires for the 1981 Annual Report were greatly expanded over 1980. To facilitate vendor response, questions were separated into four major disciplines:
 - General management.
 - Financial.
 - Personnel.
 - Technical support.
- Questionnaires received by vendors were packaged so they could be separated for distribution to the individual most able to respond in each of the four major disciplines.
- Over 50 vendors received the questionnaires (see Appendix E for a copy of the questionnaire) and 19 responded.

- Most respondents answered the majority of the questions in general management, personnel and technical support.
- An average of 70% of the respondents answered most questions concerning financial issues.
- Results were tabulated and analyzed to detect trends in key issues addressed in previous reports, and to assess new issues affecting field service management directions.

B. RESPONDENT VENDOR ORGANIZATION CONCEPTS

I. TITLES OF TOP FIELD ENGINEERING EXECUTIVES

- The trend toward recognizing the important role played by field service in the success of the entire business continues.
- Exhibit V-1 shows that a total of 69% of the 1981 respondent vendor field service organizations (as opposed to 60% in 1980) are headed by vice presidents or above.
- A heavy migration away from reporting to marketing or sales is evident.
 - Only 21% of respondent maintenance vendor organizations report to marketing or sales versus 58% one year ago.
 - The heaviest migration from reporting to marketing is toward reporting to an executive responsible for field operations (5% in 1980 to 37% in 1981).
 - A slight shift in emphasis occurred also in the percentage reporting to presidents and division heads.

EXHIBIT V-1

TITLE OF SENIOR FIELD ENGINEERING PERSON AND REPORTING STRUCTURE OF VENDORS INTERVIEWED

SENIOR FIELD ENGINEERING PERSON:

TITLE	1980 PERCENT	1981 PERCENT
VICE PRESIDENT	10%	11%
VICE PRESIDENT FIELD ENGINEERING/SERVICES	20	42
GENERAL MANAGER	0	11
DIRECTOR	40	20
PRESIDENT SERVICE DIVISION	0	5
GROUP/DIVISION MANAGER	0	11
VICE PRESIDENT MARKETING	10	0
GROUP/DIVISION VICE PRESIDENT	20	0
TOTAL	100%	100%

REPORTS TO:

TITLE	1980 PERCENT	1981 PERCENT
PRESIDENT/DIVISION GENERAL MANAGER	37%	42%
VICE PRESIDENT MARKETING/SALES	58	21
VICE PRESIDENT FIELD OPERATIONS/ SERVICES	5	37
TOTAL	100%	100%

2. PROFIT CENTERS

- Accountability as a profit center continues as the predominant method, according to the 1981 respondents, as shown in Exhibit V-2.
- Seventy-four percent, versus 70% one year ago, are accountable for profits derived from maintenance as a business.
- Virtually all respondents reported that they will become profit centers within the next three years.

3. ORGANIZATION SIZE

- Respondent vendor organizations ranged in size of field engineering staff from a low of 100 to a high of 2,096, as shown in Exhibit V-3. Eight of nineteen respondents reported actual headcounts in the survey questions about personnel distribution, the remainder responded by percentages.
- The medium-sized organization is at approximately 540 personnel as opposed to a little over 400 in 1980.

4. FIELD ENGINEERING INVOLVEMENT IN PRODUCT DEVELOPMENT

- All vendors responded with a positive trend in field service involvement in the development of maintainability and reliability in new products, as shown in Exhibit V-4.
- The current emphasis is on spare parts philosophy; this includes repair level designations and initial stock levels dedicated to maintenance.
- The least involvement by respondent vendors is in the participation in phase reviews.

EXHIBIT V-2

PROFIT CENTER OR COST CENTER ORGANIZATION OF RESPONDING VENDORS

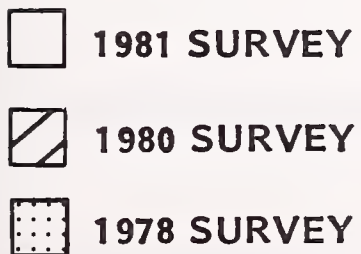
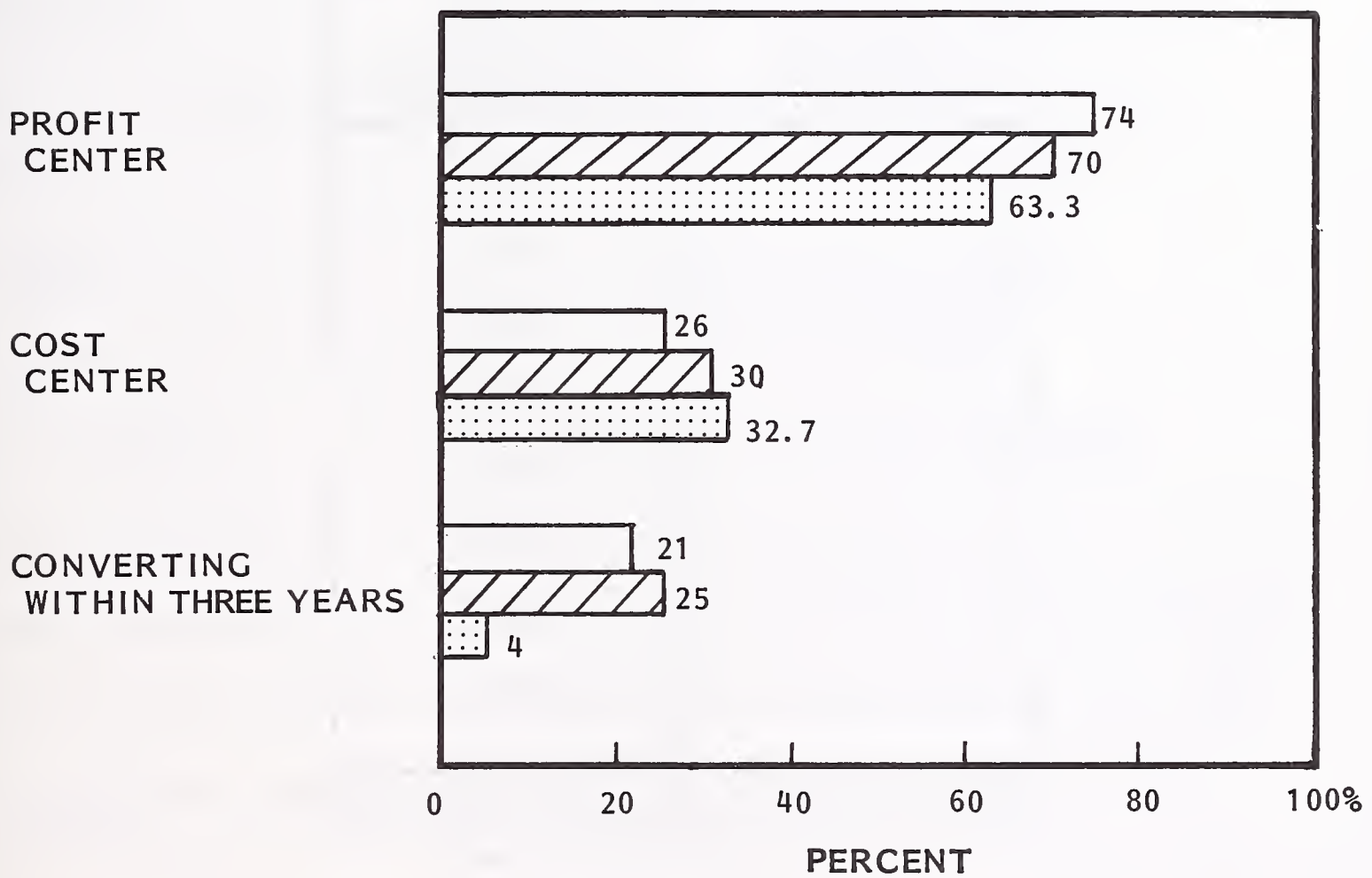


EXHIBIT V-3

RESPONDING VENDOR POPULATION

RANDOM COMPANY NUMBER *	SIZE OF FIELD SERVICE ORGANIZATION
1	100
2	148
3	356
4	525
5	568
6	730
7	934
8	2,096

*IDENTITY MASKED - PROPRIETARY INFORMATION

EXHIBIT V-4

VENDORS' RATINGS OF FIELD SERVICE INVOLVEMENT IN DEVELOPMENT OF MAINTAINABILITY AND RELIABILITY OF PRODUCTS

FACTOR

WRITTEN MAINTENANCE

DIAGNOSTIC DEVELOPMENT

DOCUMENTATION DEVELOPMENT

TEST EQUIPMENT
SPECIFICATIONS

MAINTAINABILITY DESIGN

PHASE REVIEWS

ACTIVE

PASSIVE

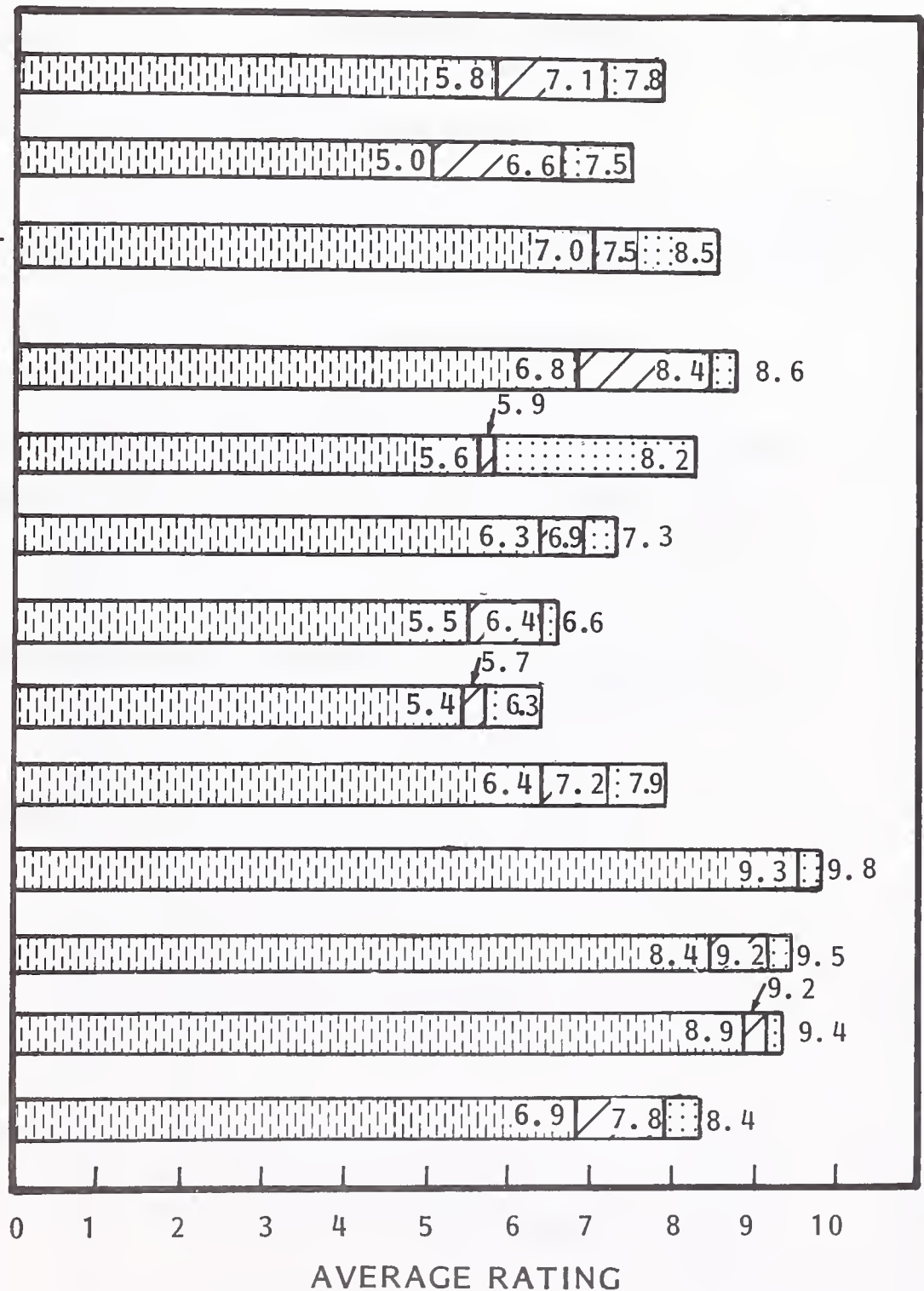
SIGN OFF AUTHORITY

SPARE PARTS PHILOSOPHY

LEVEL OF REPAIR

INITIAL STOCK LEVELS

ENGINEERING CHANGE
LIMITS



NUMBER OF RESPONDENTS: 18

0 = NO INVOLVEMENT
10 = MAXIMUM INVOLVEMENT

- 1981 INVOLVEMENT RATING
- 1983 EXPECTED INVOLVEMENT RATING
- 1986 EXPECTED INVOLVEMENT RATING

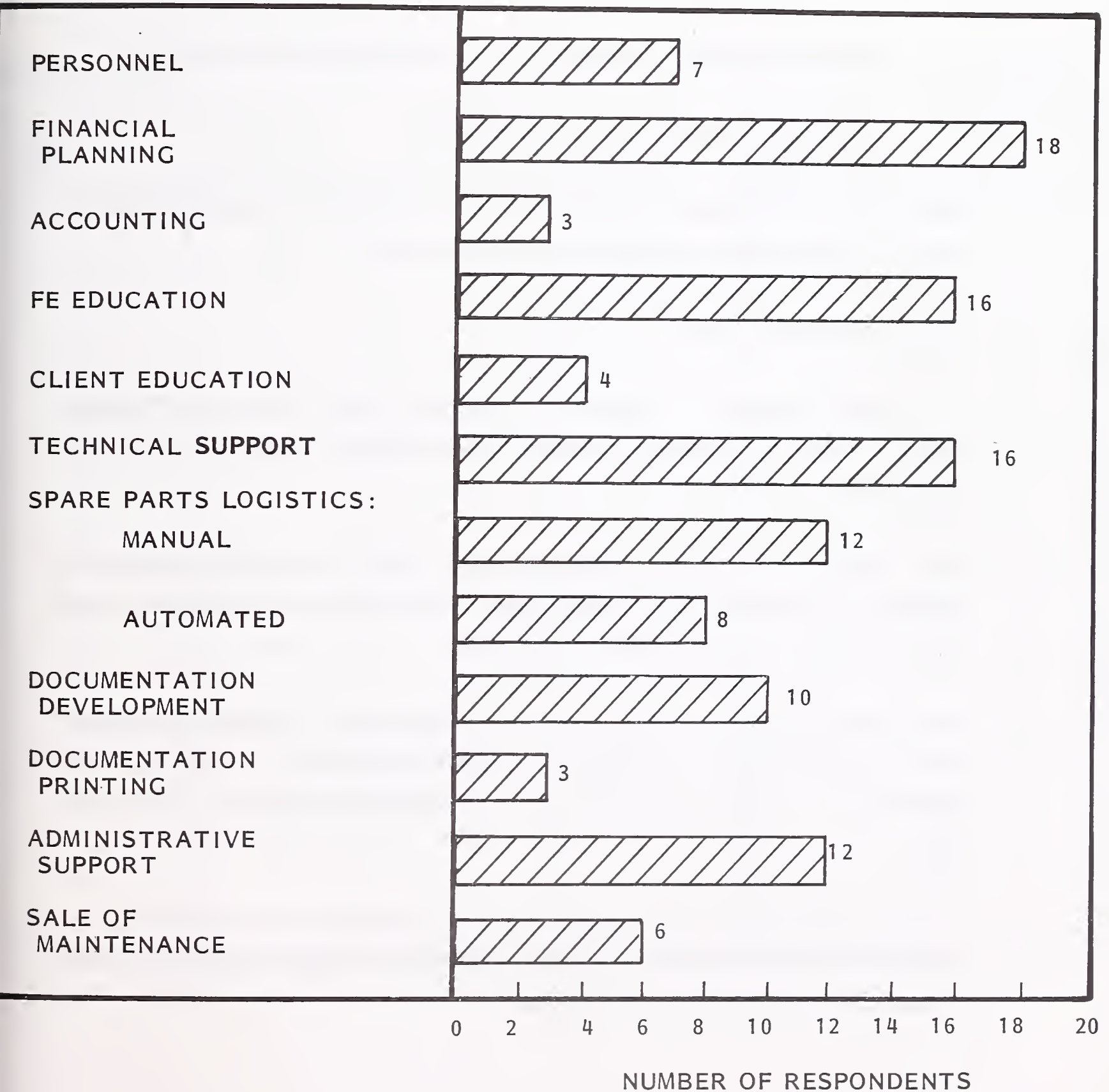
- According to respondents, the greatest changes from current to 1986 emphasis will focus on:
 - Written maintenance specifications.
 - Diagnostic development.
 - Documentation development.
 - Test equipment specifications.
 - Maintainability design.
- The level of emphasis in the involvement of field service in product maintainability design is even more evident when the one or two instances of non-involvement are removed.
 - One vendor is not involved at all with any of the activities except spare parts philosophy.
 - A second respondent indicated very little, if any, involvement with any activities except spare parts.

5. INTERNAL FIELD ENGINEERING SUPPORT FUNCTIONS REPORTING TO THE FIELD ENGINEERING DEPARTMENT

- All but one respondent field service organization reported that financial planning and measurements report to the field engineering department, as shown in Exhibit V-5.
- Over half the respondents depend on corporate personnel and accounting.
- Client education is generally performed by marketing or sales while field engineers are trained by the FE department in 85% of the responses.

EXHIBIT V-5

MAJOR FIELD SERVICE SUPPORT FUNCTIONS PERFORMED BY
FIELD ENGINEERING DEPARTMENTS



- Sixty-three percent of respondent vendors handle their own administrative support.
- All respondents have spare parts logistics reporting to field service.
 - Twelve use manual inventory control systems.
 - Eight respondents are operating with automated inventory controls.
 - One company reported using both methods.
- While 53% of respondents reported that they develop maintenance documentation, only 16% manage the printing of the documents.

6. FIELD ORGANIZATIONS

- It is readily apparent in Exhibit V-6 that the terms "District," "Region," "Branch," and even "Resident Location" have different meanings to different companies.
- Some vendors refer to any service location with one or more persons in residence as a "branch office" while others require that office space be rented and occupied by at least a first-line manager.
- Some vendors label a location with any residents as a "Resident Location," others use the term to designate a location serviced by field engineers operating out of their homes with no other company-leased space available to them.
- It will be seen later in this chapter that the semantic difficulties with office labels explain part of the difficulty in establishing ranges of compensation for comparable positions within the industry.

EXHIBIT V-6

NUMBER OF GEOGRAPHIC LOCATIONS OF FIELD ORGANIZATIONS

LOCATION OFFICE COM- PANY NUMBER	BRANCH OFFICES	DISTRICT OFFICES	REGIONAL OFFICES	RESIDENT LOCATIONS	ALIGNED WITH SALES OFFICES? Y/N
1	50	14	6	37	Y
2	105	12	3	10	Y
3	-	-	1	-	Y
4	57	15	4	125	N
5	31	15	4	50	Y
6	38	10	2	50	Y
7	46	-	6	12	Y
8	-	11	3	-	Y
9	130	16	5	-	N
10	50	25	4	-	Y
11	24	18	8	4	N
12	-	15	6	66	Y
13	70	14	4	-	Y
14	-	8	2	70	N
15	104	34	5	1	Y
16	37	8	4	2	Y
17	55	11	3	130	Y

NUMBER OF RESPONDENTS: 17

- All but four of the respondents indicated that their field offices are aligned with product sales.

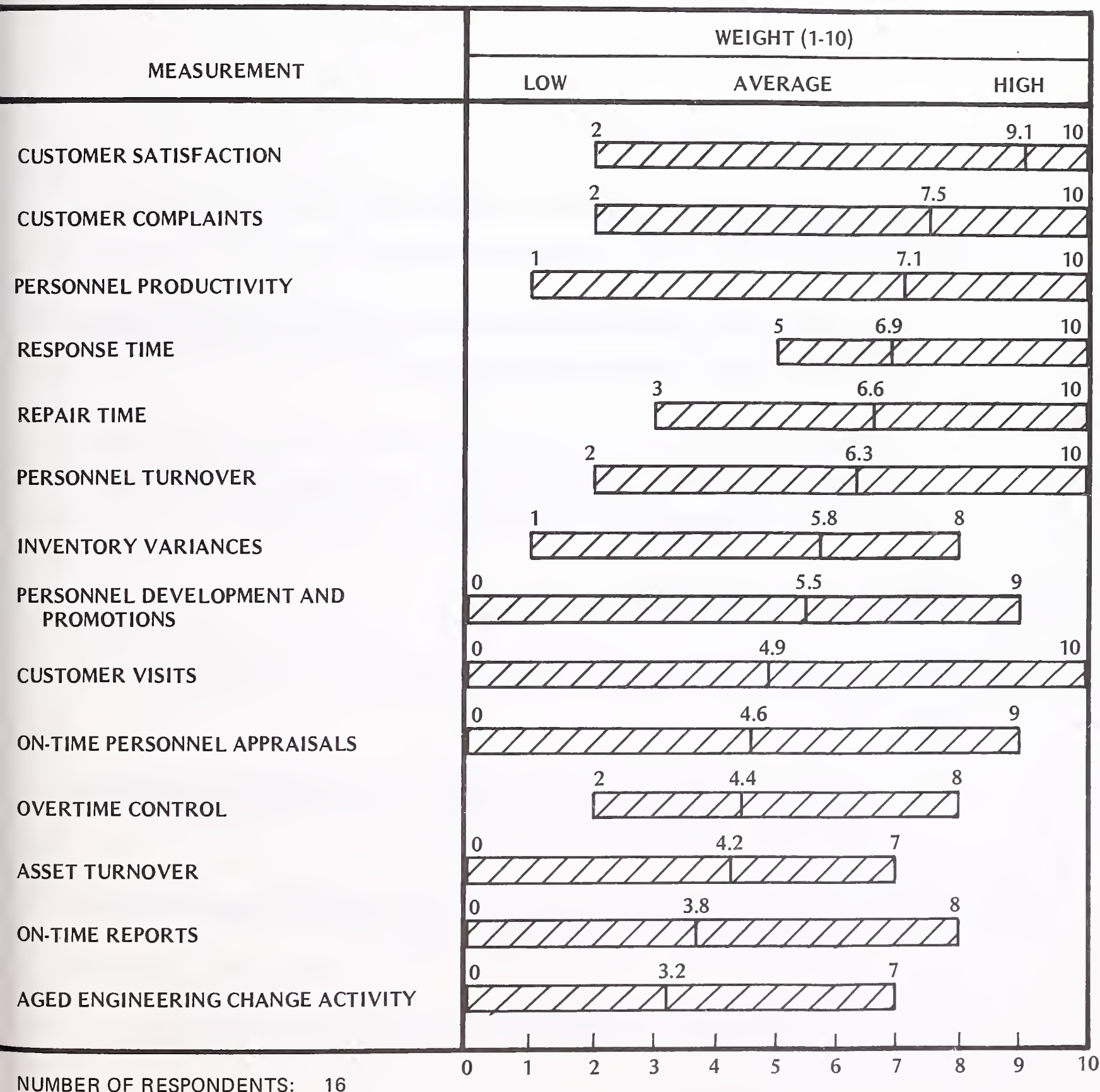
C. FIELD ENGINEERING MANAGEMENT PERFORMANCE MEASUREMENTS

I. NONFINANCIAL MEASUREMENTS OF MANAGEMENT PERFORMANCE

- Exhibit V-7 graphically displays vendor responses to the importance of nonfinancial factors in measuring the performance of line managers.
- Measurement of customer satisfaction and the counter-productive measurement of customer complaints received the greatest weight in gauging manager performance.
- Response time, being a highly visible and easily measurable standard, ranks highest in one regard. No vendor gave response time less than a 5 as a qualified measurement of manager performance.
- On the average, respondent vendors gave considerable weight to measurements of productivity. In lower density operations it is virtually impossible to measure individual manager performance based on personnel productivity.
- Respondents apply the least weight (average 3.2) to engineering change controls as a measurement of manager performance.
- Other nonfinancial measurements reported by vendors which are not charted in Exhibit V-7 include:
 - Equipment outage statistics and trends.
 - Maintenance contract renewals.

EXHIBIT V-7

NONFINANCIAL MEASUREMENTS OF FIELD ENGINEERING MANAGEMENT PERFORMANCE



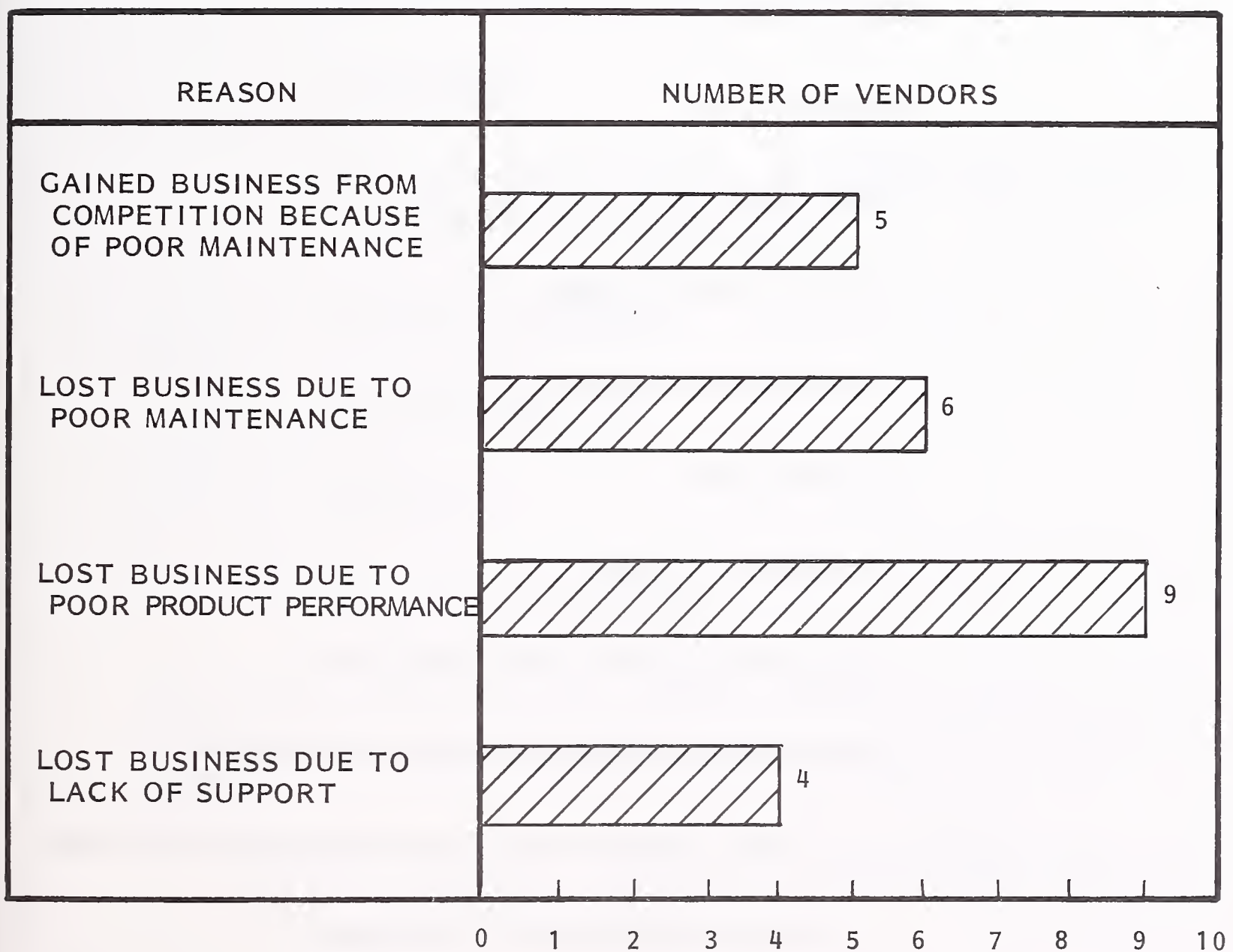
- On-time installation activity.
 - Completed versus scheduled preventive maintenance (weight 6).
 - Downtime due to parts back-orders (weight 8).
 - Support to sales efforts.
 - Lost accounts.
 - Affirmative action support.
- The major reason cited by respondent vendors losing business to competition was poor product performance, as shown in Exhibit V-8.
- Over 25% of respondents reported that they had gained business in 1980 because of poor maintenance by competitors.
 - Although six of nineteen respondents reported that they lost installations to competition in 1980 due to poor maintenance, only one vendor experienced both gains and losses because of maintenance.

2. FINANCIAL MEASUREMENTS

- Profit margins among respondents for 1981 range from a slight loss to 36% pretax profit.
- This survey produced no sharply defined conclusions about maintenance vendor profit margins for the following reasons:
 - The number of respondents providing specific financial information is low (11 out of 19 respondents).
 - Variations in accounting methods alter margins significantly.

EXHIBIT V-8

VENDORS REPORTING GAINS AND LOSSES OF BUSINESS



NUMBER OF RESPONDENTS: 19

- Detailing of specific responses would violate the confidence commitment made by the authors of this study.
- Certain general patterns suggest that a "reasonable" 1981 pretax profit for a fully matured, self-sufficient field engineering department is from 9% to 12% of gross revenues.
- For the model "self-sufficient" maintenance vendor, revenues include:
 - Maintenance contracts.
 - Shift premiums.
 - Installation fees.
 - De-installation fees.
 - Time and material charges.
 - Sales change fees (upgrades, etc.).
 - Consulting fees.
 - Refurbishment charges.
 - Parts and test equipment repairs for others.
 - Sales of excess parts or use of bulk purchasing power.
- For the model "self-sufficient" maintenance vendor, expenses include:
 - Direct labor for production of all revenues.
 - Management and staff salaries.

- . Employee benefits.
 - . Employee education and training.
 - . Facilities expenses.
 - . Total risk of all capital assets including interest, depreciation, insurance, etc.
 - . Total risk of spare parts inventories; all carrying costs.
 - . Repair costs of parts and test equipment.
 - . Documentation.
 - . Allocated overhead share for all administrative services not controlled directly; e.g., accounting.
 - . Travel and entertainment.
 - . Relocation of personnel.
 - . Recruiting.
 - . Office supplies and services.
- By varying the indirect revenues or expenses credited to various levels and/or departments, top management controls the pace of maturation of managers in the field.
- For the few respondents answering the questions, "Field Profits" are bracketed between 25% and 47% of revenues.
 - Branch office profits range from 34% to 50%.

- Only three of nineteen respondents indicated a return on investment (ROI) measurement.
 - The range for 1981 ROI is from 9.3% to 12%.
 - Interestingly, the vendor reporting 9.3% in 1981 expects to double ROI by 1983.
 - All vendors reporting a measurement for ROI also indicate that they use a net present value analysis of ROI factors for capital budgeting.
- Returns on assets range from 3% to 13.2% in 1981 indicating financial leverage working in most companies to yield the ROI figures above.
- Revenue carried per month per territory FE will double from an average \$5,575 in 1979 to \$11,000 by 1986 according to respondent vendors, as shown in Exhibit V-9.
 - Revenue burdens for all field personnel, including management, increase at a slower rate. This shows an expectation that respondents' field management will carry fewer personnel in each group.
 - The slope of the revenue curve for all personnel in field engineering is dramatically flatter than the other two, clearly indicating that respondent vendors expect to increase administration in proportion to direct labor.
- Closer examination of monthly revenues and expense burdens per territory field engineer reveals that, even though administration to direct labor personnel ratios will increase, efficiencies will result, as shown in Exhibit V-10.
 - Respondents forecasted that profit margins will increase from \$456 per month per FE in 1979 to \$3,319 by 1986.

EXHIBIT V-9

MONTHLY REVENUE PER PERSON IN FIELD SERVICE

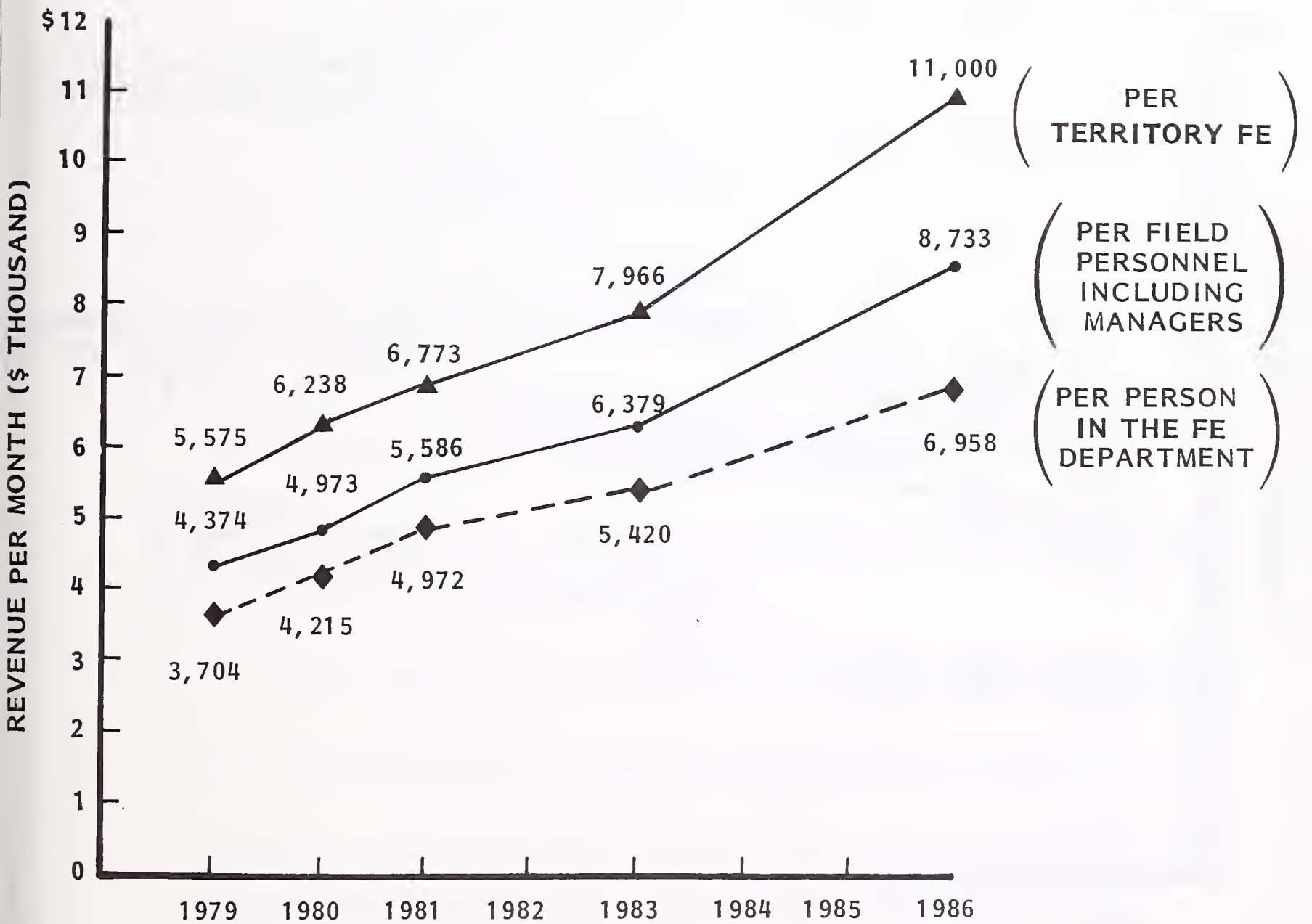
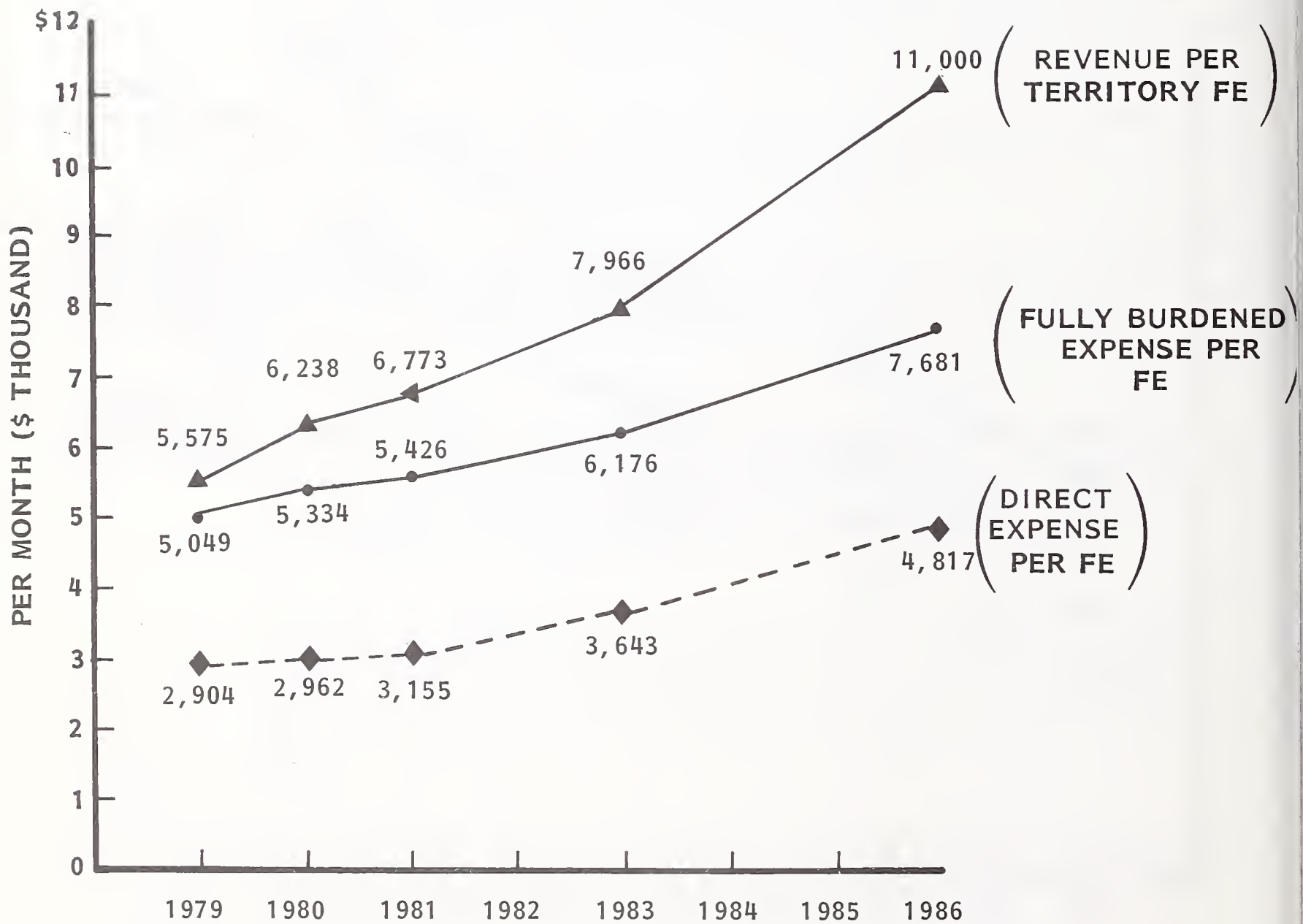


EXHIBIT V-10

REVENUE AND EXPENSES PER TERRITORY FIELD ENGINEER



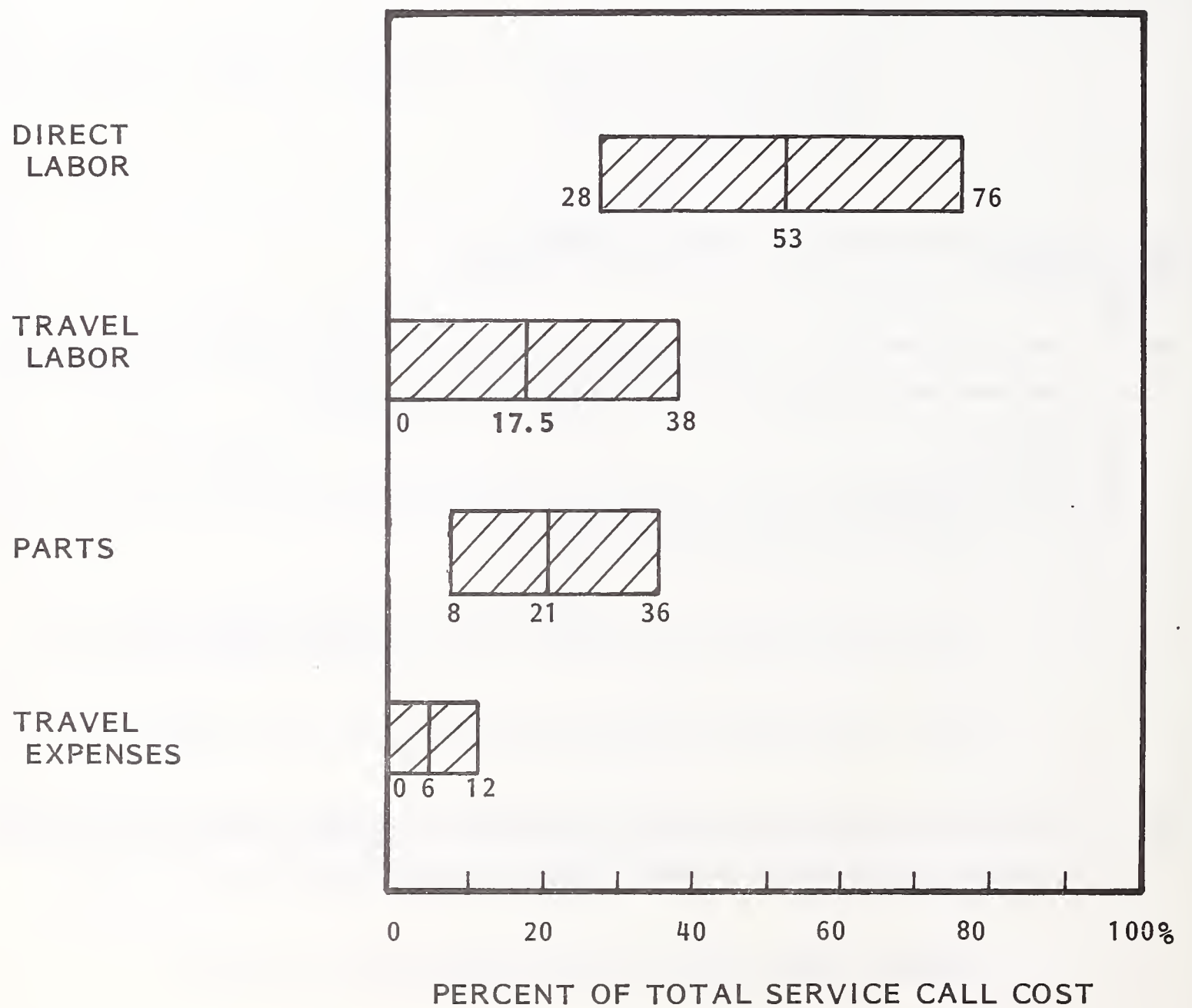
- Expense to revenue in 1979 was 91.8%.
- Expense to revenue in 1986 is projected at 70%, according to survey respondents.
- Territory profit margins per field engineer will improve from \$2,422 per month in 1979 to \$6,183 in 1986, according to respondents.
- The ratio of direct territory expense to revenues in 1979 was reported to be 57%.
- Direct territory expense to revenues in 1986 is expected by respondents to be at 44%.

