A COMPARISON OF

INTERNATIONAL FIELD SERVICE ACTIVITIES

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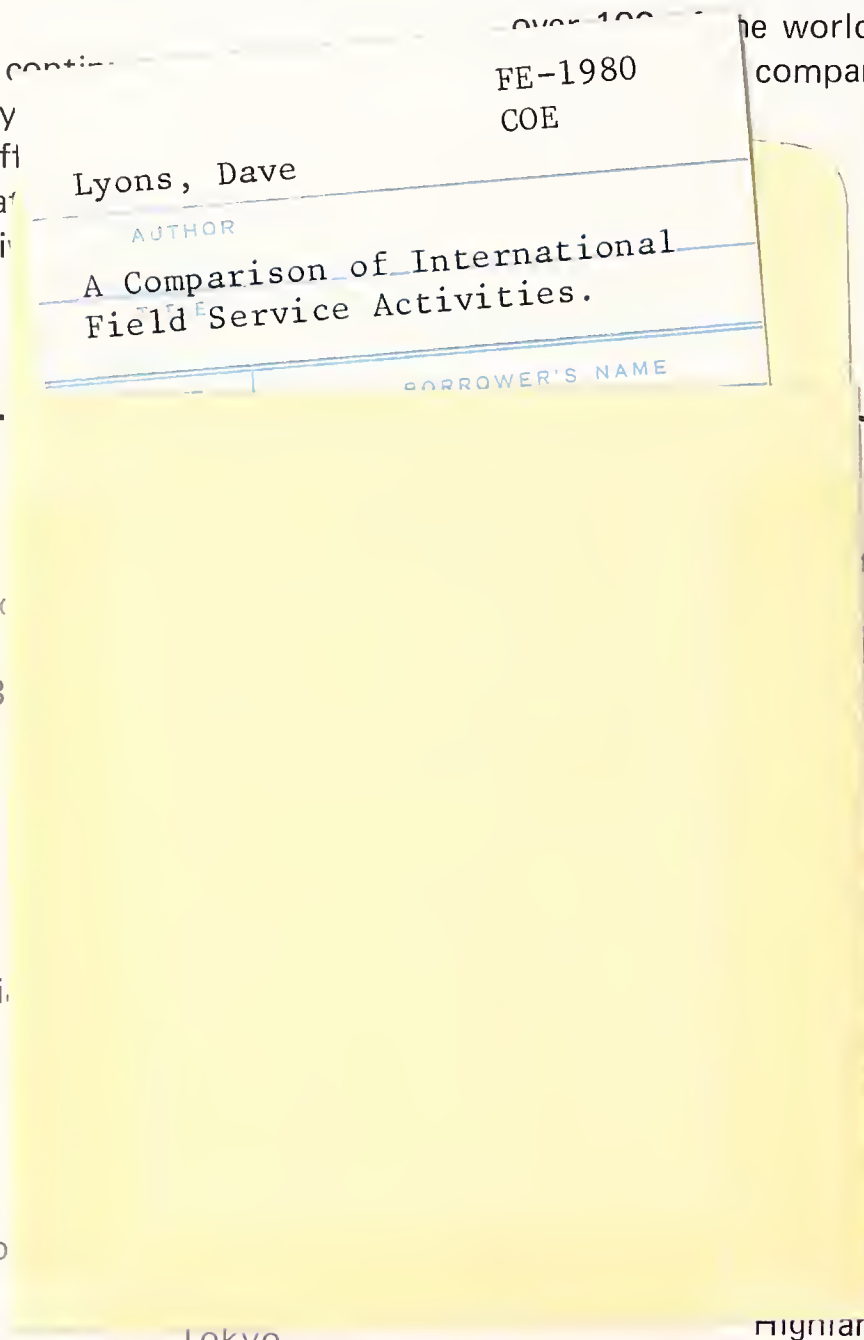

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DECEMBER 1980

A COMPARISON OF
INTERNATIONAL FIELD SERVICE ACTIVITIES

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A COMPARISON OF
INTERNATIONAL FIELD SERVICE ACTIVITIES

LIST OF EXHIBITS

1 INTRODUCTION

I INTRODUCTION

- This report is produced as part of the 1980 Field Service Programme. The report provides a summary analysis of the differences between the markets, vendor approaches and user requirements in the United States and Western Europe.

- The basic data in this report comes from interviews and analyses done in preparing the 1980 Annual Reports for the Field Service Programme in the U.S. and Western Europe.

- The objectives of the report are to:

  - Highlight opportunities for field service vendors.

  - Evaluate the lessons that can be learned from vendor experiences in both markets.

  - Examine pricing and cost differentials between the U.S. and Western Europe.

  - Compare field engineer compensation plans and salary levels.

  - Determine the growth of both markets in revenue and personnel requirements.

- Investigate the sources of new hires used currently and by 1985.

- Provide a basic information source for managers with responsibilities in both markets.

- The study maintains the same structure of equipment categories as has been used in the Field Service Programmes in the U.S. and Western Europe:

  - Medium and large mainframes.

  - Small business systems.

  - Minicomputers.

  - Peripherals.

  - Terminals.

- Inquiries and comments from clients are invited on the contents of this report or any other aspects of INPUT's Field Service Programme.

II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

A. INTRODUCTION

- The factors impacting the growth of maintenance revenues in the United States and Western Europe are almost identical and differ only by the extent to which they have been employed. These factors are:

  - An increasing proportion of minicomputers, small business systems and terminals installed (as opposed to mainframes at single, central sites) leading to higher field service costs, producing, in turn, an increase in maintenance fees relative to the cost of the equipment maintained.

  - High levels of inflation leading to increased field service costs, squeezing profit margins.

  - A scarcity of field engineers in the face of a constantly growing demand for more staff.

  - Uneven implementation of new maintenance techniques, such as remote diagnostics, and support centres which are not yet yielding expected reductions in costs and improvements in productivity.

  - Slow moves towards integrating systems software and hardware maintenance.

- Maintenance revenue will therefore grow faster than the installed base value, and is expected to increase by:

  - Fifteen percent per year, compounded, during the 1980-1985 period in the U.S.

  - Seventeen and one-half percent per year, compounded, over the same period in Western Europe.

B. U.S./WESTERN EUROPE MAINTENANCE REVENUE COMPARISONS

- Over the period 1980-1985, maintenance revenues are expected to grow to $13.2 billion in the U.S. and $7.8 billion in Western Europe, as shown in Exhibit II-1.

- In 1980, U.S. maintenance revenues accounted for 65% of the combined revenues and by 1985 this is down to 57%, reflecting the continued move to high technology in Europe.

- This shift in revenues will be accelerated if the dollar continues its downward trend.

- The number of maintenance personnel in the U.S. is predicted to grow to 176,000 by 1985, a growth of slightly less than 10% per annum. In Western Europe this growth will be only 5.2% per annum, resulting in a total maintenance force of 67,000 engineers by 1985.

- The smaller growth rate of the engineering force in Western Europe is due to the more compact market place and the very real need to improve productivity.

EXHIBIT II-1

U.S./WESTERN EUROPE MAINTENANCE
REVENUE AND PERSONNEL GROWTH,
1980-1985

YEAR	MAINTENANCE REVENUE ($ BILLION)		MAINTENANCE PERSONNEL (THOUSANDS)		REVENUE PER PERSON ($ THOUSAND)	
	UNITED STATES	WESTERN EUROPE	UNITED STATES	WESTERN EUROPE	UNITED STATES	WESTERN EUROPE
1980	$ 6.4	$3.5	110	52	$58.2	$ 67.3
1981	7.3	4.1	123	55	59.3	74.5
1982	8.4	4.8	136	58	61.8	82.8
1983	10.0	5.6	151	61	66.2	91.8
1984	11.5	6.6	163	64	70.6	103.1
1985	13.2	7.8	176	67	75.0	116.4
AAGR (PERCENT)	15%	17.5%	9.9%	5.2%	5.2%	11.6%

- Revenue per person, as indicated in Exhibit II-1, shows the Europeans producing a higher return. Factors which can impact these figures include:

  - Higher prices charged in Western Europe for equivalent services.

  - Increase of maintenance prices in Western Europe due to inflation and the change in exchange rates.

  - Operating costs in Europe include compensation packages, taxes and overheads which are considerably greater than in the U.S.

  - Differences in productivity levels and expectations.

- In 1980, the average revenue per person in Western Europe was only 15.6% higher than in the U.S., despite maintenance prices which are almost twice as high in Europe; a reflection of the better management techniques and productivity of U.S. staff.

- By 1985, it is expected that the productivity gap will narrow, while prices and costs in Europe continue to exceed those in the U.S.

- Revenue per head in Western Europe in 1985 is forecast to be 55% higher than in the U.S., compensating for the earlier stated factors and improving profit margins.

C. THE U.S. AND WESTERN EUROPEAN MARKETPLACES

- Although user resistance to price increases is growing, it is INPUT's opinion that the user is not at his 'pain threshold' and so vendors can pursue a policy of increased maintenance charges provided they are presented correctly.

- However, a major problem facing the European field service manager in the fixing of maintenance charges is the lack of published maintenance price lists. Unlike the U.S., the European market guards maintenance prices to the point of forcing the competitive field service manager to rely on gossip and undercover techniques in setting prices.

- Approaches to cost reduction are similar in both the U.S. and Europe, with the U.S. leading in the more innovative techniques.

  - User self-maintenance.

  - Depot maintenance.

  - Central dispatching of engineers.

- Problems for field service managers are similar in both geographic regions, with the shortage of personnel a driving force in the introduction of maintenance techniques which relieve this pressure. This is one of the main reasons for remote diagnostics being so popular with vendors.

  - A high proportion of U.S. and Western European vendors have implemented, or shortly plan to implement, remote diagnostics support.

  - Quantifiable success, in both regions, has been scarce to date, but 1981 should show more clearly the true value of remote diagnostics.

- In Western Europe, the rapid growth in the number of first time users is putting strains on the maintenance organisations as they come to grips with the needs and dispersion of these users.

- In the U.S., the third-party maintenance vendor (TPM) has gained some measure of respectability and is becoming more aggressive in marketing its services.

- In Europe, only the U.K. market is showing any clear sign of activity and this is moving very cautiously.

- There are signs that TPM vendors are looking to the prime markets of Germany and France where increased activity can be expected.

- Although the TPM accounts for less than 10% of the U.S. maintenance revenues, this influence has kept vendors alert, resulting in a better level of service to the end user.

- The U.S. user is more perceptive in the evaluation of maintenance vendors and places higher importance on service in selection of hardware. The European user is slowly becoming more critical but the vendors are doing very little to assist the user in the evaluation process.

- The traditional influence of IBM continues to be felt on both sides of the Atlantic. User rating of satisfaction with maintenance in comparing IBM to others was:

  - U.S. 61% rated IBM high

  - Western Europe 71% rated IBM high

  - U.S. 59% rated others high

  - Western Europe 54% rated others high

  - U.S. users rate IBM and others almost equal, while in Europe IBM is well in the lead over the others.

- Another concern of many field service managers on both sides of the Atlantic is that systems software maintenance is shortly to be their responsibility - and few are prepared for such an eventuality.

- The overall picture from the U.S. user's standpoint is that, despite his equipment being used as much as twice as often as the European's, his system availability is the same on a percentage basis, his system reliability is better, and, when a fault occurs, his engineer responds faster and takes the same amount of time (or less) to fix the failure.

- Current response and repair times, tabulated in Exhibit II-2 are similar for mainframes, with no differences greater than 40 minutes. The U.S. moves ahead rapidly for the other equipment responding, and repairs the equipment much faster than their European counterpart.

- The ideal response times are also similar in the U.S. and Western Europe, with terminals having a difference of only about 40 minutes.

- The only notable difference in the ideal repair time is in minicomputers, where the U.S. user would like 1.6 hours and the European user would be happy at 3.0 hours.

- For minimum acceptable response and repair times, the U.S. user is willing to wait twice as long for the repair of his small business system.

  - The U.S. user, however, expects a faster response to his call in the peripheral and terminal area.

- The mean time between failures reported by vendors showed wide differences across the Atlantic, with only mainframes being very similar. This is an area needing greater definition and investigation which INPUT will carry out in 1981.

D. PERSONNEL REQUIREMENTS

- A major problem reported by field service managers is the recruitment of field engineering staff and the retention of existing personnel.

EXHIBIT II-2

REQUIREMENTS OF MAJORITY (80%)
OF USERS, U.S./WESTERN EUROPE COMPARED

EQUIPMENT	MEAN RESPONSE TIME IN HOURS			MEAN REPAIR TIME IN HOURS		
	MINIMUM	CURRENT	IDEAL	MINIMUM	CURRENT	IDEAL
MAINFRAMES						
WESTERN EUROPE	1.8	2.1	1.1	3.3	3.2	1.7
U.S.	1.6	1.7	0.8	3.4	2.5	2.0
SMALL BUSINESS SYSTEMS						
WESTERN EUROPE	3.6	3.8	2.3	4.2	3.9	2.6
U.S.	4.2	4.4	1.6	8.5	3.7	3.3
MINICOMPUTERS						
WESTERN EUROPE	3.8	5.0	3.3	3.9	3.8	3.0
U.S.	3.7	5.0	3.4	2.5	2.3	1.6
PERIPHERALS						
WESTERN EUROPE	3.5	3.5	1.7	3.5	3.6	1.7
U.S.	2.2	1.5	1.4	3.7	1.9	1.5
TERMINALS						
WESTERN EUROPE	6.0	6.0	3.0	3.8	3.7	1.8
U.S.	3.8	2.4	1.7	4.0	1.8	1.4

- The changes in the field service organisations required to accommodate remote diagnostics, support centres and the maintenance of systems software will add to the unrest of the staff.

1. TOTAL STAFF REQUIREMENTS

- As indicated in Exhibit II-1, total staff growth is expected to be just over 5% per year in Western Europe and just under 10% in the U.S. While this is indicative of the budgeted growth of the average vendor, it does not represent the full picture.

  - The large vendors in Western Europe have reached a point where further staff expansion is difficult. This relates even with a low percentage turnover which, multiplied by the large numbers of staff already on board, makes replacement a difficult enough task, let alone growth.

  - In the U.S., growth is the order of the day with 16 of the 20 vendors interviewed reporting personnel growth and one vendor at the exceptionally high rate of 210%.

2. SKILL MIX

  - Current U.S. organisations place far greater emphasis on first line management and structured hierarchies than does Western Europe, where fewer managers 'manage' far larger field staffs.

  - The shift to support centres remote diagnostics, and integrated hardware and systems software will require that the skill mix of maintenance organisations change drastically.

- In many ways the greatest benefit to field service vendors from these new techniques will be the increased ratio of less qualified to more highly qualified staff. This will result in a lower average salary base as well as higher per capita revenue through greater productivity.

3. SOURCES

- Whereas it appears that in the U.S. staff sources have been clearly identified as trade schools and new hires/training, in Western Europe there is no obvious preferred source of new staff.

- The general lack of engineer training schools' graduates, despite the rising level of unemployment in Western Europe, is not a temporary shortcoming - it has existed for many years and there is little hope for a massive improvement in the near future.

  - The only real hope for Western European vendors is the increased use of productivity tools such as remote diagnostics and support centres, coupled with more emphasis on user self-maintenance.

- Maintenance engineering as a profession attracts a much lower proportion of university degreed individuals in Europe than in the U.S.