3. FIELD ENGINEERING COST BREAKDOWNS

- The constituents of a typical service call break are represented by essentially the same proportions as in 1980, as shown in Exhibit V-11.
 - According to 1981 respondents, 74% of the cost of a service call is still attributed to direct labor and parts.
 - The maximum spent on parts per call has decreased from 50% to 36%.
 - The minimum spent on labor has increased from 21% to 28%.
- The average fully burdened cost per hour per qualified field engineer is \$46, according to respondent vendors, as shown in Exhibit V-12.
 - The lower rates apply to terminal maintenance companies.
 - No significant differences are detectable among vendors of mainframes, distributed data processing, peripherals and minicomputers.

EXHIBIT V-11

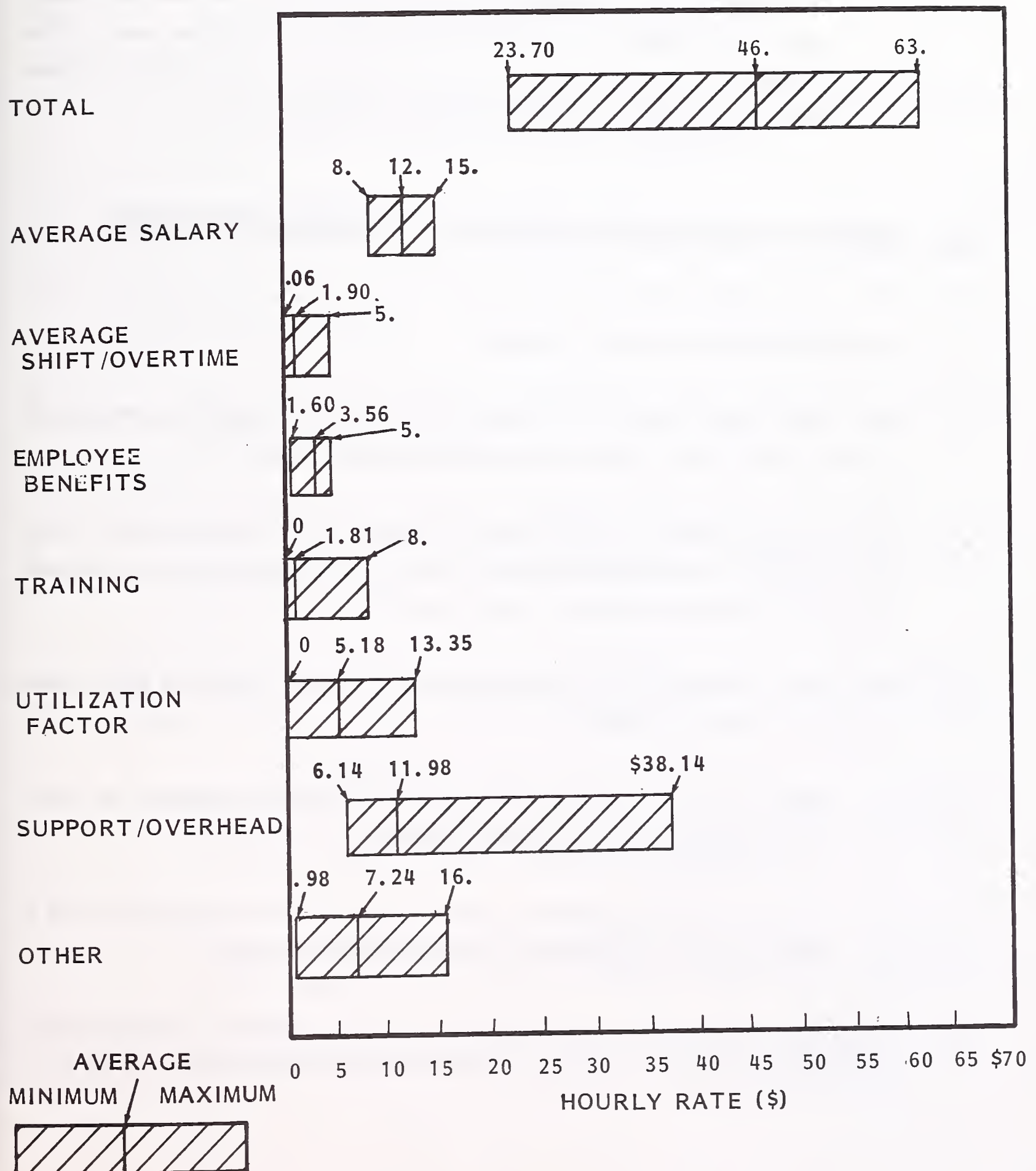
RANGE AND AVERAGE COST DIVISION OF A TYPICAL SERVICE CALL, 1981



NUMBER OF RESPONDENTS: 15

EXHIBIT V-12

RANGE AND AVERAGE COST DISTRIBUTION OF FULLY BURDENED FIELD ENGINEER LABOR RATE



NUMBER OF RESPONDENTS: 9

- Extreme variances are more readily explained by accounting differences than by differences in business styles.
- The average field engineer's service call is burdened by over \$5 per hour to compensate for utilization factors, compared to an average direct labor rate component of \$12.56 per hour of productive work. The inference is that the average vendor maintenance organization utilizes field engineers just over 60% of their available time.

D. GENERAL BUSINESS ISSUES REPORTED BY RESPONDENT VENDORS

I. MAINTENANCE CONTRACT TRENDS

- The trend toward the use of "boiler-plate" standard contracts with amendments for specialized cases continues into the near future.
- The most rapid changes in contracted maintenance are projected to be in user participation in the diagnostic effort. Anticipated improvements in remote diagnostic capabilities reinforce this trend.
- Performance guarantees are becoming more prevalent, especially in the cases of highly reliable processors.
 - Only one of nineteen vendors currently charges a premium for availability guarantees (5% over basic contract).
 - Five of nineteen vendors currently charge premiums ranging from 5% to 30% over basic contracts to guarantee response times.
- Respondent vendors show a slight reluctance to completely unbundle maintenance contracts by 1986 with only five of nineteen indicating plans to do so.

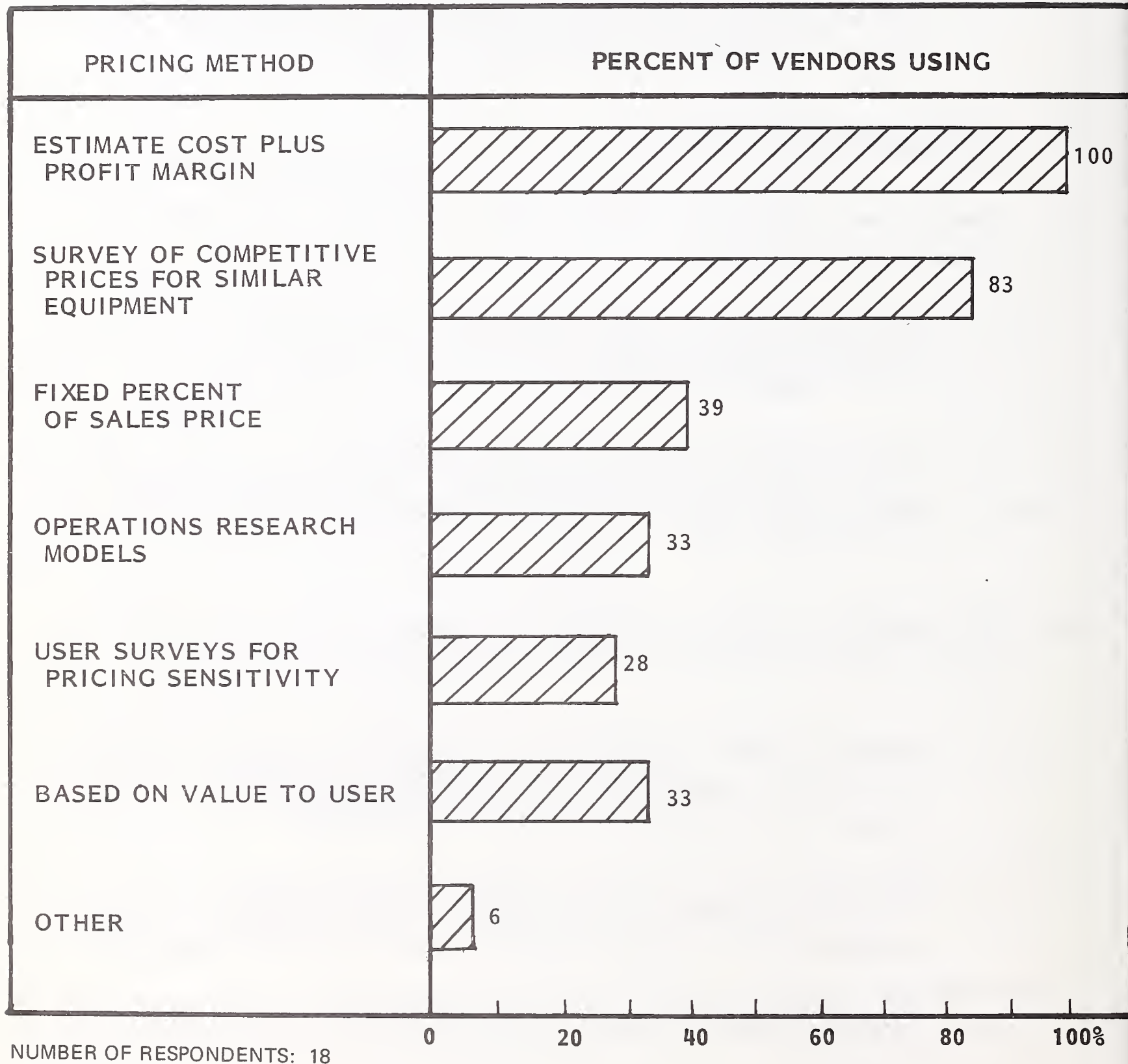
- Eleven of nineteen vendors will offer depot repair services by 1986.
- Ten of nineteen respondents use third-party maintenance to supplement their own efforts.
 - Four of the ten also provide third-party maintenance.
 - Three of nineteen respondents provide third-party maintenance, but do not use third parties to maintain their equipment.

2. MAINTENANCE PRICING

- Annual basic maintenance contract charges range from 5% to 15% of the equipment purchase price.
 - The average ratio of annual maintenance rate to purchase price is 9.1% among respondent vendors.
 - Multiple regression analysis revealed no significant correlation of the ratio to the type of vendor responding; i.e., mainframe, peripheral, word processor, etc.
- All respondents employ a "cost-plus" estimation as one of the factors in setting maintenance prices, as shown in Exhibit V-13.
 - A majority (83%) of respondent vendors consider the prices charged by competition as a significant factor in maintenance pricing, and conduct competitive surveys as one of the methods employed.
 - Only three vendors limit the methods used in pricing to one or a combination of the above methods (cost-plus and competitive pricing).
 - Two vendors reported using all methods to finalize maintenance prices.

EXHIBIT V-13

METHODS USED TO PRICE MAINTENANCE



- Two vendors reported using a combination of four of the listed methods to establish prices.
- Regression analysis reveals no significant patterns in pricing methods according to vendor type.

3. MANAGEMENT SCIENCE TECHNIQUES EMPLOYED BY RESPONDENT VENDORS

- The most commonly used management science techniques are market research, inventory modeling, attitude surveys and break-even analysis, as shown in Exhibit V-14.
 - Break-even analysis will lose some popularity by 1983 to reliability modeling.
 - Value-added analysis will enjoy the greatest relative popularity (100%).
 - Reliability modeling will show the greatest absolute change in popularity (+4).
 - Due to the nature of the field service business, INPUT expects to see greater industry-wide use of queuing theory, learning curve projections, multiple regression analysis and simulation models than are indicated by respondent vendors.
 - Queuing models allow computer simulation of density variables with random failures versus available service personnel. They can project idle times, cost of waiting, response times, cost of idle time, cost per failure in random failure environment, and other information vital to field engineering organizational decisions.

EXHIBIT V-14

MANAGEMENT SCIENCE TECHNIQUES EMPLOYED
BY RESPONDENT VENDORS

MANAGEMENT SCIENCE TECHNIQUE	1981		1983		CHANGE (PER- CENT)
	ACTUAL	PERCENT	ACTUAL	PERCENT	
QUEUING THEORY MODELS	6	33%	8	44%	+33%
MARKET RESEARCH	13	72	14	78	+8
INVENTORY MODELS (EOQ, ETC.)	13	72	13	72	0
ATTITUDE SURVEYS	14	78	15	83	+7
LEARNING CURVE PROJECTIONS	8	44	10	56	+25
LINEAR PROGRAMMING	4	22	4	22	0
OPERATIONS MODELS (SIMULATION)	7	39	10	56	+43
OPERATIONS MODELS (MATHEMATICAL)	7	39	8	44	+14
BREAK-EVEN ANALYSIS	14	78	10	56	<-29>
PERT/CPM	6	33	5	28	<-17>
RELIABILITY MODELS	8	44	12	67	+50
NET PRESENT VALUE	7	39	7	39	0
VALUE-ADDED ANALYSIS	2	11	4	22	+100
CLASSICAL ECONOMETRICS	2	11	3	17	+50
MULTIPLE REGRESSION ANALYSIS	5	28	7	39	+40
OTHER	5	28	5	28	0

NUMBER OF RESPONDENTS: 18

- . Queuing models also offer solutions to the optimum spare parts distribution networks given probability of failure, cost of stock out (alternatively, the percent of time parts should be available at successively higher levels), delivery times, mean time to replace parts, etc.
- . Learning curve analysis provides a powerful tool for estimating the total cost of service for new products, allowing for a front end loss factor to be made up in volume. Labor intensive activities have proved to be quite predictable by classical learning curve analysis.
- . Multiple regression analysis allows management to predict changes in expense trends by observing changes in more predictable groups of variables. Time-lag regression analysis is another powerful tool for predicting expense variations.
- . Simulation models, using large capacity computers, give the manager opportunities to predict with greater confidence a number of "what-if?" questions.
- Other techniques mentioned by at least one respondent vendor included:
 - . Efficiency measurement techniques.
 - . Stochastic modeling.
 - . Service cost modeling.
 - . Nonlinear programming.
 - . Network flow theory.

4. OTHER BUSINESS ACTIVITIES PURSUED BY RESPONDENTS

- Nearly half the respondent vendors reported that the field engineering department was engaged, to some degree, in business activities other than the maintenance of data processing equipment. Some of the activities mentioned were:
 - Design and construction of computer facilities.
 - Sales of supplies, parts and accessories.
 - Repair of radio communications equipment.
 - Training (other FEs and users).
 - Consulting in systems engineering.
 - Maintenance of copiers, micrographic cameras, computer output microfilm (COM) devices, and facsimile equipment.

5. MOST SIGNIFICANT ISSUES FACED BY RESPONDENT VENDORS' MANAGEMENT

- Nineteen respondents listed 21 significant issues which need to be addressed by top management in field engineering.
 - Productivity and availability of personnel were tied for the most mentioned topics, each being mentioned by seven different vendors as a significant issue.
 - Next in line as a significant issue was the requirement that field engineering play a larger, more influential role in corporate decisions.
 - This issue was mentioned by six of the nineteen respondents.

- The "significant role" issue may be expanded to nine of nineteen if one declares the three vendors' issue of "greater influence over product conception and design" to be included in the more general issue of "corporate decisions."
- Mentioned by three vendors each were:
 - Remote technical assistance and remote maintenance concepts.
 - The challenge to FEs as their role changes due to increased equipment reliability.
 - A more significant role for field engineering in product conception and design.
- Mentioned by two vendors each were:
 - Management development.
 - Personnel training.
 - Asset management.
 - Escalating costs.
 - Retention of personnel.
 - Better diagnostic tools.
- The remaining issues considered to be significant by a general manager were:
 - Equipment performance.

- . Profitability.
 - . Response time.
 - . Timely reaction by engineering to quality and design problems.
 - . Automated dispatching.
 - . Application of operations, research and other scientific techniques to FE management.
 - . Customer involvement in maintenance.
 - . Software maintenance.
 - . Professionalism.
- When asked what steps their companies are taking to meet the challenges presented by the above-mentioned issues, the general managers replied as follows:
 - On the subject of personnel shortages:
 - . "Increase company visibility and recruiting activity by assigning a personnel manager within the FE organization."
 - . "Establish a recruitment and retention program."
 - . "Develop a remote diagnostic center to relieve labor dependency . . ."
 - . Three vendors raising the issue did not comment on the solutions.

- On the subject of establishing a larger role for FE in corporate decisions:
 - "FE is a major contributor to corporate committees."
 - "They have recognized the problem and have fully divisionalized the service function."
 - "Field service is being given a leadership role by corporate."
 - Three vendors who raised the issue had no comment.
- Vendors who mentioned productivity as a major challenge offered the following comments:
 - "Improved dispatching and remote diagnostics."
 - "We're still working on it; different service philosophy, diagnostics, different kinds of labor, etc."
 - "Have developed a formalized, on-going productivity improvement program."
 - "Automating maintenance of equipment through remote and self diagnosis."
 - "... remote diagnostics ..."
- To improve management and personnel development challenges, vendors are implementing the following:
 - Increasing management development classes (in-company and out-company) and techniques to identify potentially successful managers.

- Continuing in-house formal management training.
- Other vendor responses to address issues of the 1980s include:
 - Building the next generation of equipment to facilitate customer involvement in maintenance.
 - Installing on-line management information system.
 - Increasing the emphasis on planning.
 - Providing lower cost alternatives to users; e.g., repair depots.
 - Assigning service engineers to product design teams.
 - Cross-training software and hardware maintenance.
 - Developing sophisticated simulation models for analyzing parts and technician allocation.

E. VENDOR PERSONNEL ISSUES

I. SOURCES OF PERSONNEL

- Military-trained personnel and competitors will continue to decline in importance as sources for new field service technicians, as shown Exhibit V-15.
- Trade schools appear to be moving into prominence more rapidly than previously forecast, now being tied in first place.

EXHIBIT V-15

RATINGS OF PRIMARY SOURCES FOR FIELD ENGINEERING RECRUITING

PERSONNEL SOURCE	YEAR					
	1978*	1980**	1981***	1982*	1985***	1986***
HIRE AND TRAIN (NO TECHNICAL PRE-TRAINING)	4.0	3.6	1.5	6.6	7.0	5.0
RECRUIT FROM COMPETITION	6.0	5.8	5.5	5.6	4.2	4.0
MILITARY PERSONNEL TRAINEES ON LOGIC/ELECTRONICS	5.2	5.0	6.0	4.8	3.8	4.0
TRADE SCHOOLS	5.8	8.4	6.0	5.0	4.4	7.0
TWO-YEAR COLLEGE PROGRAMS	N/D	N/D	6.0	N/D	N/D	6.5
COLLEGE GRADUATE, TECHNICAL	N/D	N/D	3.0	N/D	N/D	3.5
COLLEGE GRADUATE, NON- TECHNICAL	N/D	N/D	0.5	N/D	N/D	0.85
RECRUIT FROM OTHER FUNCTIONS WITHIN THE COMPANY	6.4	3.8	3.0	5.0	4.4	3.0

(SCALE: 0 - 10; 0 = UNIMPORTANT; 10 = VERY IMPORTANT; N/D = NO DATA)

NUMBER OF RESPONDENTS: 18

* 1978/1982 RATINGS FROM MAINTENANCE REQUIREMENTS FOR THE INFORMATION PROCESSING
INDUSTRY 1978 - 1983 SURVEY DONE IN 1978

** 1980/1985 FIGURES FROM 1980 FIELD SERVICE ANNUAL REPORT

*** 1981/1986 FIGURES FROM CURRENT SURVEY

- Two-year college programs will gain favor as the second most likely source of field engineers by the mid-1980s.
- Although the prospect of hiring and training personnel with no prior technical training is continuously predicted to become a major source, respondent vendors do not give the source high marks for 1981. The 1.5 average rating compared to 6.6 predicted for 1982 in last year's Annual Report suggests that vendors are reluctant to set up programs for training nontechnical personnel in large numbers.

2. PERSONNEL GROWTH PROJECTIONS

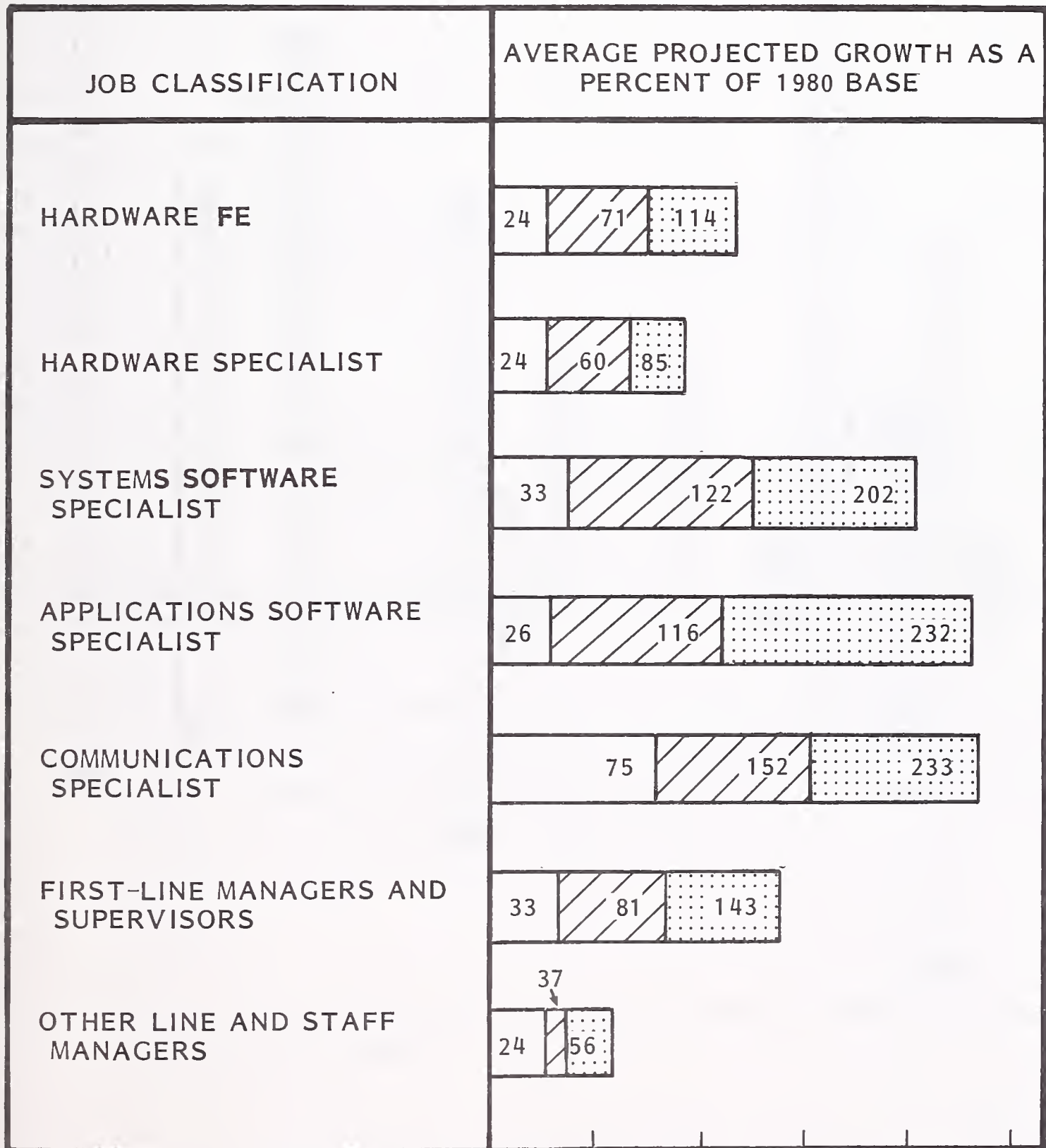
- All but two categories of personnel in maintenance vendor organizations will at least double by 1986, as shown in Exhibit V-16.
 - Staff and line managers above first line will increase by 56% over the 1980 base in 1986, suggesting a significantly broader span of control at the middle management levels.
 - Hardware specialists will be expected to support more field engineers (85% versus 114% growth).
- Three categories - systems software, applications software and communications specialists - will each more than triple by 1986.

3. PERSONNEL TURNOVER

- During 1980, 12 of 19 respondents reported hiring a total of 2,520 personnel to replace 899 losses for a net growth of 1,621 field engineers, as shown in Exhibit V-17.
 - The imputed rate of hiring 1.6 persons to gain 1 in growth is a substantial improvement over the previous year (2.7:1).

EXHIBIT V-16

GROWTH PROJECTIONS BY PERSONNEL CATEGORY

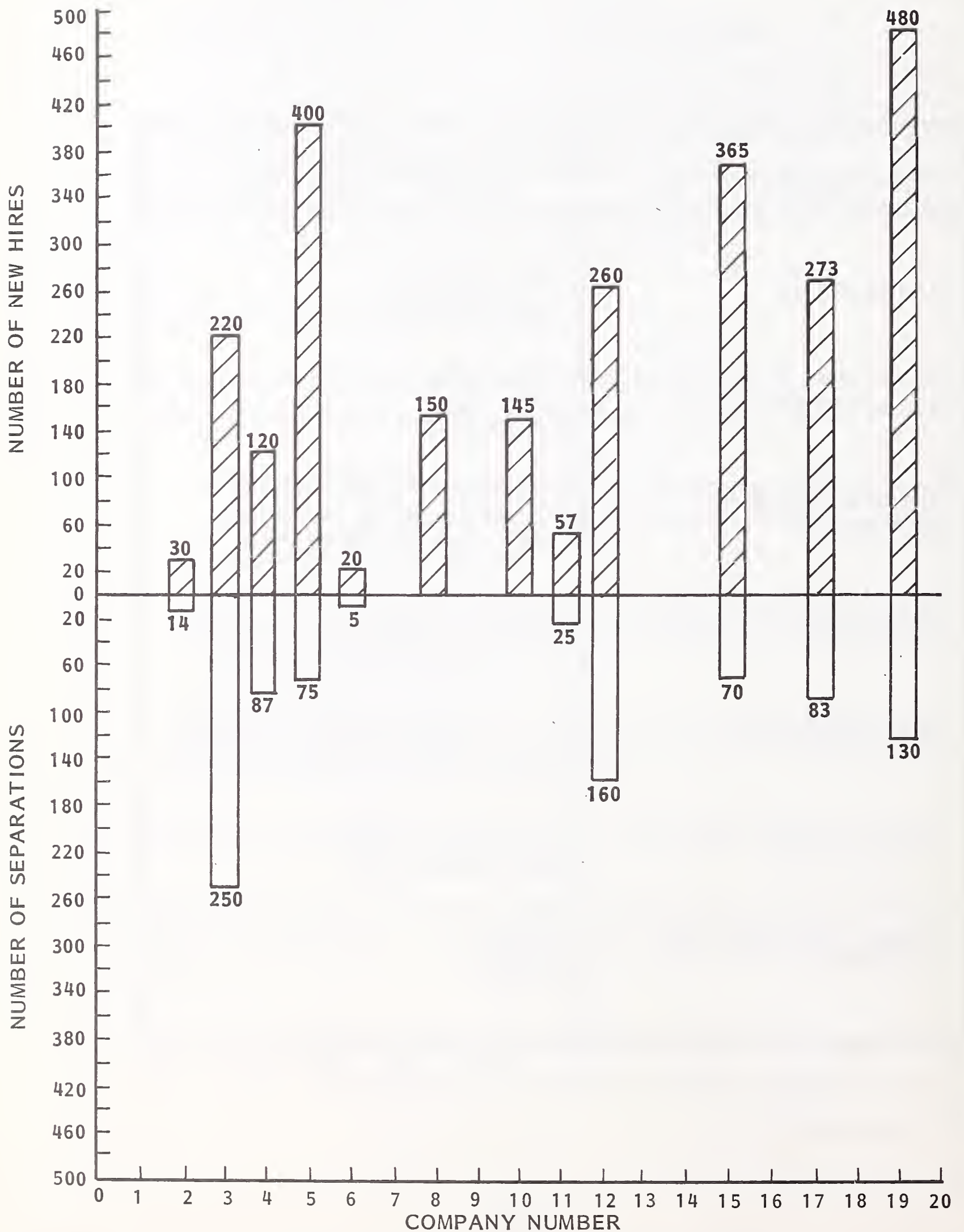


- ☐ 1981 GROWTH
- ☒ 1983 GROWTH
- ☐ 1986 GROWTH

0 50 100 150 200 250%

EXHIBIT V-17

COMPARISON OF FIELD ENGINEER NEW HIRES AND SEPARATIONS



- The recruitment problem remains critical, however, because vendors continue to hire traditional skill levels that are in short supply.
- Respondent vendors stated that the two most prevalent reasons for field engineers leaving are more money and better opportunities.
 - Involuntary separations ranked as high as third overall in 1980 as more vendors are finding it difficult to bring new hires up to standard performance criteria.
 - The lowest ranking was for persons who left to improve their education or for other careers outside field engineering.

4. UNION ACTIVITY

- Only one respondent vendor out of nineteen reported that 30% of its field engineers are represented by a union, in this case I.B.E.W.
- One other vendor of the nineteen reported that at least one organization effort had reached the election stage and been defeated.
- INPUT is aware of organization efforts at vendors reporting none, and suggests that all maintenance vendors take a serious interest in the potential of such activity. The likelihood of organizational efforts being successful is historically more real when it is ignored by management.

5. TRAINING

- The percentage of personnel days spent in training in 1980 ranged from 5% to 17% and averaged 9.8%.
- The percentages tend to remain constant within companies over the next five years, that is to say, training load is directly proportional to personnel growth according to respondents.

- Regression analysis reveals that a significant inverse relationship exists between the size of the field organization and the percentage of personnel days in training. (The smaller organizations are grouped near the 17% end of the range.)

6. INCENTIVE PROGRAMS

- Matched investment savings plans are rated tops by respondent vendors as the most effective incentive plans for field engineering personnel, as shown in Exhibit V-18.
- Very close in second place is the practice of recognizing outstanding performers by sending them to a conference.
- The most popular, but least effective, incentive plan is competitive tuition for advanced out-company education.

7. LOCAL TRANSPORTATION EXPENSES

- The majority of vendors continue the practice of reimbursing a large number of their field engineers for the use of their personal cars, as shown in Exhibit V-19.
 - Seventy-nine percent of respondents provide a mileage allowance.
 - The average mileage allowance reported was 21¢ per mile.
- Leased cars provided for a number of field engineers are based on ranges of expected minimum annual driving of from 18,000 to 20,000 miles per year.
- Several vendors employ the "Runzheimer Plan" for fixed and variable costs associated with the use of personal cars in business.

USAGE AND EFFECTIVENESS OF INCENTIVE PROGRAMS

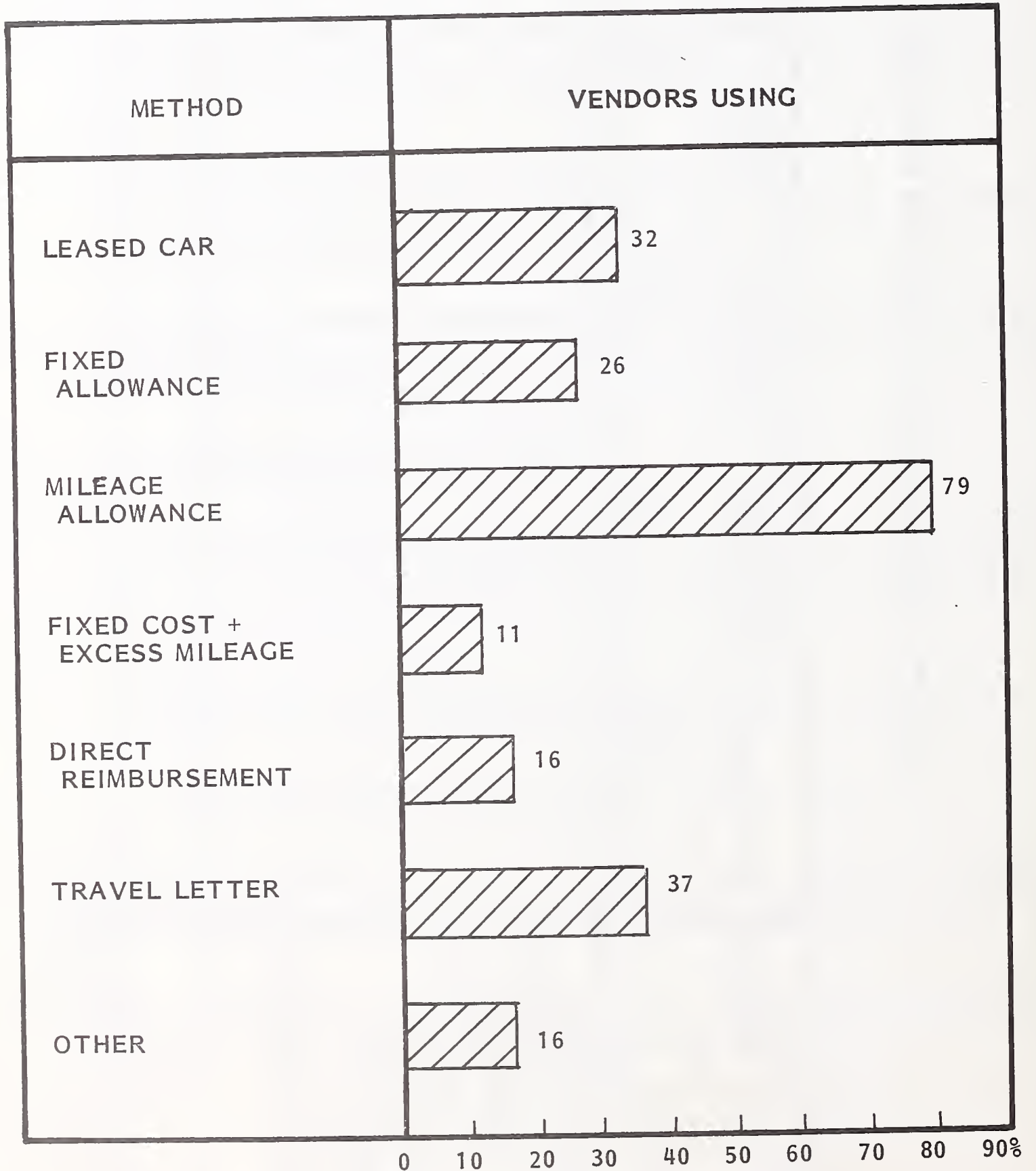
TYPE OF INCENTIVE VENDOR	PROFIT SHARING			COMPANY STOCK PURCHASE PLAN			OUTSTANDING FE CONVENTIONS			SUGGESTION AWARDS			MATCHED INVESTMENT PLANS			COMPETITIVE TUITION PLANS		
	1981	1983	EFFECTIVE RATING	1981	1983	EFFECTIVE RATING	1981	1983	EFFECTIVE RATING	1981	1983	EFFECTIVE RATING	1981	1983	EFFECTIVE RATING	1981	1983	EFFECTIVE RATING
MAINFRAMES	1	1	4	2	2	4	1	1	-	1	1	2	1	1	-	2	2	3
SMALL BUSINESS COMPUTERS	2	2	7	1	2	10	1	2	7	-	1	6	1	2	7	3	3	5
MINICOMPUTERS	1	1	8	2	1	8	-	-	-	-	-	-	1	-	8	1	1	4
PERIPHERALS	3	2	5	4	3	7	3	3	8	2	3	5	3	3	8	4	3	5
DATA TER- MINALS	1	1	5	1	1	10	1	1	9	1	1	10	1	1	7	2	2	10
WORD PROCESS- ING TERMINALS	1	1	7	2	1	5	1	-	6	1	-	2	1	-	-	2	1	4
TOTAL OR AVERAGE	9	8	6	12	10	6	7	7	8	5	6	6	8	7	8	14	12	5

RATING OF EFFECTIVENESS: 0 - 10

NUMBER OF RESPONDENTS: 18

EXHIBIT V-19

LOCAL TRANSPORTATION EXPENSES



NUMBER OF RESPONDENTS:19

PERCENT OF RESPONDENTS

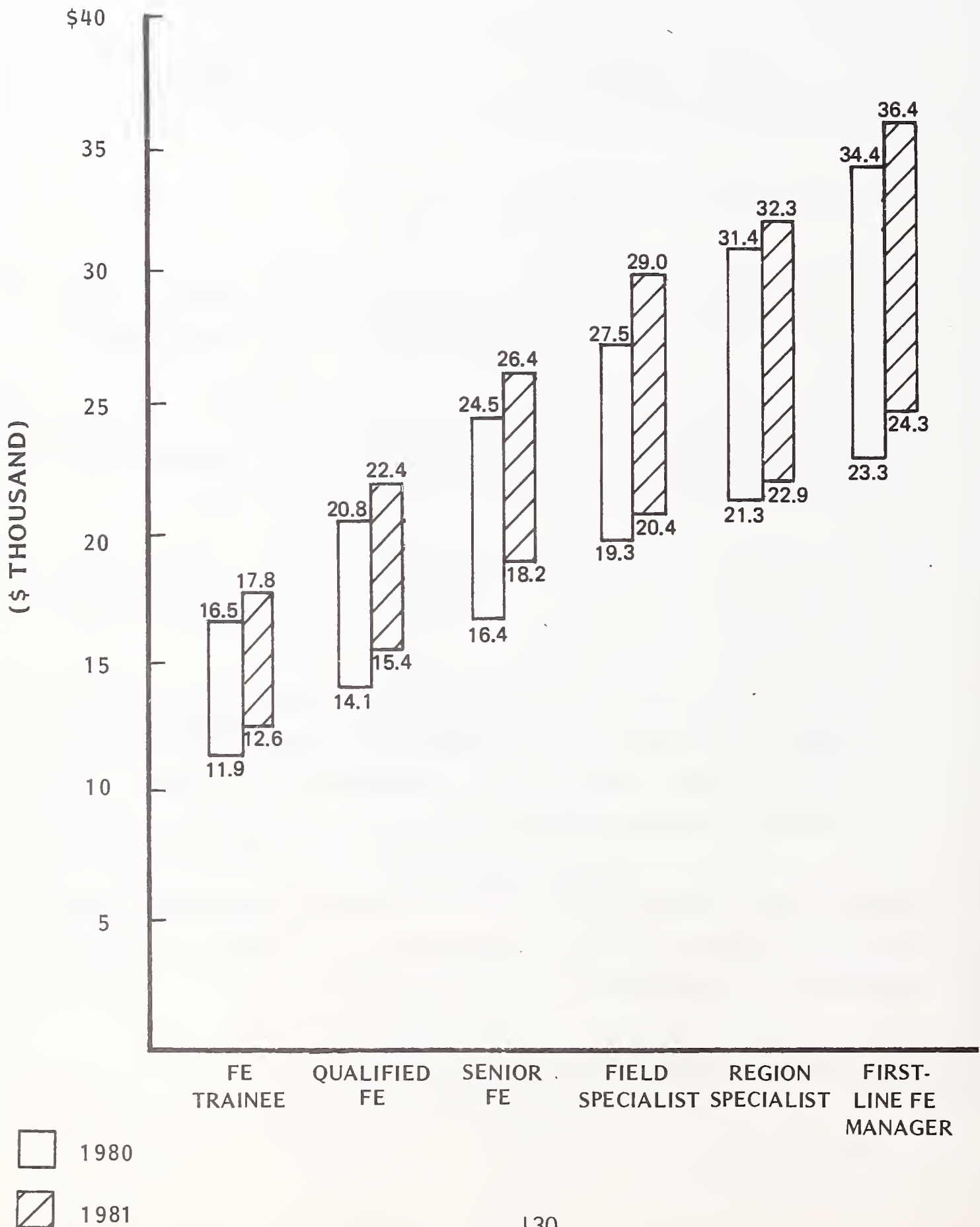
- The base costs (fixed costs) range from \$4.60 per day to \$190 per month.
- The mileage (variable costs) ranges from 9¢ to 11.5¢ per mile.
- One vendor reported heavy use of company-owned service vans and mini-pickup trucks.
- Travel letters are gaining in popularity as a method to improve turnaround on individual expenses, thereby easing the morale problems associated with using expensive personal assets in business.

8. FIELD ENGINEERING SALARIES

- Exhibit V-20 displays the average career growth salary ranges in respondent vendors' field organizations from trainee through first-line field manager.
 - As is evident in the exhibit, salary range increases from 1980 to 1981 bases averaged higher (in the 9% to 10% range) in the lower level jobs and tapered off at the higher levels (4% to 6% increases).
 - Compared to the 1980-1981 inflation rate, the salary increases are on the low side.
 - Once out of training, a field engineer has salary growth opportunity within the current position at each step above the minimum of the following grade, allowing for compensation for performance while waiting for higher openings.
- Complete salary information provided by respondents is contained in additional exhibits in Appendix B. All data sources are masked to protect the confidentiality of respondents.
 - Exhibit B-1 gives salary data in numeric form.

EXHIBIT V-20

1980-1981 AVERAGE ANNUAL SALARY RANGES FOR FIELD CAREER PATHS IN FIELD ENGINEERING



- Exhibits B-2 through B-14 give the same data by job category in graphic form.

F. VENDOR PRODUCT SUPPORT ISSUES

I. MEAN TIME TO RESPOND AND REPAIR

- Exhibits V-21 through V-25 graphically reflect a comparison of users' and vendors' attitudes toward response and repair times.
 - Respondent vendor answers are overlaid on the results of 108 user surveys.
 - The exhibits are designed to reflect the cumulative frequency of responses about mean time to respond and mean time to repair different types of equipment.
- Respondent vendors maintaining word processing terminals indicated that they are responding more slowly than users give them credit for, as shown in Exhibit V-21.
 - While 100% of respondent vendors reported all calls covered in four and one-half hours or less, a few users experienced response times of up to 24 hours.
 - Users expect response within eight hours 90% of the time, but expect the other 10% to go beyond one shift.
- Respondent vendors declare that all repairs to word processors are done within two hours; users disagree, as shown in Exhibit V-21.

EXHIBIT V-21

WORD PROCESSING TERMINALS, MEAN TIME TO RESPOND AND REPAIR: VENDOR VERSUS USER

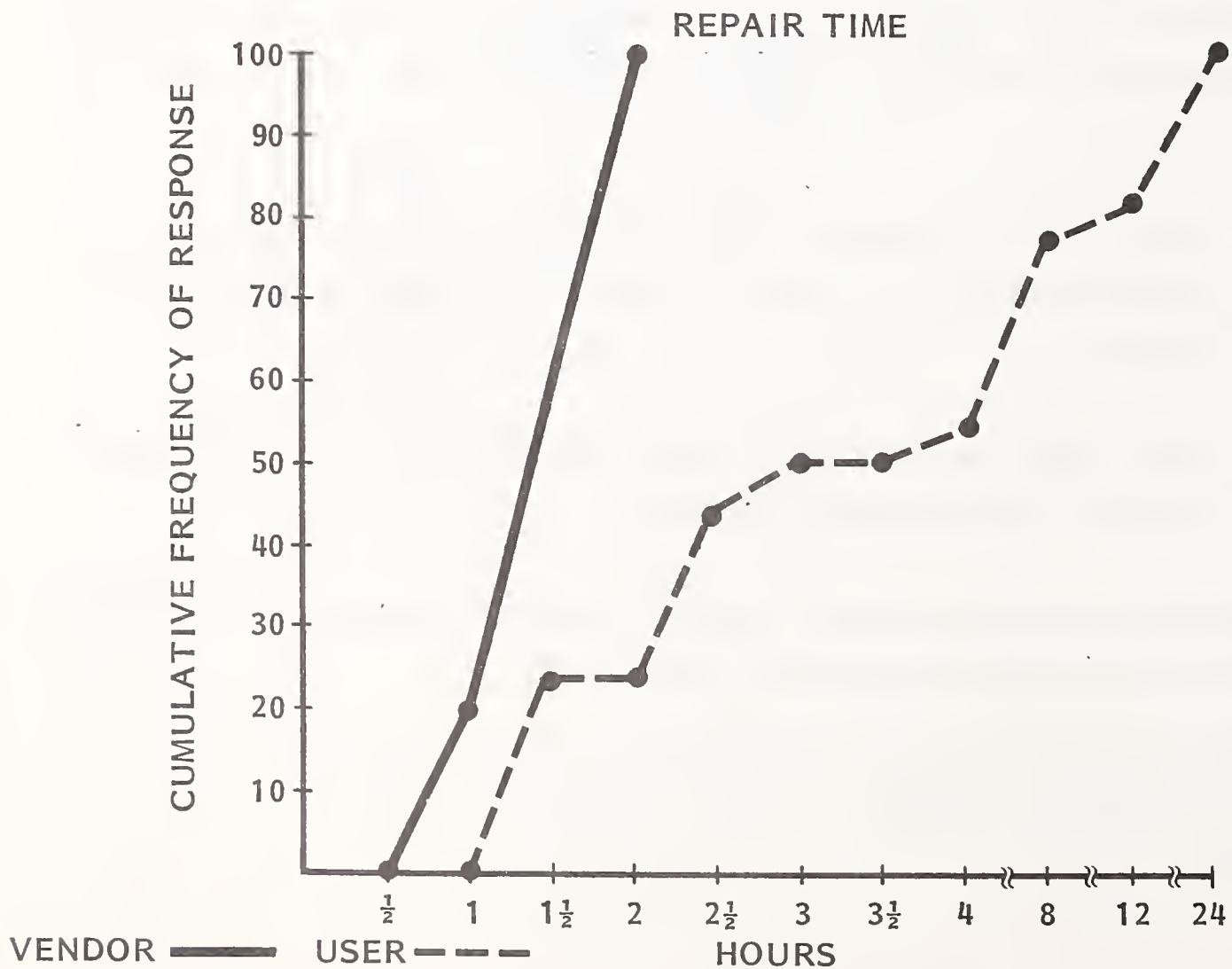
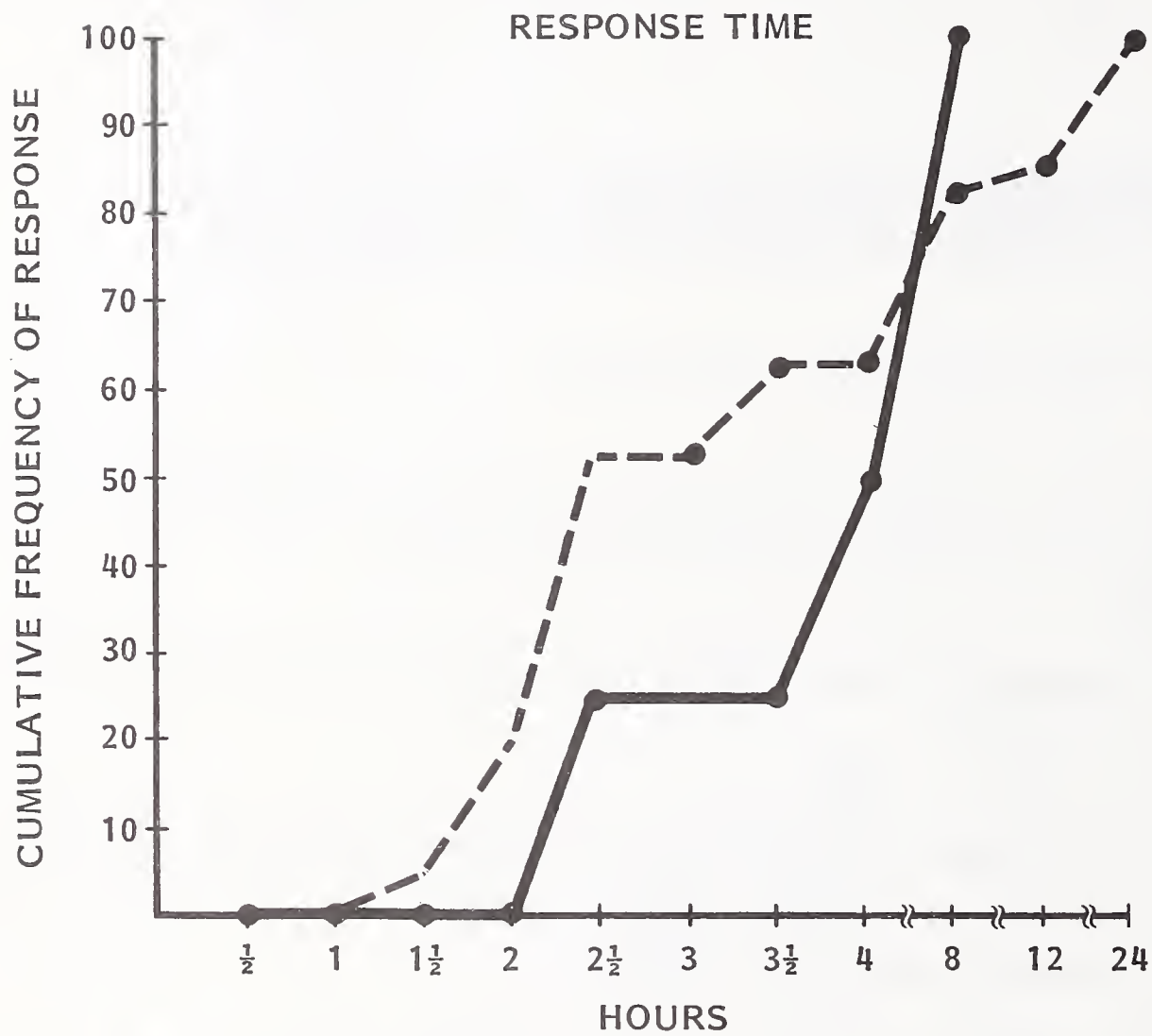
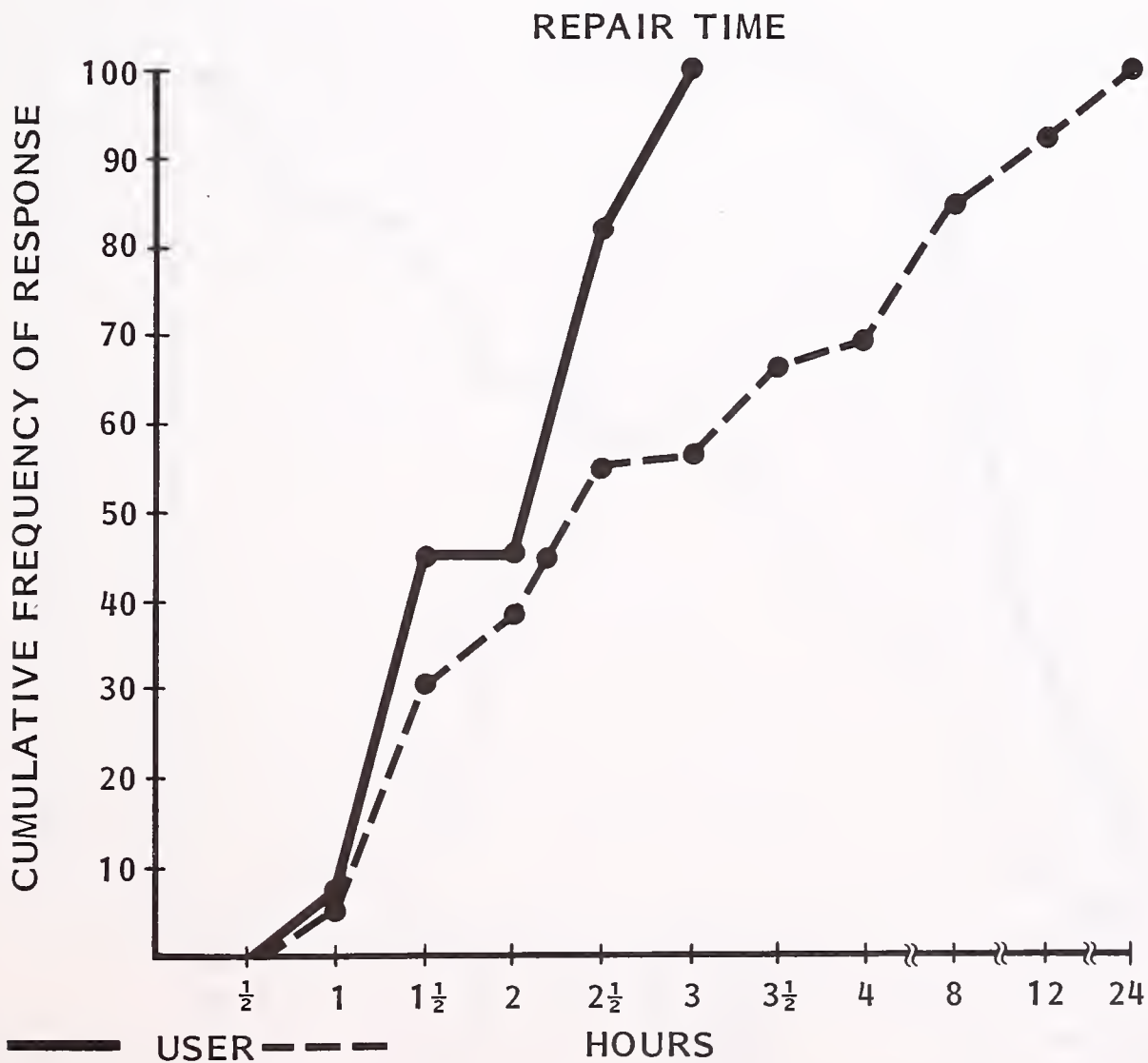
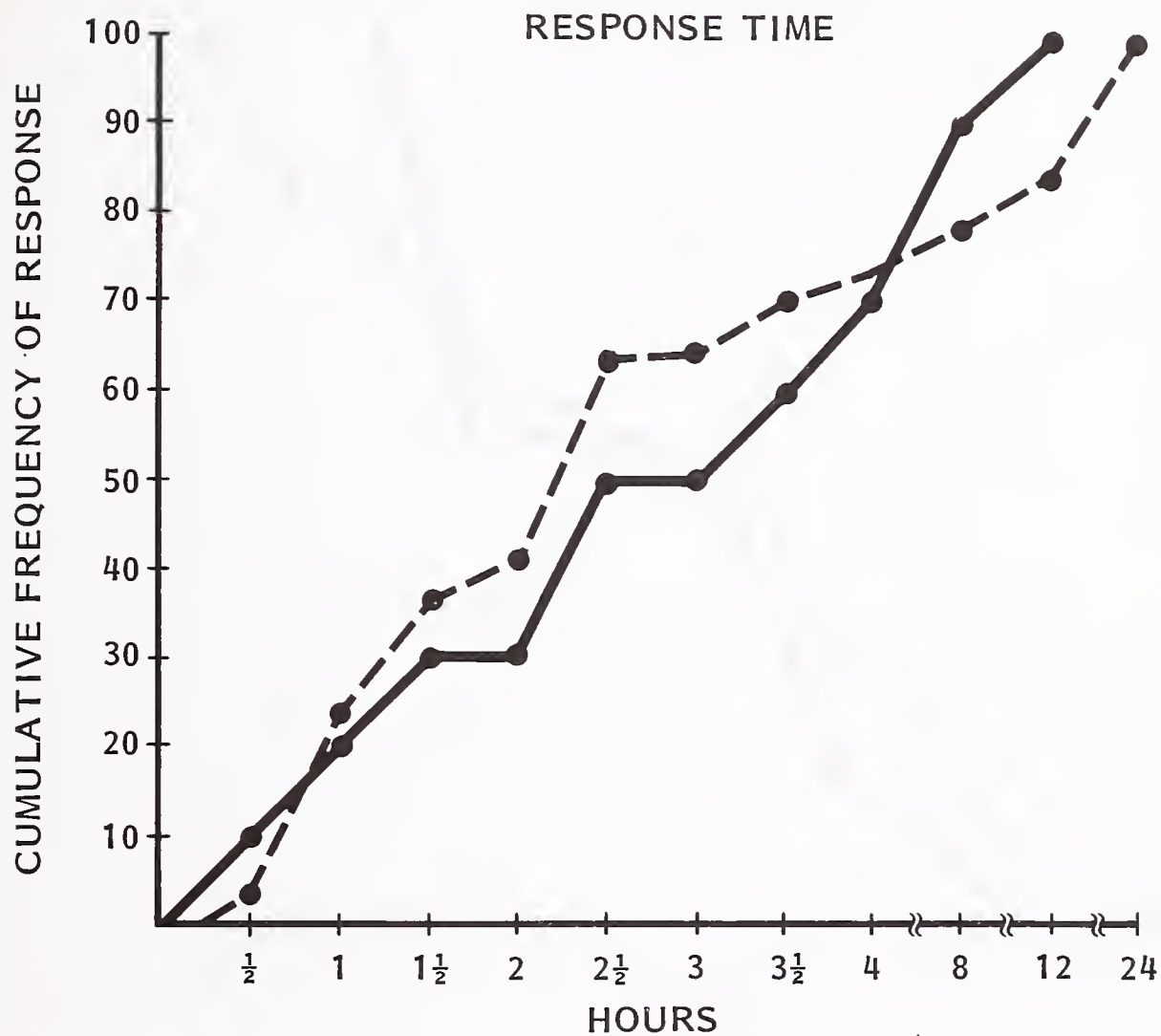
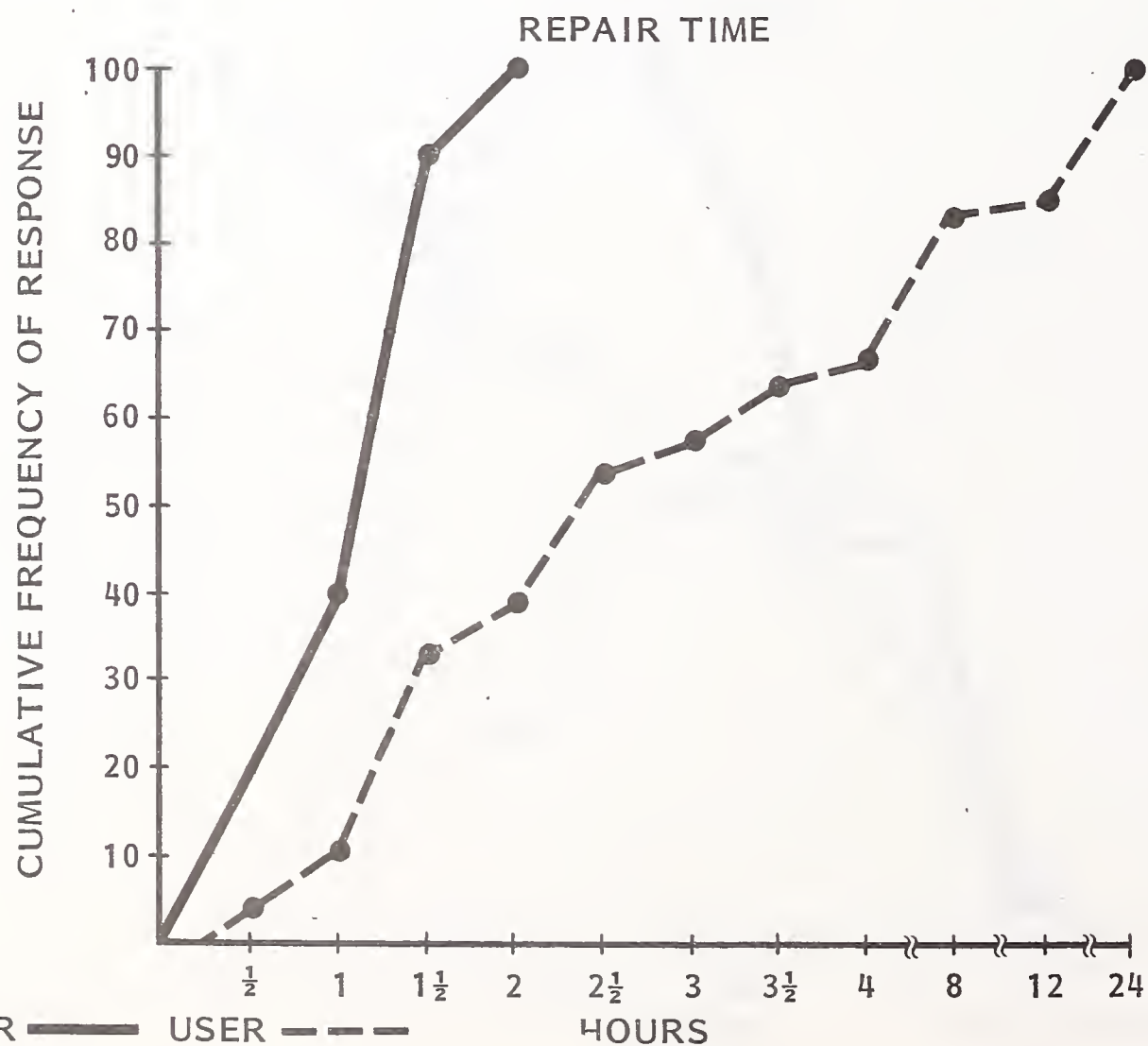
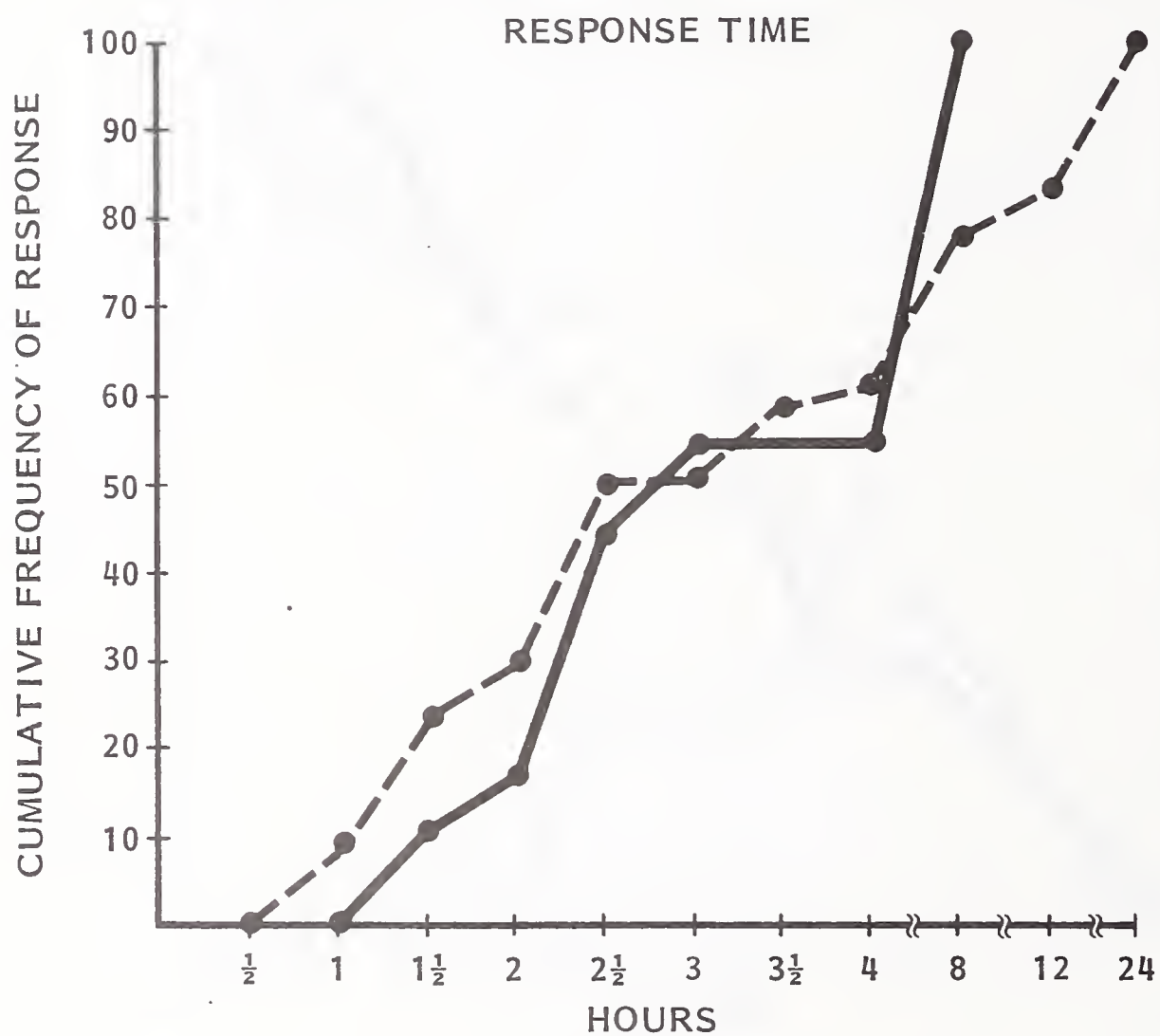


EXHIBIT V-22
PERIPHERALS, MEAN TIME TO RESPOND AND REPAIR:
VENDOR VERSUS USER

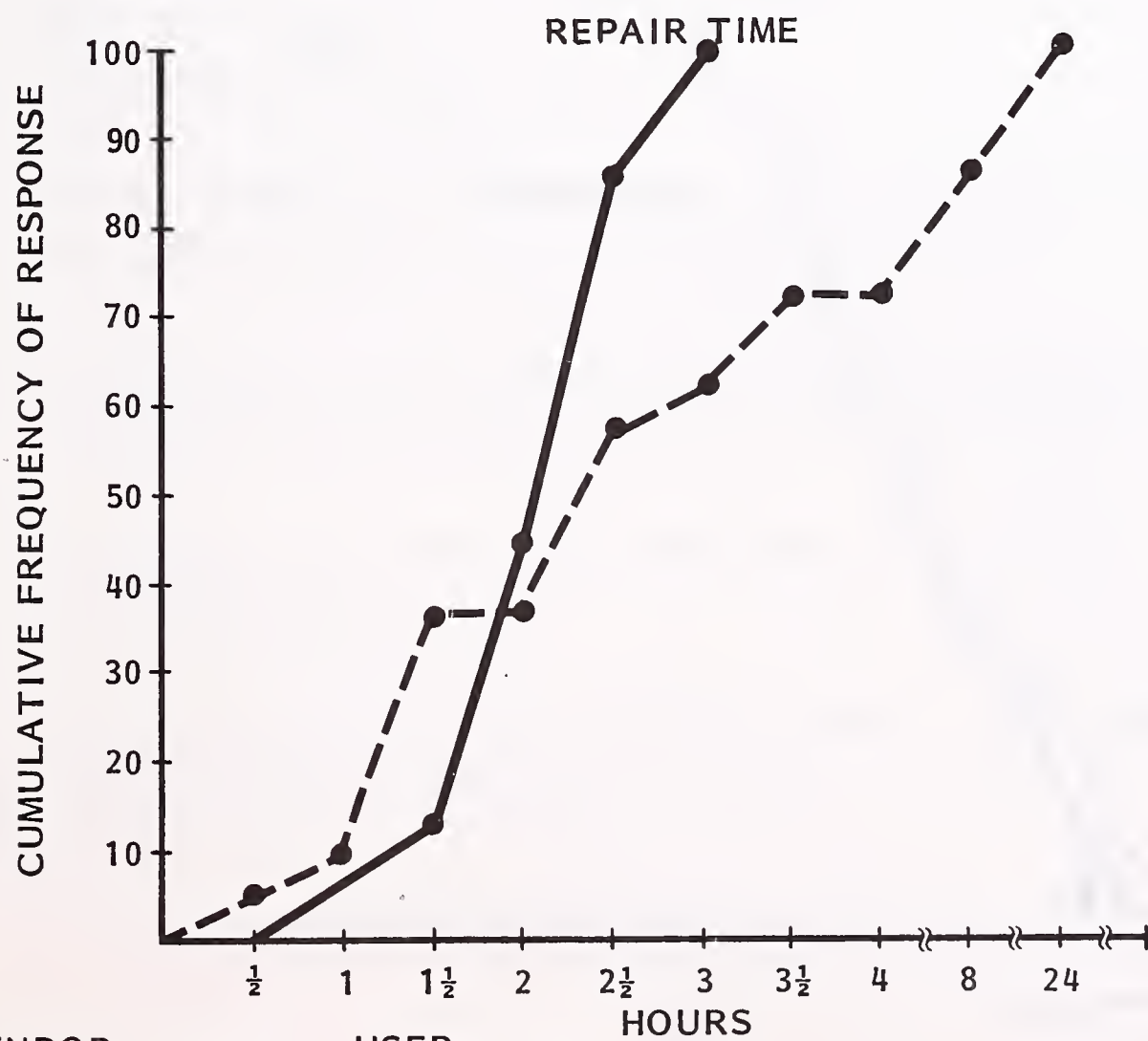
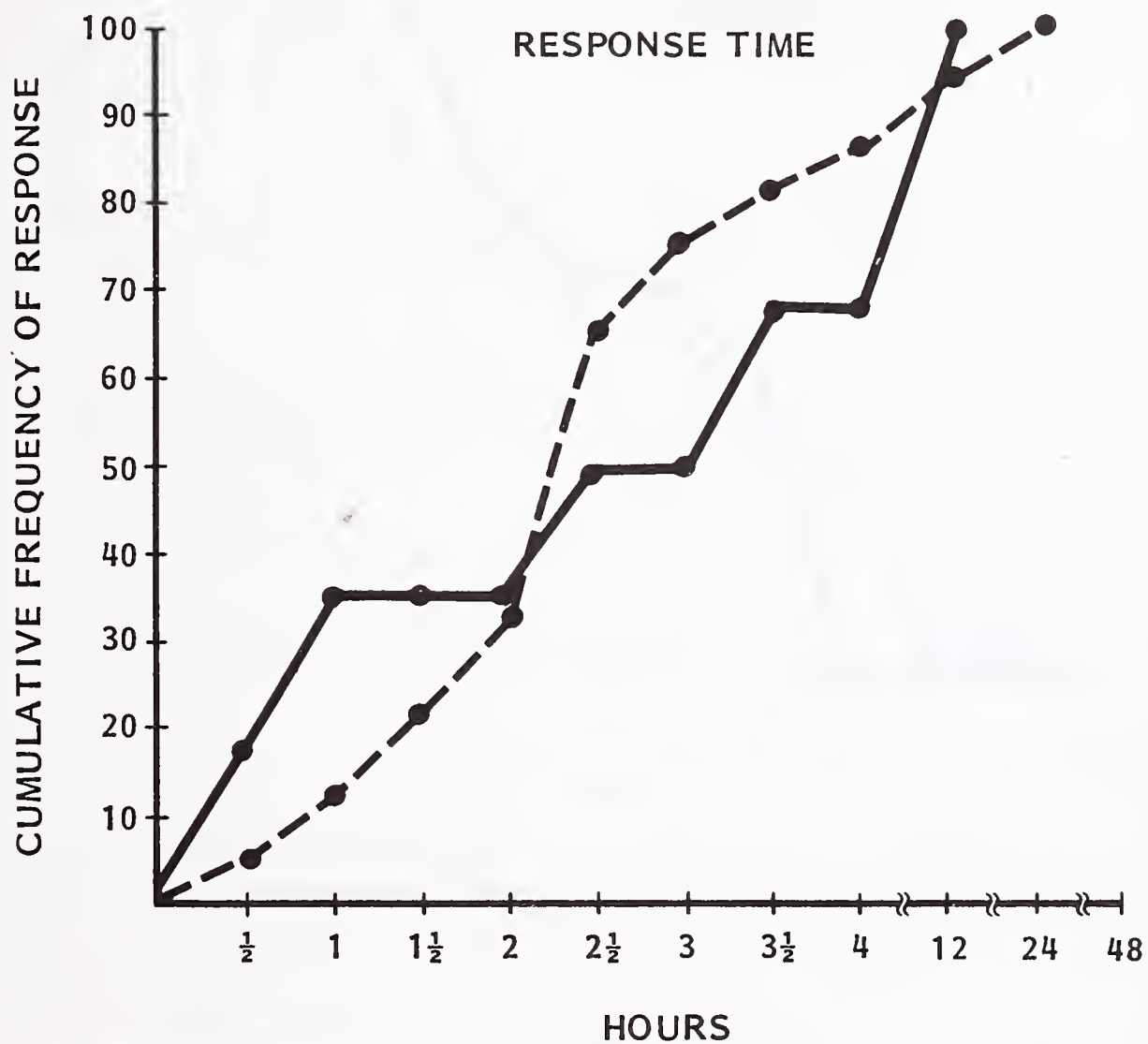


DATA TERMINALS, MEAN TIME TO RESPOND AND REPAIR:
VENDOR VERSUS USER



SMALL BUSINESS COMPUTERS, MEAN TIME TO RESPOND AND REPAIR:

VENDOR VERSUS USER



VENDOR

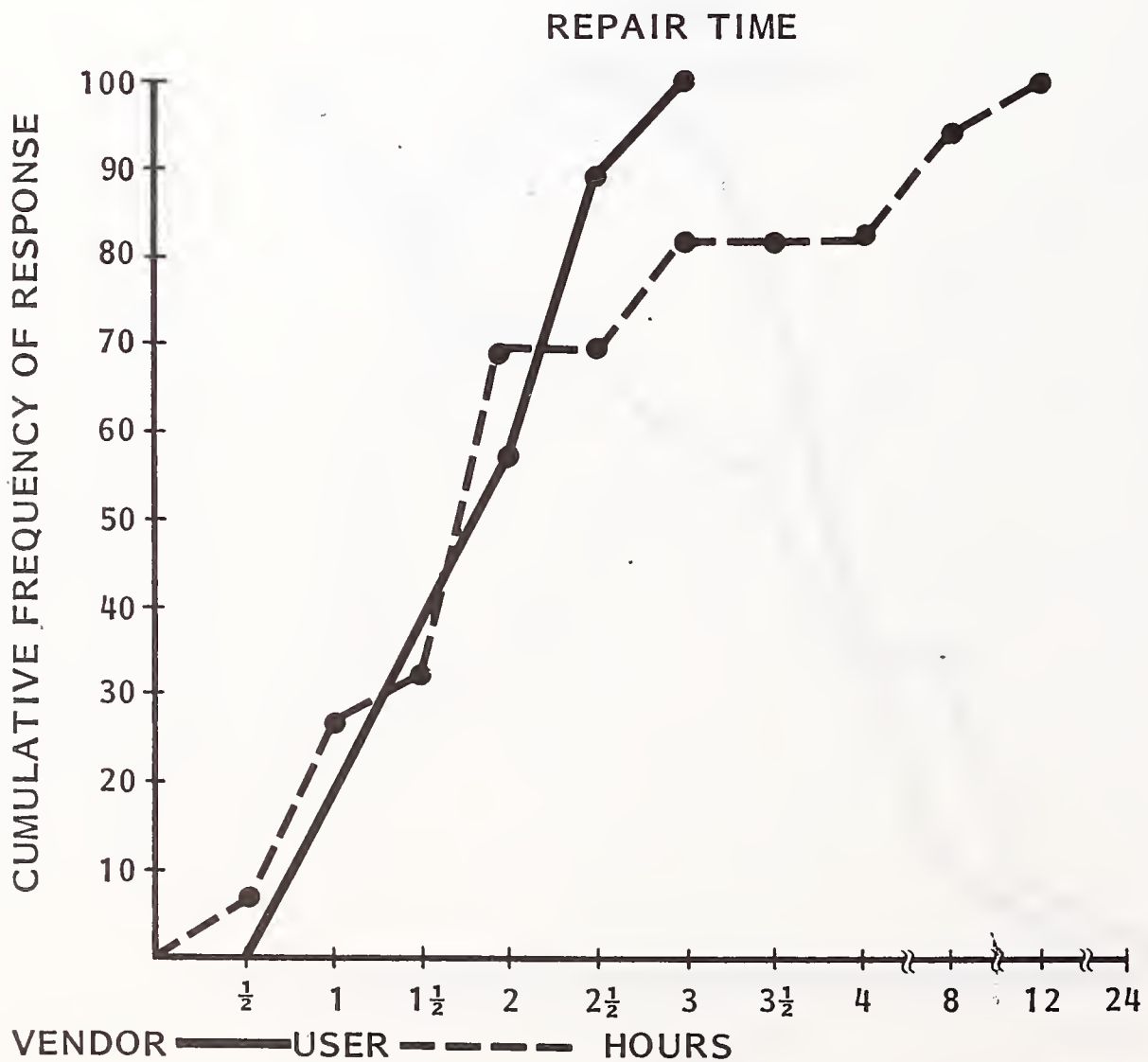
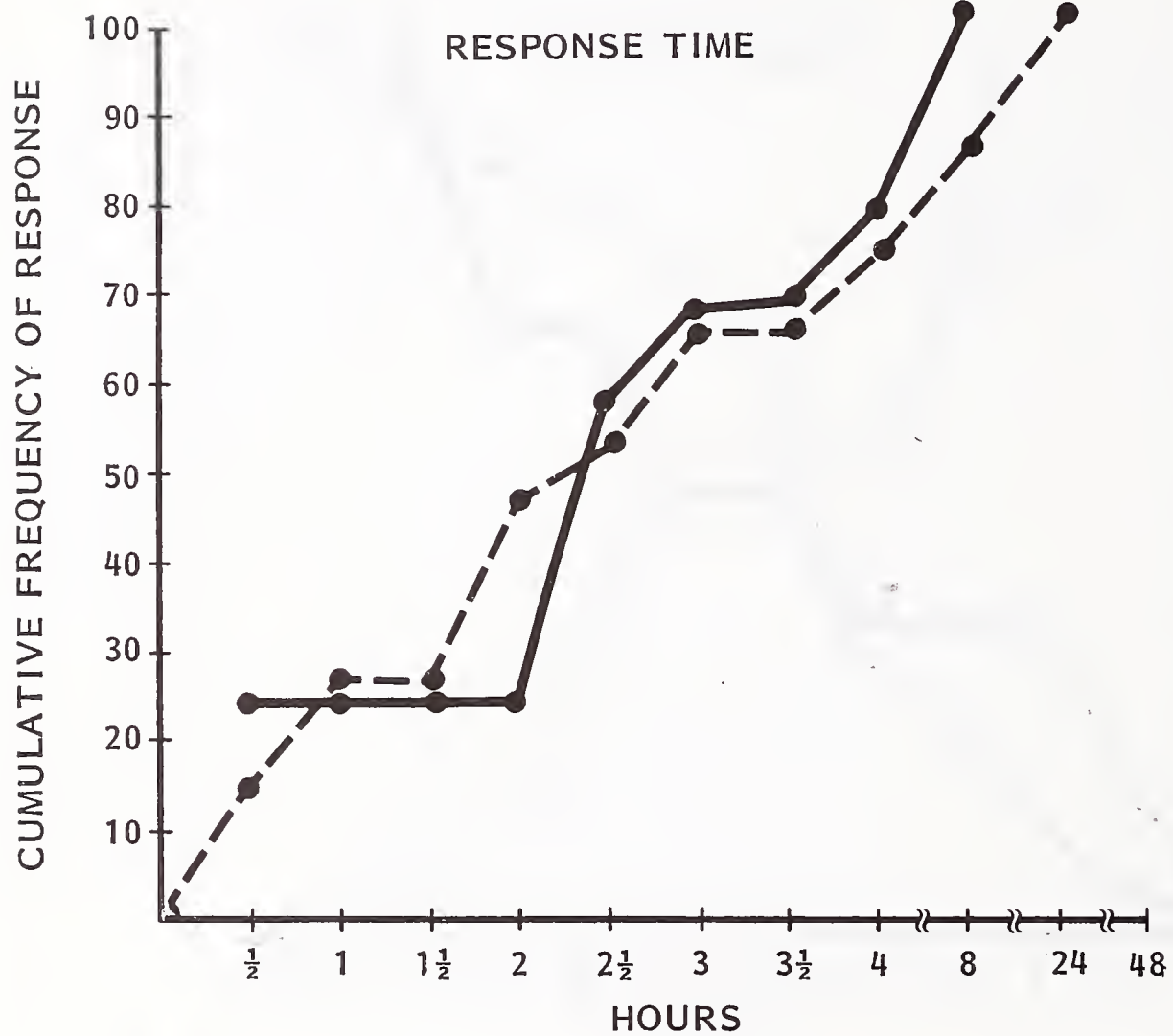
USER

HOURS

- 135 -

EXHIBIT V-25

MINICOMPUTERS, MEAN TIME TO RESPOND AND REPAIR: VENDOR VERSUS USER



- Vendors and users are generally in agreement regarding response times on peripheral equipment, as shown in Exhibit V-22, but vendors again claim quicker repairs.
- Data terminal users and vendors are also in agreement on response times, but seriously disagree on repair times, as shown in Exhibit V-23.
- The remaining two exhibits in the series reflect the same variance in user versus vendor observations about mean time to respond and repair.
 - There is general agreement on response.
 - Vendors see themselves repairing equipment more quickly than users.
 - Users generally count repair time according to the elapsed time after the vendor responds.
 - Vendors are not counting time waiting for parts or other idle time as repair time.