4. COMPENSATION

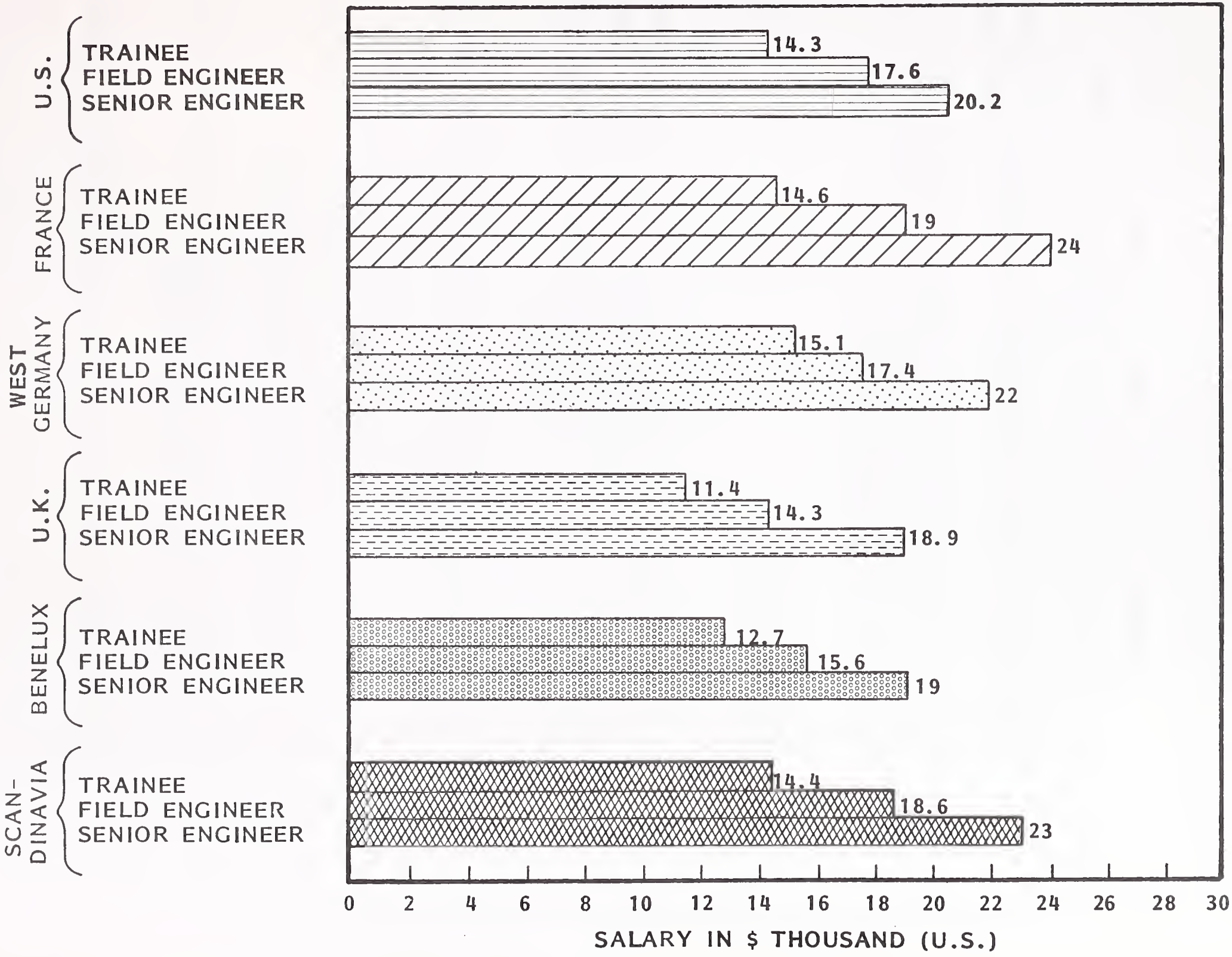
- The salary ranges for trainees, qualified and senior field engineers are shown in Exhibit II-3.

- There are on the face of it no substantial differences in salary scales, but these figures do not allow for 'fringe' benefits.

- In Europe, these fringe benefits substantially increase the real value of a field engineer's salary.

EXHIBIT II-3

VENDOR AVERAGE SALARIES



- In Europe, a car is now considered normal, and not even a perk by engineers.

- Insurance and pension plans, along with four weeks' holiday, and numerous public holidays are the norm in Western Europe.

- The spending power and local costs, however, leave the U.S. engineer with the higher standard of living when compared to his European contemporaries.

- The cost of living in Europe is now becoming standardised, with less difference country to country than a few years ago.

E. RECOMMENDATIONS

- In Western Europe, field service organisations need strengthening at the managerial level to provide better support (and control) of the in-field engineers. In parallel, it is necessary to simplify the reporting structure for the Western European field service manager.

- Tighter administration of field service contracts would benefit vendors on both sides of the Atlantic, notably:

  - Payment in advance, rather than in arrears.

  - Long-term contracts as the norm (five years plus).

  - Regular, once a year, reviews with the end user on the level of service he requires, with pressure on upgrading.

  - Regular updates of the contract to cover configuration changes.

- Personnel policies are needed for the planned conversion of current service strategies to remote diagnostics and service centres. These changes should be seen as career opportunities by the vendor staff if they are not to cause staff losses.

- Price reviews have to be marketed, matching (in the users' eyes) increased expenditure with increased service. Responsiveness to users' needs can go a long way to allowing increased revenue without user dissatisfaction.

- Western European vendors are encouraged to follow the experiences of their U.S. colleagues in the implementation of the new maintenance techniques so as to profit from the lessons that will emerge in the next few years.

III USER SURVEY COMPARISON

III USER SURVEY COMPARISON

A. INTRODUCTION

- This section analyses those field service areas where Western European and U.S. users have significant differences and explores the reasons underlying such differences.

- User attitudes and perceptions vary from one field service aspect to another but overall the conclusion can be drawn that the Western European user is easier to satisfy than the U.S. user.

  - Western European users are less demanding in their use of equipment.

  - They are less demanding in their 'ideal' requirements for response and repair times.

  - More of them are willing to pay more than current maintenance rates for improved service.

  - They are less likely to replace equipment due to poor maintenance service, even though the service they are currently receiving is, on average, well below the service received by their American colleagues.

- As a result of these less demanding attitudes the Western European user receives worse maintenance repair and response times.

- Given the enormous success of IBM in the Western European country markets, and the dominant position achieved, it is meaningful to treat IBM as a special case and to isolate IBM user response from all others. This has been done in most of the analysis.

- For the purposes of this report, Western European country markets are treated as a single entity. This is to allow summary conclusions to be drawn and a clear picture to emerge. A detailed comparison between the Western European countries is contained in INPUT's European Field Service Annual Report.

B. USER ATTITUDES TOWARDS CONTRACTED MAINTENANCE COVERAGE

- Exhibit III-1 illustrates the enormous difference that exists between the maintenance coverage of installed equipment in the U.S. and Western Europe. In each category of coverage there is a higher percentage of cumulative usage in the U.S. than in Western Europe.

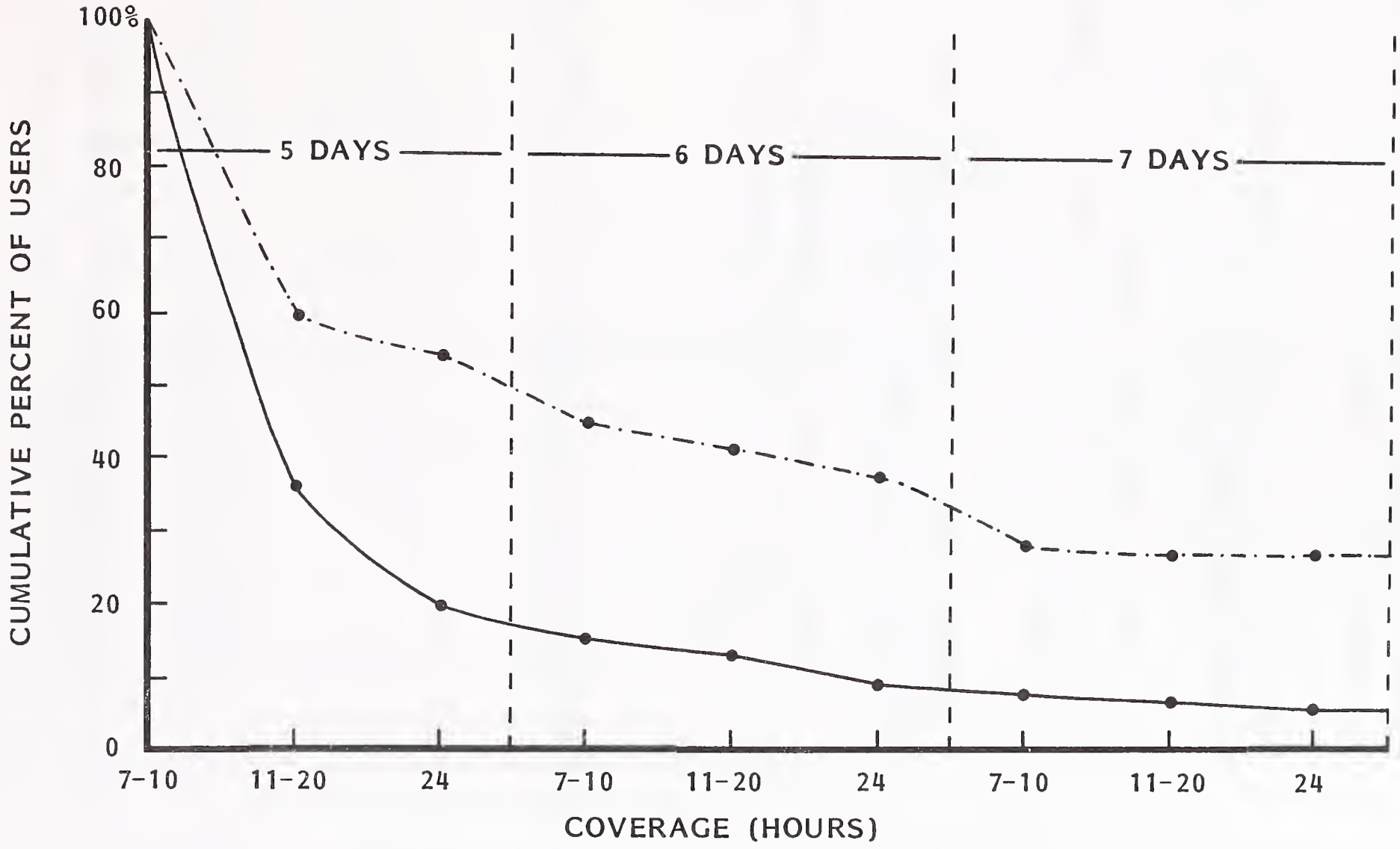
  - Only 16% of the users in Western Europe utilize their equipment more than five days a week, while in the U.S. that proportion is 45%.

  - Fifty-five percent of U.S. users have a maintenance coverage of five days/three shifts a week or more, and in Western Europe only 20% of the users fall into that category.

  - Sixty percent of U.S. users have a maintenance coverage greater than five days/one shift a week, and in Western Europe the percentage is only 36%.

EXHIBIT III-1

CUMULATIVE MAINTENANCE COVERAGE REQUIREMENTS:
CURRENT FOR WESTERN EUROPE AND U.S.



——— WESTERN EUROPE

—·—·— U.S.

IN EUROPE, 'SHIFTS' WERE DEFINED AS FOLLOWS: 7-10 HOURS = 1 SHIFT, 11-20 HOURS = 2 SHIFTS, 24 HOURS = 3 SHIFTS

- It is clear that in Western Europe there is a gross underutilisation of capital and plant, at least as compared to the U.S. It may indicate that a high proportion of Western European users have been oversold, which is not encouraging for future growth.

- This analysis has a direct bearing on the strategy which can be adopted for the pricing of maintenance services:

  - Two- and three-shift coverage and certainly six- and seven-day coverage in Western Europe affect a relatively small percentage of users.

- The reported detail of the percentage of users in each shift/coverage category in both regions is given in Exhibit III-2.

  - Again, the percentage of responding U.S. installations with a full seven-day week and 24 hours/day operation is four times larger than in Western Europe.

C. COMPARISON OF REQUIREMENTS FOR RESPONSE AND REPAIR TIMES

- Exhibits III-3 through III-7 contain data, plotted in a cumulative format, for the mean time to respond and the mean time to repair equipment. The three different sets of data for each equipment category are for:

  - Minimum value, or that number of hours regarded as the minimum acceptable performance by the maintenance vendor.

  - Current value, or the actual number of hours experienced at the moment, on average.

EXHIBIT III-2

COMPARATIVE MAINTENANCE COVERAGE REQUIREMENTS: CURRENT FOR WESTERN EUROPE AND U.S.

COVERAGE		WESTERN EUROPE, 1980		U.S., 1980	
		RESPON-DENTS	PERCENT	RESPON-DENTS	PERCENT
5 DAYS	1 SHIFT	212	64%	30	40%
	2 SHIFTS	53	16	4	5
	3 SHIFTS	13	4	8	10
6 DAYS	1 SHIFT	7	2	2	3
	2 SHIFTS	13	4	3	4
	3 SHIFTS	3	1	7	9
7 DAYS	1 SHIFT	3	1	1	1
	2 SHIFTS	3	1	0	0
	3 SHIFTS	23	7	21	28
TOTAL		330	100%	76	100%

IN EUROPE, 'SHIFTS' WERE DEFINED AS FOLLOWS:

7-10 HOURS = 1 SHIFT
11-20 HOURS = 2 SHIFTS
24 HOURS = 3 SHIFTS

EXHIBIT III-3

MAINFRAMES MEAN TIME TO RESPOND AND REPAIR:
WESTERN EUROPEAN AND U.S. USER RESPONSES

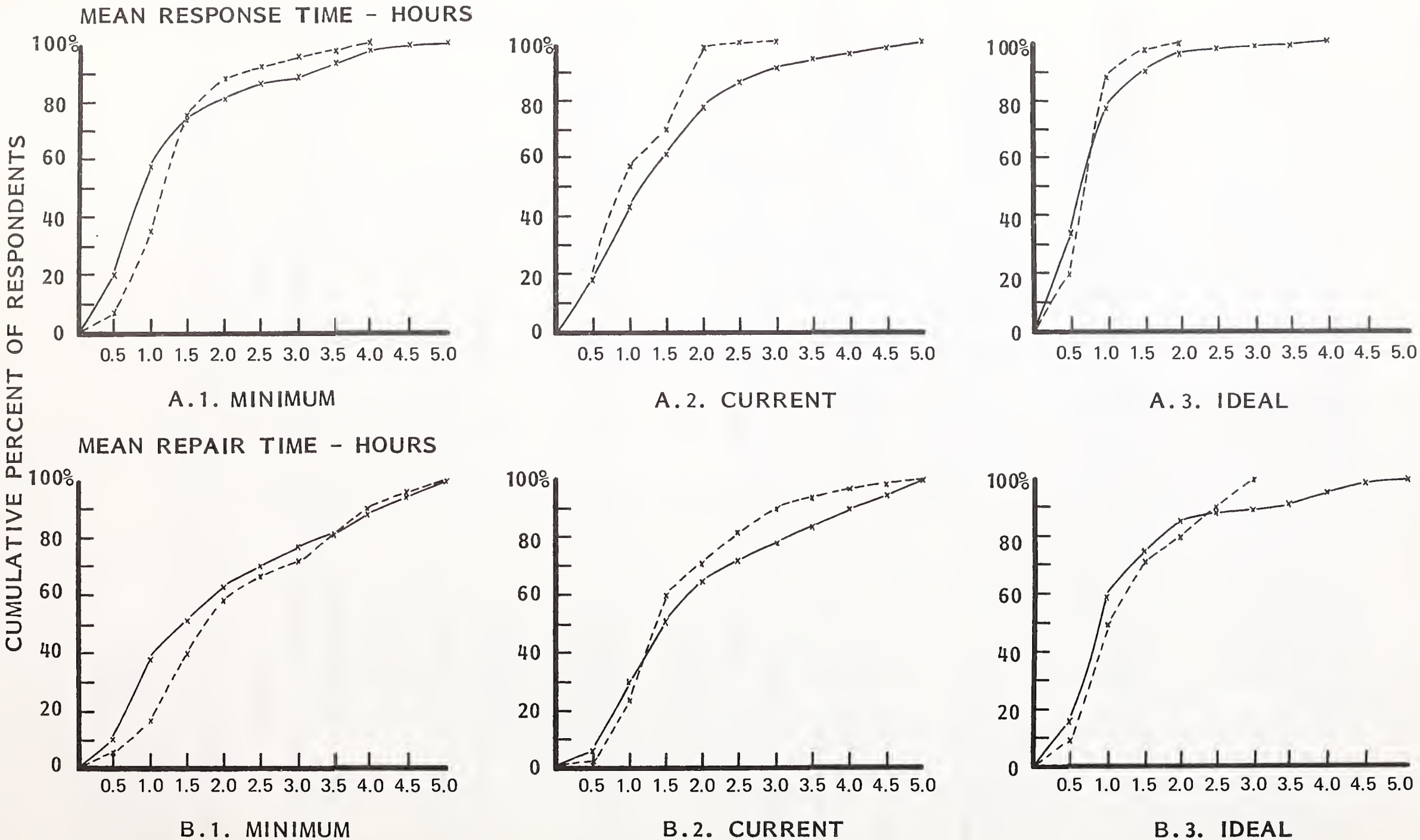


EXHIBIT III-4

SMALL BUSINESS SYSTEMS MEAN TIME TO RESPOND AND REPAIR: WESTERN EUROPEAN AND U.S. USER RESPONSES

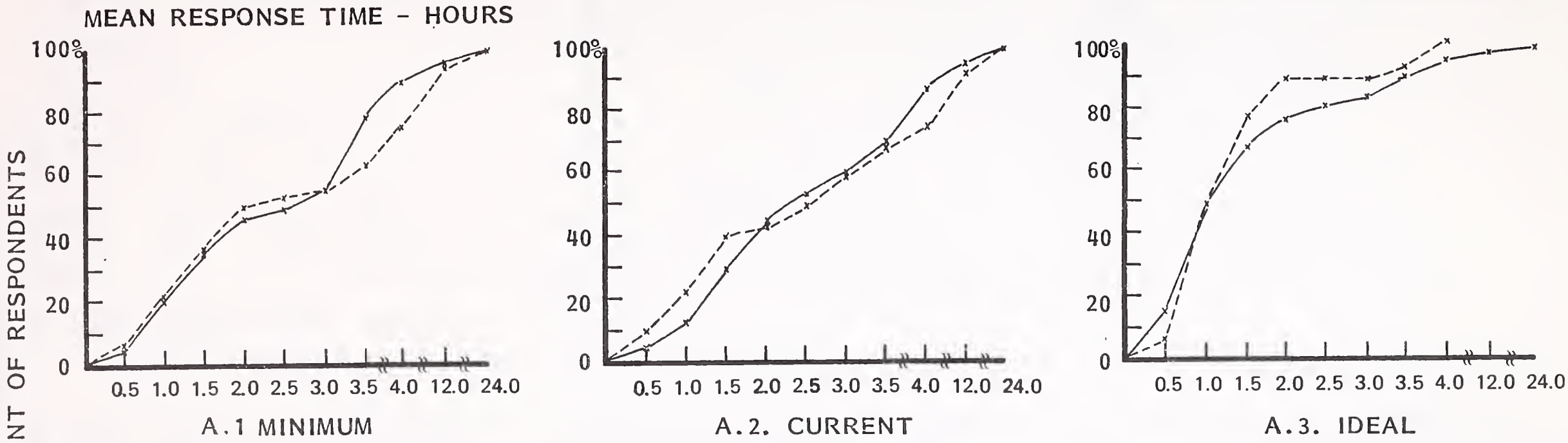


EXHIBIT III-5

MINICOMPUTERS MEAN TIME TO RESPOND AND REPAIR: WESTERN EUROPEAN AND U.S. USER RESPONSES

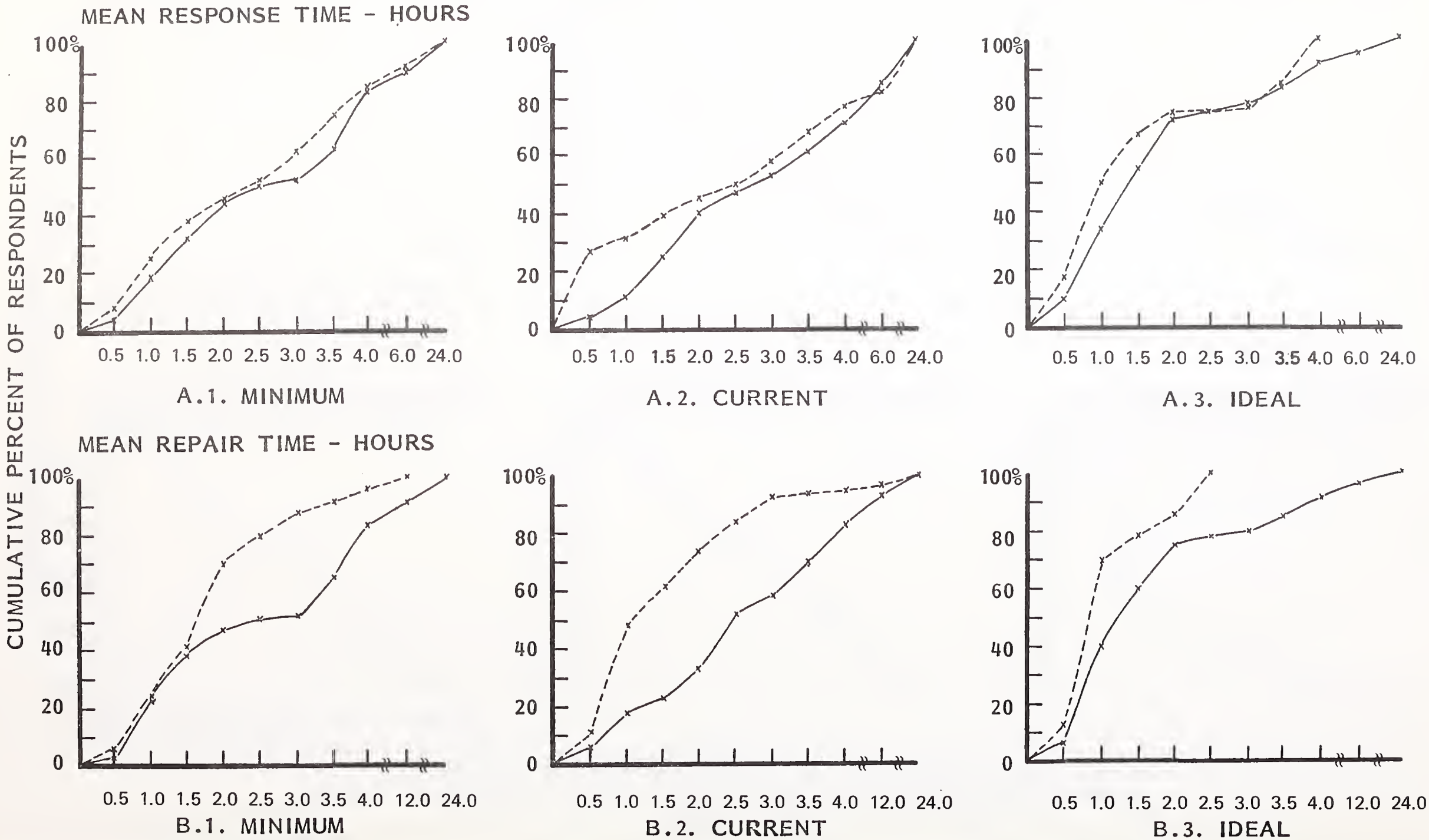


EXHIBIT III-6

PERIPHERALS MEAN TIME TO RESPOND AND REPAIR: WESTERN EUROPEAN AND U.S. USER RESPONSES

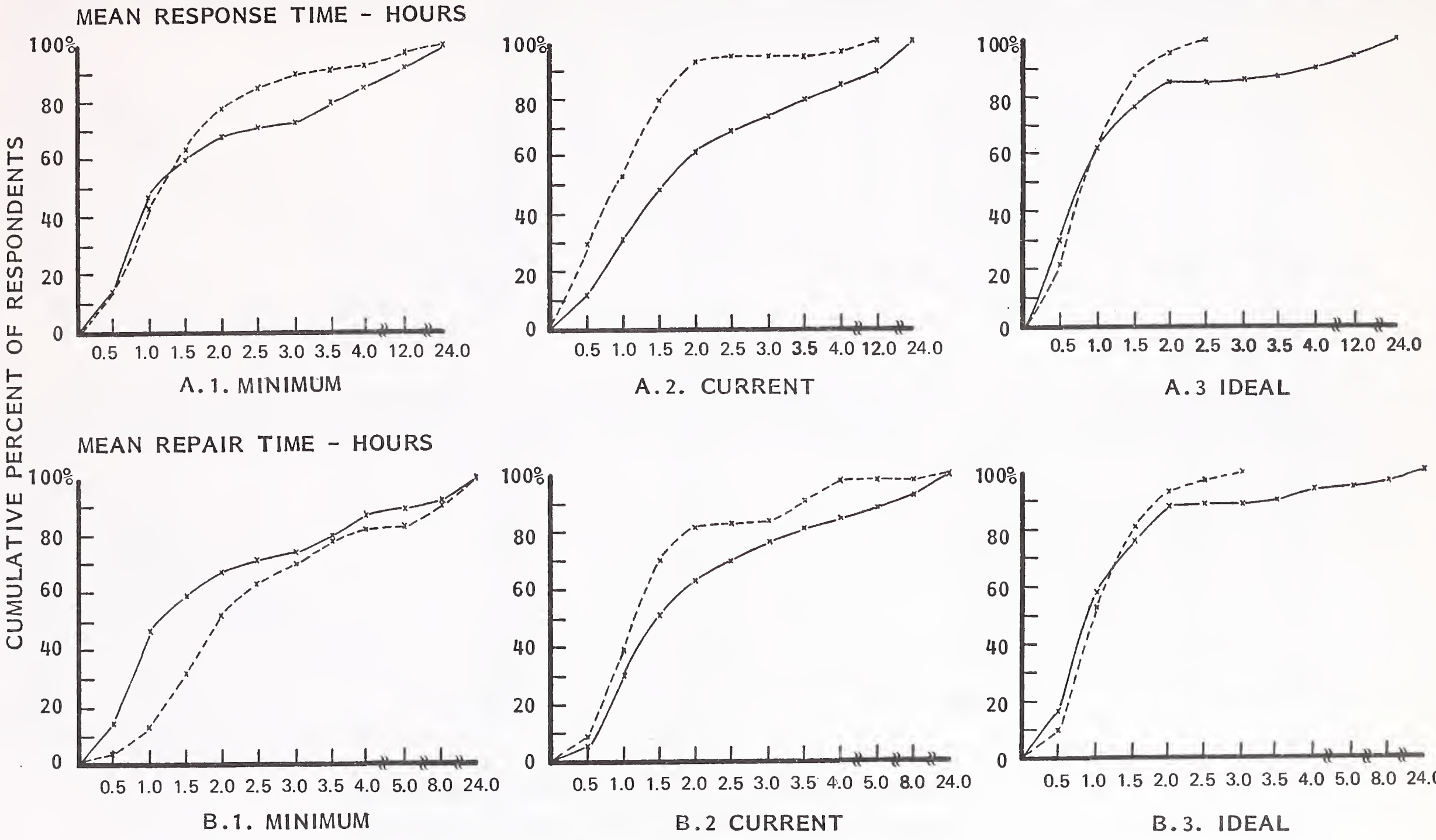
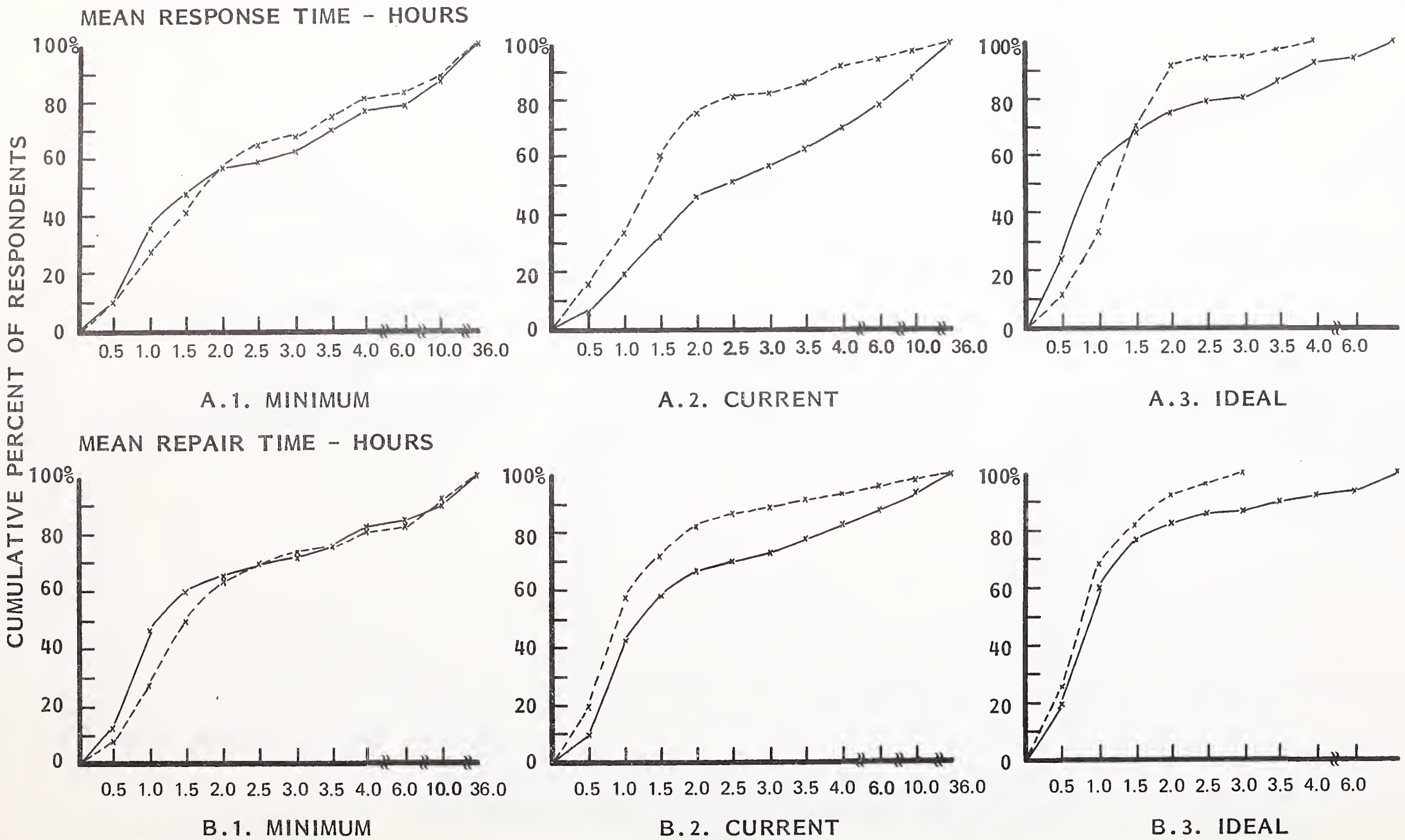


EXHIBIT III-7

TERMINALS MEAN TIME TO RESPOND AND REPAIR: WESTERN EUROPEAN AND U.S. USER RESPONSES



- Ideal value, or the number of hours that the user would ideally like to see as the service performance.

- In addition, data is provided for the five categories of hardware equipment examined.

  - Mainframes.

  - Small business systems.

  - Minicomputers.

  - Peripherals.

  - Terminals.

- In interpreting the data provided, it is best to examine the values for a majority of the users such as at the 80% points so as to eliminate extreme views.

I. MAINFRAMES

- There is almost total agreement, by U.S. and Western European users alike, on the minimum response time acceptable. Seventy-five percent expect a response in less than 1.5 hours, as shown in Exhibit III-3.

  - A minority of users accept up to 4.0 hours in the U.S. or 5.0 hours in Western Europe.

  - The majority would like a response in under one hour.

  - Currently, response times in the U.S. are slightly more than the 1.6 hours acceptable minimum, whereas in Western Europe they are somewhat less than 2.0 hours.

- Minimum acceptable times of repair range from 2.5 to 4.0 hours which is precisely the range of current performance by maintenance vendors. Ideal requirements are almost half these values, however, from 1.0 to 2.0 hours.

- Overall, there does not appear to be any justifiable dissatisfaction with maintenance response times or repair times, or any major differences between Western Europe and the U.S.

2. SMALL BUSINESS SYSTEMS

- The minimum mean time to respond, according to end users in both the U.S. and Western Europe, should be less than 4.2 hours, which coincides quite well with the response time currently obtained by most users, as shown in Exhibit III-4.

  - The ideal response times are much lower, in the the 1.6 to 2.3 hour range, more in line with mainframe systems.

- Repair times currently experienced are also well in line with the acceptable minimum of 4.2 to 8.5 hours, but well in excess of the ideal time of 2.6 to 3.3 hours.

  - Current repair times are similar in the U.S. and in Western Europe, at 3.7 to 3.9 hours.

  - Western Europeans, however, request significant improvements over the U.S. in both minimum and ideal times to repair.

3. MINICOMPUTERS

- Minimum acceptable response time for U.S. and Western European minicomputer users is significantly below current vendor peformance, indicating a level of dissatisfaction with maintenance response.