2. AVAILABILITY

- Small business computers, according to respondent vendors, enjoy the greatest percent of availability to users, as shown in Exhibit V-26.
- Terminals have the highest reliability (mean time between failures = 5,992 hours), but measuring outage by elapsed time for travel lowers the availability.
- Mainframes, with their more sophisticated diagnostics and documentation, remain the quickest repairs.
- Word processors, with finer mechanical adjustments and variable talents in operation, require the longest time to repair.

EXHIBIT V-26

VENDOR RESPONSES TO EQUIPMENT AVAILABILITY

EQUIPMENT TYPE	AVERAGE UPTIME		MEAN TIME BETWEEN FAILURES		MEAN TIME TO REPAIR		AVERAGE RESPONSE TIME	
	RESPON- DENTS	PERCENT	RESPON- DENTS	HOURS	RESPON- DENTS	HOURS	RESPON- DENTS	HOURS
MAINFRAMES	3	98.9%	2	706	2	1.1	3	2.2
SMALL BUSINESS COMPUTERS	6	99.0	6	2,304	6	2.8	7	2.0
MINICOMPUTERS	8	98.2	7	3,006	9	3.2	9	1.7
PERIPHERALS	10	97.4	10	2,262	10	3.3	11	1.7
WORD PROCESS- ING TERMINALS	5	97.9	4	1,850	4	3.5	5	1.5
DATA TERMINALS	7	98.7	8	5,992	9	2.8	10	0.9

3. VENDOR VERSUS USER ATTITUDES ABOUT MAINTENANCE FACTORS

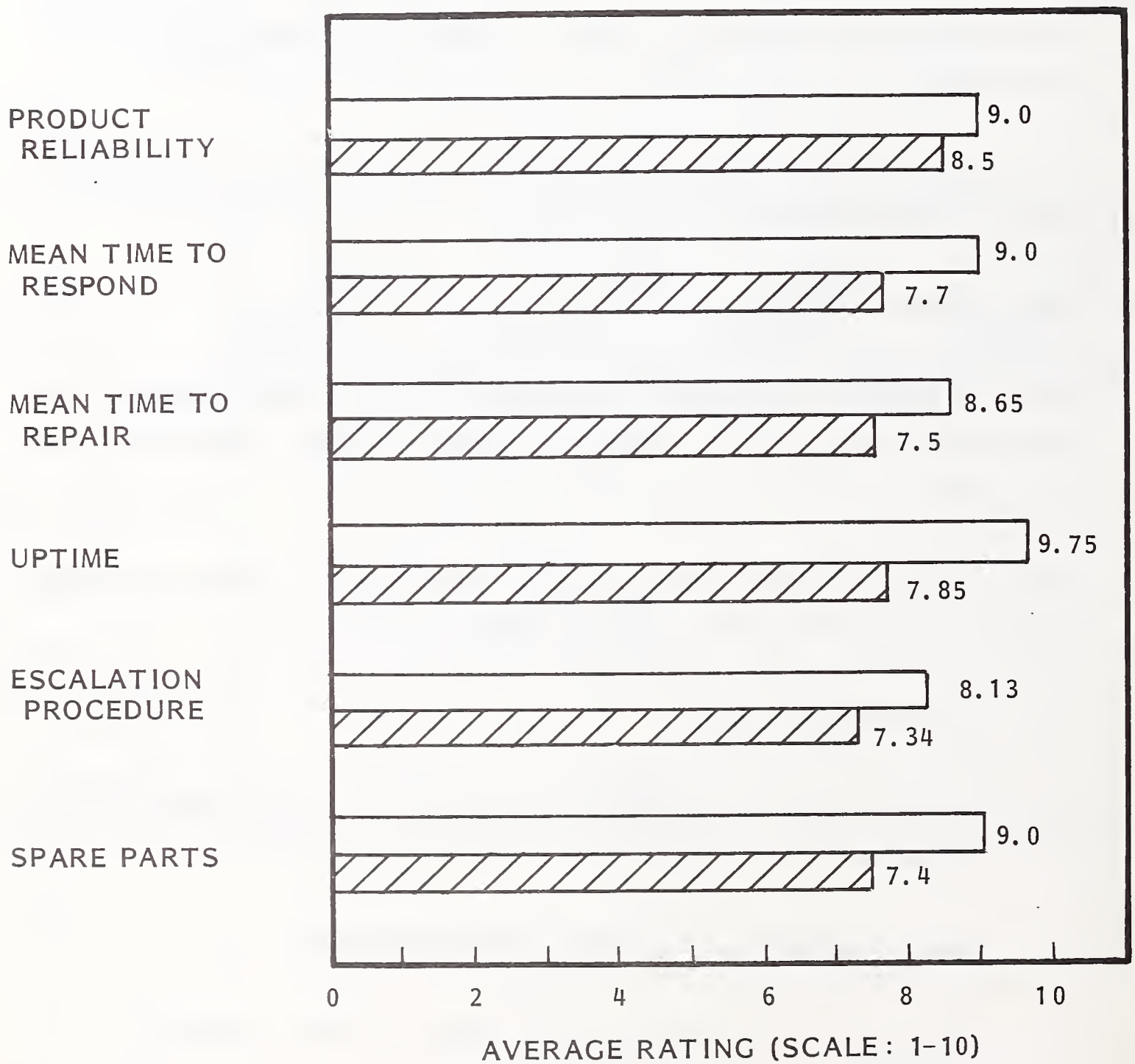
- Users consider all factors of field maintenance to be more important than respondent vendors do, as shown in Exhibit V-27.
- Vendors give the most weight to product reliability, which is generally outside the control of field engineering.
- Users were nearly unanimous in grading availability (uptime) a perfect "10" in importance.
- The contrast between user versus maintenance vendor perspectives is clearly shown in Exhibit V-27.

4. REMOTE DIAGNOSTICS

- Seven of nineteen respondents are currently using remote diagnostics, while only three have no plans to implement remote diagnostic capabilities in the near future.
- More vendors are using remote access capabilities of remote diagnostic interface to provide software services, such as:
 - Transmission of dumps.
 - Remote control of applications modules to obtain specific failure patterns.
 - Remote upgrades and temporary software patches.
 - Remote trace, trap and interrupt on elusive software problems.
 - New business by providing remote consulting services by vendor systems engineers.

EXHIBIT V-27

IMPORTANCE OF FIELD MAINTENANCE CHARACTERISTICS:
VENDOR VERSUS USER RATING



- ☐ USER - 105 RESPONSES
- ☒ VENDOR - 18 RESPONSES

- One mainframe respondent is conducting pilot tests on customers initiating the first call to the national support center for diagnostics.
- Concern is less for hardware and support center capability than for customer acceptance.
- Users accustomed to on-site, visible diagnosis of this vendor's mainframe problems may resist the remote technique.

5. NATIONAL ACCOUNT COORDINATION

- Nearly 80% of respondent vendors have a formal procedure in place to coordinate maintenance activities and problem resolution for national accounts.

6. INSTALLATION/WARRANTY PROBLEMS

- Only one respondent reported having experienced significant loss of lease or maintenance revenue due to installation and/or warranty problems.

7. SOFTWARE MAINTENANCE

- Six of nineteen (32%) respondent vendor field service organizations are maintaining at least a part of the systems software.
- Of 10 respondents to the question, "Will you maintain software by 1986?", only two (20%) said "no."
- Of those vendors who do not maintain applicable systems software, 50% do have field engineering management coordinate service by software engineering until customer complaints are resolved.

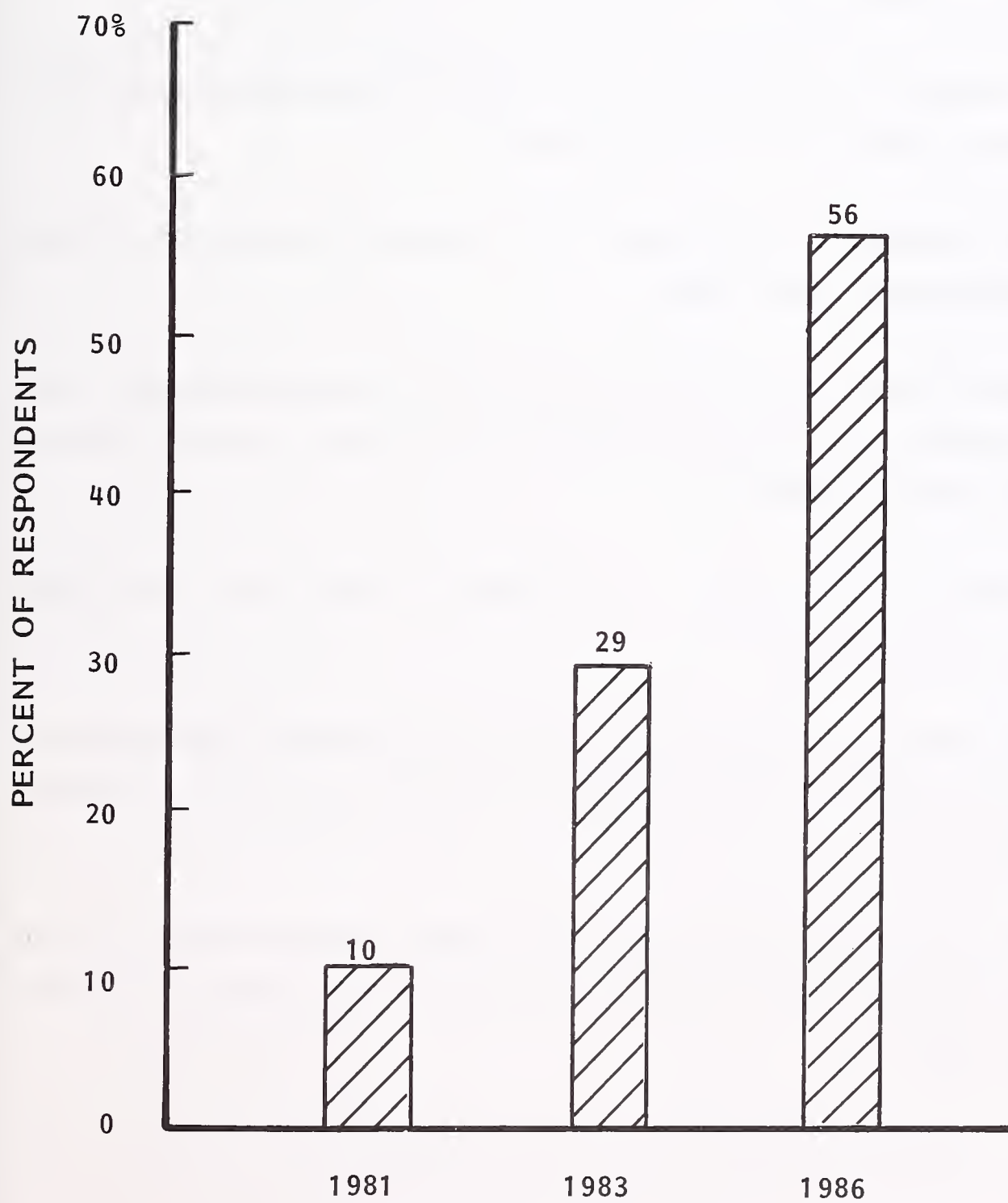
- Maintenance vendors clearly expect to maintain and/or improve productivity of skilled field service personnel by using them in applications software maintenance, as shown in Exhibit V-28.
- Only 10% of the vendor organizations are currently involved in applications software maintenance.
- A 41% compounded annual growth is indicated by projected involvement of 56% of the vendors in applications software by 1986.

G. CONCLUSIONS

- Vendors are focused on short-term issues in large numbers to the exclusion, in most cases, of vital medium-term issues.
- Near-term shortage of skilled personnel has the attention of most vendors.
- The real personnel problem facing most maintenance vendors in the very near future is what to do with the skilled resources now on board when the next generation of equipment replaces current equipment.
 - Significant improvements in reliability are expected.
 - Remote diagnostics will replace the requirement for many skilled technicians in the field.
 - Customers will become more involved to help save costs.
 - A significant portion of labor will be involved in module delivery and replacement, not trouble-shooting.

EXHIBIT V-28

FIELD ENGINEERING VENDORS
MAINTAINING APPLICATIONS SOFTWARE



- Many managements are not anticipating this problem.
- Unions can make progress within field service and may do so as the economics of maintenance grow in conflict with the career goals of field engineers.
 - Vendors are largely ignoring the facts and driving forces of labor organization.
 - Enough vendor management personnel are not aware of management's legal and proper role in dealing with union organization efforts.
- Business management development with field engineering has not accelerated to the pace of changes within the environment.
 - More vendors should experiment with functional management rotation among different departments.
 - Certain "promote-from-within" policies may become outdated in order to create a true business atmosphere in the middle and top levels of field service management.
- There remains a large gap, on the average, between user and vendor perceptions of performance.
 - Users consider outage by elapsed time and unscheduled interruptions at critical times to be the most important factors relative to maintenance management.
 - Most vendors continue in conflict with users when their focus is on the sterile measurements of reliability as perceived by design and continuation engineering.
- Discrete measurements of mean time to failure.

- Discrete measurements of repair times.
- The continuously successful vendors are represented by managers who remain aware of both perspectives, in:
 - Outage impacts for customer service management.
 - Reliability numbers for continuation engineering and for input to future product design.
- There remains no common method of accounting for cost and profitability of field service organizations.

VI SIGNIFICANT VENDOR ACTIVITIES, 1980-1981

VI SIGNIFICANT VENDOR ACTIVITIES, 1980-1981

- Price increases, the introduction of remote and self-diagnostic capabilities, expansion of maintenance options and general growth of field service organizations have dominated the field service news scene this year.
- As was indicated in last year's Field Service Annual Report, this summary section is intended not as a chronology of all announcements, but as an indication of industry trends.

A. EXAMPLES OF MAINTENANCE PRICE INCREASES

- As part of a general round of price increases undertaken last June to improve sagging profits, IBM's DPD and GSD raised both monthly and hourly maintenance for some equipment by as much as 10%. With the announcement of the new H Series in November, IBM actually lowered maintenance fees for its 303X series systems from 5% to 15%, however, this move was soon counter-balanced by a new round of price increases for other systems. Citing "the impact of inflation on the cost of doing business" as the culprit, IBM raised prices again in late December 1980. Monthly maintenance went up 15% and hourly maintenance 10%. This second increase was nearly a replica of its December 1979 price increase. Both IBM price increases were announced at the end of the year and both applied to similar equipment lines in the same ratio.

- Price increases by other vendors have mirrored the IBM maintenance picture.
 - Last May Amdahl increased maintenance costs 5% for its V/5 to V/7B models and up to 7% for its higher performance V/7 and V/8 models. T&M rates were also increased approximately 20% effective July 1, 1980.
 - In connection with price hikes on most of its matrix and band line printers, Centronics increased maintenance rates 10% in May of 1980; rates for carry-in service remained unchanged.
 - Control Data also announced a round of price changes in January. Maintenance services via the Central Enhancement and Maintenance Service (CEMS) were increased by 9½% effective May 1981.
 - Digital Equipment (DEC) announced price increases in January 1981 for most of its packaged computer systems, peripherals, software products and services. The price hikes affect every one of DEC's products, except the VAX-11/780 and 750 and the Decsystem Model 2020, and mark the second time that DEC has raised its product prices within a year. Last spring, the firm increased packaged system prices by 5%, hardware by 7% and software by up to 15%. In a separate move, DEC unbundled a number of past warranty software services for languages supported by Tops-10. According to published reports describing the policy changes, the unbundling services could result in an increase in software maintenance fees of almost 100% for some users.
 - Blaming the increase on the "high cost of doing business," Honeywell hiked system and field engineering charges and monthly hardware and software maintenance fees. The August 1980 increases include a 10% hourly and monthly systems engineering increase covering all Honeywell computer products, and 12% to 19% boosts in field engineering on-call time and material rates. Monthly maintenance charges were increased again in January 1981 from 5% to 15% for the DPS 8 and Levels 62, 64,

66 and 68 DPS and non-DPS central systems as well as for certain peripherals, communications terminals and selected banking equipment.

- Magnuson Computers announced plans to increase maintenance fees by 10% as of March 1981.
- Maintenance prices on Memorex tape subsystems were hiked effective April 1980. In addition, Memorex also raised the hourly, per-call service rates for all its storage system products by 10%.
- Hourly rates for NCR hardware field engineering services were increased 10% in February 1981. At the same time, software engineering rates were hiked 10% to 25%.
- Sperry Univac announced plans to increase maintenance prices of its System 80 line, its 1100 Series and its Computer Assisted Data Entry (CADE) systems by 9% effective April 1981. Charges for maintenance on selected other systems were also scheduled to increase by 15%. Monthly fees for certain Univac terminal products and systems software support were hiked previously in September 1980.
- Xerox Corporation joined in the round of 1981 maintenance price increases by revealing an average maintenance charge increase of 14% for its 9700 printer line.

B. NEW MAINTENANCE TECHNIQUES

I. REMOTE DIAGNOSTICS

- Maintenance innovations have focused on three major areas - expansion of remote and self-diagnostic capabilities, the provision of a menu of support options for users, and expanded software support.

- Remote diagnostic options have been added by many vendors.
 - . The Remote Disk Operating System (Remdos) from Datapoint reportedly facilitates remote maintenance and diagnosis by allowing any Datapoint processor with synchronous communications capability to assume control over another similar processor's functions. This capability allows the user to test software on a remote location.
 - . Fairchild has recently designed a testing system for Sorbus, one of the leading suppliers of third-party maintenance services, that can give each one of the vendor's major repair facilities autonomous, on-site diagnostics and repair.
 - . In its 1980 Annual Report, Four-Phase announced that it is currently developing its remote diagnostic capabilities in order to allow a user's system to be linked via a remote test diagnostic system to analysts in its Cupertino headquarters.
 - . General Electric (GE) has included remote diagnostic capability in its Terminet 200 Series. Each circuit board of the printer terminal series features self-test functions implemented in read-only memory, which the user can make accessible to service centers via public telephone lines should troubles arise.
 - . Modular Computer Systems (Modcomp) has introduced a remote system diagnostics interface package for use with its Modacs III data acquisition and control system. The new package operates as an interface between a host computer and a remote system.
 - . This past summer, Perkin Elmer (PE) announced the availability of remote diagnostics to domestic users of the firm's models 3220 and 3240 32-bit minicomputers. Customers will be able to demonstrate remotely a hardware problem to a support engineer

located in one of PE's participating nationwide service centers. For security reasons, the customer must initiate the contact. Once dial-up contact is established, the system is activated, allowing the support engineer to access the system remotely and commence a set of special diagnostics.

2. SELF-DIAGNOSTICS

- o The success of remote diagnostics depends to a large extent on the computer user's helping himself. The key to this self-help concept is localized self-diagnostics. By paying greater attention to the possibilities of self-diagnostics at the conceptual-design state, a computer designer can include in his product a great deal of self-diagnostics which make the system more amenable to remote diagnostics. Several vendors have offered self-diagnostic options for their products.
 - Computer Automation introduced a standalone software test program that indicates the operational status of all elements in a configured Naked Mini 4 system.
 - Among the reliability features provided by the Control Data 32111-2 Fastrain printer is a microprocessor-driven, integrated maintenance panel that allows up to 90% of fault isolation and maintenance diagnostic routines to be performed off-line.
 - A self-diagnostic hardware and software system has also been included in Data General's Eclipse MV/8000 introduced last April. The MV/8000 system control processor (SCP) is a subsystem, separate from the MV/8000 central processor, with an independent I/O system. The SCP performs all the diagnostic control and console functions.
 - Tandem Computers has included an operations and service processor in its Non-Stop II computer system. Early fault isolation and error detection is provided through the OSP, a separate, self-contained

system that is also used for the console operation of the Non-Stop II. The OSP provides detailed system status information and diagnostic facilities to assist service personnel, thereby reducing the mean time to repair. The OSP also includes a modem that supports remote diagnostics and remote system operation.

- Texas Instruments has added an on-line diagnostics package for several models of its DS990 commercial systems.

3. SPECIAL MAINTENANCE OFFERINGS

- As maintenance prices continue to rise vendors have started to realize that not all customers have the same needs, and have begun to tailor their maintenance offerings to their clients' needs.
 - DEC, for example, has provided its customers with five maintenance agreements from which to choose.
 - Centronics Data Corporation has offered a maintenance option for its Model 700 and 730 Miniprinters that is a substitute for repair service house calls. The new plan - which averages 30% less than on-site T&M rates - allows users to return their machines to a walk-in service center for repair or routine maintenance.
 - HP introduced a service plan that permits users to select one of four different agreements.
 - The HP Standard Maintenance Agreement provides same-day, four-hour response for users within 100 miles of an HP service office.
 - The Basic Systems Agreement provides next-day service, but is otherwise the same as the Standard Agreement. It provides a savings of 20% to 25% over the same-day service plan.

- . An On-Site Product Services Agreement offers next-day response and on-site maintenance for portable, high or desktop computers that have built-in diagnostic capability volume items such as terminals.
- . A Field Repair Center Agreement offers repair service from designated HP repair centers for a fixed fee. An on-site service option has also been added for HP's 85 personal computer.
- Responding to growing user demand for increased product reliability, HP has offered users of its 3000 Series 44 processor a money-back guarantee of at least 99% hardware uptime within a three-month period. The guarantee forms the centerpiece of an optional maintenance agreement that adds 7.1% to the cost of a normal, full-time contract.
- Lear-Siegler is offering a walk-in service facility option. The express depot service, which is offered for a fixed yearly fee, allows users to bring terminals to a central repair site. The service can be performed while the user waits, or within 48 hours.

4. EXPANDED SOFTWARE SUPPORT

- Several vendors have increased their software support options.
- Data General has added a new software support center that provides a toll-free hotline between 9 and 5 PM to customers within the 48 contiguous states, the District of Columbia and Canada. During the first 90 days following software shipment, users encountering a problem can call the software support center at no charge. After the warranty period expires, the customer will be charged for software support center services. If the center cannot solve a problem over the telephone within 12 business hours, local system engineering personnel will be dispatched to provide on-site assistance.

- DEC expanded its coverage from its Colorado Springs software center to 24 hours per day, 7 days per week. The center handles telephone requests from users for help with VAX/VMS, RSTS/E, CTS/500, RSX-11M, and RT-11 operating systems which run on VAX and PDP-11 computers. The users can connect their systems remotely to DEC's support center where specialists can troubleshoot software problems. Telephone support services are currently available for DEC users in the U.S. and Canada under warranty or by subscribing to DEC's Post Warranty Software Products Service. The expansion of service to 24 hours comes at no additional fee.
- . IBM has extended its dial-up support service that allows MVS users to check their problems against a data base of known complaints. The service had previously been available only to users of DOS/VSE, OS/-VSI Release 7 and VM/370 Release 6.
- . Sperry Univac has established a remote software support center for users of its 1100/60 series computers. Users will be able to call in to the center between 7 AM and 9 PM central time, Monday through Friday, to get help with software problems.

C. ADDITIONAL MAINTENANCE ACTIVITIES

- Several vendors have expanded their field service staffs in order to provide additional customer support. Others have reorganized their field service divisions.
- In an attempt to improve conditions which had previously resulted in the filing of numerous damage suits by dissatisfied users and in an effort to forestall future product/maintenance problems, the Burroughs Corporation has established six new staging centers in the U.S. and one in England to integrate and test equipment prior to shipment to customers.

- A recent entrant to the CAD/CAM systems market, Calcomp, has announced plans to market a host of new products, including six software packages, a low-cost work station and a high-speed laser scanner. In order to sell and service these products, Calcomp plans to increase its field staff by as much as 50%.
- Another CAD/CAM vendor, Calma, has split its operations into two new divisions, a Microelectronic Division and a Mechanical Products Division. According to company sources, the establishment of two separate divisions was mandated by marketing and supporting products aimed at two different product areas. Calma was recently acquired by General Electric Company from United Telecommunications.
- As demand for CAD/CAM systems continues to grow, Computervision also doubled both its sales and customer-support forces worldwide. During the year, 18 new sales/service offices were established in the U.S.
- IBM has merged the field service operations of its general systems and office products divisions into a new Customer Service Division. Some industry observers see the latest move as the last step in the eventual consolidation of the two entities, although IBM denies this possibility. Last August IBM formed the Information Systems Division (ISD) to develop and manufacture GSD small computer systems and OPD products concurrently; currently only their sales and marketing efforts remain separate.
- British computer vendor International Computers Limited (ICL), has announced the formation of a National Customer Service Division. The new division will be responsible for the installation and maintenance of ICL computers, data terminals and peripheral systems in the U.S.
- Recognition Equipment, Inc. (REI) has acquired the operating assets of Cummins-Allison Corporation's Data Systems Division. Manufacturing,

engineering and quality assurance functions remain with the subsidiary, however REI will take over the marketing and service functions.

- Acquisition by Storage Technology Corporation (STC) of Documation has greatly increased STC field service staff. STC has moved aggressively to integrate Documation into its operations and to consolidate the field service functions of the two entities.
- In an attempt to improve customer satisfaction, Wang Laboratories has restructured its maintenance organization to provide a separate major accounts support group and has added customer engineers to support clients in remote locations.

D. THE THIRD-PARTY MAINTENANCE MARKET

- Rising costs of computer maintenance have opened up new opportunities for many third-party service vendors. These vendors appeal to users with multivendor hardware who are required to hold a separate service contract for each vendor's system, to small equipment vendors who have encountered difficulty in organizing their own field service, and to vendors who require additional geographic coverage.
- Alpha Serve, the third-party service network being developed by Alpha Micro, continues to expand. It has recently added four firms to its service network: LMS Technical Services will service Delta Micro dealers and OEMs in the New York City area; Systems Maintenance, Inc. will cover accounts in Knoxville, Tennessee; Business Products Services will handle Alpha Micro equipment sold in Arizona; and Service Dimensions will provide maintenance in the midwest.
- In December 1980, CDC received a \$20.6 million Air Force contract for computer maintenance and support services related to satellite control.

- A group of independent executives from various computer and electronic companies has incorporated a new company called Data Systems Services which specializes in the sale, support and service of computers and peripherals to DEC users.
- Decision Data Computer Corporation has established a Customer Service Division to provide third-party maintenance. The company said that it would not limit itself to any specific type of equipment, but would take the broad approach used by TRW and Sorbus.
- Indeserve has signed an agreement to provide supplemental maintenance for Centronics' printer customers in areas not covered by Centronic's field service group. In addition, Indeserve has signed an agreement for contract field services for Radio Shack's TRS-80 Model II computers. This agreement will supplement Radio Shack's own maintenance direct field service. Indeserve has also introduced a program called the Fast Track depot service for microprocessor systems, peripherals and accessories. Indeserve will arrange for one of its local member firms to be trained by the manufacturer in the repair of its microcomputer systems in geographic areas where the manufacturer requires service coverage.
- The Sorbus division of Management Assistance, Inc. (MAI), has expanded the number of its drive-in service center locations from three to fifty. The new centers will repair portable EDP equipment with or without a service contract. Repairs will be offered for several Diablo printers, Qume Sprint 5 series and seven Lear Siegler terminals.
- Purolator Courier and Indeserve have jointly established a depot repair operation for small business systems and computers.
- Technical Data Corporation has offered a three-hour guaranteed service plan for IBM 3101 display terminal users who live within a 75-mile radius of New York City.

- The Computer Service Division of TRW has embarked on a \$4.8 million service and maintenance plan for users of Hazeltine's visual display terminals in the U.S. Under the agreement, TRW markets long-term service agreements directly to OEMs and end users. TRW has also signed agreements to provide maintenance for both Anadex and Data-products.
- Additional announcements are being made almost daily by vendors in areas of pricing and new offerings. INPUT will continue to track these announcements, and invites clients to inquire regarding requirements for additional information.

APPENDIX A: SUPPORTING CHARTS

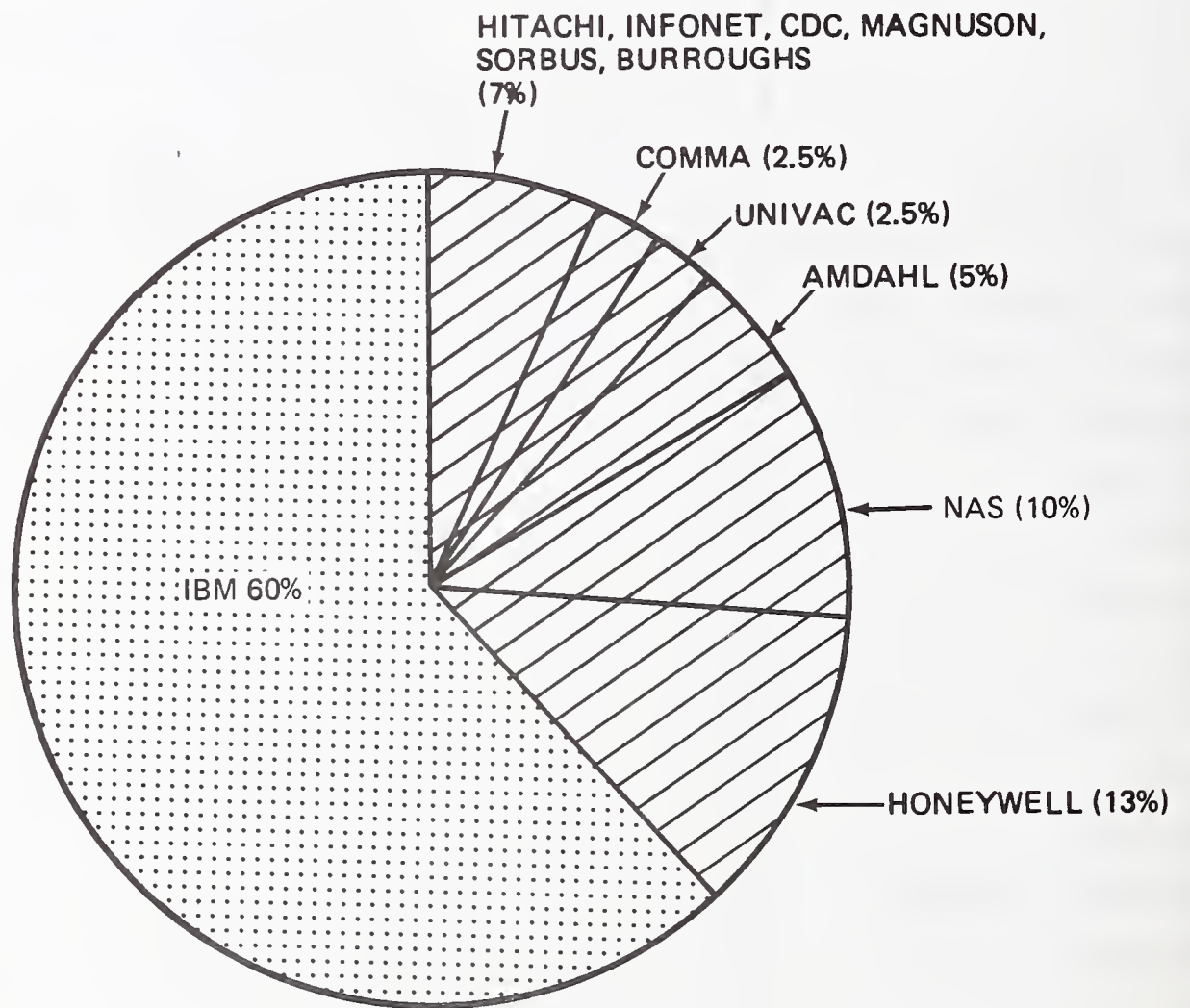
EXHIBIT A-1

USER RESPONDENT PROFILE

INDUSTRY SECTOR	TOTAL NUMBER OF RESPON- DENTS	USER COMPANY BY SIZE IN ANNUAL REVENUES				
		SALES NOT DEFINED	\$1 BILLION	\$500-999 MILLION	\$100-499 MILLION	<\$99 MILLION
DISCRETE MANUFACTURING	22	2	5	2	9	4
PROCESS MANUFACTURING	11	2	5	-	3	1
TRANSPORTATION	2	-	1	-	-	1
UTILITIES	7	2	2	2	1	-
BANKING	7	2	1	3	-	1
INSURANCE	13	3	6	2	2	-
MEDICAL	1	1	-	-	-	-
EDUCATION	5	5	-	-	-	-
RETAIL	6	1	4	-	1	-
WHOLESALE	2	1	-	-	1	-
GOVERNMENT - FEDERAL	4	4	-	-	-	-
GOVERNMENT - LOCAL	7	7	-	-	-	-
SERVICES	17	13	-	-	1	3
OTHER	4	3	1	-	-	-
TOTAL	108	46	25	9	18	10

EXHIBIT A-2

LARGE AND MEDIUM MAINFRAME
MAINTENANCE VENDORS IDENTIFIED BY RESPONDENTS

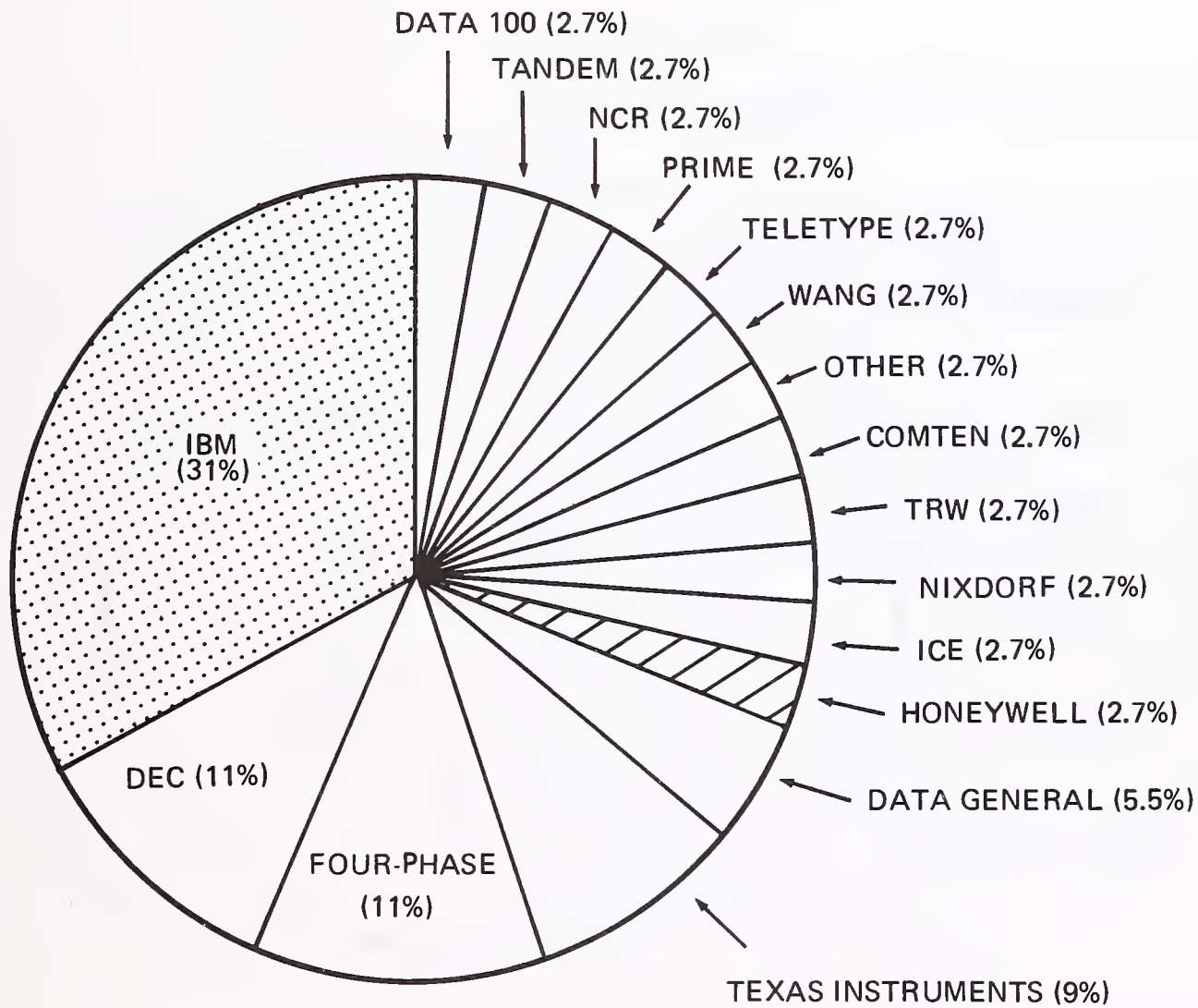


TOTAL RESPONSES: 83

	IBM	60%
	OTHER MAINFRAME	40%
	NONMAINFRAME	

EXHIBIT A-3

SMALL BUSINESS COMPUTER MAINTENANCE VENDORS IDENTIFIED BY RESPONDENTS

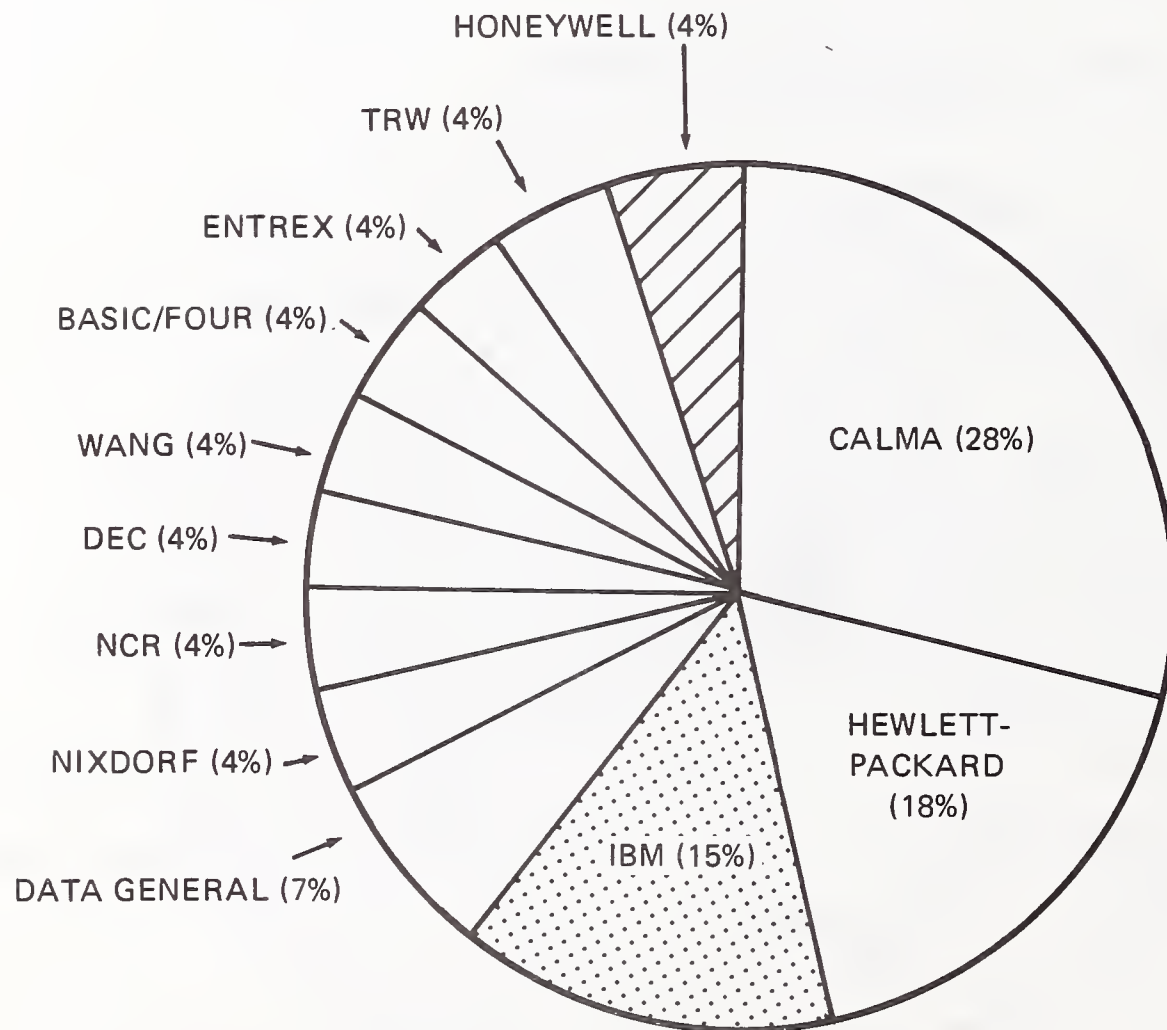


TOTAL RESPONSES: 35

	IBM	31%
	OTHER MAINFRAME	2.7%
	NONMAINFRAME	66.3%

EXHIBIT A-4

MINICOMPUTER MAINTENANCE VENDORS IDENTIFIED BY RESPONDENTS

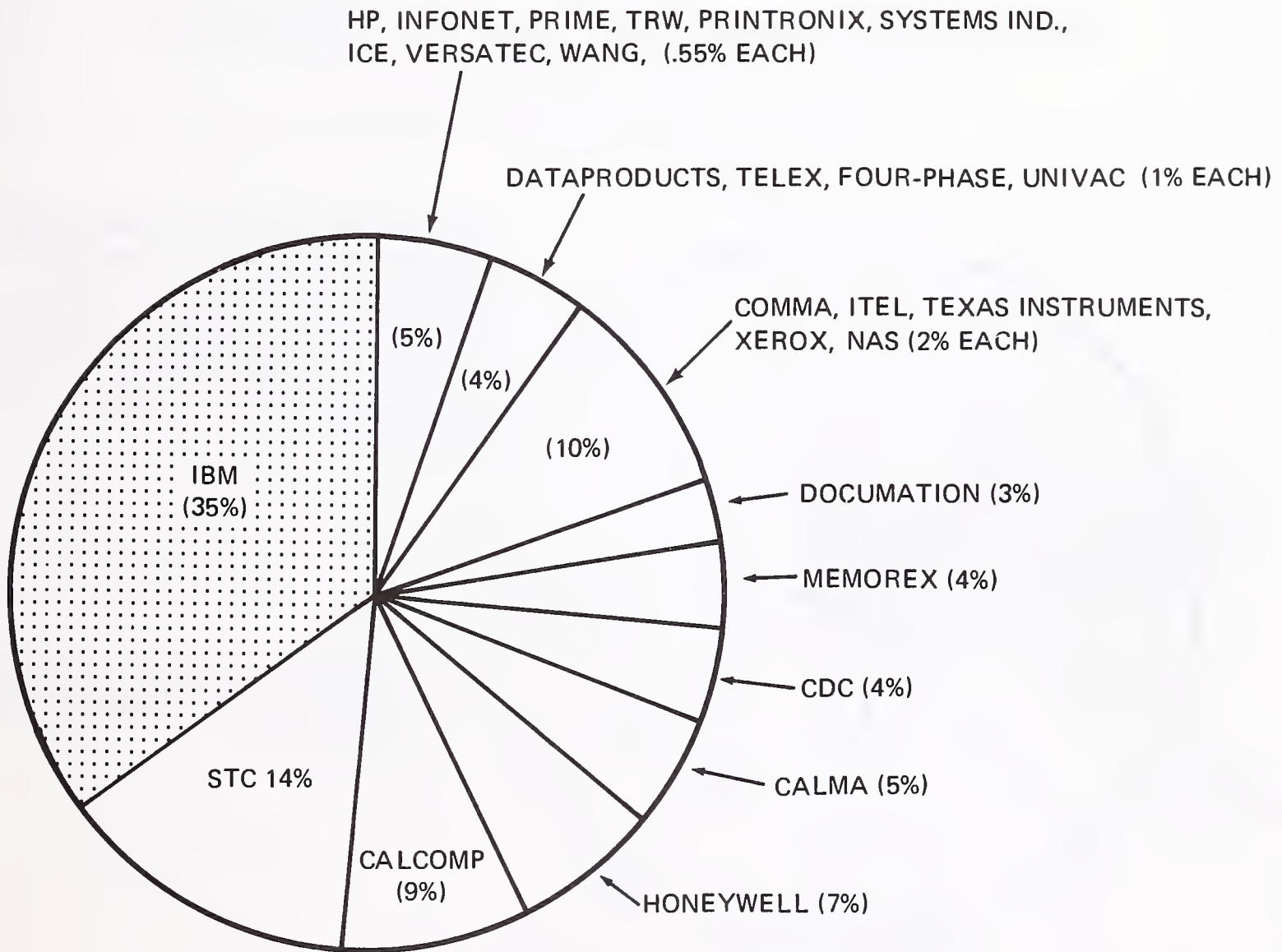


TOTAL RESPONSES: 27

	IBM	15%
	OTHER MAINFRAME	4%
	NONMAINFRAME	81%

EXHIBIT A-5

PERIPHERAL MAINTENANCE VENDORS IDENTIFIED BY RESPONDENTS

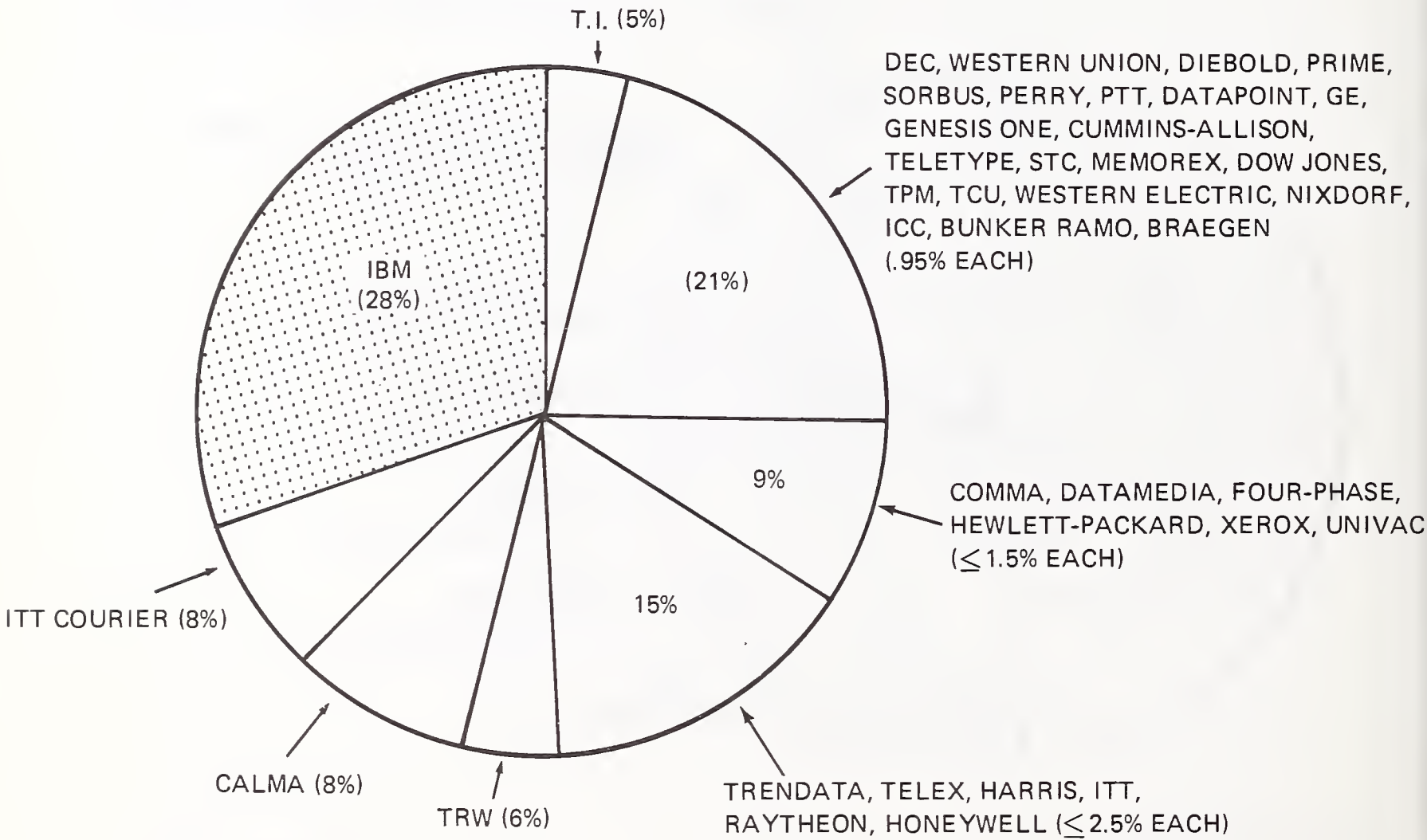


TOTAL RESPONSES: 147

	IBM	35%
	OTHER MAINFRAME	14%
	NONMAINFRAME	51%

EXHIBIT A-6

DATA TERMINAL
MAINTENANCE VENDORS IDENTIFIED BY RESPONDENTS

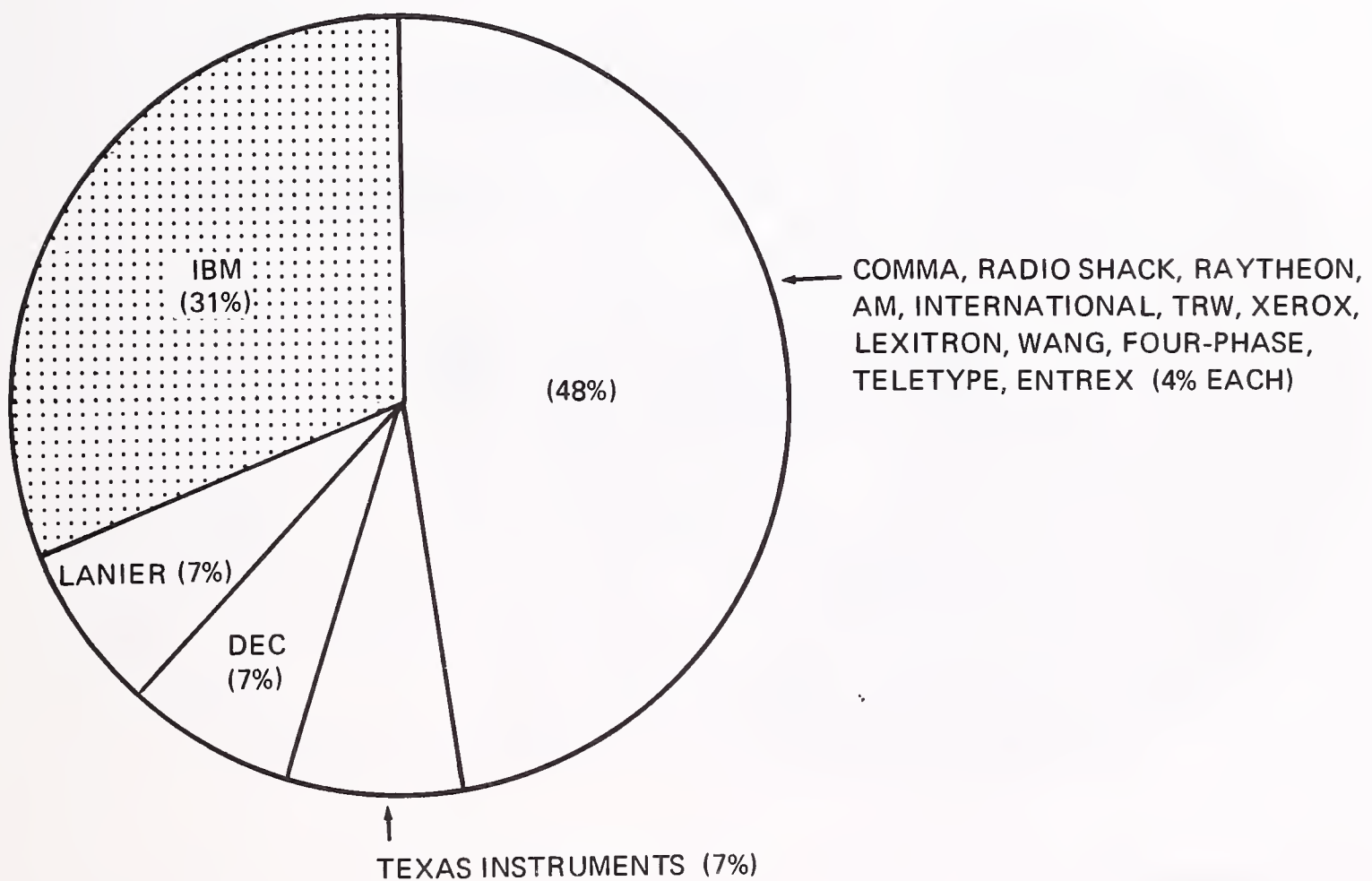


TOTAL RESPONSES: 115

	IBM	28%
	OTHER MAINFRAME	4%
	NONMAINFRAME	68%

EXHIBIT A-7

WORD PROCESSING TERMINAL VENDORS IDENTIFIED BY RESPONDENTS

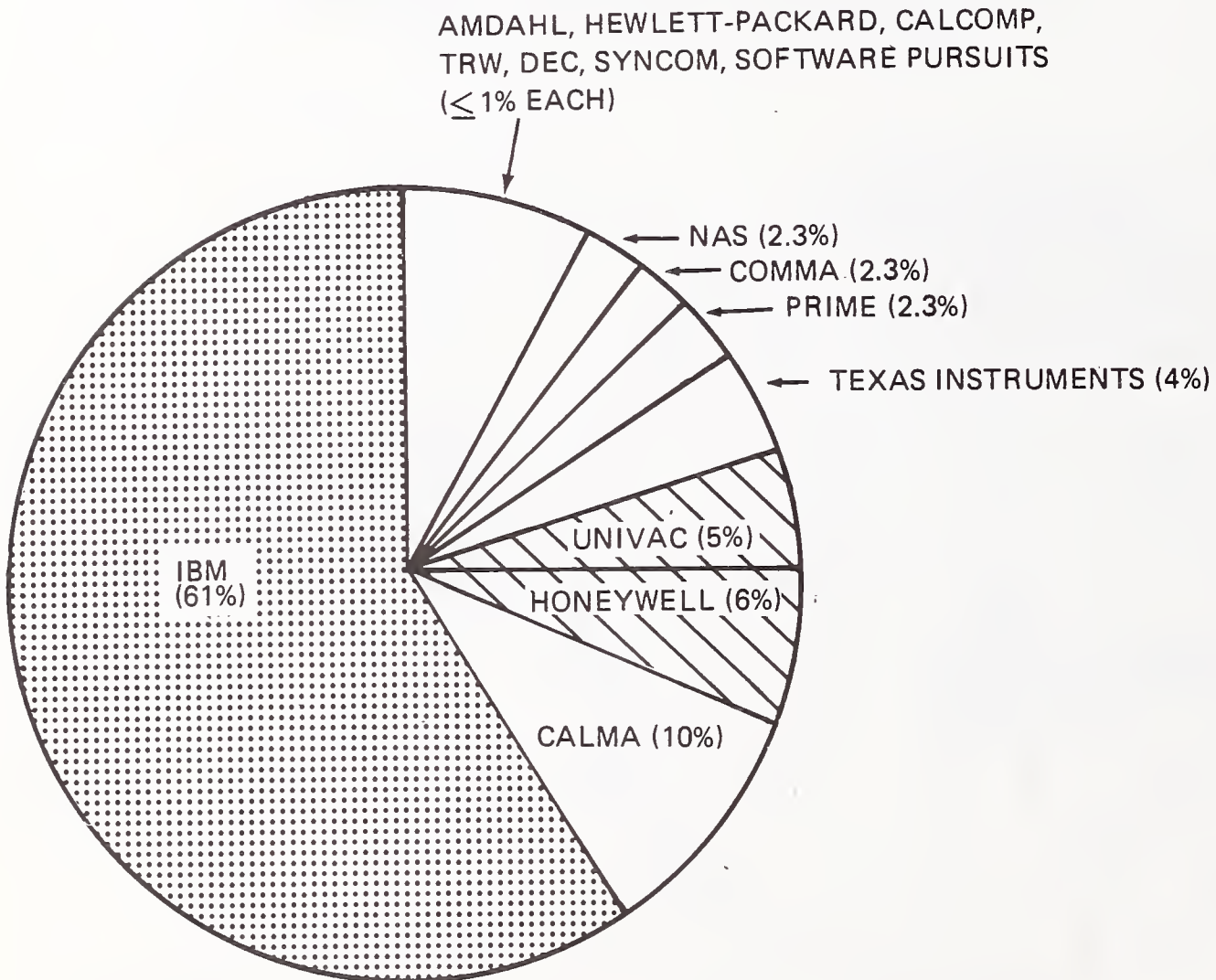


TOTAL RESPONSES: 26

	IBM	31%
	OTHER MAINFRAME	
	NONMAINFRAME	69%

EXHIBIT A-8

SYSTEMS SOFTWARE MAINTENANCE VENDORS IDENTIFIED BY RESPONDENTS

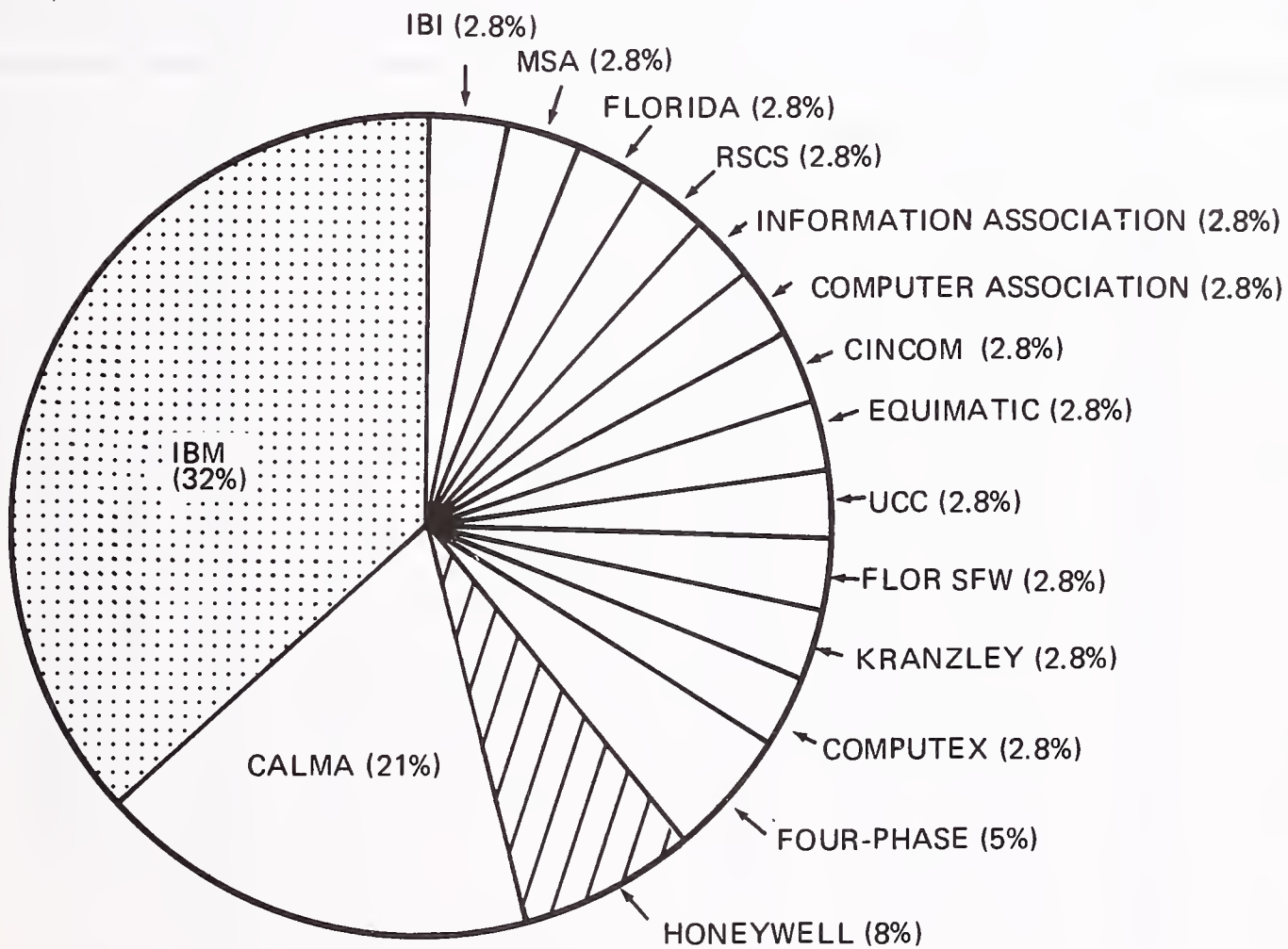


TOTAL RESPONSES: 84

	IBM	61%
	OTHER MAINFRAME	12%
	NONMAINFRAME	27%

EXHIBIT A-9

APPLICATIONS SOFTWARE MAINTENANCE VENDORS IDENTIFIED BY RESPONDENTS



TOTAL RESPONSES: 37

	IBM	32%
	OTHER MAINFRAME	8%
	NONMAINFRAME	60%

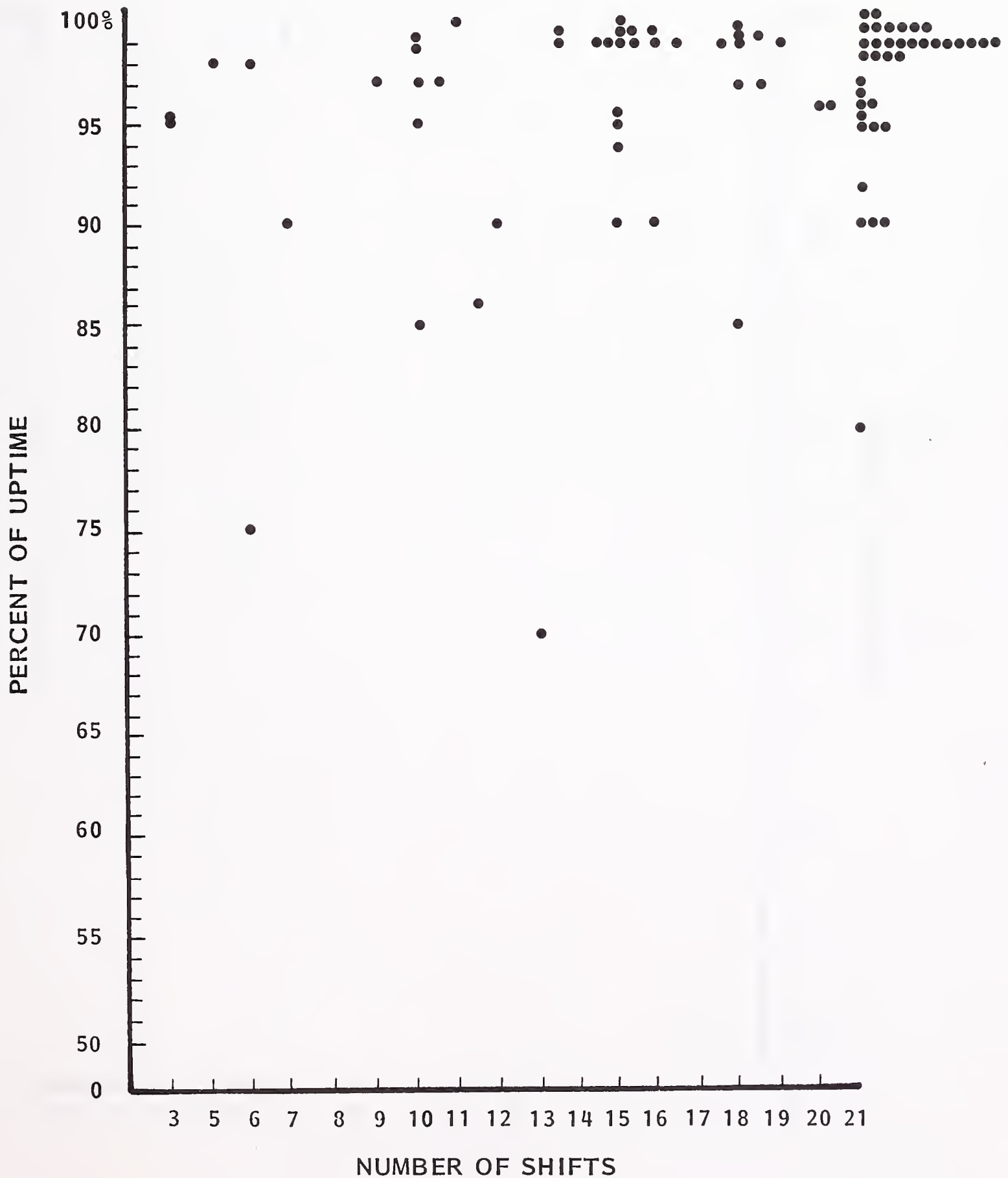
EXHIBIT A-10

COMPARATIVE MAINTENANCE COVERAGE REQUIREMENTS,
1978, 1980, 1981

COVERAGE SHIFTS PER WEEK	1978		1980		1981	
	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT
5	46	35%	30	39.5%	7	6%
6	10	8	2	3	2	2
7	3	2	1	1.5	3	3
8	0	-	0	-	1	1
9	0	-	0	-	2	2
10	8	6	4	5	8	7.5
12	2	1.5	3	4	8	7.5
14	1	0.5	0	-	0	0
15	13	10	8	11	15	14
16	0	-	0	-	3	3
17	0	-	0	-	2	2
18	11	8	7	9	9	8
19	0	-	0	-	1	1
20	0	-	0	-	1	1
21	39	29	21	27	45	42
TOTAL	133	100%	76	100%	107	100%

EXHIBIT A-11

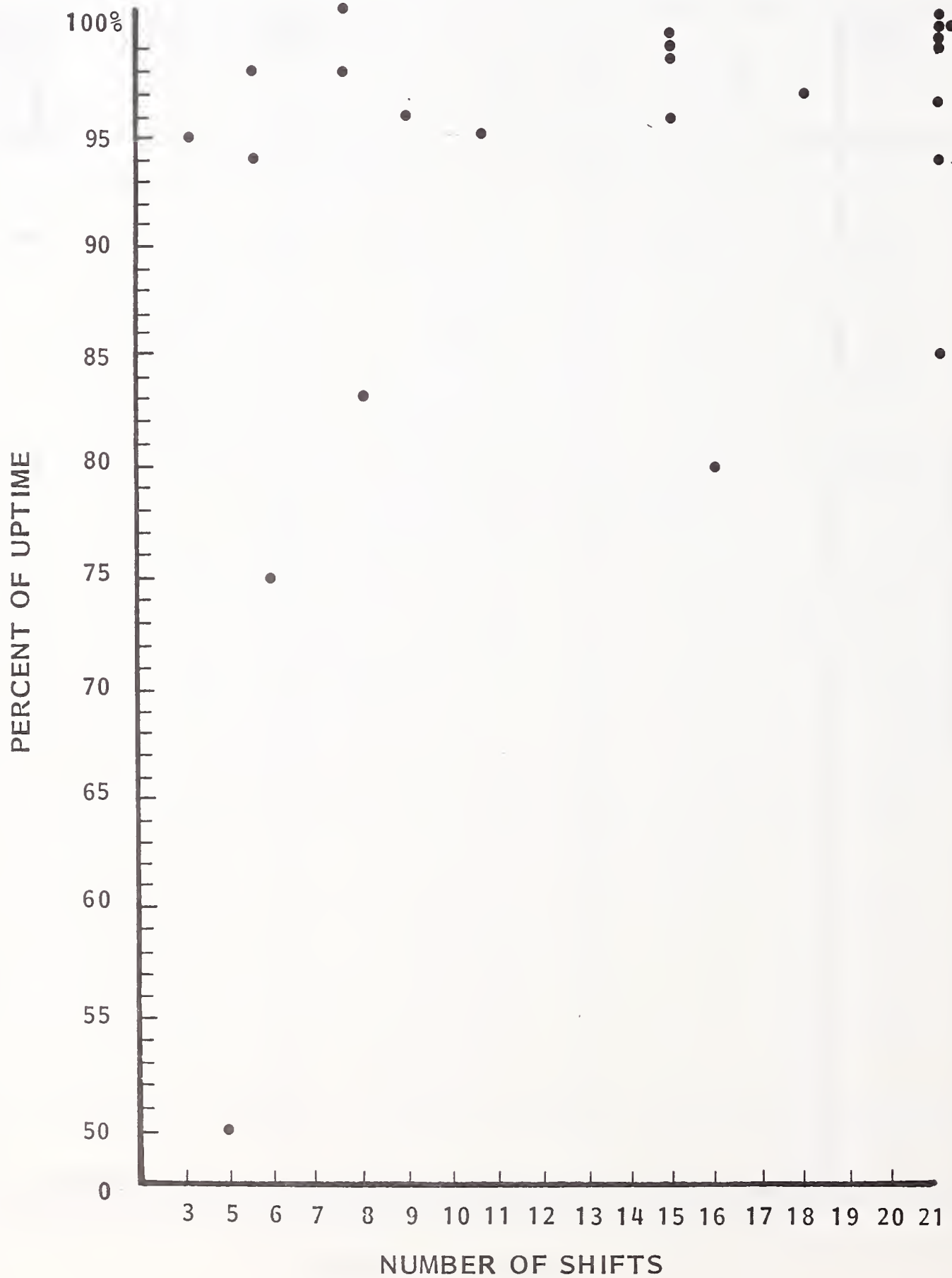
PERCENT UPTIME VERSUS NUMBER OF SHIFTS, LARGE AND MEDIUM MAINFRAMES



EACH DOT REPRESENTS AN INDIVIDUAL USER RESPONSE.

EXHIBIT A-12

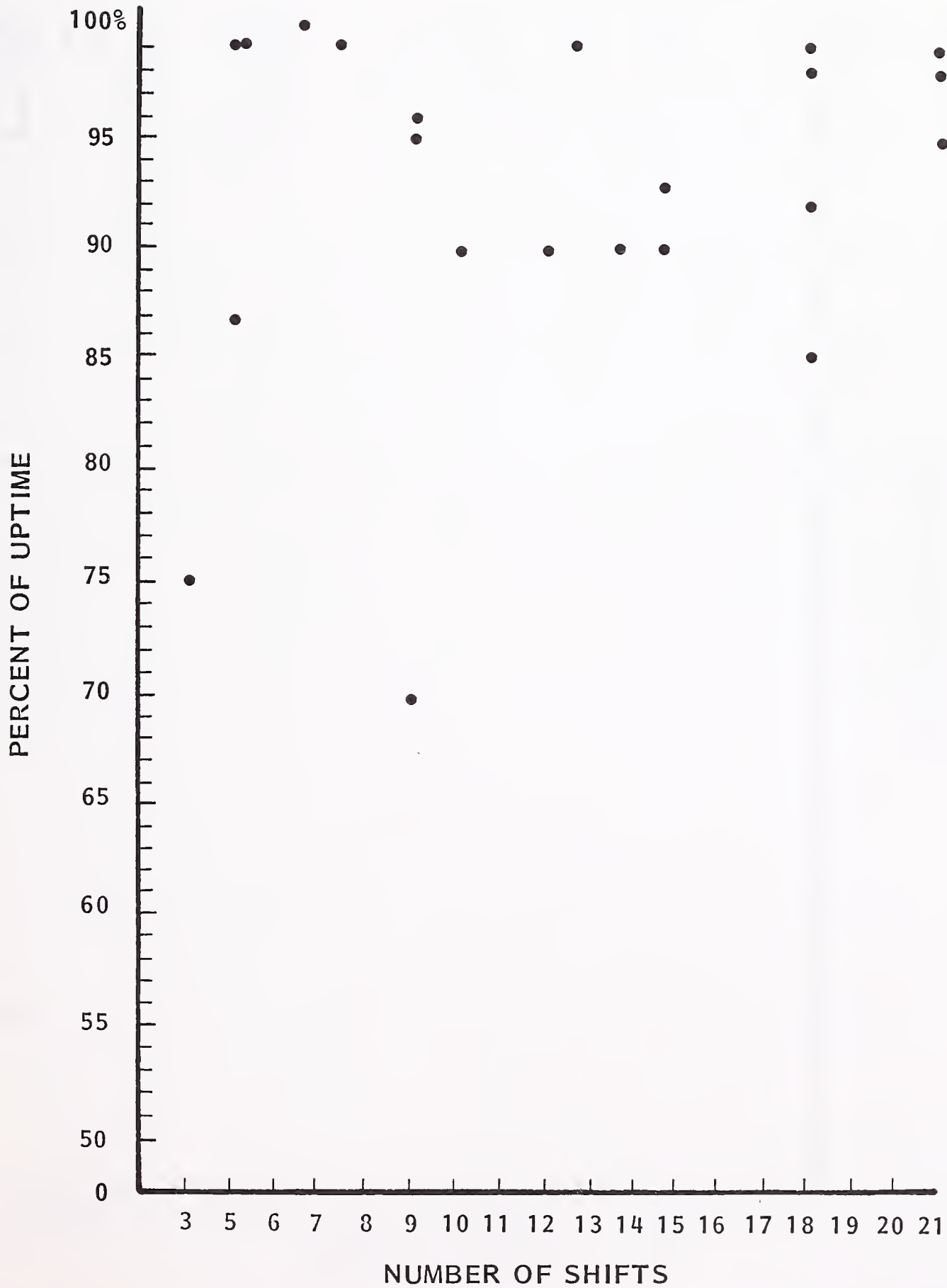
PERCENT UPTIME VERSUS NUMBER OF SHIFTS,
SMALL BUSINESS COMPUTERS



EACH DOT REPRESENTS AN INDIVIDUAL USER RESPONSE.