- In both countries, users' 'ideal' requirements are over one hour the current performance.

- In repair times, there are substantial differences between U.S. and Western European users' service and their minimum requirements. In the U.S. a majority of minicomputer users' ideal repair time is less than 2.0 hours, while in Western Europe the requirement is for 3.0 hours.

- Actual performance of vendors in both countries has aligned itself with the minimum requirements, so that in each case users' minimum requirements are met: 3.9 hours in Western Europe, 2.5 hours in the U.S.

  - Western European users are requesting and receiving repair times which are nearly twice those of their U.S. counterparts.

4. PERIPHERALS

- Peripheral response and repair times in the U.S. are one to two hours less than those obtained by Western European users, but both user groups have similar ideal requirements, as shown in Exhibit III-6.

- In the U.S., current vendor performance on response times is about 1.5 hours compared to 3.5 hours in Western Europe. The minimum user requirement in both countries is for 2.0 hours or less; this clearly indicates a lack of adequate response in Western Europe. Ideally, both user groups would like to see response times of less than 1.5 hours.

- Again in the U.S., current vendor performance on repair time is 2.0 hours or less, a considerable improvement on the users' minimum requirements. In Western Europe, current repair times are 3.0 hours or more, barely in line with the minimum requirement as expressed by users. Both user markets would ideally like to see 2.0 hours or less, a requirement that is fulfilled for the majority of U.S. users, but which is half the performance currently obtained by Western European users.

5. TERMINALS

- Given the increasingly significant role that terminals play it is surprising to see the poor quality of response and repair times in both markets, as is illustrated in Exhibit III-7.

- A wide spectrum of requirements is fulfilled by terminals, from high frequency inquiry/response to low volume ad hoc data capture and enquiry.

  - Many configurations do not suffer catastrophically from the loss of a single terminal.

- No other item of equipment has seen so broad a penetration by third-party maintenance vendors, each of which faces identical service problems of geographical dispersion of installed equipment, rapid rate of growth of the number of terminals maintained, etc. This contributes largely to a generally poor level of service.

- U.S. users benefit from a better level of service once again, although users on both sides of the Atlantic have similar minimum repair requirements.

- In the U.S., response times are of the order of 2.5 hours or less, on average, against a minimum requirement of 4.0 hours or less. In Western Europe, average response times are much higher at 6.0 hours, and this is also the minimum requirement.

- Again in the U.S., repair time is normally less than 2.0 hours, exceeding the minimum requirement of 4.0 hours expressed by users. In Western Europe, however, repair times are of the order of 3.5 hours, slightly better than the minimum required.

- Ideally, both U.S. and Western European users concur that repair time should be 2.0 hours or less - in line with requirements for all other types of equipment.

D. USER REQUIREMENTS

- The foregoing section dealt in some detail with 'ideal' user requirements which, for the most part represent enormous improvements in the levels of field service currently provided.

- Such improvements are already available from most vendors in the guise of special maintenance service at higher rates. Equally obviously users are willing to pay more to obtain the improvements they require.

- Exhibit III-8 details the proportion of users who are willing to pay more and the size of the average increase. The exhibit shows the extent of new revenue opportunities for field service organisations since it details the percentage of users who are willing to pay more than their current rate.

  - It confirms INPUT's belief that there is no great difference between the prices vendors currently ask for the level of service users require and the level of cost increase users are willing to accept.

- Once again, it can be seen that the Western European field service market is far easier than that of the U.S.

  - The proportion of users willing to pay more in Western Europe is more than double that found in the U.S.

  - The amount of increase they would accept is over 40% higher; a 20% increase on average as opposed to 14% for the U.S..

- The U.S. opportunities are limited.

  - Small business machines, minicomputers and terminals alone have reasonably high percentages of users willing to pay more.

EXHIBIT III-8

USERS' WILLINGNESS TO PAY MORE
FOR IDEAL MAINTENANCE:
WESTERN EUROPE AND U.S.

CATEGORY	WILLING TO PAY MORE (PERCENT)		AMOUNT WILLING TO PAY (AVERAGE PERCENT)	
	U.S.	WESTERN EUROPE	U.S.	WESTERN EUROPE
MAINFRAMES	12%	41%	13%	19%
SMALL BUSINESS SYSTEMS	32	39	14	26
MINICOMPUTERS	19	37	14	18
PERIPHERALS	13	44	11	19
TERMINALS	17	36	17	17
AVERAGE	19%	39%	14%	20%

- These three markets are precisely the markets where the highest increases, ranging from 14% to 17%, can be obtained.

- In Western Europe, opportunities exist for all five equipment types examined by the study and nearly 40% of all users are willing to pay 20% more, on average, for a halving in their current service response and repair times. This is an important prospect for Western European service vendors since:

  - Many can provide this increased level of service with a more productive organisation structure, orientated around regional support centres assisted by remote diagnostics; in other words, without major increases in staff numbers, but with a more efficient deployment of existing staff.

  - A light marketing effort to the existing user base is all that is needed to ascertain which users are willing to upgrade their service requirements.

- As patterns of user requirements are substantially different from one Western European country to another, vendors are advised to carefully examine the country level data provided by the 1980 Annual Report in order to verify which equipment categories represent the best opportunities in their local markets.

- Overall, the following conclusions can be drawn:

  - A high enough proportion of end user additional or enhanced requirement exist for all categories of equipment vendor to poll their user bases for specific requirements.

  - The percentage increases that users say they are willing to pay over their current rates are close to the 'two-hour response' uplift that vendors practise, so that the overall effect will be that of a simple upgrade of service to a part of the installed user base, with the attendant increase in revenues and profitability.

- The relative importance U.S. and Western European end users attach to the three 'visible' aspects of field service (response time, repair time and preventive maintenance) is examined in Exhibit III-9.

- It is instructive to compare these values to the vendors' views of the same characteristics, as shown in Exhibit IV-5.

- Little difference exists between the U.S. and European users' rating on the importance of response, repair and preventive maintenance (PM).

- Response and repair times share top position while PM, not far behind, is considered important to the ongoing reliability of the equipment.

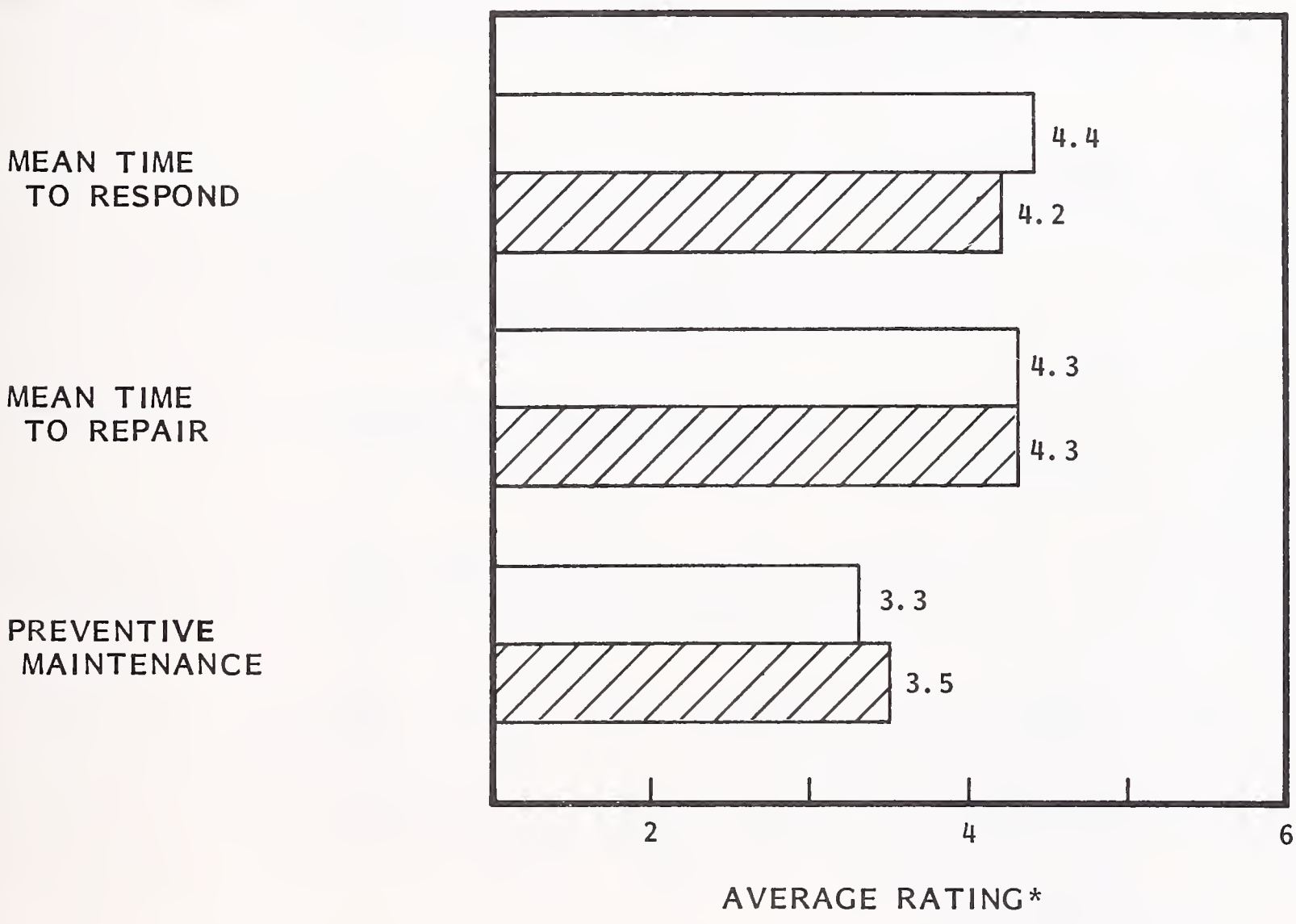
E. REMOTE DIAGNOSTICS EVALUATION

- With significant emphasis being placed on new maintenance techniques to resolve lack of trained staff, improve productivity of existing engineers, improve customer service, etc., it is opportune to look at the users' acceptance of remote diagnostics.

- Before doing so, it necessary to stress one surprising factor in this context that would otherwise distort the data being presented. Section F deals with the evaluation of IBM's performance in the U.S. and Western Europe vis a vis that of the other vendors. Normally IBM's individual performance tends to improve the overall average performance of vendors, taken as a whole. In this particular case, IBM's performance in Europe decreases the overall performance.

EXHIBIT III-9

IMPORTANCE OF FIELD MAINTENANCE CHARACTERISTICS: RATINGS BY USERS IN WESTERN EUROPE AND THE U.S.



WESTERN EUROPE

UNITED STATES

* RATED ON A SCALE WHERE 1 = LOW, 5 = HIGH

- Exhibit III-10 shows the users' reaction to the remote diagnostics technique as a maintenance aid. In the U.S., users are fairly evenly split between findings of 'same level of service' and 'better performance'. In Western Europe the majority of users agree with this verdict, but 15% do not like the loss of personal contact such remote service implies.

- Exhibit III-11 takes IBM out of the equation and immediately the picture changes. Whereas more than 60% of non-IBM users in Western Europe and the U.S. found an improvement in service, only 38% to 40% of IBM users in those same markets could agree.

- IBM can argue that:

  - Its service up to the introduction of remote diagnostics was so good that any change was bound to be adversely evaluated.

  - This is a temporary reaction to a service that has yet to be fully established.

  - The average quality of non-IBM service was so bad that any change, even remote diagnostics, was bound to improve the overall quality.

- Taking the facts at their face value, however, suggests that the introduction of remote diagnostics by IBM has not been successfully handled in the U.S. or Western Europe, and that non-IBM vendors have had noticeably better success than IBM with the introduction of their own particular type of remote diagnostics.

F. IBM's PERFORMANCE IN THE U.S. AND EUROPE

- Exhibits III-12 through III-16 reflect the position of IBM when compared to other vendors. In the U.S. there is a drop in IBM's absolute authority of

EXHIBIT III-10

USER SATISFACTION LEVELS WITH REMOTE DIAGNOSTICS: WESTERN EUROPE AND THE U.S.

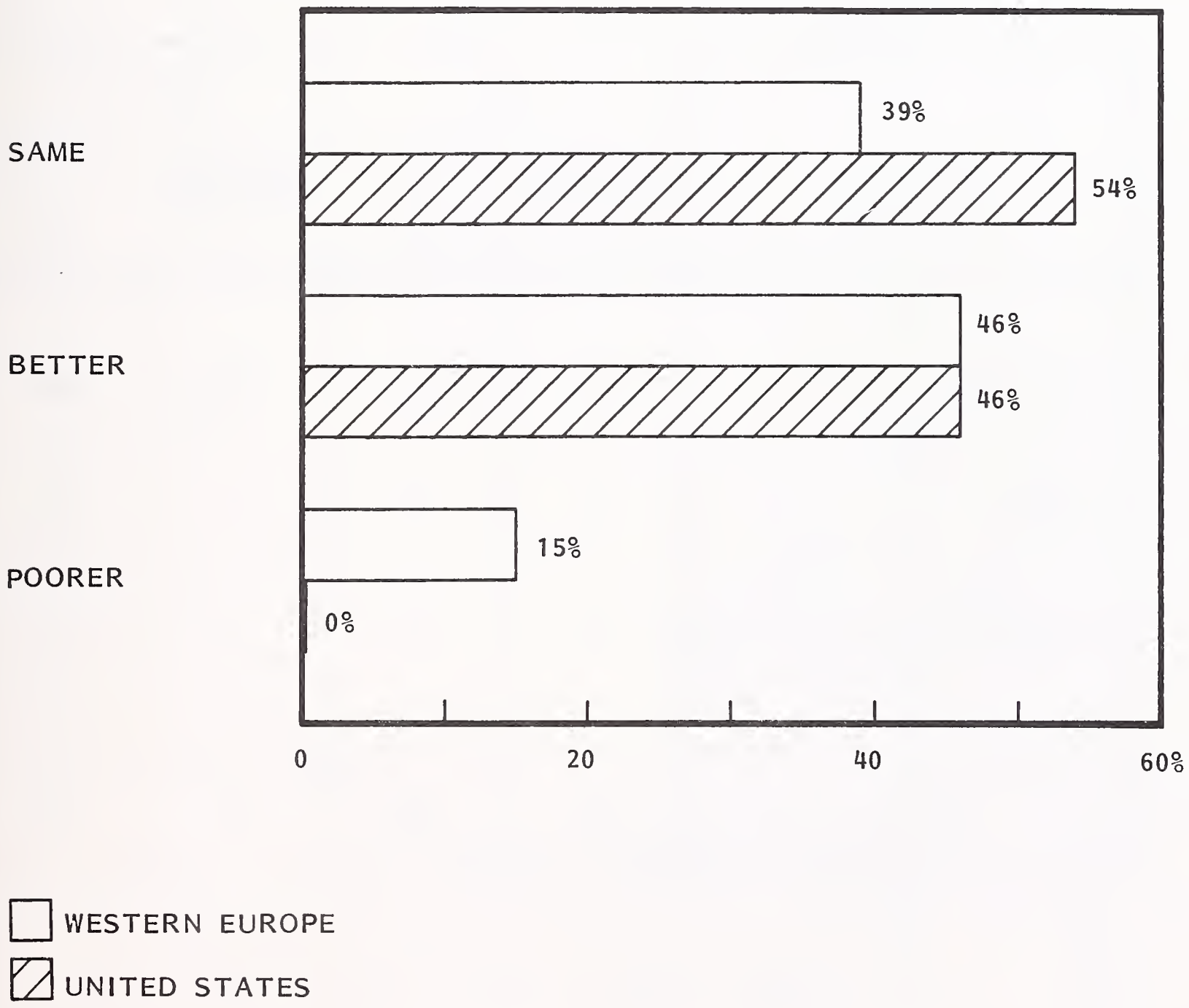


EXHIBIT III-11

USER SATISFACTION LEVELS WITH REMOTE DIAGNOSTICS: IBM AND OTHERS IN WESTERN EUROPE AND THE U.S.

OPINION	IBM		OTHER	
	WESTERN EUROPE	U.S.	WESTERN EUROPE	U.S.
BETTER	40%	38%	62%	64%
SAME	42	62	35	36
POORER	18	0	3	0
TOTAL	100%	100%	100%	100%

EXHIBIT III-12

USER SATISFACTION WITH MAINTENANCE OF MAINFRAMES:
IBM AND OTHERS IN WESTERN EUROPE AND THE U.S.

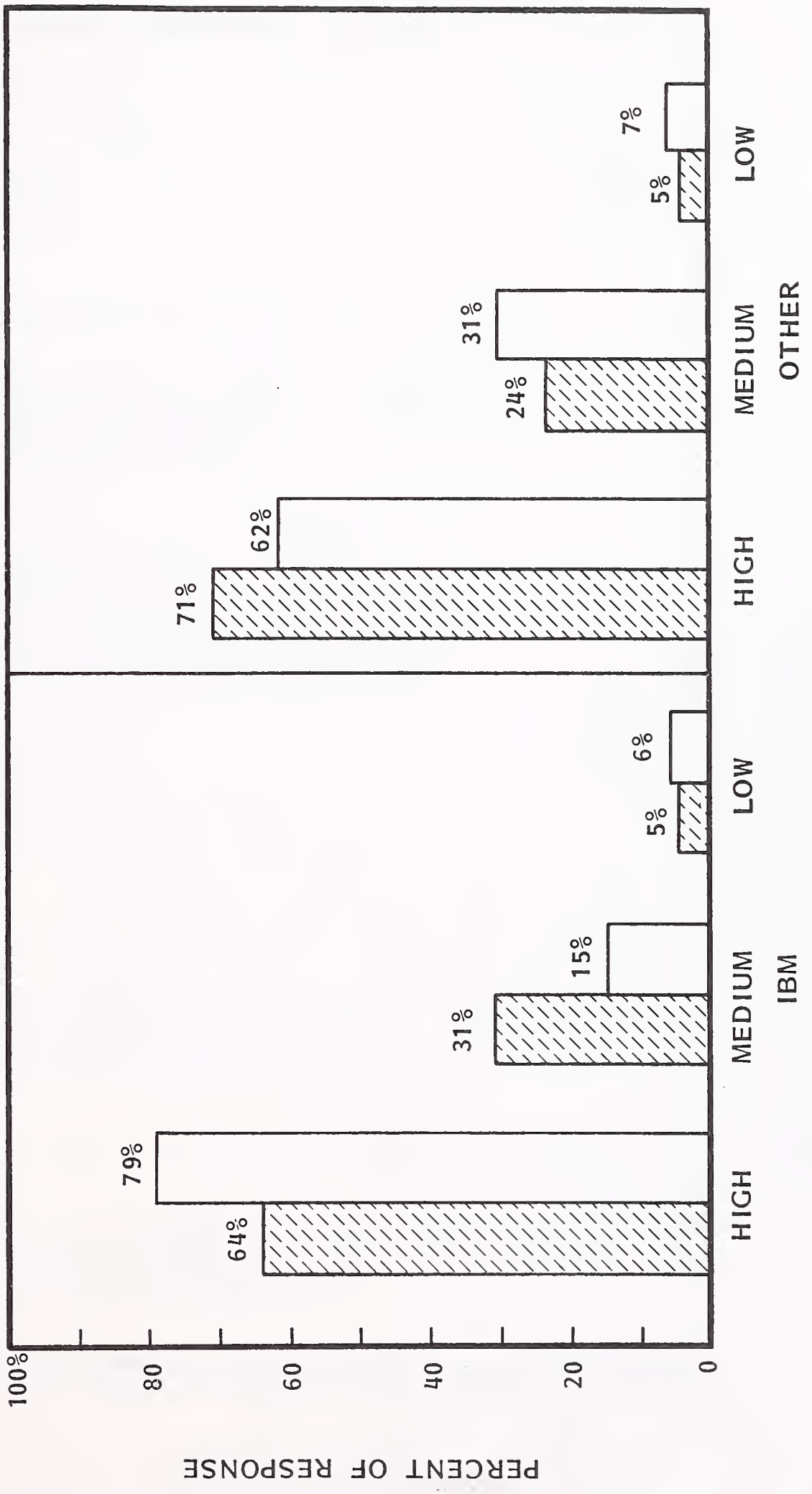


EXHIBIT III-13

USER SATISFACTION WITH MAINTENANCE OF SMALL BUSINESS SYSTEMS:
IBM AND OTHERS IN WESTERN EUROPE AND THE U.S.

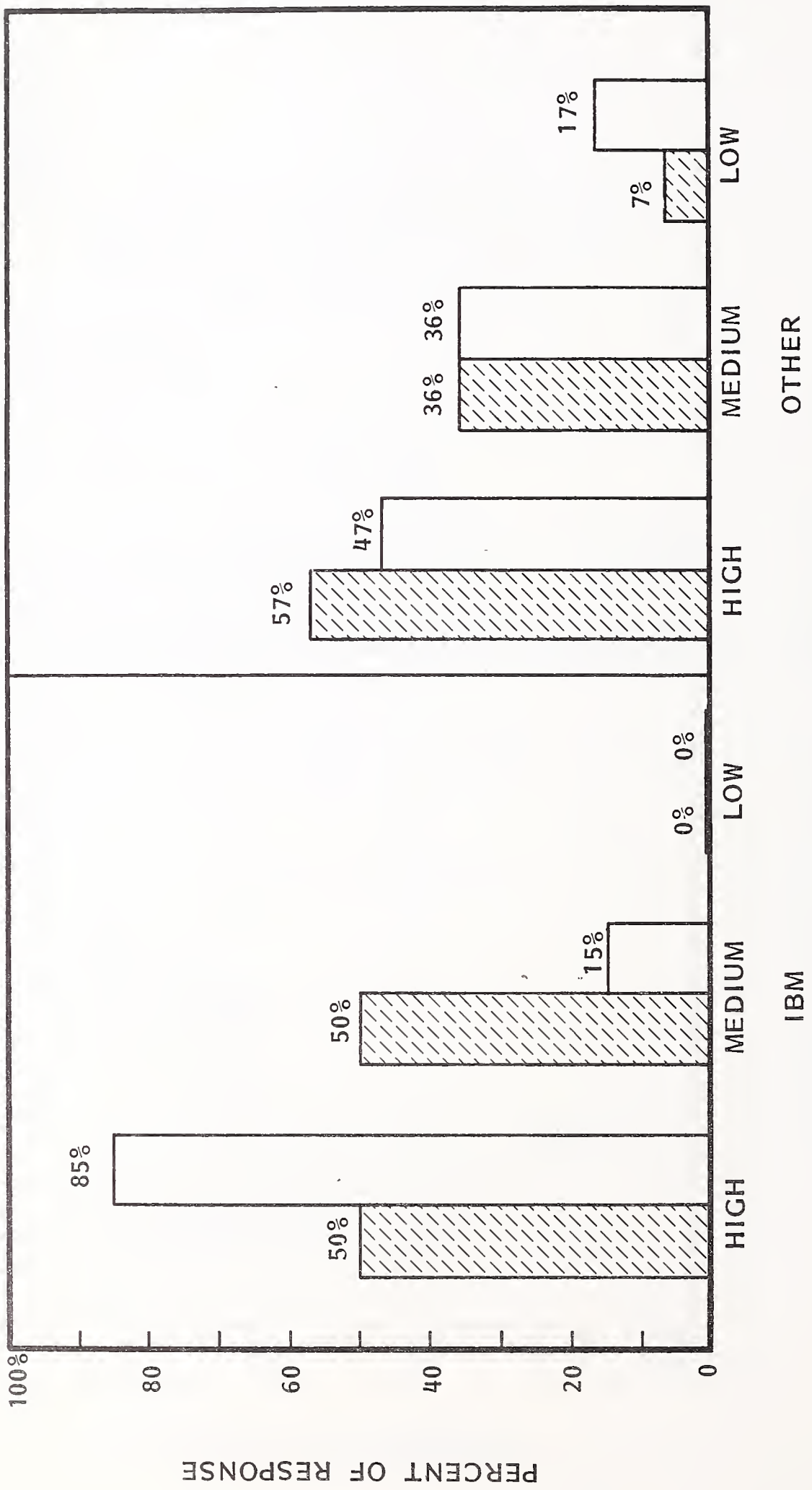


EXHIBIT III-14

USER SATISFACTION WITH MAINTENANCE OF MINICOMPUTERS:
IBM AND OTHERS IN WESTERN EUROPE AND THE U.S.

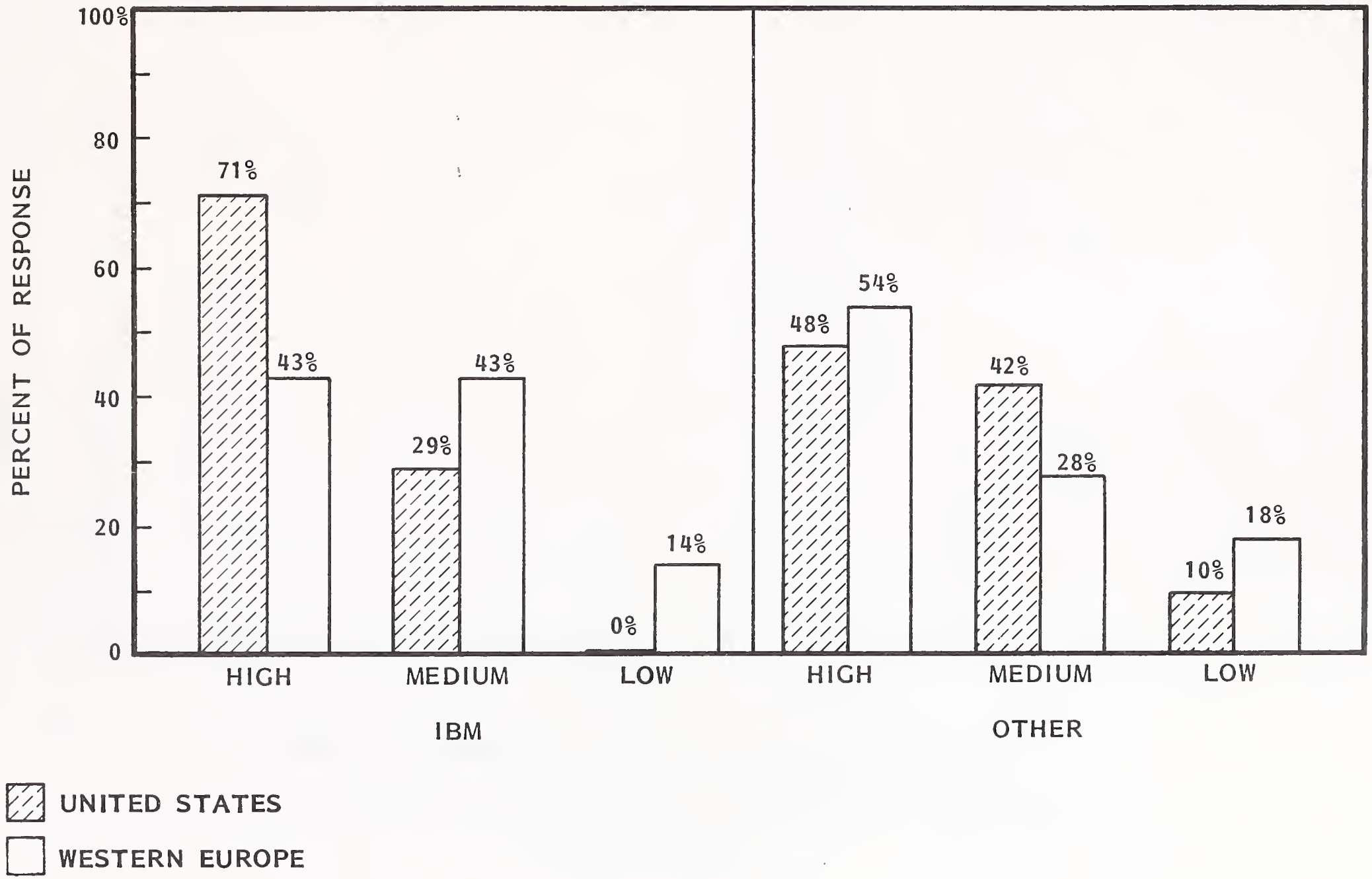


EXHIBIT III-15

USER SATISFACTION WITH MAINTENANCE OF PERIPHERALS:

IBM AND OTHERS IN WESTERN EUROPE AND THE U.S.

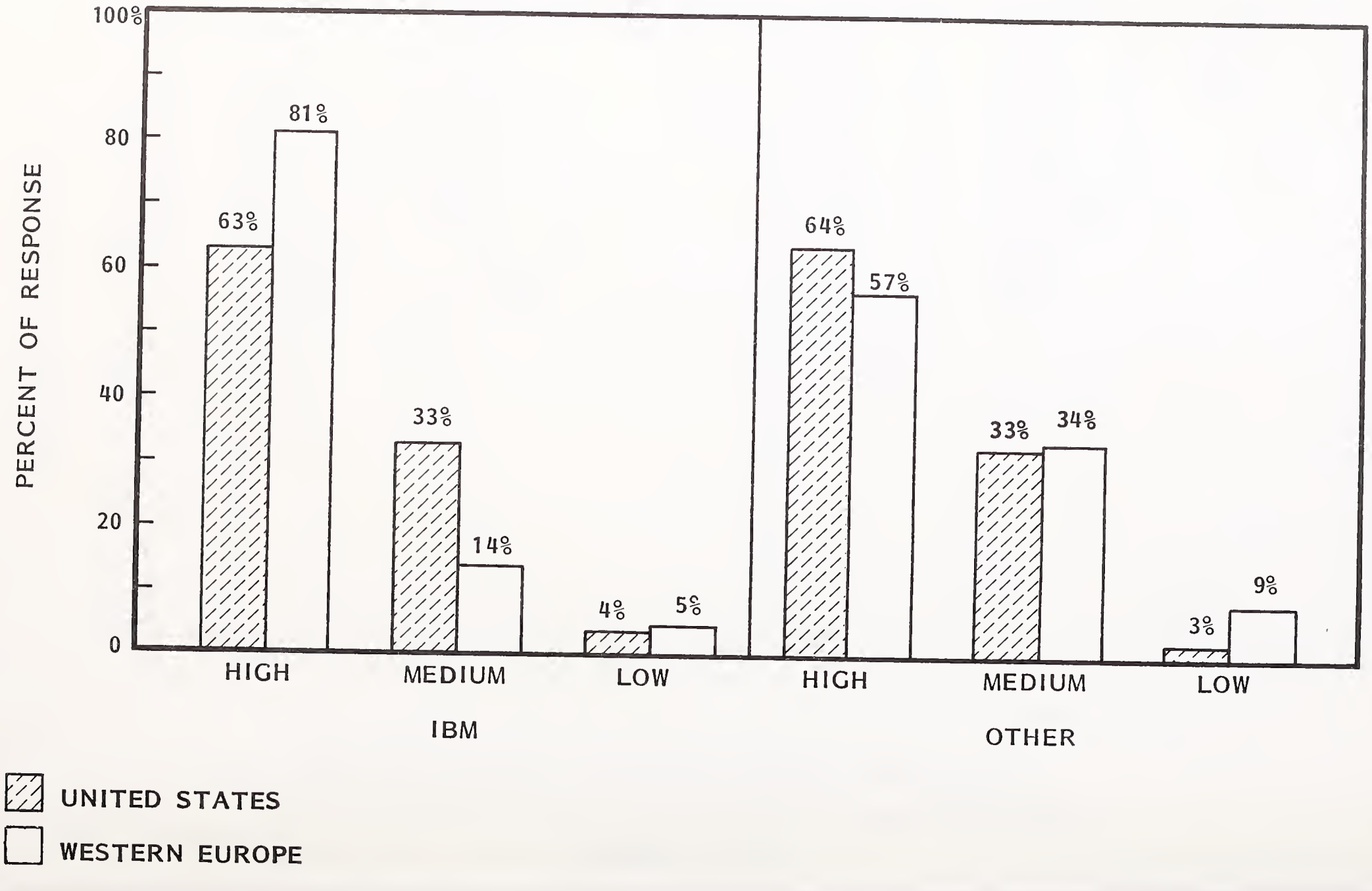
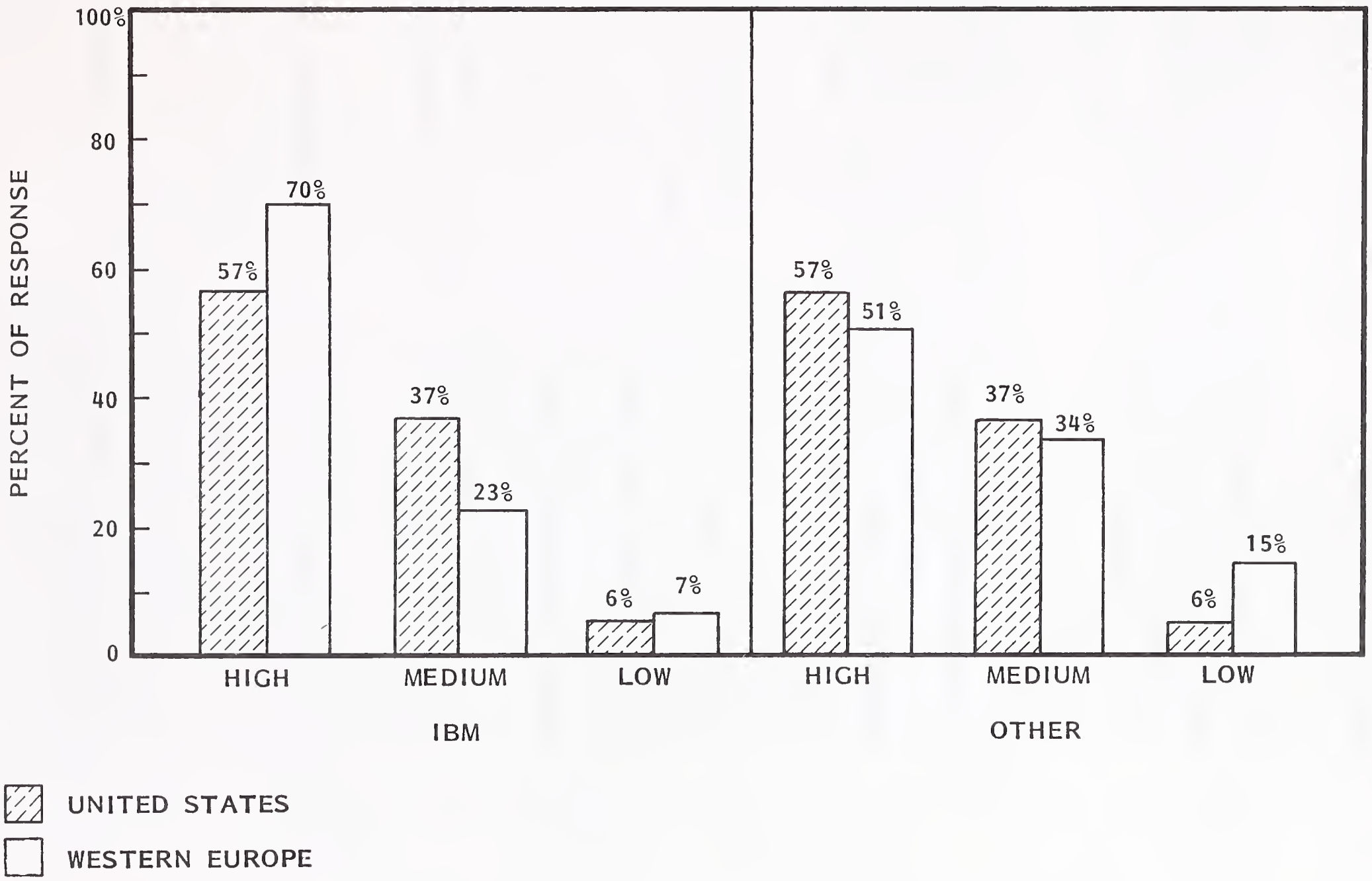