EXHIBIT A-13

PERCENT UPTIME VERSUS NUMBER OF SHIFTS,
MINICOMPUTERS



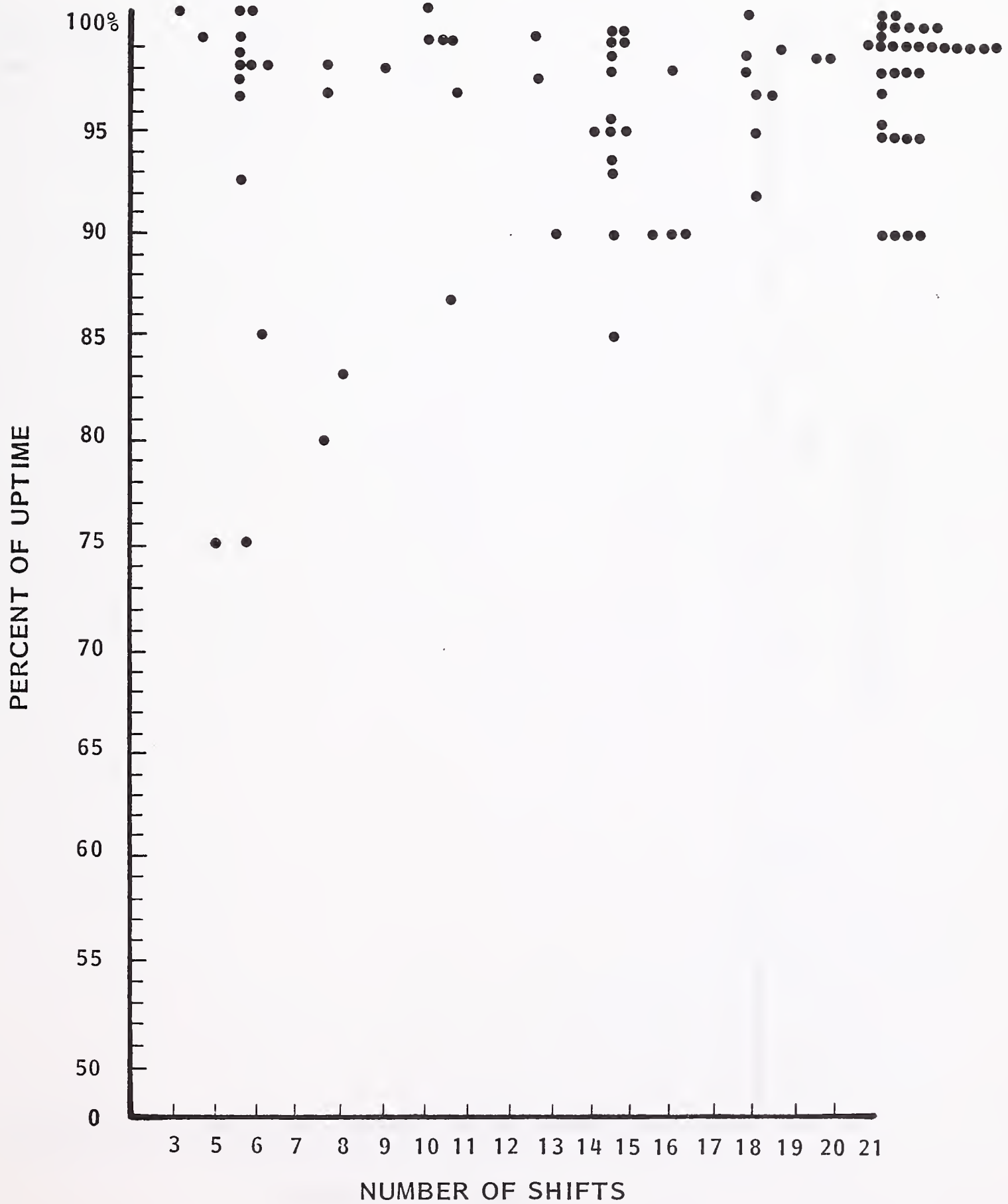
EACH DOT REPRESENTS AN INDIVIDUAL USER RESPONSE.

PERCENT UPTIME VERSUS NUMBER OF SHIFTS, PERIPHERALS



EXHIBIT A-15

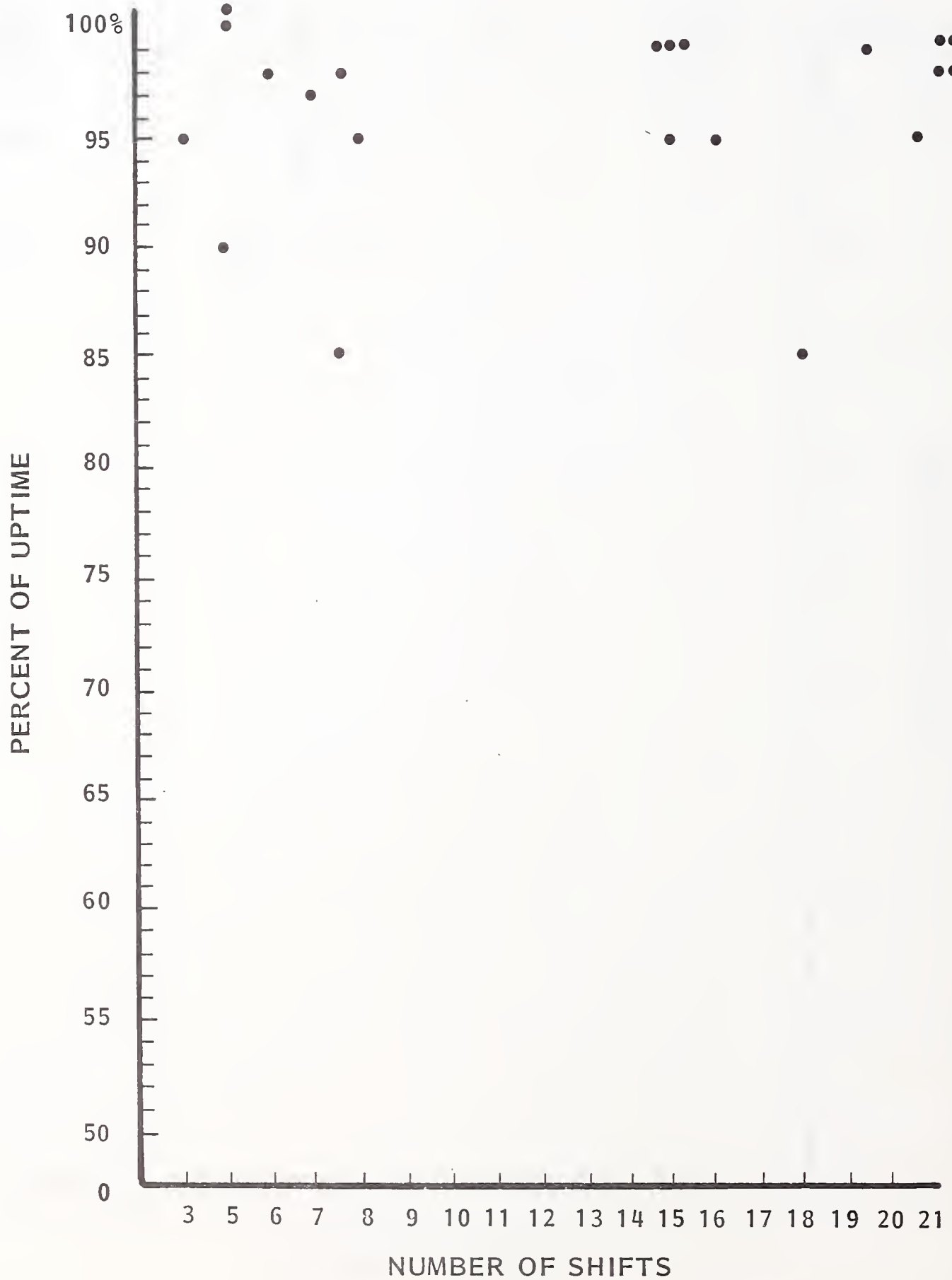
PERCENT UPTIME VERSUS NUMBER OF SHIFTS, DATA TERMINALS



EACH DOT REPRESENTS AN INDIVIDUAL USER RESPONSE.

EXHIBIT A-16

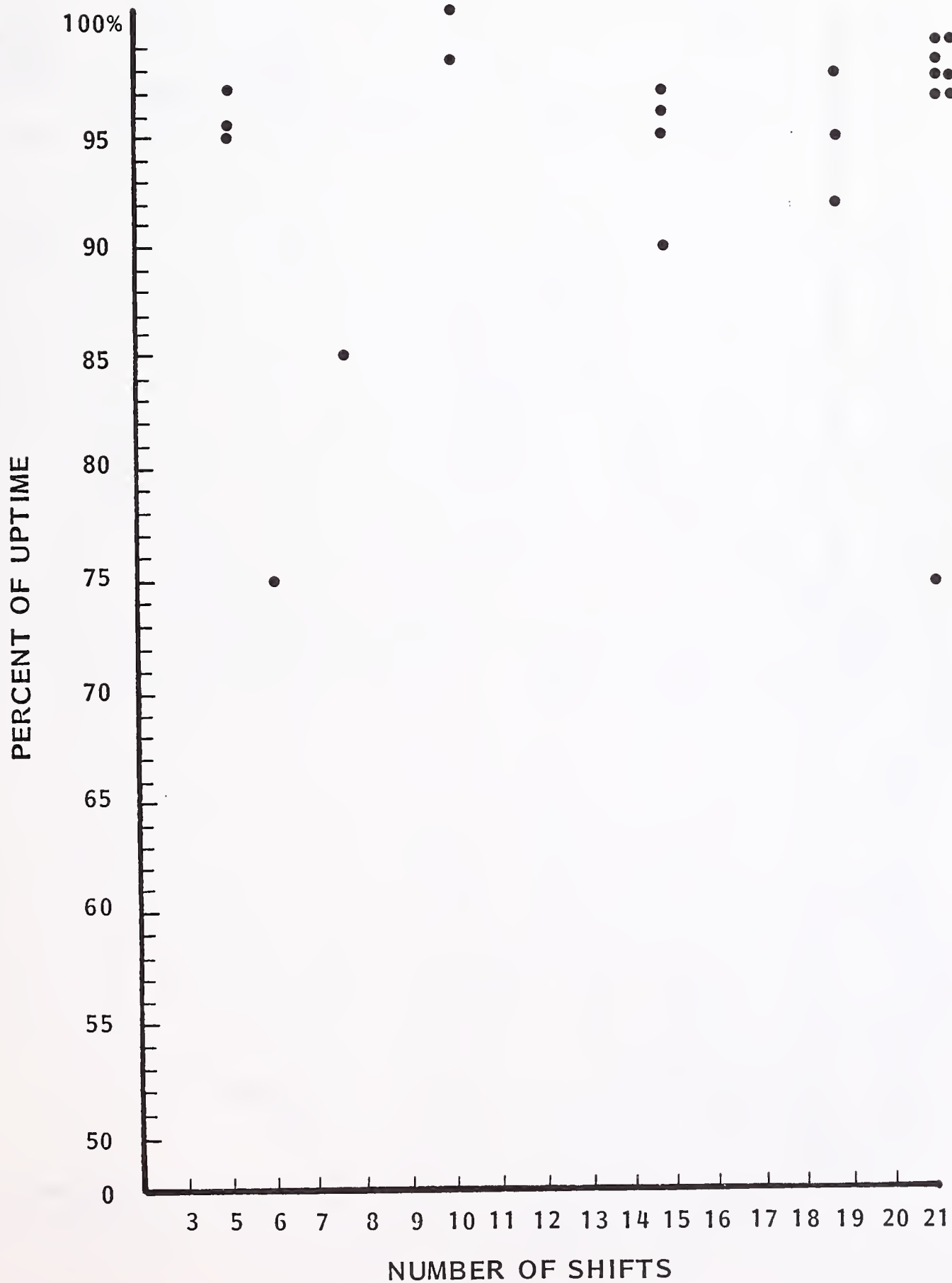
PERCENT UPTIME VERSUS NUMBER OF SHIFTS,
WORD PROCESSING TERMINALS



EACH DOT REPRESENTS AN INDIVIDUAL USER RESPONSE.

EXHIBIT A-17

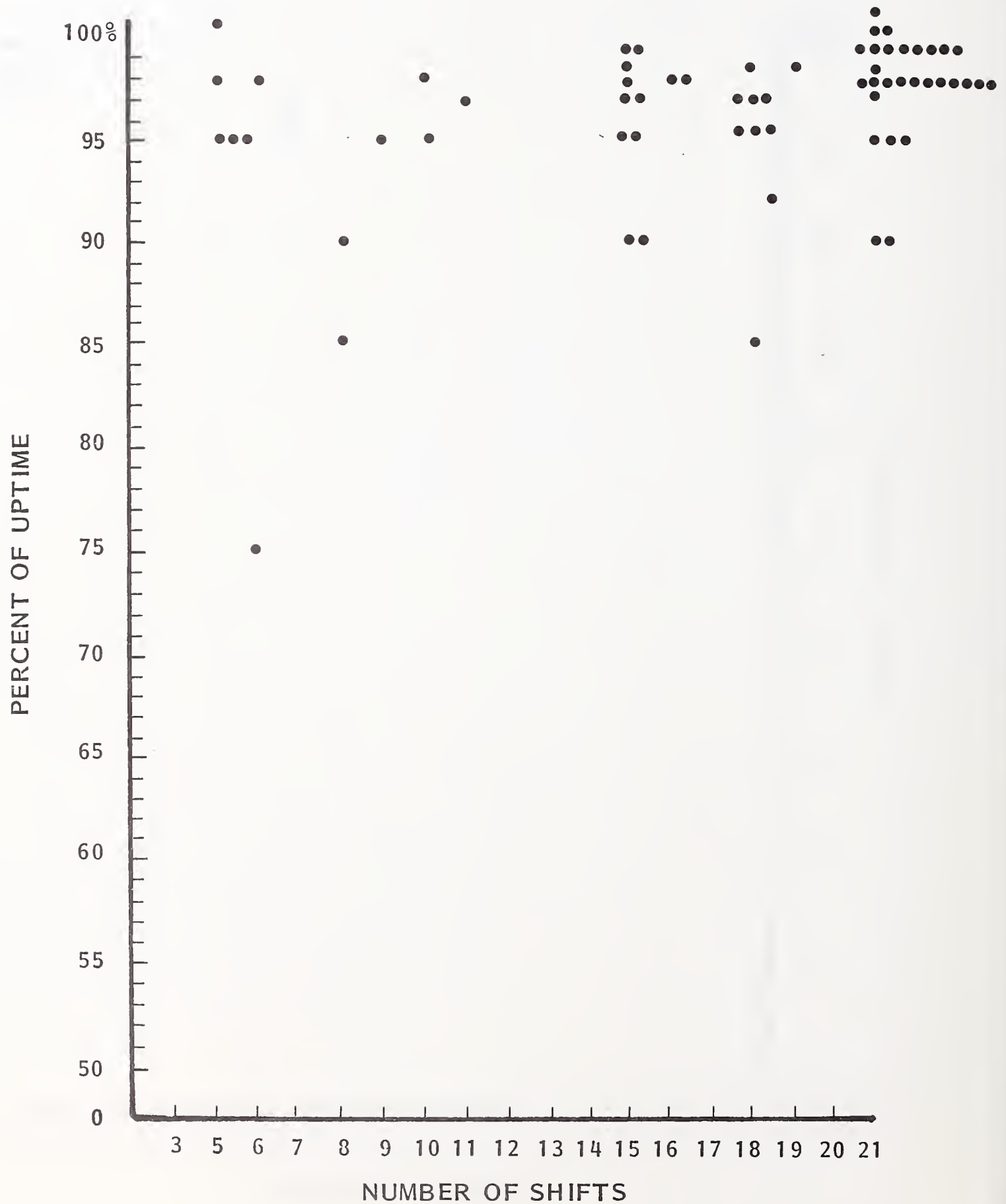
PERCENT UPTIME VERSUS NUMBER OF SHIFTS, APPLICATIONS SOFTWARE



EACH DOT REPRESENTS AN INDIVIDUAL USER RESPONSE.

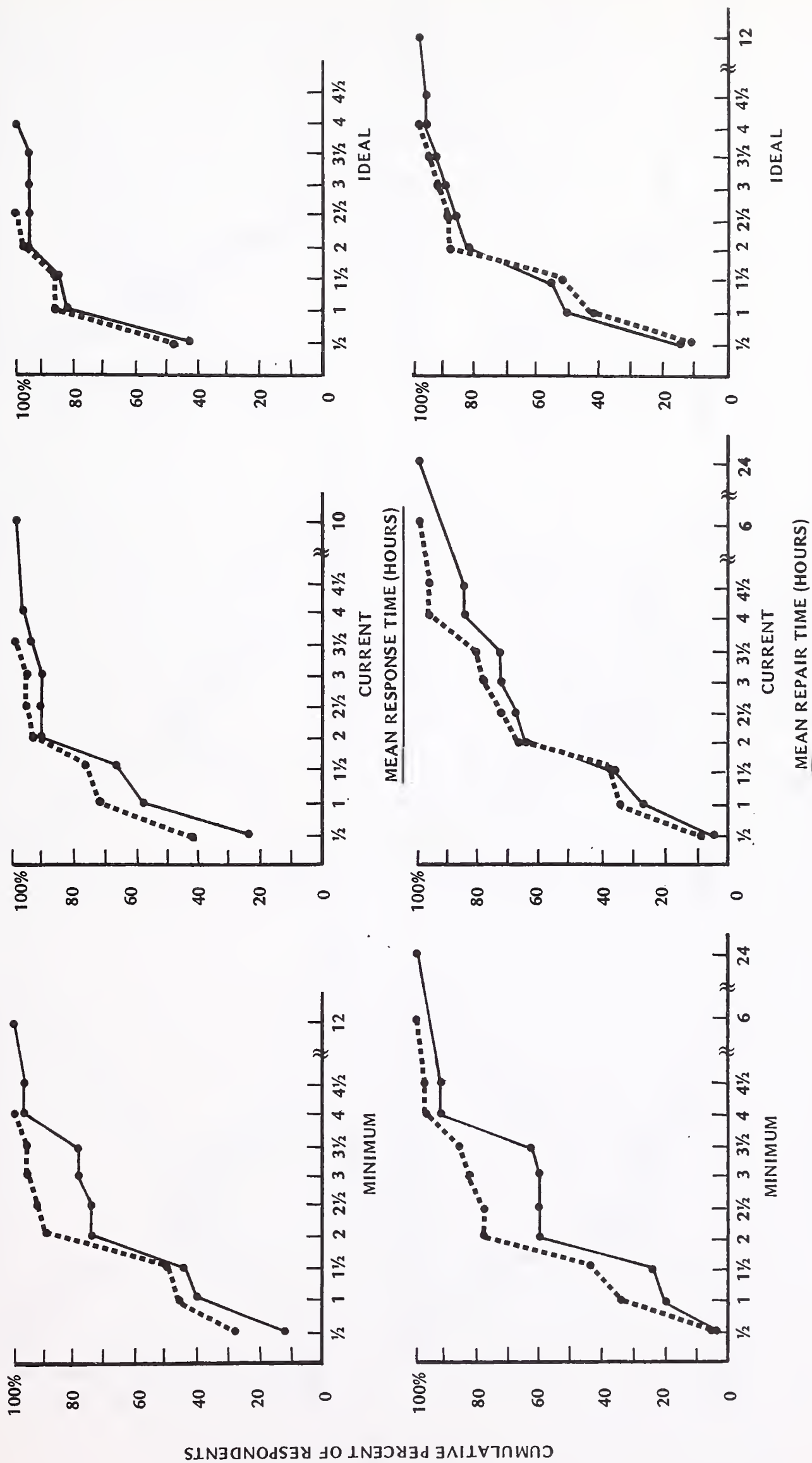
EXHIBIT A-18

PERCENT UPTIME VERSUS NUMBER OF SHIFTS,
SYSTEMS SOFTWARE



EACH DOT REPRESENTS AN INDIVIDUAL USER RESPONSE.

MAINFRAMES, TIME TO RESPOND AND REPAIR, IBM AND OTHERS - USER RESPONSES

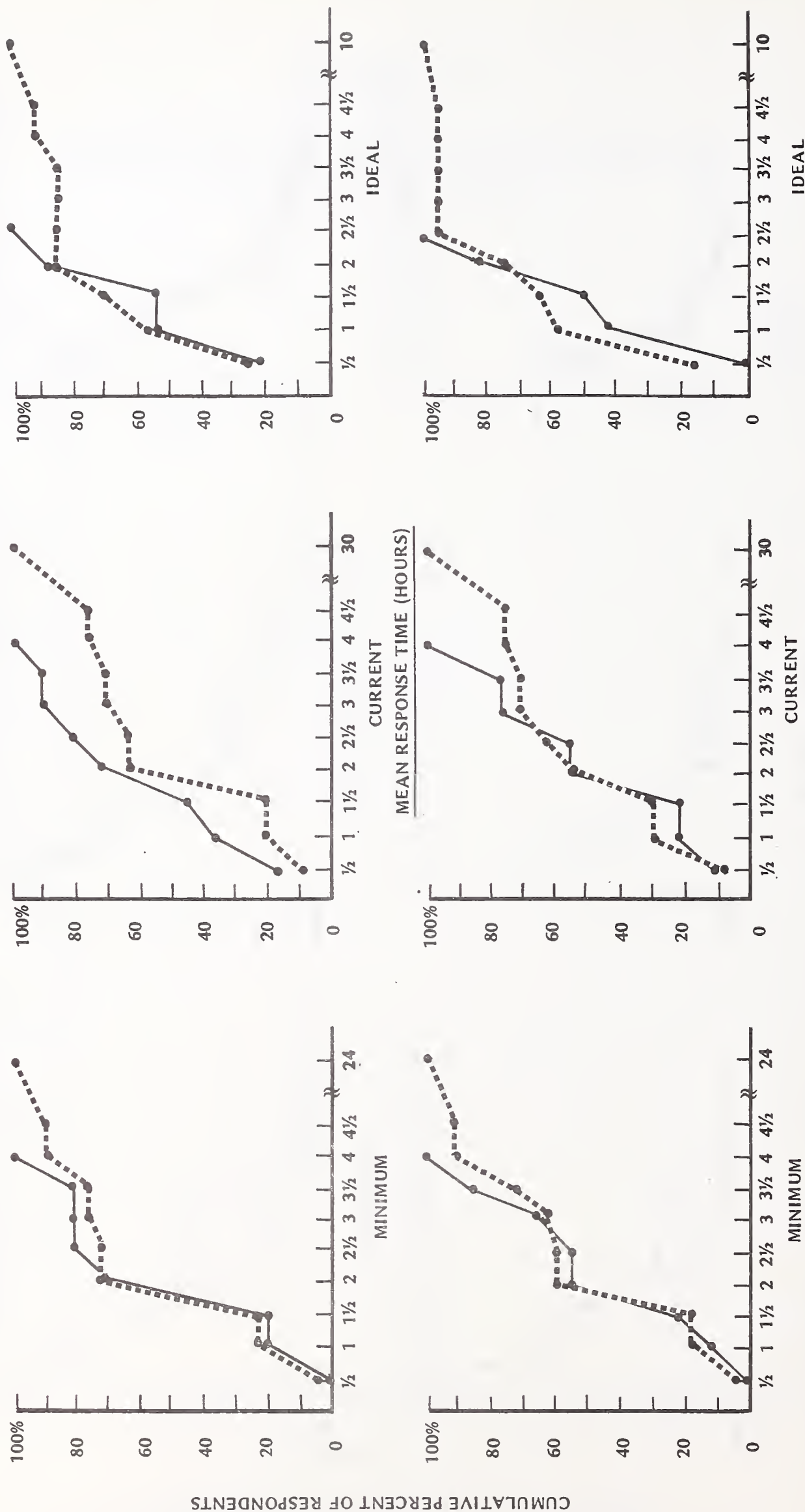


— IBM
- - - OTHER

EXHIBIT A-20

SMALL BUSINESS COMPUTERS, TIME TO RESPOND AND REPAIR, IBM AND OTHERS -

USER RESPONSES



MINICOMPUTERS, TIME TO RESPOND AND REPAIR, IBM AND OTHERS - USER RESPONSES

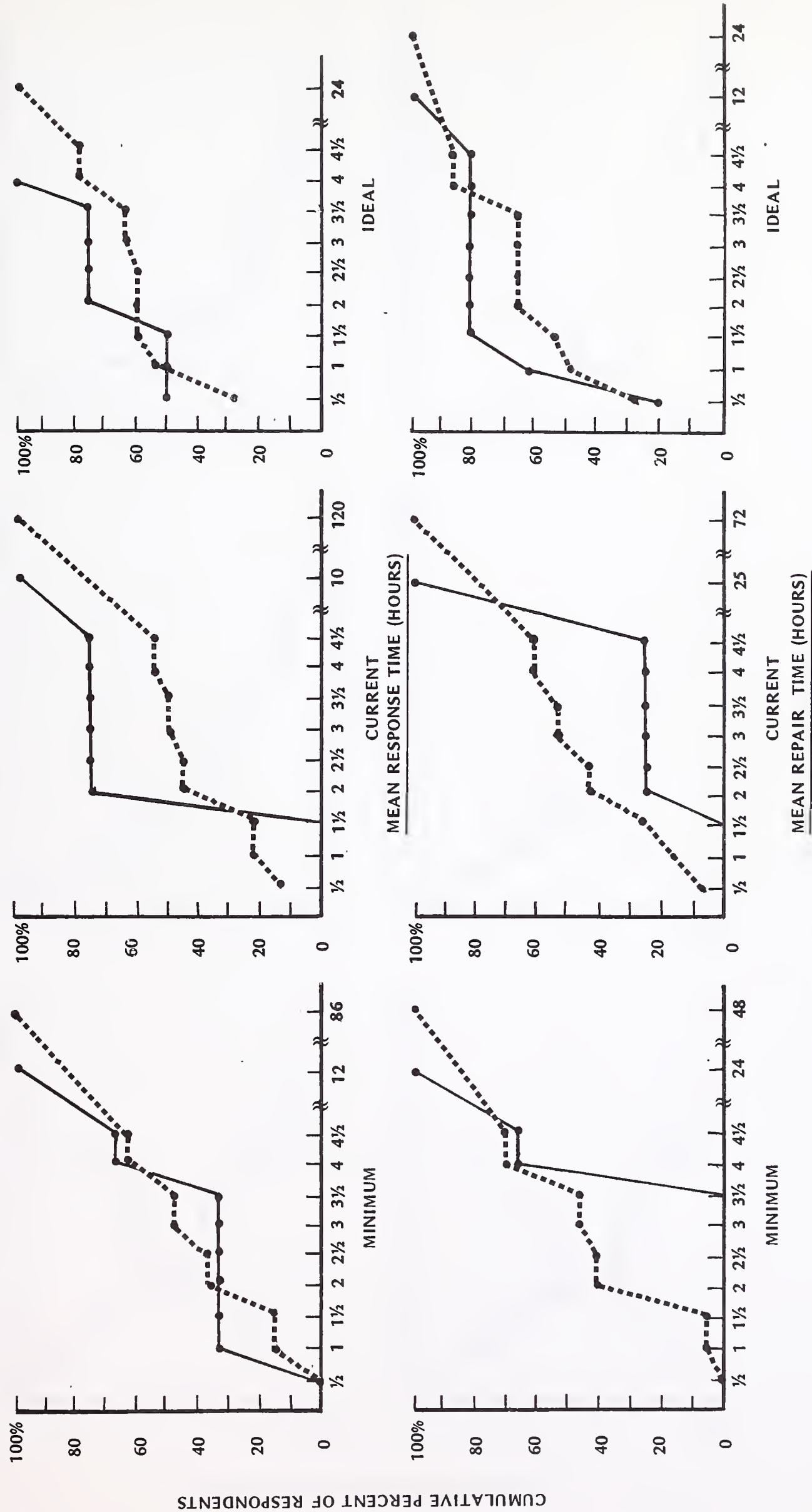
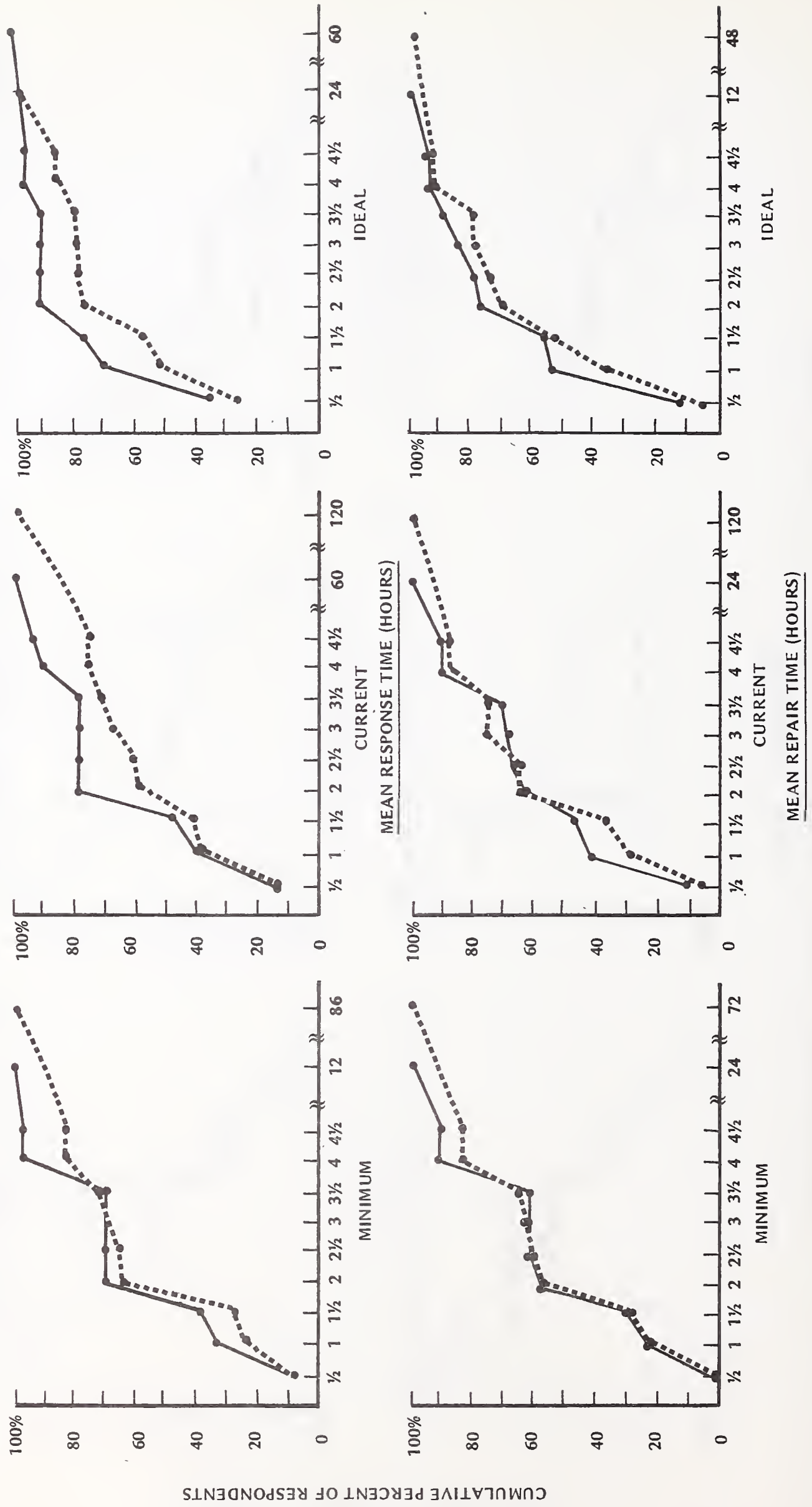


EXHIBIT A-22

PERIPHERALS, TIME TO RESPOND AND REPAIR, IBM AND OTHERS -

USER RESPONSES



DATA TERMINALS, TIME TO RESPOND AND REPAIR, IBM AND OTHERS --
USER RESPONSES

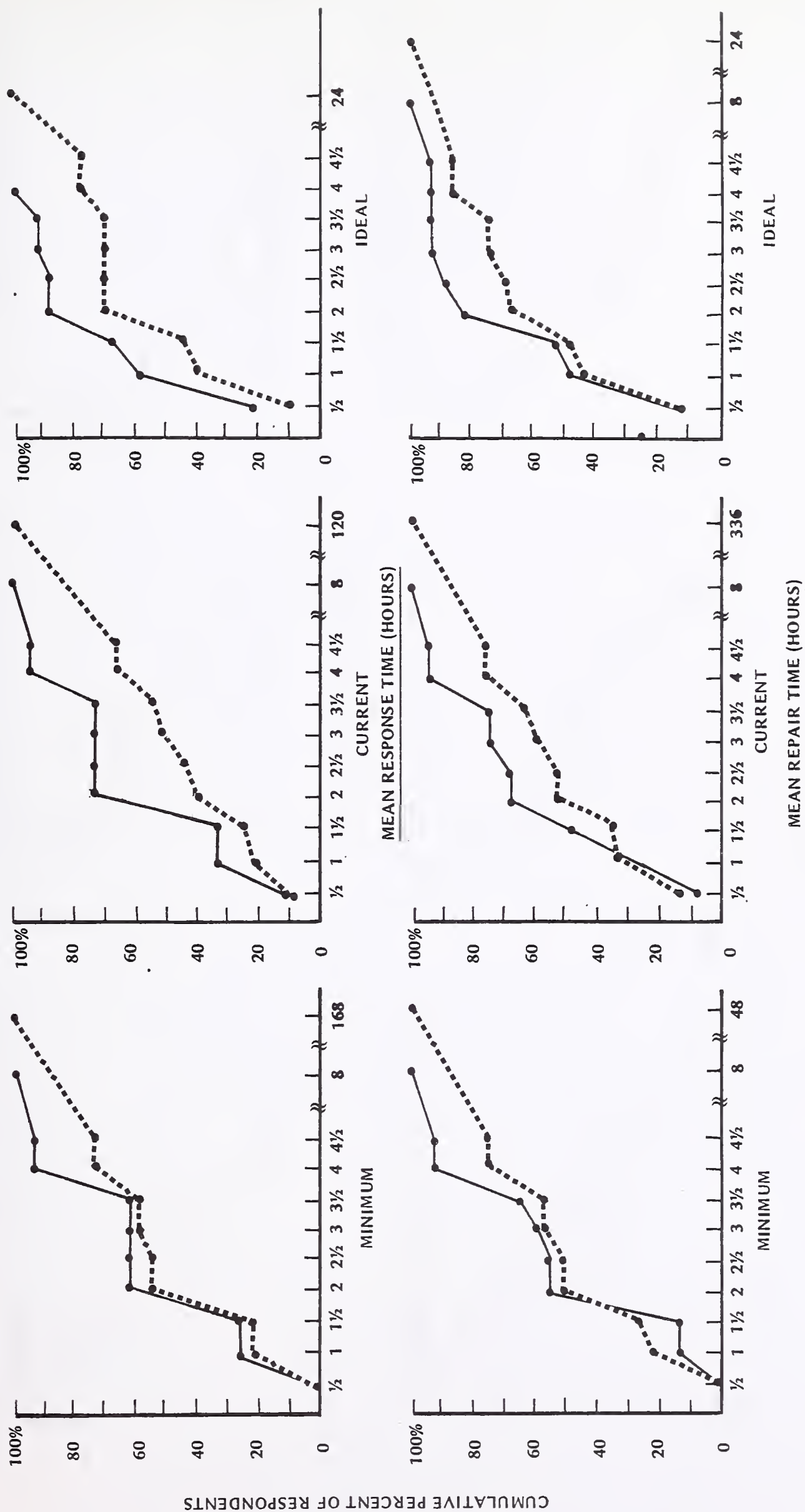
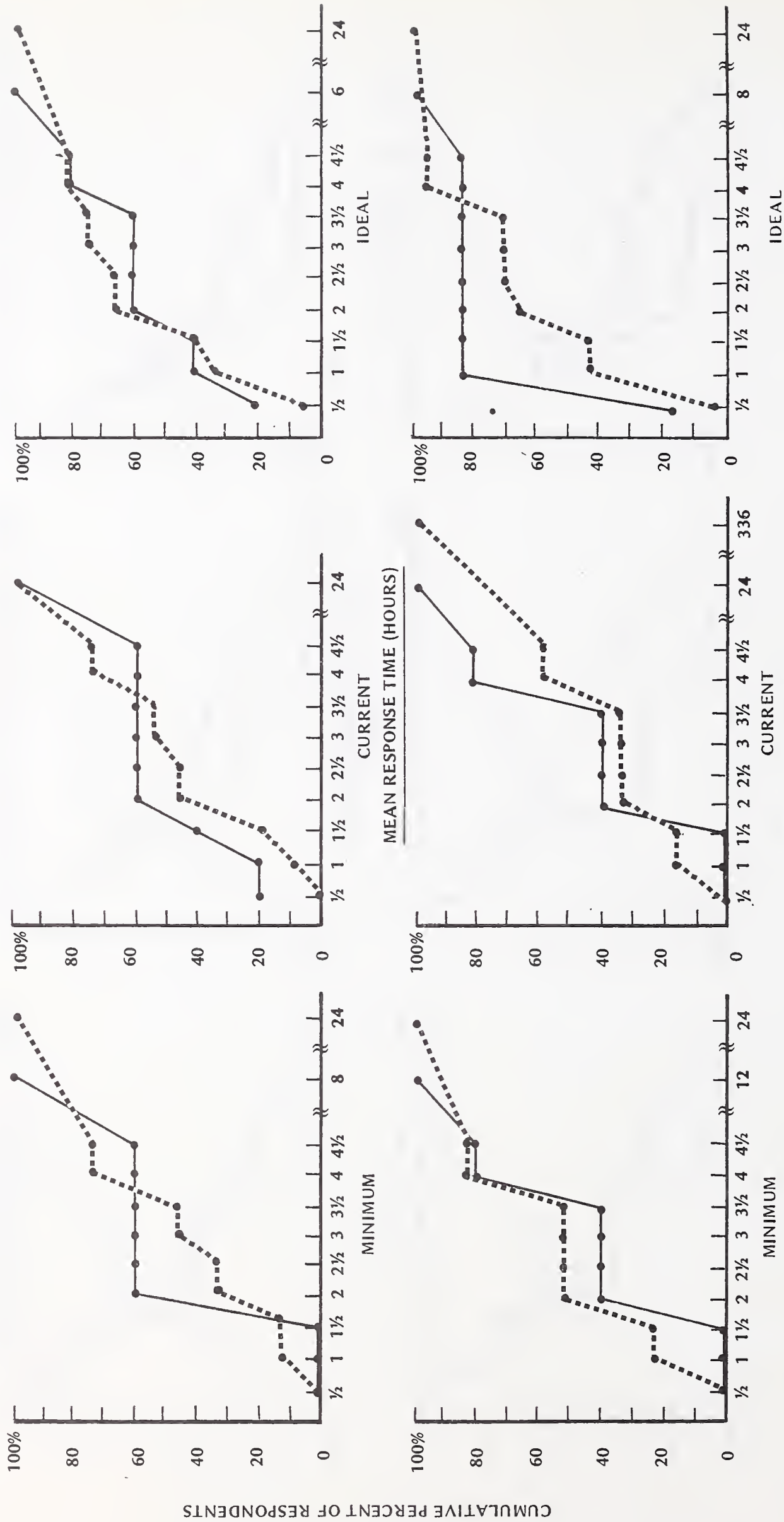


EXHIBIT A-24

WORD PROCESSING TERMINALS, TIME TO RESPOND AND REPAIR, IBM AND OTHERS - USER RESPONSES



— IBM
- - - OTHER

APPENDIX B: VENDOR SALARY INFORMATION

EXHIBIT B-1

ANNUAL SALARY RANGES

(\$ thousands)

RANDOM COMPANY NUMBER	FE TRAINEE				QUALIFIED FE				SENIOR FE			
	1980		1981		1980		1981		1980		1981	
	FROM	TO	FROM	TO	FROM	TO	FROM	TO	FROM	TO	FROM	TO
1	\$12.3	\$17.3	\$12.0	\$20.7	\$15.5	\$21.8	\$14.9	\$25.9	\$17.8	\$25.0	\$16.6	\$29.2
2	12.0	14.0	13.0	15.0	15.0	18.0	16.0	19.0	19.0	21.0	20.0	23.0
3	12.6	18.6	14.4	20.0	14.3	21.1	15.9	23.1	17.3	25.4	19.0	28.1
4	10.6	15.9	11.0	16.5	12.0	25.1	14.6	22.0	15.9	23.9	16.5	24.7
6	10.4	15.6	10.4	15.6	12.3	21.7	12.3	21.7	17.1	25.7	17.1	25.7
8	12.0	17.0	13.2	19.8	14.2	21.2	16.2	24.2	16.5	25.7	19.4	29.2
11	12.0	16.2	12.0	16.2	13.2	18.6	13.2	18.6	18.0	26.4	18.0	26.4
12	11.8	16.6	13.3	18.7	13.5	18.9	15.2	21.2	15.4	21.5	17.3	24.2
13	11.4	16.0	12.5	17.6	15.3	22.3	16.9	24.4	17.4	24.9	19.2	27.9
14	10.8	18.7	N/A	N/A	13.0	20.3	N/A	N/A	14.4	25.6	N/A	N/A
15	11.0	14.0	-	-	13.0	18.0	-	-	16.0	25.0	-	-
17	12.8	18.6	12.8	19.8	16.0	23.5	16.0	25.1	18.2	27.0	18.2	28.8
18	14.0	15.2	14.0	15.2	16.0	17.5	16.0	17.5	18.0	19.6	18.0	19.6
19	12.2	17.1	13.1	19.0	16.6	23.3	17.8	26.6	18.2	26.5	19.4	29.8

(DATA MASKED TO PROTECT RESPONDENTS)

(CONTINUED)

EXHIBIT B-1 (CONT.)