EXHIBIT III-16

USER SATISFACTION WITH MAINTENANCE OF TERMINALS:
IBM AND OTHERS IN WESTERN EUROPE AND THE U.S.



performance in all EDP areas. In Europe, IBM on average still leads the EDP market in user satisfaction.

- This judgement cannot be limited to a single market (Western Europe or U.S.) or a particular product area (e.g., mainframes, terminals, etc.). In only two maintenance areas (peripherals and terminals) does IBM match the overall average performance of all other vendors combined.

1. MAINFRAMES

- The mainframes system market is where the third-party maintenance vendors have been most active, particularly in regard to IBM installations. It is therefore surprising to see that overall satisfaction of IBM users in the U.S. is significantly lower than that of non-IBM equipment users, as shown in Exhibit III-12.

- In Western Europe this is not the case. IBM has the best rating on maintenance service with a higher percentage of 'high' user satisfaction than the other vendors as a group.

2. SMALL BUSINESS SYSTEMS

- The situation for IBM in small business systems is almost identical to that just described for mainframe systems, and can be examined in Exhibit III-13. It shows:

  - Far better performance in Western Europe than in the U.S.

  - Inferior U.S. performance to that of the competition.

- While this is not the trend for all categories of equipment, it affects a large enough revenue base for the trend to be of serious interest to IBM.

- It is also of sufficient importance to be used by the competition in sales negotiations with prospects.

- IBM's competition in the U.S. has always been stiffer than that in Western Europe; with after-sales service to users creating this level of discontent it can only be harder.

3. MINICOMPUTERS

- In this category of equipment there is a reversal from the pattern for mainframes and small business systems, as can be seen in Exhibit III-14.

  - Satisfaction of IBM users is higher in the U.S. than it is in Western Europe.

  - Non-IBM vendors in Western Europe have a better reputation as service suppliers than IBM.

- IBM has yet to be successful as a minicomputer supplier in Western Europe. Not only has DEC captured the major share but any number of secondary suppliers (Data General, Hewlett Packard, Honeywell, etc.) lead IBM. Recent forays with the Series/1 have been less than totally successful.

4. PERIPHERALS

- IBM users' satisfaction with maintenance service on peripherals is closely allied with their satisfaction with the service for the computer to which they are attached. Data on this service aspect is contained in Exhibit III-15.

- Satisfaction is very high in Western Europe but noticeably lower in the U.S.

- User satisfaction with the maintenance service provided by plug compatible peripheral vendors is not high, which is a serious impediment to their commercial success in both markets.

5. TERMINALS

- This is the third-party vendor market par excellence. However, service satisfaction is low, as already seen earlier in this section.

- IBM's own performance is not exceptionally good, and again the pattern of lower performance in the U.S. compared to Western Europe appears, as shown in Exhibit III-16.

- It is difficult to judge how much the difference in user opinions is due to, say, lower standards of expectation in Western Europe, or, conversely, higher demands of U.S. users. This subjective difference no doubt accounts for some of the differences shown.

G. USER SATISFACTION WITH SOFTWARE MAINTENANCE

- Although this is not so crucial an issue as equipment failures, given the relatively long lead times accepted by users for response and repair, it will become increasingly important over the next five years for the following reasons:

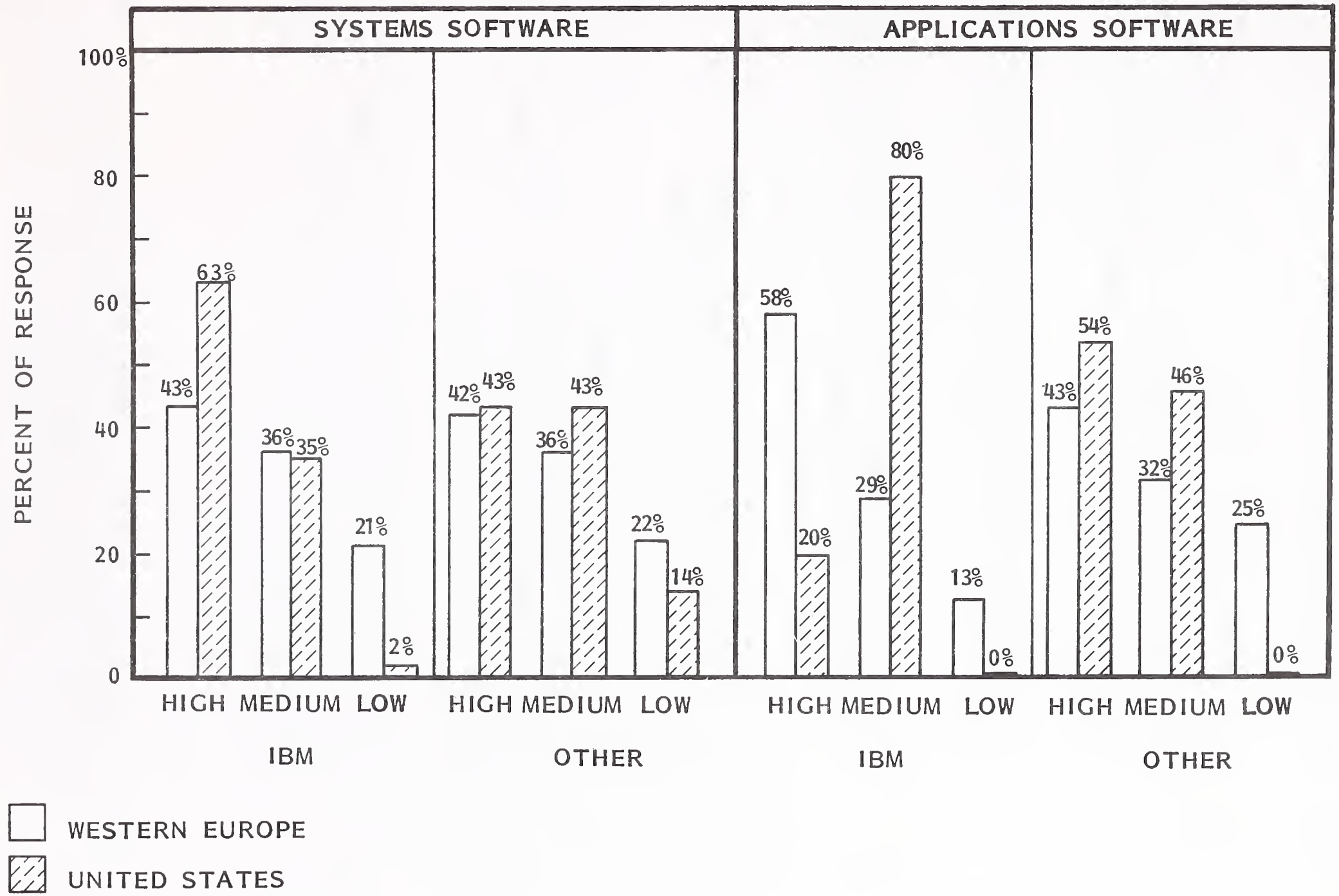
  - The ratio of hardware costs to software costs will continue to diminish so that software, as a significant budget item, will grow in visibility.

  - Systems software will be increasingly supported by field engineers, and systems reliability, as opposed to hardware and/or software reliability, will become the performance measurement norm.

- Exhibit III-17 details user satisfaction for both systems and applications software, with IBM separated from all other vendors.

EXHIBIT III-17

USER SATISFACTION WITH SOFTWARE MAINTENANCE:
IBM AND OTHERS IN WESTERN EUROPE AND THE U.S.



1. SYSTEMS SOFTWARE

- The systems software referred to is the operating system, languages, compilers and utility programs provided by the manufacturer. While the operating system is nearly always included in the price of the system, it is becoming the rule that languages, compilers and utility software are charged for separately, both for an initial perpetual license and ongoing maintenance.

- The majority of the installed systems cannot function at all without systems software and very few of the operating systems in use are error free.

  - In addition, changes are usually months in coming, so that today's users operate within the bounds of the 'current capabilities' of the latest release of systems software.

  - The errors contained in these systems are never of the type to completely shut down a computing system.

- It is in this context that the data in Exhibit III-17 should be viewed. In Western Europe few users are completely satisfied with the systems software maintenance service they obtain. In the U.S., however, the proportion of satisfied users rises to almost two thirds.

- The principal reason behind this difference is probably the fact that the average U.S. user is closer to the source of systems software development than his Western European counterpart. New releases and fixes for errors are therefore available faster.

2. APPLICATIONS SOFTWARE

- Applications software is increasingly supplied by third-party vendors or by the end user himself, as opposed to the system manufacturer. In addition, applications are in a constant state of change, adding functions, changing input or output formats, etc.

- The product to be serviced is a moving target for the applications software maintenance team.

- This probably accounts for the high level of dissatisfaction experienced by users in both the U.S. and Western Europe. The cost of maintaining such software is high and increasing, which does not help matters.

H. REPLACEMENT OF EQUIPMENT DUE TO POOR MAINTENANCE

- The answer to the question of how far a service vendor can go in providing poor service before the end user throws the system out depends on.

  - The type of the equipment.

  - If you're in Europe or the U.S.

  - Whether you're IBM or someone else.

- Exhibit III-18 compares users in the U.S. and Western Europe with regard to replacing equipment due to poor service. The data in the table show the percent of respondents who actually replaced the type of equipment shown.

- Since it is the easiest piece of equipment to replace, it would seem that a terminal would be the equipment to be the least tolerated if service is not adequate. In point of fact this is not the case, probably because a single terminal's failure rarely has a catastrophic or even very significant effect on the ability of the overall configuration.

- Peripherals, on the other hand, which are very visible to the user in terms of entering data, storing data, supporting systems and applications software and obtaining a permanent copy of results, are more easily changed than any other device.

EXHIBIT III-18

REPLACEMENT OF EQUIPMENT DUE TO POOR MAINTENANCE: IBM AND OTHERS IN WESTERN EUROPE AND THE U.S.

EQUIPMENT TYPE	PERCENT OF USERS REPLACING			
	IBM		OTHER	
	WESTERN EUROPE	U.S.	WESTERN EUROPE	U.S.
MAINFRAME	0.8%	1.5%	0.4%	-
SMALL BUSINESS SYSTEM/MINICOMPUTER	-	9.0	4.0	-
PERIPHERAL	9.7	13.0	12.2	22.0%
TERMINAL	-	5.0	3.0	2.0
PERCENT OF USERS RESPONDING	1.6%	6.0%	3.9%	12.0%

- In addition, the selling efforts of plug compatible units are heavily targetted towards these products.

- Small business systems are also readily changed, no doubt because there are many eager suppliers around to solve the problem, and because in general the nature of the processing task is not complex.

- Mainframes, on the other hand, are virtually immovable, with a heavy software component.

- U.S. users are visibly less tolerant than European users, which may account for the fact that they get better service.

- IBM users are apparently more satisfied with their service than users of other equipment.

IV VENDOR SURVEY COMPARISON

IV VENDOR SURVEY COMPARISON

A. INTRODUCTION

- This section is a comparative analysis of the data provided by U.S. and Western European field service executives of significant equipment vendors selling mainframes, small business systems, minicomputers, peripherals and terminals.

- In the U.S., INPUT interviewed 20 vendors, selected from the 50 vendors analysed in the 1978 multiclient study. In Western Europe, INPUT, Ltd. interviewed 41 vendors, 33 whose operations were country-specific (e.g., U.K. only, West Germany only, etc.) and eight whose responsibilities were international (i.e., pan-European - not worldwide).

- The actual size of the field service organisations interviewed ranged from those with 20 field engineers to those with 5,672 field engineers.

  - The majority in Western Europe fell in the 100- to 150-engineer category, while in the U.S. the majority were in the 300- to 900-engineer range.

- The level of executives responding was high - over 80% report to either the group general manager or a senior executive vice president. This lends credence to the data supplied.

B. VENDOR RATINGS OF COMMON PROBLEMS

- There is a remarkable similarity in the difficulties that field service organisations face on both sides of the Atlantic, and a marked similarity in the underlying attitudes of the vendors towards field service staff.

- Exhibit IV-1 compares the vendor ratings of the importance of a number of problem areas.

- To begin with, more attention is paid to acquiring people than to retaining those already on board or making existing staff more efficient and satisfied in their work. This is substantiated by the following ratings:

  - Recruiting personnel is rated very high.

  - Morale is rated low but turnover of staff is high, as shown in Exhibit IV-2.

  - Adequate diagnostic equipment is not available.

- Similarly, spare parts shortage is universally a problem which has an impact on the morale of the staff, the satisfaction of the customers and the mean time to repair the equipment.

  - Apparently this is not a budget difficulty, which is rated low as a problem, so it must be difficulties of organisation, planning and distribution that artificially create the shortage.

  - For new product introductions this shortage is made worse by lack of manufacturing capacity - what capacity there is being almost exclusively dedicated to product production, not spares.

EXHIBIT IV-1

VENDOR RATINGS OF PROBLEMS
RELATED TO FIELD SERVICE

PROBLEM	AVERAGE RATING*	
	UNITED STATES	WESTERN EUROPE
ADEQUATE DIAGNOSTIC EQUIPMENT	3.8	3.2
RECRUITING PERSONNEL	3.8	3.1
ADEQUATE REMOTE DIAGNOSTIC ASSISTANCE	2.9	2.9
SPARE PARTS SHORTAGE	3.2	3.0
CUSTOMER DEMANDS	3.0	3.0
PRODUCT QUALITY	3.2	2.8
TRAINING	3.0	2.7
LABOUR TURNOVER	2.9	2.3
MORALE OF STAFF	1.9	2.8
BUDGET LIMITATIONS	2.3	2.6
VENDOR INTRODUCED TOPICS		
MARKETING DEMANDS	3.0	-
SALARY ADMINISTRATION	-	2.4
ASSET CONTROL	-	2.7
COMPETITIVE SALARIES	-	2.7

* RATED ON A SCALE WHERE 1 = LOW , 5 = HIGH

EXHIBIT IV-2

COMPOSITION OF FIELD SERVICE ORGANISATIONS

CATEGORY	PERCENT OF TOTAL	
	UNITED STATES	WESTERN EUROPE
FIELD ENGINEERS	65%	86%
MANAGERS	20	5
ADMINISTRATORS	15	4
TECHNICAL SUPPORT ENGINEERS	N/A	5
AVERAGE NET GROWTH IN STAFF OF REPORTING COMPANIES	20	26
AVERAGE STAFF TURNOVER OF REPORTING COMPANIES	4.8	9.2

- The spares problem is liable to increase rather than decrease since product introductions are increasing.

- With regard to administrators, little inference can be drawn from the larger percentage of field service people found in that capacity in the U.S., as shown in Exhibit IV-2.

  - In Western Europe, although increasingly measured as a business in its own right, the field service organisation is not run as a separate business, but as a division of a company. Hence the administration, personnel and accounting functions are usually part of the general overhead and not assigned specifically to field service.

- An important category of field service personnel in Western Europe is the technical support engineer, whose role is to support the in-field engineers with specialist knowledge on specific products or product lines. In the context of the field support centre, this role will increase rapidly over the next five years.

- Net growth of staff in Western Europe exceeded that in the U.S., but over a smaller number of engineers. The demand for qualified engineering staff continues unabated, without any significant sources of new hires having been identified.

- Recruiting from competitors, as shown in Exhibit IV-3, continues to be the prime source of new hires in Western Europe since end user bases are growing faster than training programs can produce qualified engineers from graduates and new hires.

  - In the U.S., trade schools have risen to first place and although some minor efforts in this direction have been made in Western European countries, the potential of this source is not comparable to that of the U.S.

EXHIBIT IV-3

FIELD SERVICE PERSONNEL SOURCES, 1980-1985

SOURCE	1980		1985	
	UNITED STATES	WESTERN EUROPE	UNITED STATES	WESTERN EUROPE
HIRE AND TRAIN	1.8	2.2	3.5	3.0
RECRUIT FROM COMPETITION	2.9	3.0	2.1	2.7
RECRUIT FROM INDUSTRIES	2.1	2.2	2.4	2.4
TRAIN DISCHARGED ARMED SERVICES PERSONNEL	2.5	1.9	1.9	1.8
RECRUIT FROM OTHER FUNCTIONS WITHIN THE COMPANY	1.9	1.7	2.2	1.6
TRADE SCHOOLS	3.7	2.1	4.1	2.4

RATED ON A SCALE WHERE 1 = LOW, 5 = HIGH.

- In both markets, the competition is expected to provide fewer new hires over the next five years than that experienced to date, recruitment from industries is expected to increase, and the principal source of new engineers is expected to be people hired and trained for the function by the company's own efforts.

- INPUT estimated growth rates, weighted according to the number of engineers employed by each vendor, show average growths of:

  - For the U.S., 11% in 1979-1983, and 8% in 1984-1985.

  - For Western Europe, 5.2% in 1980-1985.

C. WORK-FORCE COMPOSITION AND SOURCES

- Exhibit IV-2 shows that there is a large disparity between the structure of field service organisations in the U.S. and Western Europe. The average ratio of field engineers to managers is 3.2 to 1 in the U.S., while in Europe the average is 17 to 1.

- While variances from company to company, title distinctions and structural differences account for part of this difference, it seems clear that the U.S. field engineer is better supported and probably better managed than his European counterpart.

- In this context the search for productivity improvements takes on added significance.

  - Is it better to tightly manage available resources, or to keep adding engineers as the installed base grows?

  - What is the optimal ratio of engineers to managers?

- Seen from the standpoint of the manager, it is impractical to have more than ten direct reports unless some are totally self-sufficient. However, it is also likely that with only three or four people to control, a manager can 'overcontrol' his resources.

- Recruiting from other functions within the company was rated in Exhibit IV-3, by both U.S. and Western European field services executives as the smallest source of staff. However the relative importance of this source in the U.S. is expected to outweigh recruitment from the competition by 1985.

D. WORK-FORCE COMPENSATION

- Salary scales in the U.S. tend to span a broader range in each category than those found in Western Europe. The rule in Europe seems be to have a large number of intermediate grades/titles per category, with a small salary range for experience, qualifications, performance and seniority.

- The comparisons given in Exhibit IV-4 are a bit misleading in that for a specific title the salary ranges in Western Europe appear very narrow. These are in fact the range of average salaries in the five countries examined. In each country there is a further range variance around the average, so that the true variance is slightly broader.

- Nevertheless, it is true to say that the least experienced engineer in each category is paid more in Europe, while the most experienced engineer in each category is paid more in the U.S.

  - This suggests that a possible new source of trainee engineers for European companies could be U.S. hires, and a good source of fully trained engineers for the U.S. vendors could be European competitors.

EXHIBIT IV-4

FIELD SERVICE SALARY RANGES

STAFF CATEGORY	ANNUAL SALARY RANGE ($ THOUSAND)	
	UNITED STATES	WESTERN EUROPE
TRAINEE	$12.0-20.2	$11.4-15.1*
FIELD ENGINEER	15.0-23.0	14.3-19.0*
SENIOR FIELD ENGINEER	17.0-26.0	18.9-24.0
SALARY RANGE INCREASE IN 1980 (PERCENT)	6.0-15.0	8.0-15.0%
AVERAGE ADJUSTMENT (PERCENT)	9.5	10.0
INCENTIVE PROGRAMME (PERCENT OF TOTAL INTERVIEWED)	25.0	32.0

* UNITED KINGDOM VALUES DISTORT THE RANGE.

- Actual salary ranges used in Exhibit IV-4 are further distorted by the U.K., where trainee and field engineer salary averages are far below their European counterparts:

  - Trainee salaries:

    . Average U.K. salary $11.4 thousand

    . Average salary elsewhere in Europe $14.2 thousand

  - Field engineer salaries:

    . Average U.K. salary $14.3 thousand

    . Average salary elsewhere in Europe $17.7 thousand

  - Senior engineer salaries:

    . Average U.K. salary $18.9 thousand

    . Average salary elsewhere in Europe $22.0 thousand

- Almost one third of the 41 vendors interviewed have an incentive programme based on:

  - Productivity bonuses; e.g., based on calls per week.

  - Objective-related bonuses; e.g., availability of equipment maintained, revenue, expenses.

  - Growth related; e.g., revenue growth, profit growth.

- The effectiveness of these programmes is disputed, however. Most field engineers would prefer improvements in company status, holidays, etc., rather than small cash bonuses (the maximum appears to be 10% of annual salary).

- Salary increases this past year have been in general below the rate of inflation in Europe.

  - This merely augments the conviction of the field service work-force that there is one rule for them and another for other categories of company personnel.

  - Whatever vendors say about field engineering morale, the field engineering work-force is not settled at the moment.

E. IMPORTANCE OF FIELD MAINTENANCE CHARACTERISTICS

- In the vendor's eyes, the most important part of good field service is to get a man out on site; i.e., to be seen to be doing something. Needless to say, the users' views are far more orientated towards how soon the failed system is back in action.

- European vendor attitudes towards this problem are slightly worse than their U.S. counterparts, as demonstrated by Exhibit IV-5.

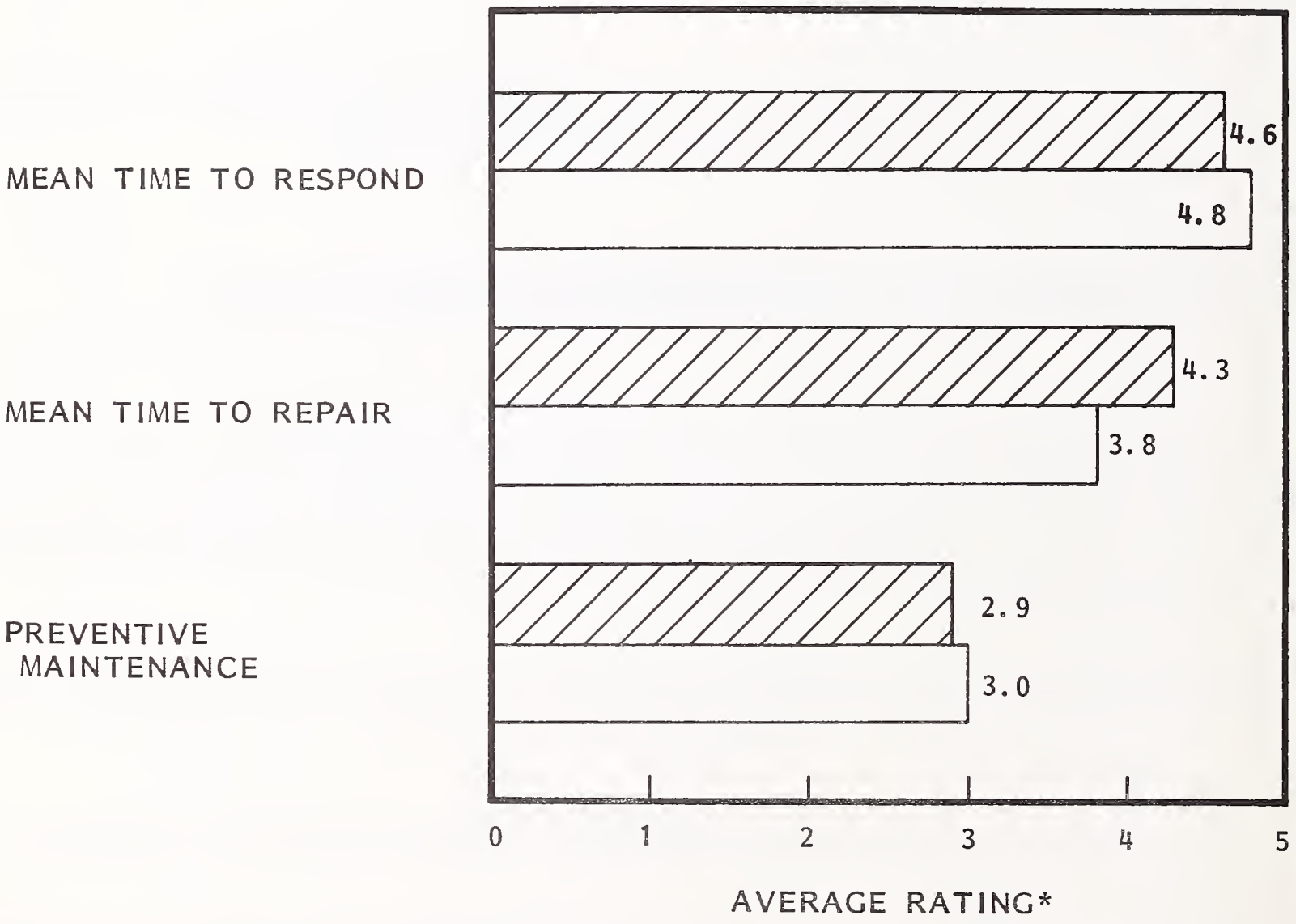
- With regard to preventive maintenance, again user and vendor views differ.

  - While the vendors rate PM at around 3.0, users in the U.S. and Europe rate it significantly higher in importance.

  - Users appear to believe what the vendors have told them about the effectiveness of PM, while the vendors are gradually losing interest.

EXHIBIT IV-5

IMPORTANCE OF FIELD MAINTENANCE
CHARACTERISTICS: VENDORS' RATINGS



*RATED ON A SCALE WHERE 1 = LOW, 5 = HIGH

- Apart from electomechanical devices, the information that PM provides is increasingly logged automatically by the operating system and stored on disk for engineer analysis. In the context of remote diagnostics, this data can be monitored remotely for failure forecasting, thereby eliminating unnecessary site visits.

- One significant concern raised by European vendors, which does not appear in Exhibit IV-5, is the importance of a stable engineering population.

  - This rated at 3.5 or almost equal to the European vendors' view of the importance of mean time to repair. U.S. vendors do not attach as much importance this problem.

  - The reason for wanting a stable engineering force is that a constant flux of engineers has a deleterious effect on user confidence, as well as destabilising the field engineer work-force. In addition, organisational management becomes difficult, hiring and training costs rise and work-force productivity drops.

F. AVAILABILITY, MEAN TIME BETWEEN FAILURES, AND RESPONSE TIMES

- On three out of four of the crucial vendor field service performance criteria (mean time between failures, mean time to repair, and response time), U.S.-based vendors outscore their Western European colleagues. On the fourth and most important of all - system uptime - Western European vendors perform marginally better.

- In considering the data of Exhibit IV-6, it must be remembered that on average, installed U.S. equipment is utilised 1.7 to 2.0 times more heavily than equipment installed in Western Europe. Given the margin of error in the sample, no significance can be attached to differences that are less than 1%.

EXHIBIT IV-6

VENDOR RESPONSES TO EQUIPMENT AVAILABILITY

EQUIPMENT TYPE	AVERAGE UPTIME (PERCENT)		MEAN TIME BETWEEN FAILURES (HOURS)		MEAN TIME TO REPAIR (HOURS)		AVERAGE RESPONSE TIME (HOURS)	
	UNITED STATES	WESTERN EUROPE	UNITED STATES	WESTERN EUROPE	UNITED STATES	WESTERN EUROPE	UNITED STATES	WESTERN EUROPE
MAINFRAMES	95.3%	97.1%	1,187	1,110	2.56	3.20	1.26	2.9
SMALL BUSINESS SYSTEMS	95.0	96.5	2,164	1,474	3.08	3.10	3.17	4.3
MINICOMPUTERS	96.4	95.2	2,204	1,340	2.00	2.40	3.18	4.8
PERIPHERALS	95.9	96.5	3,548	1,360	1.78	1.75	1.78	5.1
TERMINALS	95.6	93.4	5,187	3,134	0.98	1.40	3.48	8.6

- There are some outstanding differences in these comparisons, however, which will be further investigated by INPUT in 1981.

- With regard to average uptimes, vendors declare mainframe and small business system availability to be better in Western Europe than in the U.S.; peripheral availability is equivalent in both markets. Minicomputer and terminal availability are marginally better in the U.S. than in Europe.

- Mean time between failures of all categories of equipment is uniformly better in the U.S. than in Europe, with improvements of between 7% for mainframes to 160% for terminals. On a total system basis, it is safe to say that U.S. installed equipment is far more reliable than that installed in Europe; INPUT will investigate and verify these figures in future research.

- The overall picture from the U.S. users' standpoint is that, despite using his equipment as much as twice as often as the European, his system availability is the same on a percentage basis, his system reliability is better, and, when a fault occurs, his field engineer responds faster and takes the same amount of time (or less) to fix the failure.

- This is not a reflection on the individual ability or capability of the European field engineer; it simply reflects the fact that the environment in which he works is less conducive to good performance than that of his U.S. colleagues:

  - The installed equipment is less modern.

  - The system environment is less reliable and extremely variable.