ANNUAL SALARY RANGES

(\$ thousands)

RANDOM COMPANY NUMBER	SOFTWARE FE				HARDWARE FIELD SPECIALIST				SOFTWARE FIELD SPECIALIST			
	1980		1981		1980		1981		1980		1981	
	FROM	TO	FROM	TO	FROM	TO	FROM	TO	FROM	TO	FROM	TO
1	N/A	N/A	N/A	N/A	\$18.5	\$29.3	\$20.3	\$32.2	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	22.0	25.0	23.0	27.0	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	18.5	27.8	20.3	30.7	\$18.5	\$27.8	\$20.3	\$30.7
4	N/A	N/A	N/A	N/A	17.7	26.7	18.3	27.4	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	17.8	28.5	17.8	28.5	N/A	N/A	N/A	N/A
8	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	17.4	23.7	19.6	26.6	N/A	N/A	N/A	N/A
13	-	-	\$19.2	\$27.5	20.0	29.3	21.8	31.7	-	-	21.8	31.7
14	-	-	-	-	-	-	-	-	-	-	-	-
15	\$13.0	\$23.0	-	-	18.0	30.0	-	-	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A	20.8	31.0	20.8	33.0	N/A	N/A	N/A	N/A
18	20.0	21.8	20.0	21.8	22.0	24.0	22.0	24.0	22.0	24.0	22.0	24.0
19	-	-	-	-	-	-	-	-	-	-	-	-

(DATA MASKED TO PROTECT RESPONDENTS)

(CONTINUED)

EXHIBIT B-1 (CONT.)

ANNUAL SALARY RANGES

(\$ thousands)

RANDOM COMPANY NUMBER	REGION SUPPORT SPECIALIST (EXEMPT)				REGION SUPPORT SPECIALIST (NON-EXEMPT)				HQ SUPPORT SPECIALIST			
	1980		1981		1980		1981		1980		1981	
	FROM	TO	FROM	TO	FROM	TO	FROM	TO	FROM	TO	FROM	TO
1	\$21.1	\$33.8	\$23.2	\$37.2	N/A	N/A	N/A	N/A	\$21.1	\$33.8	\$23.2	\$37.2
2	22.0	25.0	23.0	27.0	N/A	N/A	N/A	N/A	25.0	28.0	27.0	30.0
3	-	-	-	-	\$20.4	\$30.5	\$22.6	\$35.0	20.4	30.5	22.6	35.6
4	N/A	N/A	N/A	N/A	21.9	32.9	21.9	30.6	19.3	29.0	20.1	30.1
6	19.3	30.8	19.3	30.8	N/A	N/A	N/A	N/A	22.1	35.4	22.1	35.4
8	21.2	32.8	23.5	36.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11	-	-	-	-	-	-	-	-	-	-	-	-
12	19.3	28.5	21.0	31.0	-	-	-	-	21.0	31.0	23.0	34.0
13	24.3	35.6	25.1	36.7	-	-	-	-	23.3	34.0	25.1	36.7
14	20.1	37.5	N/A	N/A	15.5	25.6	N/A	N/A	-	-	-	-
15	-	-	-	-	-	-	-	-	25.0	42.0	-	-
17	-	-	-	-	-	-	-	-	23.0	35.8	23.0	38.1
18	25.0	27.0	25.0	27.0	-	-	-	-	26.0	28.0	26.0	28.0
19	N/A	N/A	23.1	32.4	20.8	30.4	21.6	32.0	-	-	-	-

(DATA MASKED TO PROTECT RESPONDENTS)

(CONTINUED)

EXHIBIT B-1 (CONT.)

ANNUAL SALARY RANGES

(\$ thousands)

RANDOM COMPANY NUMBER	FIRST LINE MANAGER				SECOND LEVEL MANAGER				REGION MANAGER			
	1980		1981		1980		1981		1980		1981	
	FROM	TO	FROM	TO	FROM	TO	FROM	TO	FROM	TO	FROM	TO
1	\$29.8	\$48.1	\$24.8	\$39.8	\$36.4	\$57.0	\$32.1	\$51.8	\$37.5	\$70.2	\$43.2	\$75.8
2	22.0	25.0	24.0	28.0	25.0	28.0	27.0	32.0	32.0	36.0	33.0	38.0
3	24.8	39.2	27.0	43.2	30.2	51.4	33.1	56.3	43.6	70.4	43.6	70.4
4	20.0	30.1	21.9	32.8	N/A	N/A	23.9	35.9	29.5	44.3	32.1	42.3
6	N/A	N/A	N/A	N/A	24.9	40.0	24.9	40.0	28.9	46.2	28.9	46.2
8	23.2	35.8	25.8	40.2	N/A	N/A	N/A	N/A	30.5	48.3	33.7	53.7
11	N/A	N/A	N/A	N/A	-	-	-	-	N/A	N/A	N/A	N/A
12	21.0	36.0	23.0	39.0	27.0	54.0	29.0	59.0	44.0	67.0	48.0	73.0
13	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-
15	18.0	30.0	-	-	28.0	45.0	-	-	32.0	51.0	-	-
17	23.0	35.8	23.0	38.1	27.4	43.1	27.4	45.8	36.2	57.7	36.2	61.3
18	28.0	30.0	28.0	30.0	28.0	30.0	28.0	30.0	32.0	35.0	32.0	35.0
19	N/A	N/A	23.1	36.3	N/A	N/A	27.3	43.3	-	-	-	-

(DATA MASKED TO PROTECT RESPONDENTS)

(CONTINUED)

EXHIBIT B-1 (CONT.)

ANNUAL SALARY RANGES

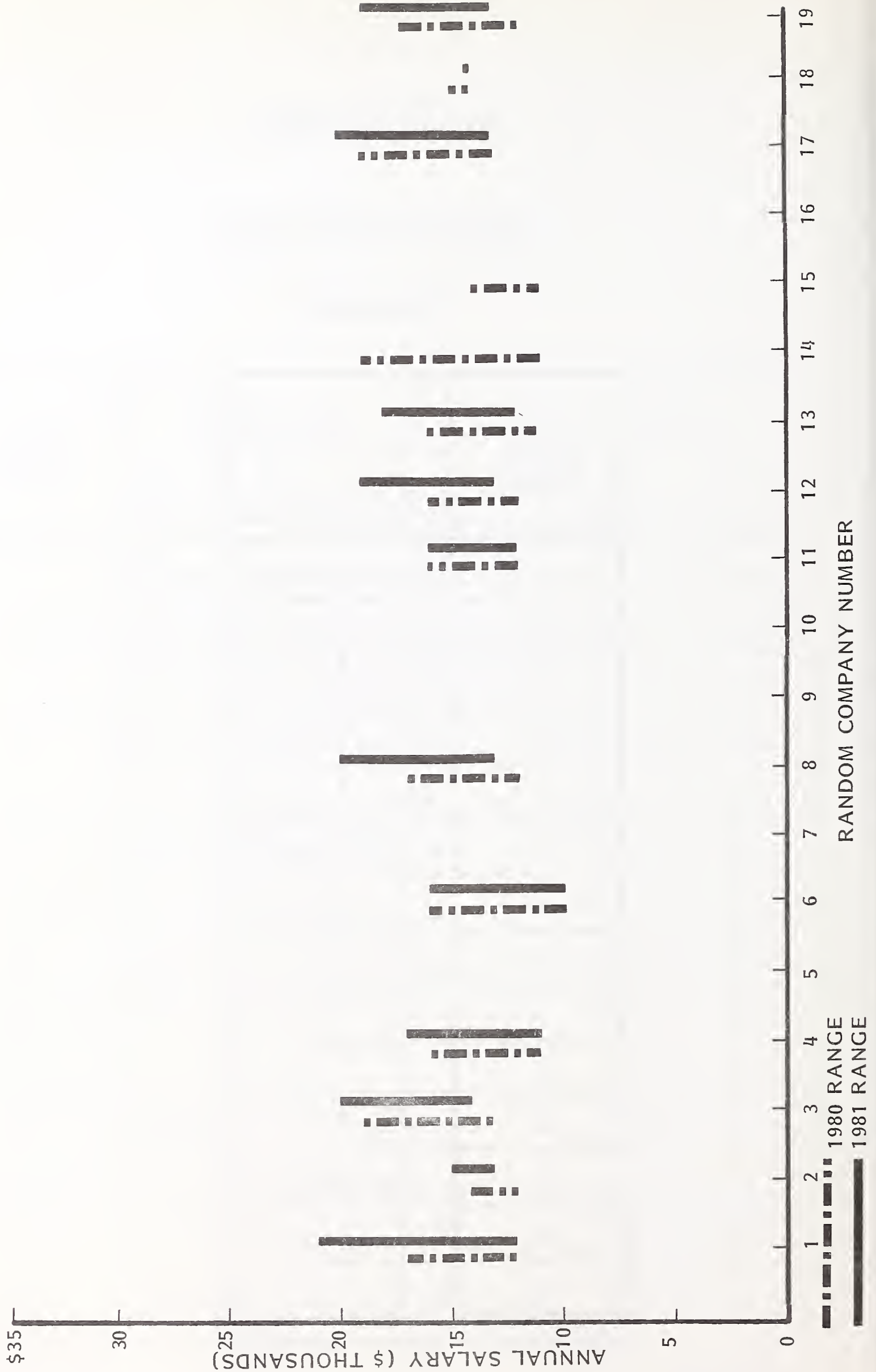
(\$ thousands)

RANDOM COMPANY NUMBER	STAFF MANAGER			
	1980		1981	
	FROM	TO	FROM	TO
1	\$37.5	\$70.2	\$43.2	\$75.8
2	28.0	32.0	30.0	34.0
3	32.7	55.4	39.5	60.9
4	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A
8	N/A	N/A	N/A	N/A
11	25.0	45.0	25.0	45.0
12	32.0	54.0	35.0	59.0
13	-	-	-	-
14	-	-	-	-
15	35.0	57.0	-	-
17	N/A	N/A	N/A	N/A
18	33.0	35.0	33.0	35.0
19	-	-	-	-

(DATA MASKED TO PROTECT RESPONDENTS)

EXHIBIT B-2

ANNUAL SALARY RANGE, FIELD ENGINEER TRAINEE



ANNUAL SALARY RANGE, QUALIFIED FIELD ENGINEER

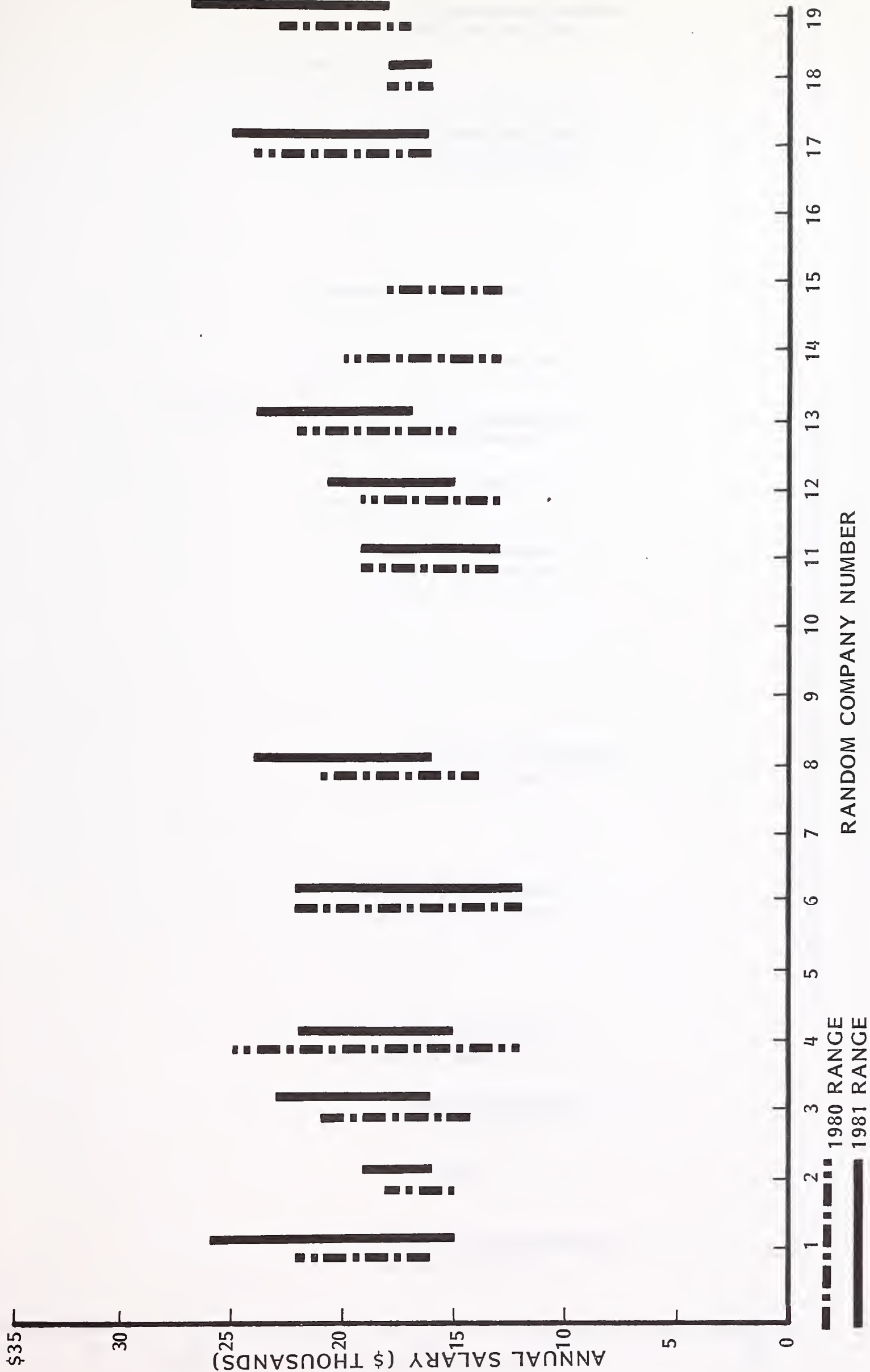
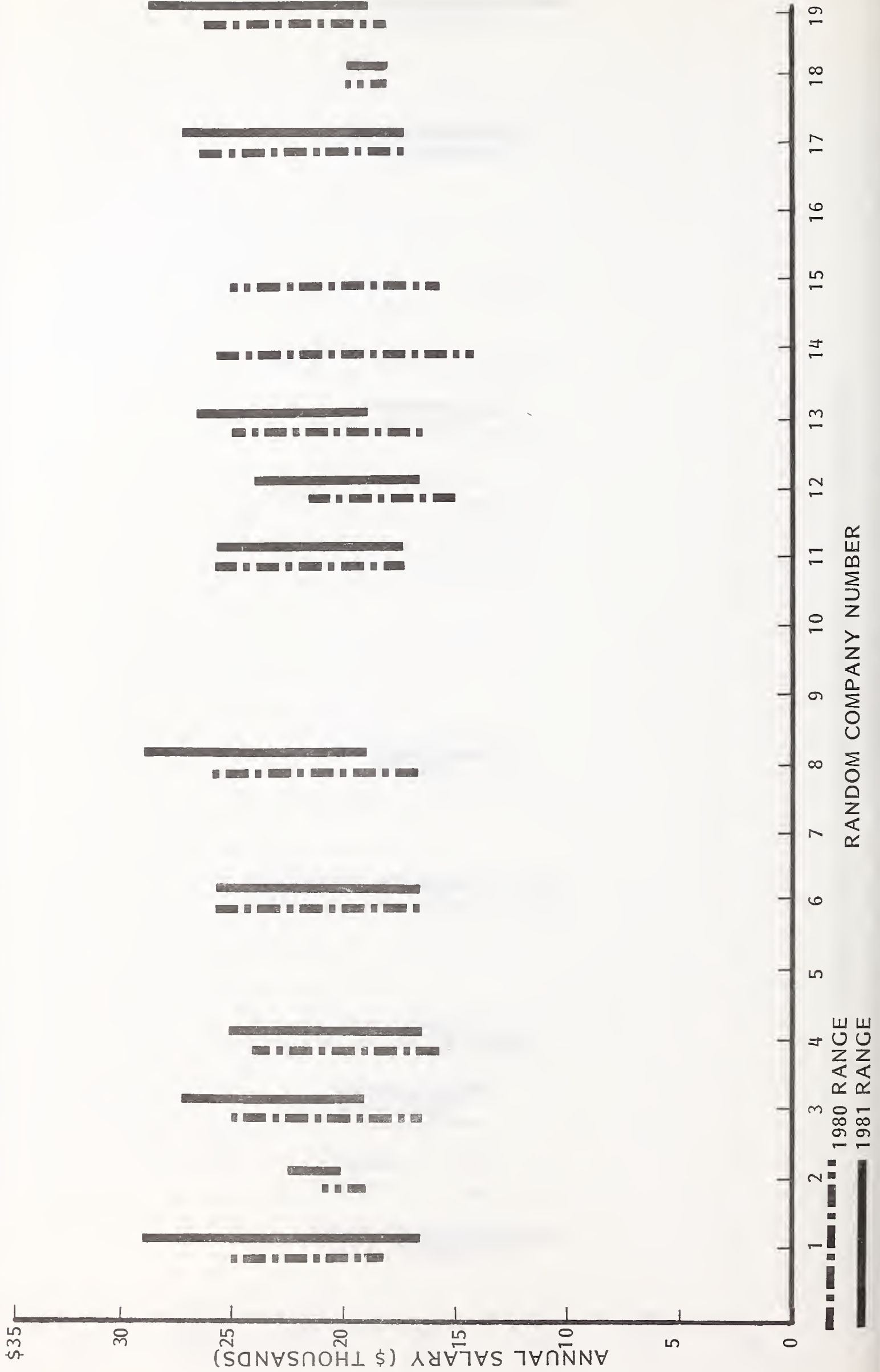


EXHIBIT B-4

ANNUAL SALARY RANGE, SENIOR FIELD ENGINEER



ANNUAL SALARY RANGE, SOFTWARE FIELD ENGINEER

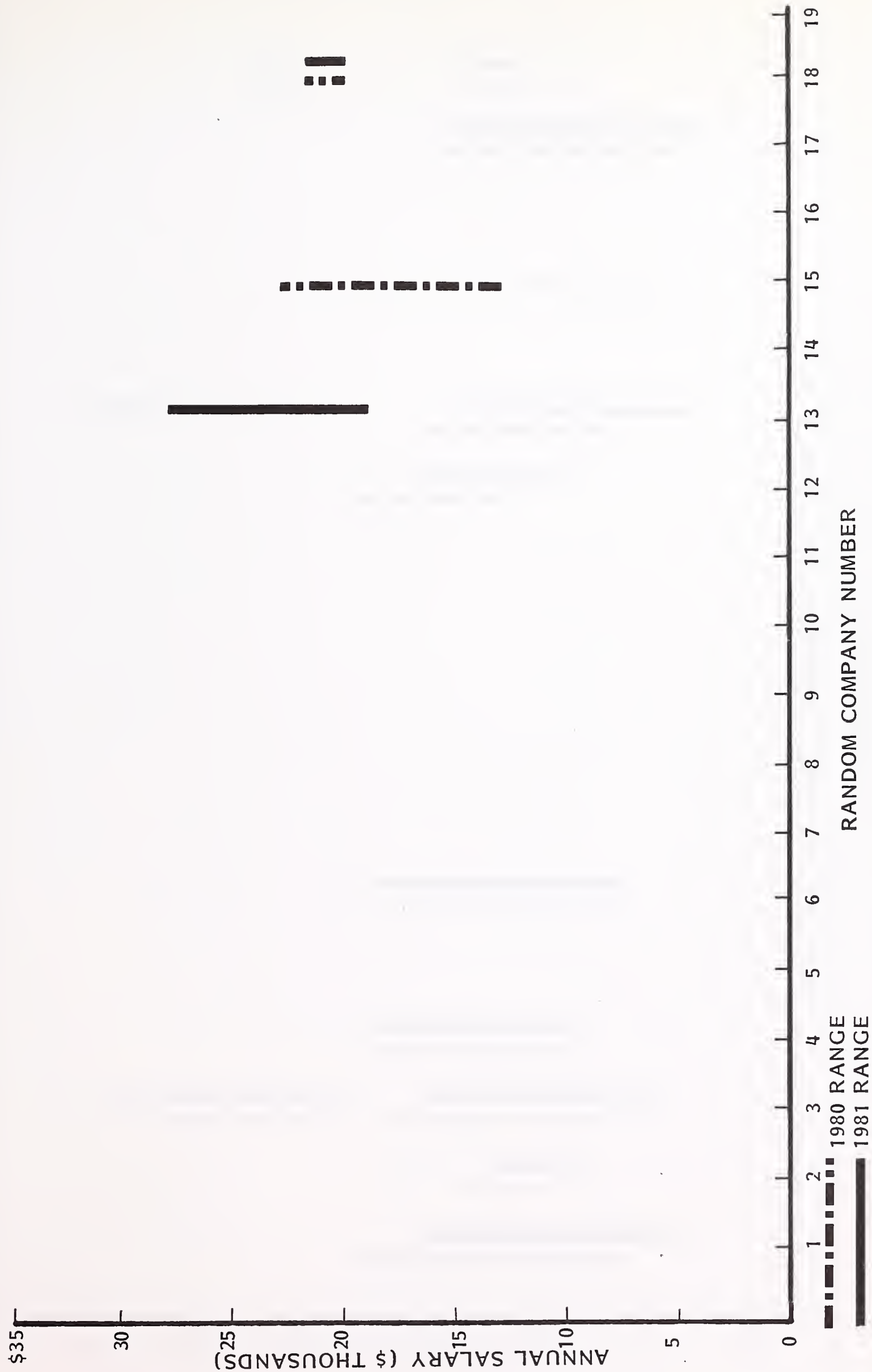
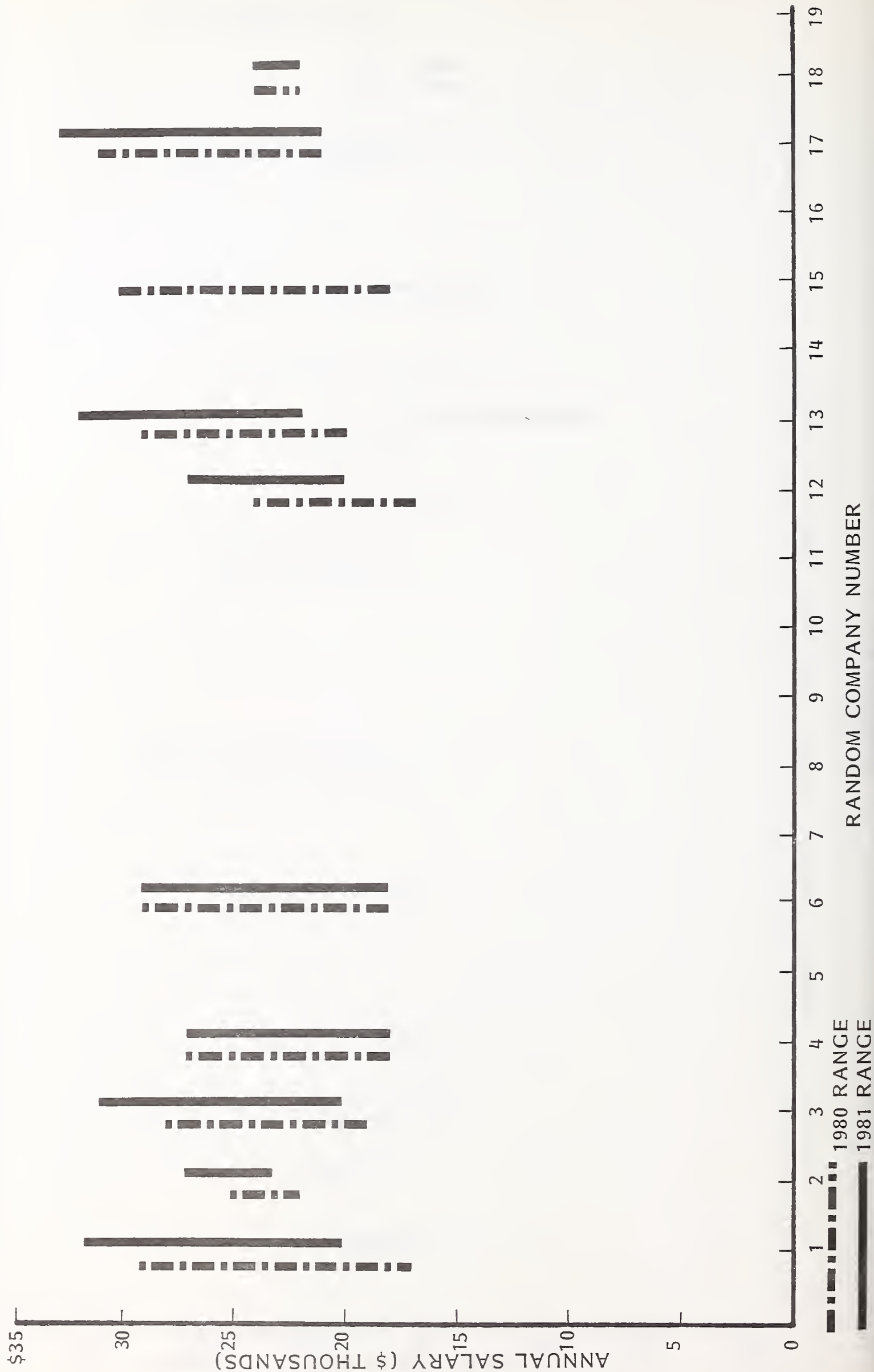


EXHIBIT B-6

ANNUAL SALARY RANGE, HARDWARE FIELD SPECIALIST

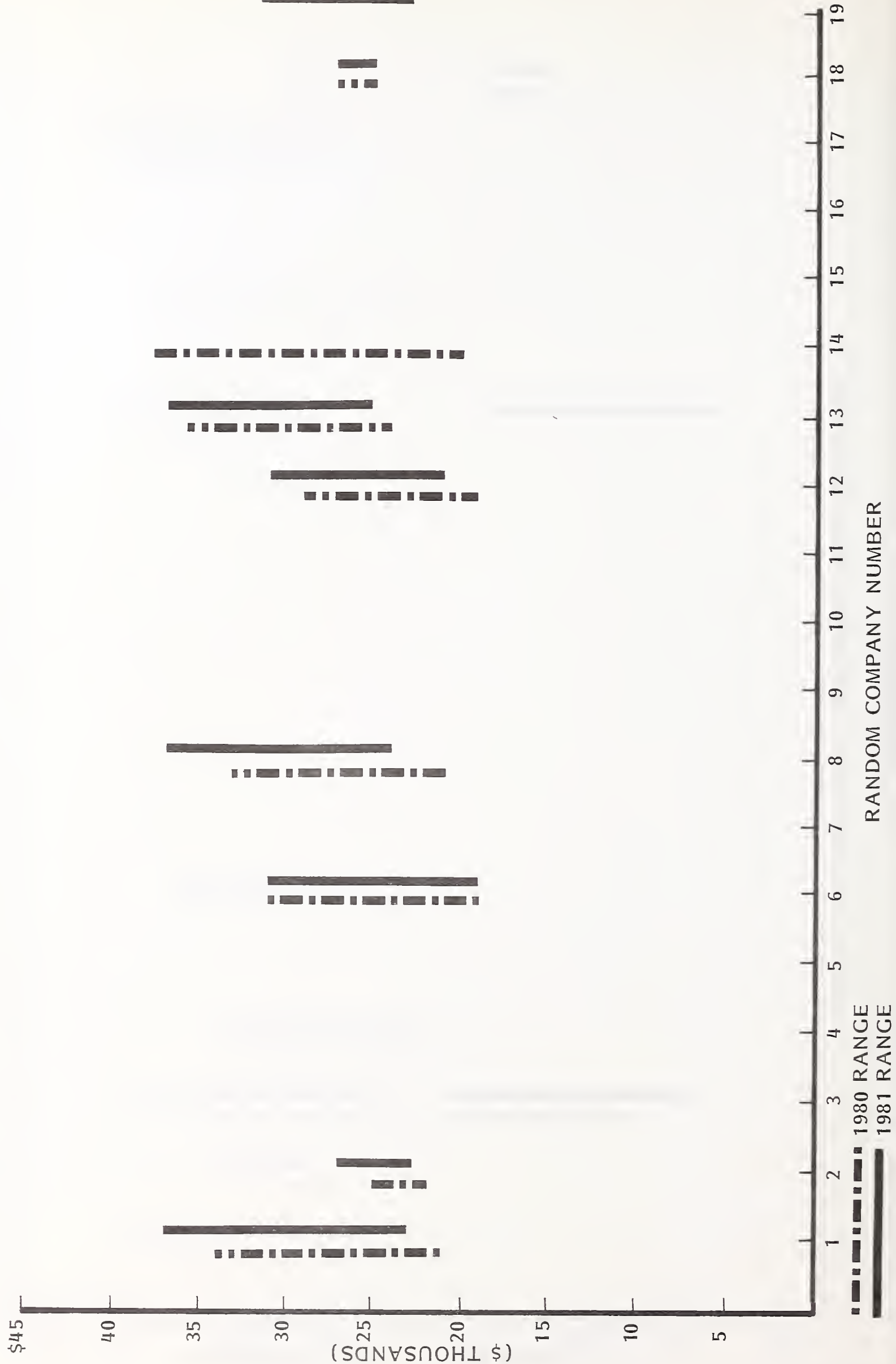


ANNUAL SALARY RANGE, SOFTWARE FIELD SPECIALIST



EXHIBIT B-8

ANNUAL SALARY RANGE, REGION SUPPORT SPECIALIST (EXEMPT)



ANNUAL SALARY RANGE, REGION SUPPORT SPECIALIST (NON-EXEMPT)

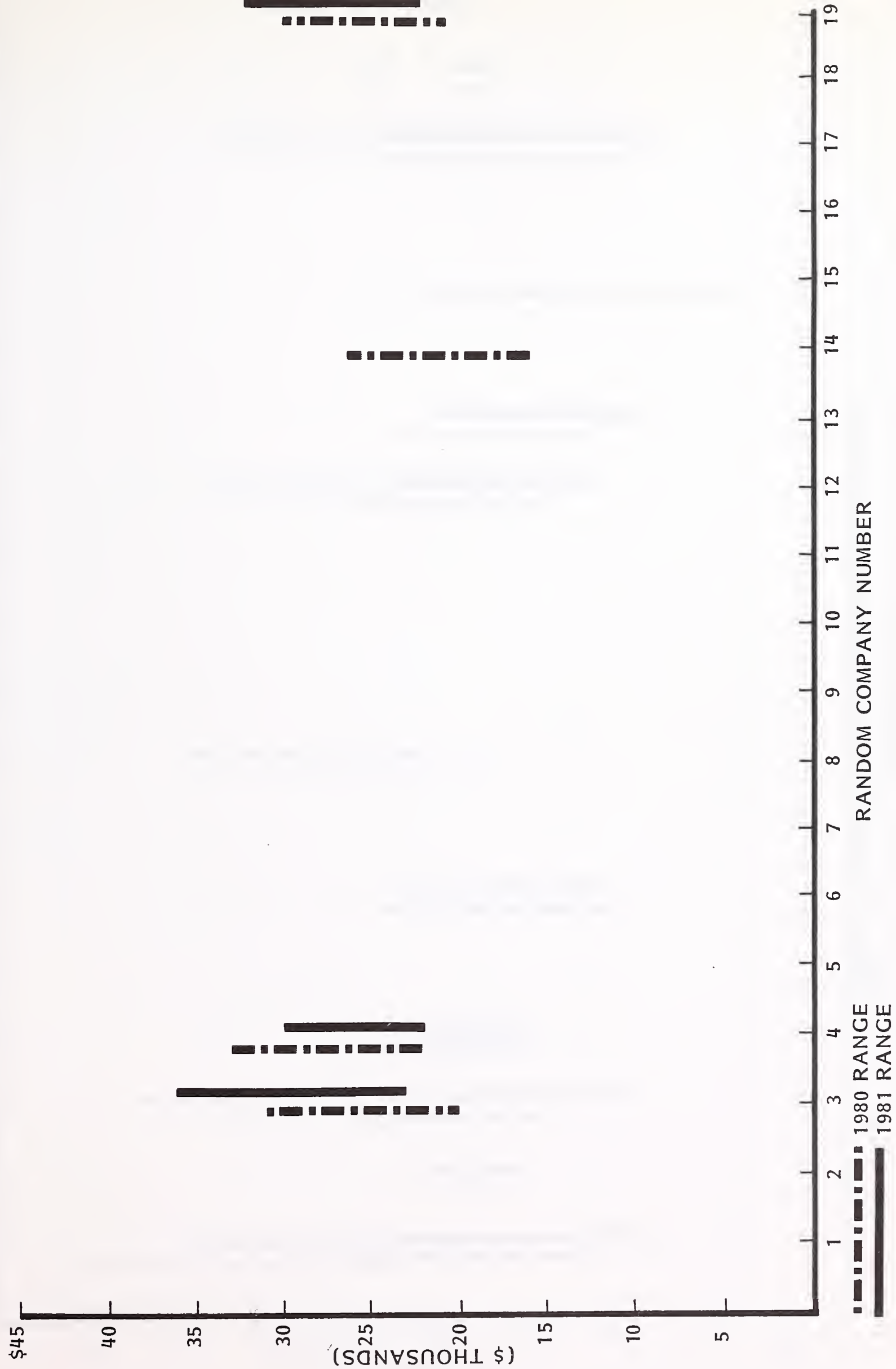
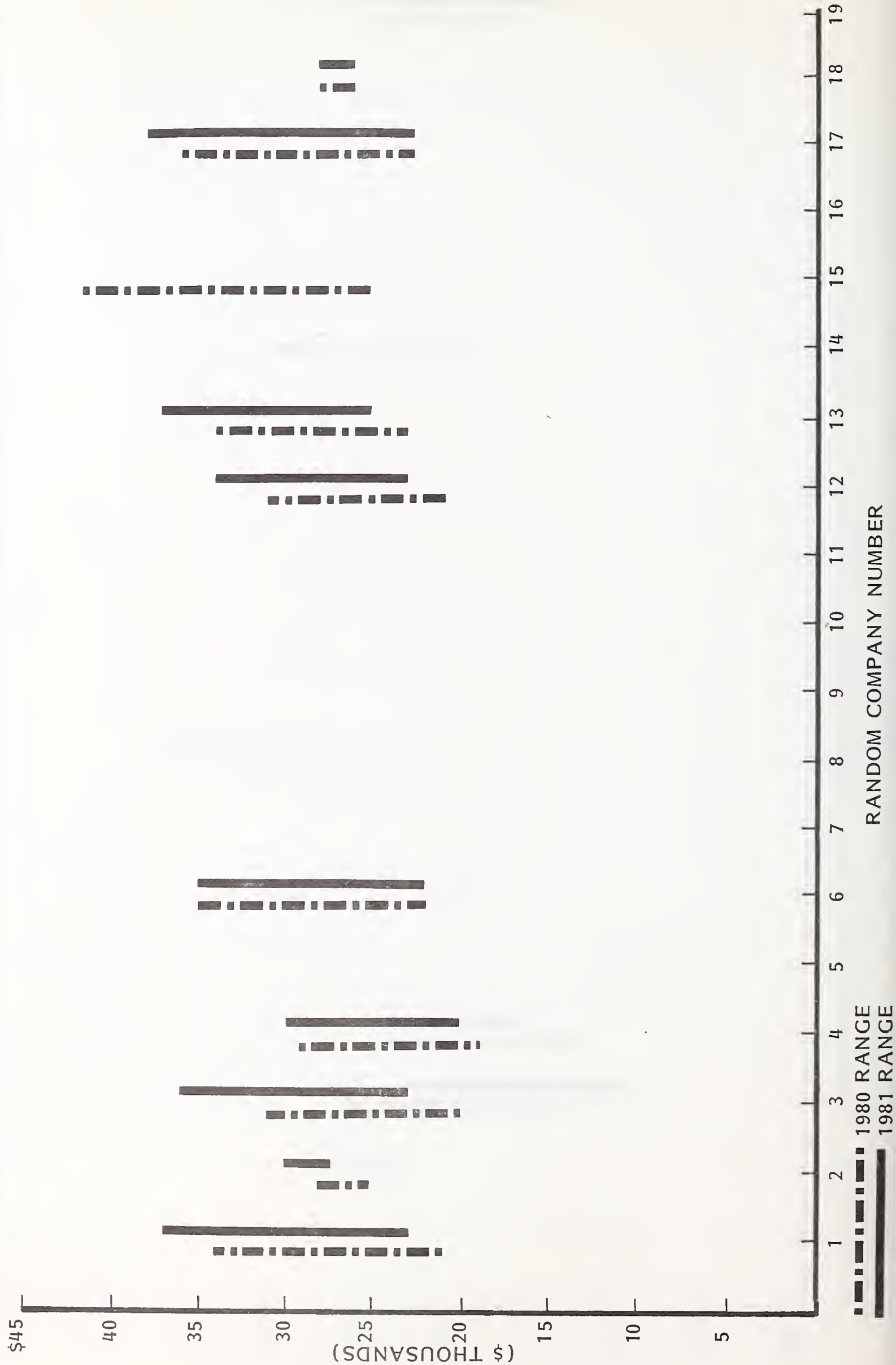


EXHIBIT B-10

ANNUAL SALARY RANGE, HQ SUPPORT SPECIALIST



ANNUAL SALARY RANGE, FIRST LINE MANAGER

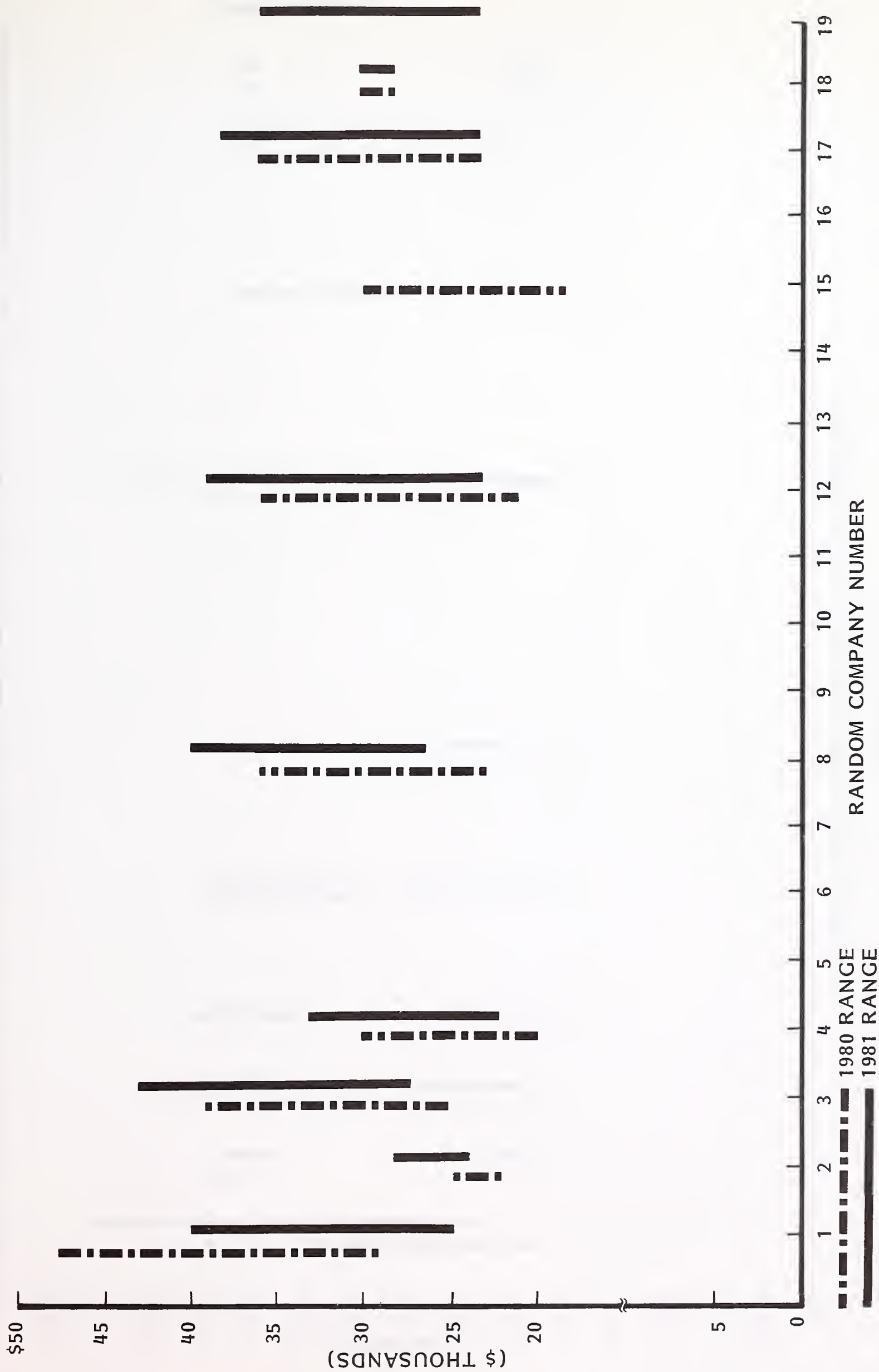
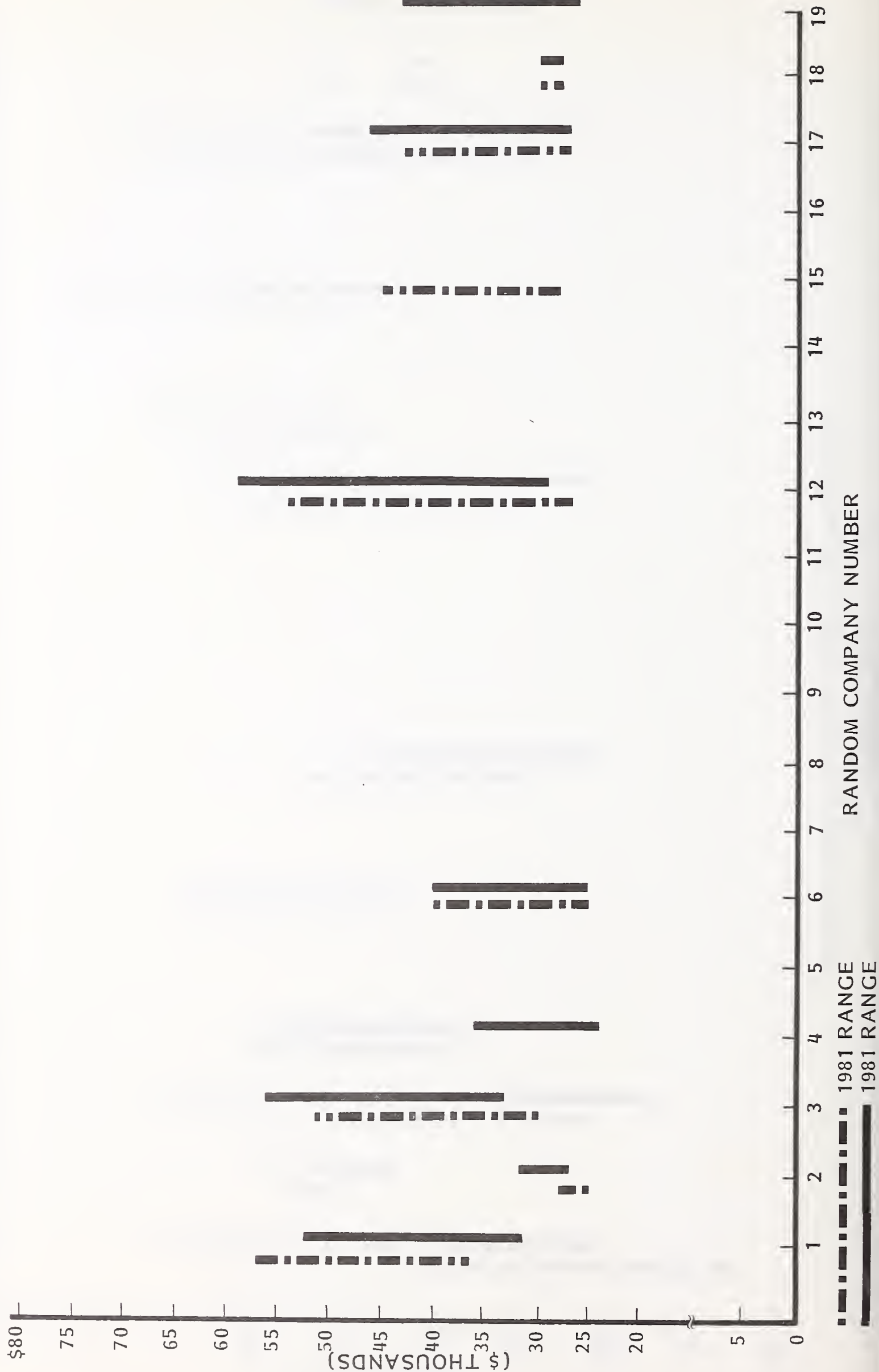


EXHIBIT B-12 ANNUAL SALARY RANGE, SECOND LEVEL MANAGER



ANNUAL SALARY RANGE, REGION MANAGER

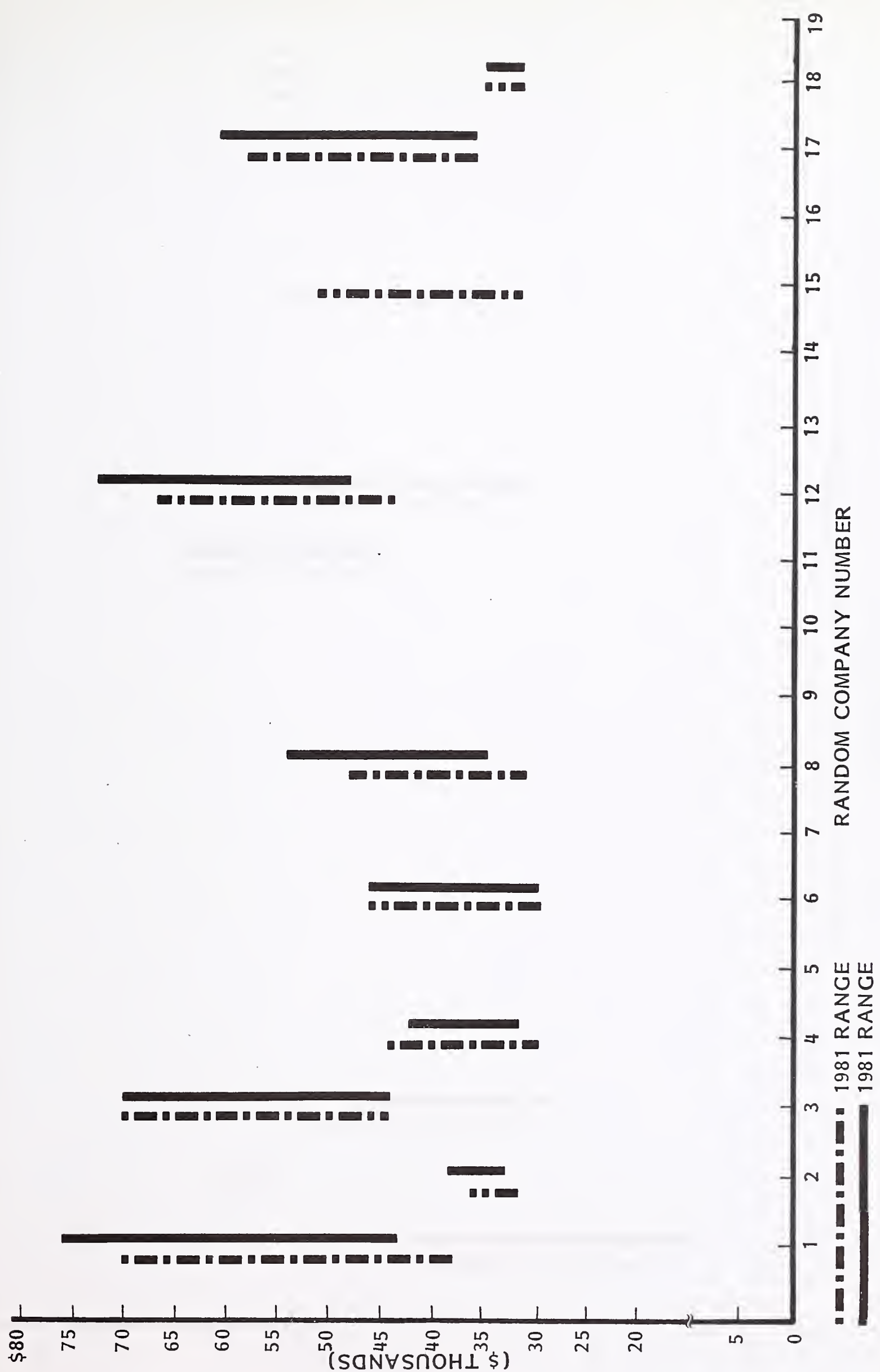
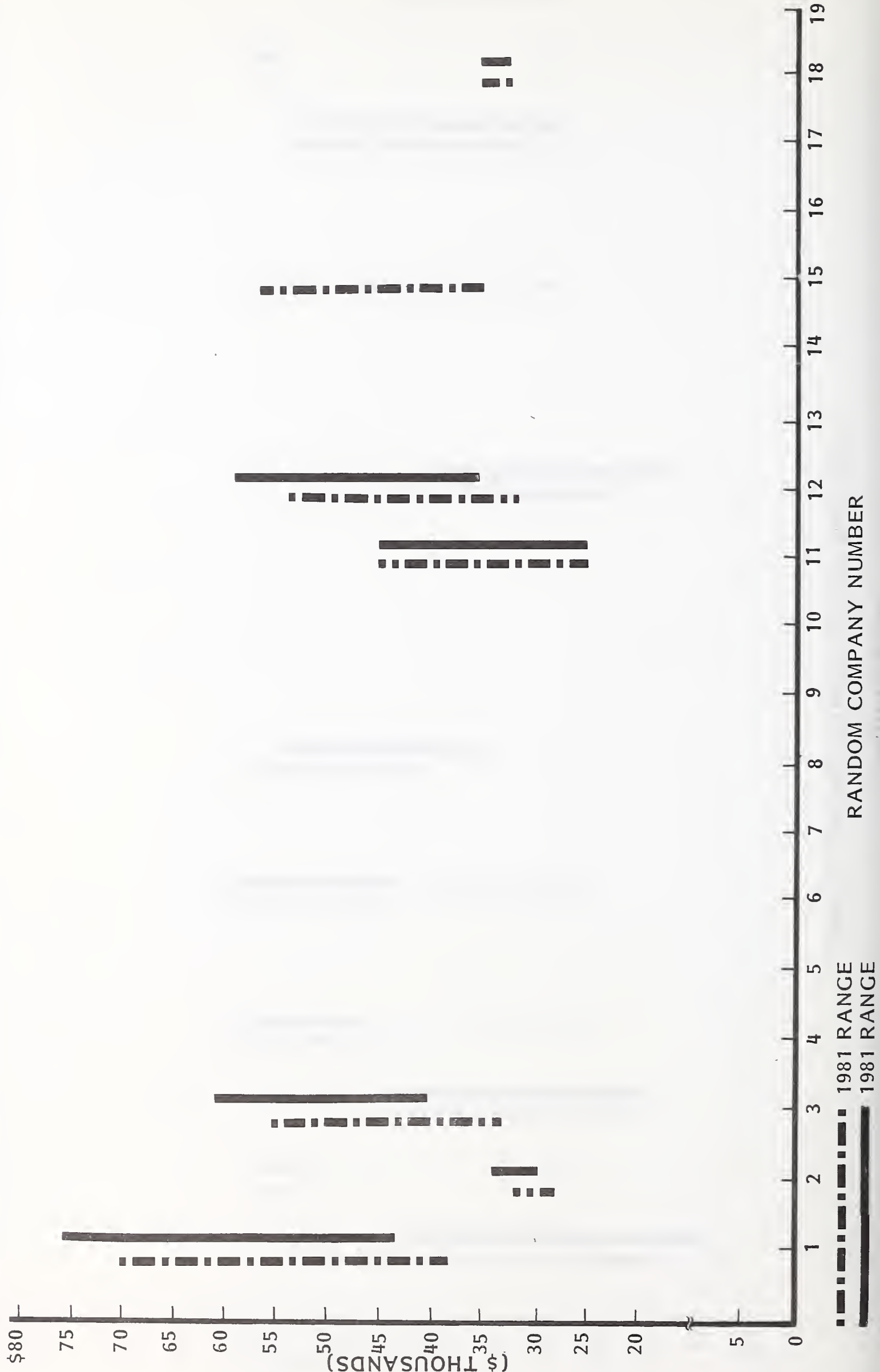


EXHIBIT B-14

ANNUAL SALARY RANGE, STAFF MANAGER



APPENDIX C: DEFINITIONS

APPENDIX C: DEFINITIONS

- DISTRIBUTED DATA PROCESSING - Distributed processing is the deployment of programmable intelligence in order to perform data processing functions where they can be accomplished most effectively, through the electronic interconnection of computers and terminals, arranged in a telecommunications network adapted to the user's characteristics.
- DISTRIBUTOR - Purchases the small business computer on an OEM basis from the manufacturer and markets it to the end user. It may or may not provide a turnkey system.
- END USER - May buy a system from the hardware supplier(s) and do his own programming, interfacing and installation. Alternatively, he may buy a turnkey system from a systems house or hardware integrator.
- ENGINEERING CHANGE NOTICE (ECN) - Product changes to improve the product after it has been released to production.
- ENGINEERING CHANGE ORDER (ECO) - The follow-up to ECNs which include parts and a bill of material to effect the change in hardware.
- FIELD ENGINEER (FE) - For the purpose of this study, field engineer, customer engineer, serviceperson and maintenance person were used interchangeably and refer to the individual who responds to a user's service call to repair a device or system.

- HARDWARE INTEGRATOR - Develops system interface electronics and controllers for the CPU, sensors, peripherals and all other ancillary hardware components. He may also develop control system software in addition to installing the entire system at the end user site.
- MEAN TIME BETWEEN FAILURES (MTBF) - The elapsed time between hardware failures on a device or a system.
- MEAN TIME TO REPAIR - The elapsed time from the arrival of the field engineer on the user's site until the device is repaired and returned to the user for his utilization.
- MEAN TIME TO RESPOND- The elapsed time between the user placement of a service call and the arrival at the user's location of a field engineer.
- PERIPHERALS - Include all input, output and storage devices, other than main memory, which are locally connected to the main processor and are not generally included in other categories, such as terminals.
- SMALL BUSINESS COMPUTER - For the purpose of this study, is a system which is built around a Central Processing Unit (CPU), has the ability to utilize at least 20M bytes of disk capacity, provides multiple CRT work stations and offers business-oriented system software support.
- SOFTWARE PRODUCTS - Systems and applications packages, which are sold to computer users by equipment manufacturers, independent vendors and others. Also included are fees for work performed by the vendor to implement a package at the user's site.
- SYSTEMS HOUSE - Integrates hardware and software into a total turnkey system to satisfy the data processing requirements of the end user. He may also develop system software products for license to end users.

- TURNKEY SYSTEM - Composed of hardware and software integrated into a total system designed to completely fulfill the processing requirements of a single application.

APPENDIX D: USER QUESTIONNAIRE

USER QUESTIONNAIRE - FIELD SERVICE ANNUAL REPORT

1. Considering your total EDP installation, who is your dominant maintenance vendor?

2. For each of the following equipment classifications, please rate the quality of each vendor's equipment, software and maintenance. (On a scale of 0 - 10, 0 = poor and 10 = excellent)

Equipment Classification	Predominant Maintenance Vendor	Quality of Maintenance (0 - 10)	Quality of Hardware/ Software (0 - 10)	Vendor of Hardware/ Software	Up time	
					Percent-age	Number of shifts /week
Large and Medium Mainframes						
Small Business Computers						
Other Minis						
Peripherals (Tape, Disk, Printer)						
Data Terminals						
Word Processing Terminals						
System Software						
Applications Software						

3. For each equipment classification, please give the minimum acceptable, current and desired mean time to respond and repair. (In same vendor profile as previous question)

Equipment Classification	Current Mean Time between failures	Respond	TIME (in Hours)		Percentage more willing to pay to go from "current" to "ideal"	
		Repair	Minimum Acceptable	Current	Ideal	
Large and Medium Mainframes						%
Small Business Computers						%
Other Minis						%
Peripherals						%
Data Terminals						%
Word Processing Terminals						%
Facsimile						%
Systems Software						%
Applications Software						%

4.a. During the past two years, have you replaced, or are you currently replacing, any hardware due to poor maintenance?

Yes _____ No _____

b. If yes:

Hardware/software vendor: _____

Type of hardware/software: _____

Maintenance vendor: _____

Replaced or being replaced by: _____

c. Please give details of poor maintenance:

5. Who (by title) are the primary decision makers for equipment selection? Is this changing?

EQUIPMENT CLASSIFICATION	DECISION MAKERS (by title)		IF CHANGING, EXPLAIN
	PRIMARY	SECONDARY	
LARGE AND MEDIUM MAINFRAMES			
SMALL BUSINESS COMPUTERS			
OTHER MINIS			
PERIPHERALS			
DATA TERMINALS			
WORD PROCESSING TERMINALS			

Comments: _____

6. Please rate the importance of the following maintenance related issues (0 = not important, 10 = very important)

ISSUE	RATING	COMMENTS (i.e., is it becoming more important, etc.)
a. Equipment Reliability		
b. On-Site Field Engineers		
c. Response time		
d. Repair Time		
e. Support Centers		
f. Remote Diagnostics		
g. Escalation procedures		
h. Centralized FE dispatch		
i. Software maintenance		
j. Network Maintenance		
k. Multiple locations		
l. Price of maintenance		
m. Up Time		
n. Other (Describe)		

7. What guidelines do you use to evaluate the cost of maintenance?

8. At what percentage increase over current maintenance costs would you consider doing your own maintenance? _____%

a. Does this vary by equipment type? If so, describe: _____

9. Would you be interested in a vendor's presentation of their maintenance philosophy and plans for the future?

If no, explain: _____

If yes, please rate your interest in the following topics (0 = no interest, 10 = high interest)

	<u>Rating</u>
a. Methods for handling your multiple sites	_____
b. Vendor's future product plans	_____
c. Pricing alternatives	_____
d. Methods for improving vendor/user communication	_____
e. Methods for improving productivity	_____
f. Other (describe) _____	_____

Comments: _____

10. What maintenance needs or service requirements do you have that are not being met?

Thank You

APPENDIX E: VENDOR QUESTIONNAIRE

I. QUESTIONS FOR GENERAL MANAGER, SENIOR FIELD SERVICE EXECUTIVE

1. Please provide the title of your senior corporate executive for field service.

- a. To whom does this position now report?

_____ (1981)

- b. To whom will this position report in:

1982? _____

1984? _____

1986? _____

2. We are interested in determining which major field service functions are performed by the field service department. If the function is not applicable or is performed by another department, please explain. Extra space is provided to record exceptions, such as splitting of a major functional responsibility between field service and other departments.

FUNCTION (Check if performed by Field Service Dept.)	NOT APPLICABLE (explain)	PERFORMED BY OTHER DEPARTMENT FOR FIELD SERVICE (Please specify)
a) Personnel		
b) Financial Planning and Measurements		
c) Accounting		
d) Education 1. Internal Education 2. Client Education		
e) Technical Support		
f) Spare Parts Logistics 1. Manual System 2. Automated System		
g) Documentation development		
h) Documentation printing		
i) Administrative support		
j) Sale of Maintenance		

Other Comments: _____

3. Please review the major business functions in question #2 above which are now performed by other departments and project those which will be performed by field service in 1983.

4. Please project the field service organization as a profit and loss center or cost center in the space below.

	1981	1983	1986
PROFIT AND LOSS			
COST CENTER			
OTHER: (Specify) _____			

5. How many geographic locations are in the United States?

Branch Offices _____

District Offices _____

Regional Offices _____

Resident Locations _____

6. Are your field service locations aligned with product sales offices?

Yes ☐ No ☐

Comments: _____

- 7.a. Does your company measure field service manager performance by any of the following criteria?

(Please indicate level of importance as measurement of manager's performance from 0 - 10)

MEASUREMENT: (OTHER THAN PROFITABILITY)	(0-10)
A) PERSONNEL TURNOVER	_____
B) INVENTORY VARIANCES	_____
C) ASSET TURNOVER	_____
D) TERSPONSE TIMES	_____
E) ON-TIME PERSONNEL APPRAISALS	_____
F) AGED ENGINEERING CHANGE ACTIVITY	_____
G) PRODUCT PERFORMANCE/REPAIR TIME	_____
H) CUSTOMER COMPLAINTS	_____
I) PERSONNEL PRODUCTIVITY	_____
J) OVERTIME	_____
K) CUSTOMER VISITS	_____
L) PERSONNEL DEVELOPMENT AND PROMOTIONS	_____
M) ON TIME REPORTS	_____
N) CUSTOMER SATISFACTION	_____

- b. Please comment on any of the above or other significant measurements used by your company:

8. Did your company gain business in 1980 as a direct result of poor maintenance by a competitor?

Yes ☐ No ☐

What competitor was replaced, and why? _____

9. Did your company lose any installations in 1980 with the stated reason being:

			How Many
a) Poor product performance?	Yes _____	No _____	_____
b) Poor Maintenance?	Yes _____	No _____	_____
c) Lack of support?	Yes _____	No _____	_____

Comments: _____

- Yes ☐ No ☐

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12. What steps are being taken by your company to meet these challenges?

THANK YOU!

II. QUESTIONS FOR FINANCIAL PLANNING, CONTRACTS, ADMINISTRATION.

1. As applicable, please provide the following measurements of field service profitability in your company. (Adjusted to normal operating profits)

MEASUREMENTS USED BY YOUR COMPANY	RECORDED (PERCENT)		FORECAST (PERCENT)	
	1979	1980	1981	1983
A) FE Division/Dept Gross Profit before taxes as percent revenue	_____ %	_____ %	_____ %	_____ %
B) Field Profit (excluding HQ support, G & A) as percent revenue	_____	_____	_____	_____
C) Average branch office profit as percent revenue	_____	_____	_____	_____
D) Field service division (pre tax) return on assets (%)	_____	_____	_____	_____
E) Field Service Division (pre tax) return on investment (ROI %)	_____	_____	_____	_____
F) Other (Specify) _____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Please comment on significant accounting methods affecting your operating profit statements.

a. INVENTORY CHARACTERISTICS

COMMENTS

- | | |
|--|--|
| i. Average cost method | |
| ii. Standard cost method | |
| iii. Carrying charges stated in cost or carried elsewhere? | |
| iv. Transfer cost to FE as percent of Manufacturing or purchased cost? | |
| v. LIFO? | |
| vi. FIFO? | |
| vii. Reserves for obsolescence and depreciation of parts | |
| viii. Accountability for variances in FE? | |
| ix. Warranty accounts (Field credits, percents, etc.) | |
| x. Repair costs | |
| xi. General comments: (Inventories) | |
| | |
| | |
| | |

- b. Do you have an automated inventory control system? Yes ☐ No ☐

- i. If no, when do you expect to implement such a system?

- ii. If yes, please describe:

2. (continued)

c. ALLOCATION OF OVERHEAD EXPENSES TO F.E. MANAGER'S
OPERATING STATEMENTS.

Overhead Expense Category

Manager Level

i. Facilities

ii. Education

iii. Personnel

iv. Tech. Support

v. Administrative

vi. Documentation

vii. General Comments:

d. Revenue Treatment (and at what F.E. Manager level)

(Operating Statement)

i. Time and Material

ii. Contract Revenue

iii. Warranty Credits (to FE from
Manufacturing and/or suppliers)

iv. Installation/Deinstall (Credit or
Revenues)

v. Inter-divisional maintenance revenues

vi. Sales Changes (Credits or revenues)

vii. Engineering Changes (Credits or
revenues)

viii. General Comments:

3. Please indicate the trends in the types of maintenance contracts used by your company:

TYPE CONTRACT	1981 (X)	1983 (X)	1986 (X)
A) STANDARD CONTRACT ONLY	_____	_____	_____
B) CUSTOMIZED CONTRACTS.	_____	_____	_____
C) STANDARD WITH AMENDMENTS.	_____	_____	_____
D) UNBUNDLED:	_____	_____	_____
- P.M.(USER)	_____	_____	_____
- DEPOT REPAIR	_____	_____	_____
- USER DIAGNOSTICS	_____	_____	_____
- USER INSTALL	_____	_____	_____
- USER PURCHASE SPARES	_____	_____	_____
E) PERFORMANCE GUARANTEES	_____	_____	_____

Comments: _____

4. If you use performance guarantees, what types and what amount of premiums are charged over basic maintenance?

(x) and (%)

- | | | | |
|----|---------------------|-------|---------|
| a) | Response time? | _____ | _____ % |
| b) | Availability? | _____ | _____ % |
| c) | Reliability (MTBF) | _____ | _____ % |
| d) | Return call limits? | _____ | _____ % |
| e) | Parts availability | _____ | _____ % |
| f) | Other: _____ | _____ | _____ % |
| | _____ | | |
| | _____ | | |

5. What is the typical breakdown of the cost of a trouble call by your field engineers?

- | | |
|----------------------------------|---------|
| | 100% |
| a) Total | _____ % |
| b) Direct Labor (Fully burdened) | _____ % |
| c) Travel labor | _____ % |
| d) Parts | _____ % |
| e) Travel Expense | _____ % |

6. What amount do you use as a fully burdened F.E. labor rate, and how is the cost distributed among the components?

<u>COMPONENT</u>	<u>RATE/HR.</u>
a) Total	\$____/hr.
b) Average Salary	____/hr.
c) Average Shift/Overtime	____/hr.
d) Employee Benefits	____/hr.
e) Training	____/hr.
f) Utilization factor	____/hr.
g) Support and overhead	____/hr.
h) Other: _____	____/hr.
_____	____/hr.
_____	____/hr.

Comments: _____

7. Does your company use third party maintenance?

Yes ☐ No ☐

8. Does your company perform third party maintenance?

Yes ☐ No ☐

Comments: _____

9. How would you best describe the methods used to price your maintenance contracts and fees? (Please check all appropriate methods)

- a) Estimated cost plus profit margin _____
- b) Survey of competitor prices for similar equipment _____
- c) Fixed percentage of equipment sales price _____
- d) Operations Research Models _____
- e) User Survey of price sensitivity _____
- f) Value to the user _____
- g) Other _____

10. What percentage of purchase price is your average annual basic contract maintenance charge?

_____ %

11. Please indicate the trends in your field service personnel burden.

	HISTORICAL		FORECAST		
	1979	1980	1981	1983	1986
a) Total Revenue per month per field engineer (direct)	_____	_____	_____	_____	_____
b) Total revenue per mo. per field personnel including managers	_____	_____	_____	_____	_____
c) Total revenue per mo. per person in the field service division	_____	_____	_____	_____	_____
d) Fully burdened cost per month per field engineer	_____	_____	_____	_____	_____
e) Direct cost per month per field engineer	_____	_____	_____	_____	_____

12. Which of the following management science techniques are being employed within the field service organization or do you anticipate will be employed by 1983?

(Indicate usage by (x))

TECHNIQUES	USAGE	
	1981 (X)	1983 (X)
a) Queuing theory models	_____	_____
b) Market Research	_____	_____
c) Inventory Models (EDQ, etc.)	_____	_____
d) Attitude Surveys	_____	_____
e) Learning curve projections	_____	_____
f) Linear programming	_____	_____
g) Operations model (simulation)	_____	_____
h) Operations model (mathematical)	_____	_____
i) Break even analysis	_____	_____
j) Pert/CPM	_____	_____
k) Reliability Models	_____	_____
l) Net Present Value	_____	_____
m) Value added analysis	_____	_____
n) Classical econometrics	_____	_____
o) Multiple regression analysis	_____	_____
p) Other: _____	_____	_____
_____	_____	_____
_____	_____	_____

III. QUESTIONS FOR PRODUCT/TECHNICAL SUPPORT DEPARTMENT

1. For each type of product serviced by your field service organization, please provide the following information as of 1980.

EQUIPMENT CLASSIFICATION	AVERAGE PERCENT UP TIME (PERCENT)	AVERAGE MEAN TIME BETWEEN FAILURE (HOURS)	AVERAGE MEAN TIME TO RESPOND (HOURS)	AVERAGE MEAN TIME TO REPAIR (HOURS)
A) Medium to Large mainframes.				
B) Small Business Computers				
C) Mini-computers				
D) Peripherals				
E) Word Processors				
F) Terminals				
G) Facsimile				
H) System Software	(N/A)	(N/A)		
I) Application Software	(N/A)	(N/A)		

Comments : _____

2. What percentage of productive field engineering time was spent in the installation of engineering changes in 1980?

_____ %

Comments: _____

3. Did your company experience a significant loss of maintenance or lease revenues due to installation and/or warranty problems in 1980?

Yes ☐ No ☐

Comments: _____

4. Do you have a procedure and/or a special position within field engineering to coordinate national accounts, that is, a single customer with multiple service locations?

Yes ☐ No ☐

Comments: _____

5. Do you use remote diagnostics?

Yes ☐ No ☐

a. How long have you been using remote diagnostics? _____

b. Do you plan to implement remote diagnostics soon?

Yes ☐ No ☐

When? _____

c. Please briefly describe the operation of your remote diagnostics for hardware problems:

d. Please briefly describe the operation of your remote diagnostics when used in software maintenance:

6. Please indicate which of the following remarks describe field service involvement in the development of maintainability and reliability in your products. Please use a scale of 0 to 10 to indicate from 0 no involvement to 10 maximum involvement.

(0 - 10)

ACTIVITY	1981	1983	1986
A) WRITTEN MAINTENANCE SPECIFICATIONS	_____	_____	_____
B) DIAGNOSTIC DEVELOPMENT	_____	_____	_____
C) DOCUMENTATION DEVELOPMENT	_____	_____	_____
D) TEST EQUIPMENT SPECIFICATIONS	_____	_____	_____
E) MAINTAINABILITY DESIGN	_____	_____	_____
F) PHASE REVIEWS	_____	_____	_____
- ACTIVE	_____	_____	_____
- PASSIVE	_____	_____	_____
G) SIGN-OFF AUTHORITY	_____	_____	_____
H) SPARE PARTS PHILOSOPHY	_____	_____	_____
- LEVEL OF REPAIR	_____	_____	_____
- INITIAL STOCK LEVELS	_____	_____	_____
- ENGINEERING CHANGE LIMITS	_____	_____	_____
I) OTHER : _____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

7. How do you expect that your users would rate your product performance and maintenance services in 1980?
(Please rate on a scale of 0 - 10, with 0 = poor, 10 = excellent)

Rank the importance of the top 5 items
(1 = most important)

USER ATTITUDES TOWARD:	USER'S RATING 1 - 10	RANK TOP 5
A) PRODUCT CAPACITY TO PERFORM	_____	_____
B) PRODUCT RELIABILITY (MTBF)	_____	_____
C) SOFTWARE SUPPORT	_____	_____
D) GENERAL SUPPORT	_____	_____
E) OVERALL MAINTENANCE	_____	_____
F) MEAN TIME TO RESPOND	_____	_____
G) MEAN TIME TO REPAIR	_____	_____
H) EQUIPMENT AVAILABILITY (Uptime)	_____	_____
I) F.E. ATTITUDES	_____	_____
J) F.E. MANAGEMENT	_____	_____
K) ESCALATION PROCEDURES	_____	_____
L) SPARE PARTS AVAILABILITY	_____	_____
M) OTHER: _____	_____	_____

Comments: _____

8.a. Are the systems programs provided by your company maintained by field service?

Yes ☐ No ☐ N/A ☐

b. If no, will they be maintained by field service in 1983? _____
1986? _____

c. If no, are systems software maintenance problems co-ordinated by field service management?

Yes ☐ No ☐

d. If yes, is software maintained by:

i. Hardware Maintenance Personnel? _____

ii. Software Specialist? _____

e. If yes, what percentage of your field force was involved:
in 1980 _____?

What percentage do you expect to be involved in 1985? _____

How are your software support personnel distributed between
field _____%, and support _____%?

9. Does the field service department have, or expect to have responsibility for applications software maintenance?

1981? Yes ☐ No ☐

1983? Yes ☐ No ☐

1986? Yes ☐ No ☐

IV. QUESTIONS FOR PERSONNEL AND TRAINING DEPARTMENTS

1. Please rate the following field engineering recruiting sources:
(Scale 0 - 10, 0 = not important; 10 = of great importance or primary source)

PERSONNEL SOURCE	RATE (1981) 0-10	RATE (1986) 0-10
A) HIRE, AND TRAIN IN BASICS		
B) COMPETITOR ORGANIZATIONS		
C) MILITARY PERSONNEL TRAINED IN LOGIC/ELECTRONICS		
D) TRADE SCHOOLS		
E) TWO YEAR COLLEGE PROGRAMS		
F) COLLEGE GRADUATES, TECHNICAL		
G) COLLEGE GRADUATES, NON- TECHNICAL		
H) DEVELOPMENT PROGRAMS COORDINATED WITH OTHER DIVISIONS, e.g., MANUFACTURING		
I) OTHER: _____ _____ _____ _____		

2. How much growth does your company project in FE personnel requirements over the next five years? (Use +/- percentage with 1980 as base year).

PERSONNEL	1981 (PERCENT over 1980)	1983 (PERCENT over 1980)	1986 (PERCENT over 1980)
A) HARDWARE F.E.'S			
B) HARDWARE SPECIALISTS			
C) SYSTEM SOFTWARE SPECIAL- ISTS			
D) APPLICATION SOFTWARE SPECIALISTS			
E) COMMUNICATIONS SPECIAL- ISTS			
F) FIRST LINE MANAGERS AND SUPERVISORS			
G) OTHER LINE AND STAFF MANAGERS			

Comments: _____

- 3.a. How many field engineers did you hire in 1980? _____
- b. How many did you lose? _____

4. Please indicate the most significant reasons for turnover in field engineering personnel during 1980. (Rank top 5 with 1 being most significant). Also, provide percentage of turnover attributable to reasons if available.

REASON FOR TURNOVER	RANK (1-5)	(PERCENT)
A) PROMOTIONS (INTERNAL)		
B) INVOLUNTARY SEPARATIONS		
C) RESIGNED FOR MORE MONEY		
D) RESIGNED FOR BETTER OPPOR- TUNITY		
E) RESIGNED TO PURSUE DIFFERENT CAREER		
F) RESIGNED TO IMPROVE EDUCATION		
G) MUTUAL AGREEMENT RESIG- NATIONS		
H) OTHER: _____ _____		

- 5.a. How many personnel/days were spent by field engineers in training in 1980? _____
- b. Alternatively, what percentage of personnel days available to your field service organizations were spent in training in 1980?
_____ %
- c. Please project either personnel days or percentage of time spent in training for the next five years:
1981: _____ (days or percent)
1983: _____
1986: _____
- 6.a. Are any of your field engineers represented by a labor union?
Yes ☐ No ☐
- b. If yes, what percentage? _____ %
what Union? _____
- c. If no, has any labor organization effort since 1977 resulted in a vote in your field service organization?
Yes ☐ No ☐
- d. Are any unions actively engaged in organization efforts at your company at this time?
Yes ☐ No ☐

7. Does your company use any of the following incentive programs for field engineers? Please rate the effectiveness of each program. (0 = not effective, 10 = very effective)

PROGRAM	1981 (X)	1983 (X)	Effec- tiveness 0 - 10
A) PROFIT SHARING	_____	_____	_____
B) COMPANY STOCK PURCHASE PLAN	_____	_____	_____
C) OUTSTANDING F.E. CONVENTIONS AND/OR MEETINGS	_____	_____	_____
D) SUGGESTION AWARDS	_____	_____	_____
E) MATCHED INVESTMENT PLANS	_____	_____	_____
F) COMPETITIVE TUITION PLANS	_____	_____	_____
G) OTHER: _____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

8. Please fill in the following salary ranges:

POSITION	ANNUAL RANGES (\$000)			
	1980		1981	
	From	To	From	To
A) F.E. TRAINEE				
B) QUALIFIED F.E.				
C) SENIOR F.E.				
D) SOFTWARE F.E.				
E) HARDWARE FIELD SPECIAL- IST				
F) SOFTWARE FIELD SPECIALIST				
G) REGION SUPPORT SPECIALIST				
- EXEMPT				
- NON-EXEMPT				
H) HQ SUPPORT SPECIALIST				
I) FIRST LINE MANAGER				
J) SECOND LEVEL MANAGER				
K) REGION MANAGER				
L) STAFF MANAGERS				

9. How do you provide local transportation for field engineers?
(Multiple answers possible)

- a) Leased Auto _____
- b) Fixed Allowance/Mo _____
- c) Mileage Allowance _____
- d) Fixed cost base plus excess
Mileage _____
- e) Direct reimbursement _____
- f) Travel letter _____
- g) Other: _____

- h) None _____
- i) Please comment in spaces above and/or here: _____

- 10.a. Please comment on changing business/management educational requirements for field service managers:

- b. Do you perceive serious problems in assisting field service managers in your company to achieve required educational goals?

Yes ☐ No ☐

- c. What steps have been taken by your company to develop new and experienced managers?

11. Please indicate the current and projected distribution of your field service personnel by function. (Use percentages if exact numbers not available) (U.S. only)

	<u>1980</u>	<u>1985</u>
Territory field engineers	_____	_____
Field Management (Line Managers outside HQ)	_____	_____
Staff Managers in field	_____	_____
Field Technical Support	_____	_____
Field Administrative Support	_____	_____
HQ Line Executives	_____	_____
HQ Staff Managers	_____	_____
HQ Technical Support	_____	_____
HQ Administrative Support	_____	_____