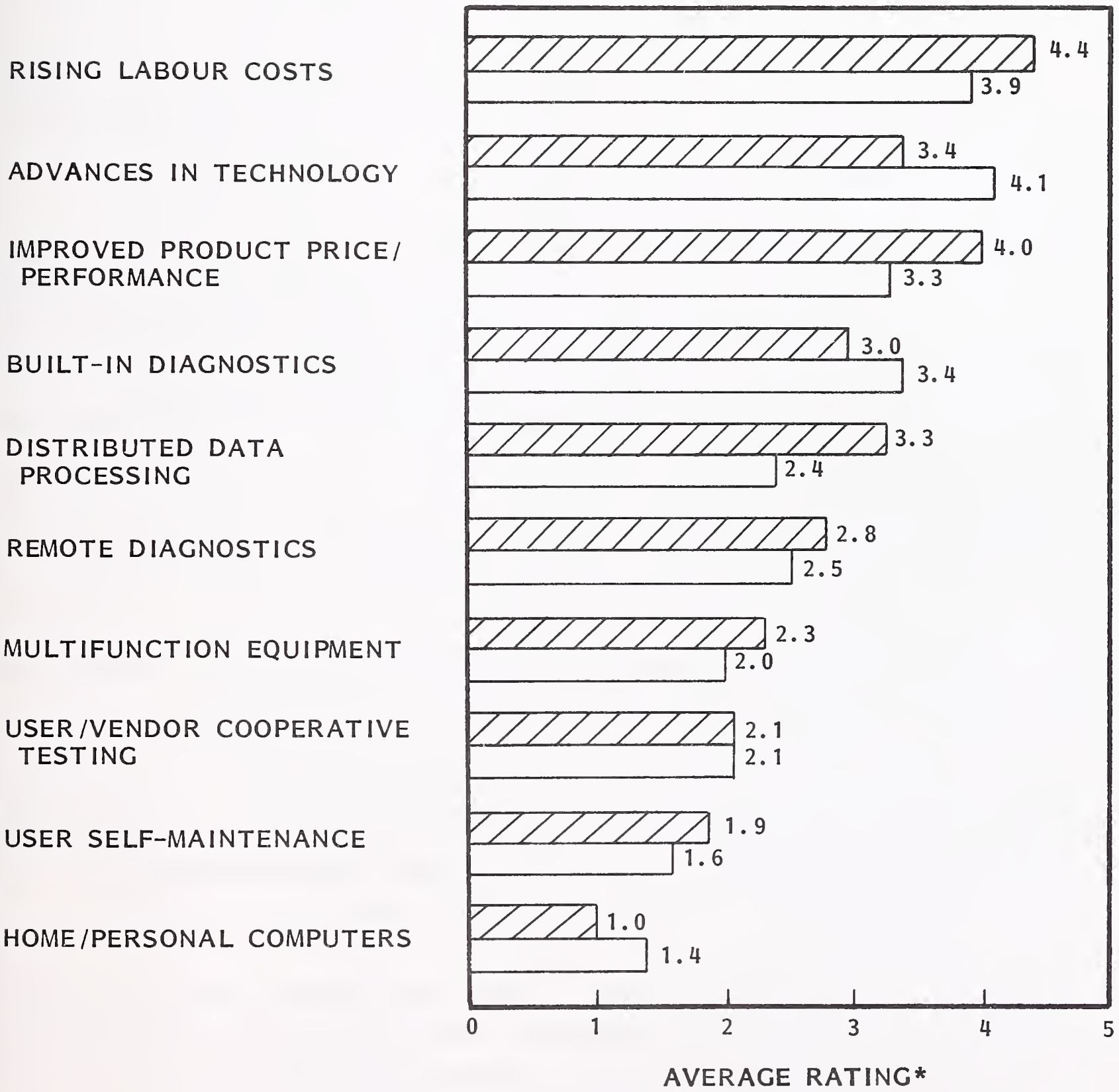
  - Communications (transport and voice/data) are, in general, poorer.

G. MAINTENANCE TECHNIQUES

- The following techniques are included in this section:
  - Board and unit repair.
  - Engineering changes notices (ECN).
  - Remote diagnostics.
  - Support centres.
  - User self-maintenance.
  - Built-in diagnostic aids.
  - Preventive maintenance.
- However, the range of factors impacting maintenance techniques is far broader, as shown in Exhibit IV-7.
- An appreciable amount of field engineering resources is spent on installing ECNs in both markets:
  - In Europe, this accounts for 6.5% of available field engineering time.
  - In the U.S., it accounts for 5.0% of available field engineering time.
- Many European vendors confessed to an ever-growing backlog of ECNs and are simply not managing their installed bases correctly. Some phase ECN activity into normal repair activities or 'next service call'.

EXHIBIT IV-7

IMPACT OF FACTORS RELEVANT
TO MAINTENANCE TECHNIQUES



*RATED ON SCALE WHERE 1 = LOW, 5 = HIGH

- On-site repairs are almost always board or subassembly replacements, with the exception of electromechanical devices.

  - Very few vendors allow component replacement on-site.

  - Terminal vendors frequently replace the entire terminal.

- Field maintenance is becoming a procedurised and structured activity, with a high proportion of vendors utilising system support centres as the focal point for hardware and software support.

  - The implementation of such centres is best achieved as a user-transparent, in-house organisation so that the user does not lose the personalised interface of his local field engineering representative.

- Remote diagnostics is a function of the support centre which has been partially implemented in the U.S. and Europe.

  - Not all vendors use remote diagnostics and those that do generally apply it to hardware only.

  - Where it is applied to software, it is for systems software, not applications software as yet.

- With these structural changes visibly making inroads into U.S. and European maintenance organisations, the mix of skills required at the various levels is changing. It is now possible to envisage the maintenance organisation of the 1980s.

  - At the user interface level, a low-skilled engineer is required with first-level knowledge of hardware and systems software architecture. Built-in diagnostics will guide the on-site engineer 80% of the time.

- For more complex failures, backup support is obtained remotely, with the failed system diagnosed by communications link to the regional support centre.

- At the regional support centre, the second-level expertise in hardware and systems software resides, with direct on-line links to the headquarters support centre, where the top-level system expertise is found.

- The vendors' own view of the principal factors impacting their maintenance techniques is reflected in Exhibit IV-7. Labour costs are the constant spur to implement more effective and efficient techniques to reduce the amount of time spent on call, and are the principal reason for the sudden preoccupation with remote diagnostics.

- Constantly changing technology also affects the ability of the field service organisation to adequately support the installed base.

  - Each change of product requires a lengthy period of apprenticeship during which an understanding of the technical characteristics gradually permeates the maintenance organisation.

  - This affects efficiency and productivity, so that a constant evolution of products means that the entire vendor organisation is always operating below maximum capability.

- One of the effects of improved product price/performance is that maintenance costs become more visible to users at a time when improved product reliability and performance are being touted.

- The dispersion of equipment brought about by distributed data processing (DDP) and the multiplication of sites that results is of major concern to maintenance organisations for obvious reasons. The impact of this is felt more in the U.S., - where DDP has been more widely adopted, than in Europe.

- Other possibilities, such as the adoption of multifunction equipment or the spread of user self-maintenance are not yet rated by vendors as having any great impact.

H. PRICING COMPARISONS

- The basis for pricing, both in Western Europe and the U.S., is to:
  - Cover costs (at a minimum).
  - Make a profit (though not always possible).
- The starting point for an analysis of pricing is, therefore, the level of per-service costs experienced by vendors and the major components of those costs.
- Exhibit IV-8 shows that, although there is broad agreement on the breakdown of per-call costs into labour, travel, parts and materials, and other, between the U.S. and Western Europe, the average cost of a call in Europe is significantly higher, 35.9%.
- The range of costs per call in Western Europe, as declared by the vendors interviewed, was $75 to $500 respectively, for a terminal supplier and a plug compatible mainframe vendor. The range of costs in the U.S. is notably lower at $58 to $280, as shown in Exhibit IV-8.
- Mainframe vendors in Europe charge from 7% to 12% of the undiscounted purchase price of the equipment as an annual maintenance charge. In the U.S., the rates are 3.6% to 10%. Given that Western European equipment prices are usually about twice the dollar cost of the equipment to a U.S. prospect, this is a doubling of maintenance charges in Western Europe as compared to the U.S.

EXHIBIT IV-8

COMPARISON OF U.S. AND WESTERN EUROPEAN PER-CALL COSTS

COMPONENT	WESTERN EUROPE		UNITED STATES	
	RANGE	AVERAGE	RANGE	AVERAGE
COST DISTRIBUTION (PERCENT)				
• LABOUR	30-75%	50%	21-75%	50%
• TRAVEL	5-35	18	4-29	15
• PARTS AND MATERIALS	8-45	22	5-50	24
• OTHER	0-34	10	0-35	11
TOTAL COST PER CALL (DOLLARS)	$75-500	$230	$58-280	$170

- On minicomputers and small business systems, the Western European maintenance charges range from 8.5% to 15% of purchase price, compared to 6% to 12% in the U.S.

- For peripheral and terminal vendors, maintenance charges are around 10% of purchase price in both the U.S. and Europe.

APPENDIX A: DEFINITIONS

APPENDIX A: 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 includes parts and a bill of materials to effect the change in hardware.

- FIELD ENGINEER (FE) - For the purposes 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 systems software in addition to installing the entire system at the end user's site.

- MEAN TIME BETWEEN FAILURE (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 utilisation.

- MEAN TIME TO RESPOND - The elapsed time between the user's placement of a service call and the arrival of a field engineer at the user's location.

- 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 purposes of this study, is a system which is built around a Central Processing Unit (CPU), has the ability to utilise at least 20M bytes of disc capacity, provides multiple CRT work-stations and offers business-orientated systems 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. It may also develop systems 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 B: USER QUESTIONNAIRE - EUROPE

EUROPEAN FIELD SERVICE ANNUAL REPORT
USER QUESTIONNAIRE

1. Please complete the table below and rate on a scale of 1-5 (1 = low, 3 = medium, 5 = high) the maintenance service you receive.

Equipment Classification	Predominant Vendor's Name	Maintenance Vendor's Name	Maintenance Contract or Time and Materials	Rating of Maintenance Service (circle your response)
a) Medium and Large Mainframes				1 2 3 4 5
b) Small Business Computers				1 2 3 4 5
c) Other Minicomputers				1 2 3 4 5
d) Peripherals (plug compatible)				1 2 3 4 5
e) Terminals				1 2 3 4 5
f) Software: Systems				1 2 3 4 5
g) Software: Applications				1 2 3 4 5

2. a) For how many hours per day have you presently contracted maintenance?

_____ Hours

b) For how many days a week do you have coverage?

_____ Days

c) Will this coverage change in the future?

☐ Yes ☐ No

Comments: _____

_____

_____

d) Does this coverage vary depending on type of equipment?

☐ Yes ☐ No

If yes, please comment:

_____

_____

_____

_____

e) What happens outside of contracted hours?

_____

_____

_____

_____

3. Please complete the table below in hours:

   - Respond time from placing fault call to engineer arriving on site.

   - Repair time from engineer arriving on site to machine being returned to you.

   - What percent increase in maintenance charges would you pay to move from your current position to your ideal position?

Equipment Classification	What Is Your Minimum Acceptable Level		What Is Your Current Average		What Is Your Ideal, Considering the Real World		Percent Willing to Pay
	Respond	Repair	Respond	Repair	Respond	Repair	
a) Medium and Large Mainframes							
b) Small Business Computers							
c) Other Minicomputers							
d) Peripherals (plug compatible)							
e) Terminals							
f) Software: Systems							
g) Software: Applications							

4. Rate the importance to you of the following field maintenance characteristics on a scale of 1-5 (1 = low, 3 = medium, 5 = high).

Factor	Rating (circle your response)
a) Mean Time to Respond (in person)	1 2 3 4 5
b) Mean Time to Repair (of equipment) (not including response time)	1 2 3 4 5
c) Regularly Scheduled Preventive Maintenance	1 2 3 4 5
d) Other (specify)	1 2 3 4 5

5. During the past two years have you or are you currently replacing any hardware due to poor maintenance?

a) Yes _____

b) No _____

c) If yes:

- Vendor _____
- Type of Machine _____
- Maintenance Vendor _____

6. Over the same period have you or are you replacing any software due to poor maintenance?

   a) Yes _____

   b) No _____

   c) If yes:

   - Vendor _____
   - Type of Software _____
   - Maintenance Vendor _____

7. During the past year how would you rate the quality of the field service engineers that service your installation compared to earlier years?

   _____ Same Quality

   _____ Poorer Quality

   _____ Improved Quality

   Please comment: _____

   _____

   _____

8. During the past year how would you rate the quality of the field service management that is responsible for your installation compared to earlier years?

   _____ Same Quality

   _____ Poorer Quality

   _____ Improved Quality

   Please comment: _____

   _____

   _____

9. As a result do you currently perform any of the following maintenance activities?

		Perform	Cost Saving Percent	Consider	Expected Cost Saving
a)	Install equipment	Y N	_____	Y N	_____
b)	Perform diagnostics before calling for vendor maintenance	Y N	_____	Y N	_____
c)	Perform maintenance on your hardware system	Y N	_____	Y N	_____
d)	Perform maintenance on vendor-supplied software	Y N	_____	Y N	_____
e)	Deliver equipment to vendor maintenance depot for repair or replacement	Y N	_____	Y N	_____

10. Do any of your vendors provide a remote diagnostic capability?

☐ Yes ☐ No

a) If yes, which vendor provides this service? _____

If yes, for which equipment type? _____

b) How long has it been provided? _____ Months

c) How would you rate the quality of your maintenance service with this remote diagnostic capability?

_____ Same Quality

_____ Improved Service

_____ Poorer Service

Please comment: _____

_____

_____

11. Has this remote diagnostic capability reduced your maintenance costs?

☐ Yes ☐ No

a) If yes, by what percent have your maintenance costs decreased?

_____% Decrease

12. If offered remote diagnostics, what would be your reaction?

_____

_____

_____

_____

13. Do any of your vendors provide a formal escalation procedure as part of their maintenance activities?

☐ Yes ☐ No Vendor _____

Equipment _____

a) If yes, what affect has this had on the maintenance support that has been provided to you?

_____

_____

_____

b) If no, do you believe that a formal escalation procedure would provide improvements over the present level of maintenance support you are receiving?

☐ Yes ☐ No

How would it help? _____

_____

_____

_____

14. Would you prefer to buy products from a vendor who provides a formal escalation procedure as a part of their maintenance activities?

☐ Yes ☐ No

15. What other new maintenance techniques have your vendors introduced in the past year?

_____

_____

_____

_____

a) How effective have they been?

_____

_____

_____

_____

16. What is your current budget for EDP? $_____

What portion of this is spent on: ($ or %)

	1980	1982	1985
a) Hardware			
b) Software			
c) Personnel			
d) Hardware Maintenance			
e) Software Maintenance			

17. How have your maintenance costs changed in the last 12 months compared to earlier years?

	More (%)	Less (%)	Same
In absolute $			
Relative to Value of Equipment			

18. What do you plan to do about rising maintenance costs?

19. At what point does this become a problem?

There have been some recent changes in the manner vendors charge for maintenance services. These changes have been primarily in providing an incremental pricing structure where individual maintenance activities are billed separately.

20. For which types of equipment would you prefer maintenance to be billed as a:

a) Fixed monthly maintenance charge? _____

_____

_____
(equipment type)

b) Incremental maintenance charge based on service provided? _____

_____

_____
(equipment type)

Why? _____

_____

_____

21. Would you be willing to pay for on-site spares for your installation?

☐ Yes ☐ No

a) If yes, what advantages?

_____

_____

_____

b) If no, why not?

_____

_____

_____

22. For what percentage of cost saving in your maintenance contract would you eliminate preventive maintenance (PM)? (encircle)

a) Would Not Consider Elimination of PM

b) < 5% of Contract Cost

c) 5-10% of Contract Cost

d) 11-20% of Contract Cost

e) 21-30% of Contract Cost

f) >30%

23. If currently using a third party for maintenance, please state the reasons.

_____

_____

_____

_____

a) What is the percent savings?

_____%

24. If you are not currently using a third party for maintenance, would you consider it?

a) Yes _____

b) No _____

If no, why not?

_____

_____

_____

_____

c) If yes, please state the reasons for using a third party for maintenance.

_____

_____

_____

d) What is the expected savings (if any)?

_____%

25. What, in your opinion, would improve your maintenance service? How important are these?

	High	Medium	Low
_____	☐	☐	☐
_____	☐	☐	☐
_____	☐	☐	☐
_____	☐	☐	☐

26. What maintenance needs or service requirements do you have which are not now being met?

_____

_____

_____

_____

27. In the next two years, do you expect to see your quality of maintenance improve, stay the same, or decline?

☐ Improve ☐ Same ☐ Decline

- All information is treated in strictest confidence.
- A photo copy of your current maintenance agreement would greatly assist our survey.
- Thank you for your cooperation.

APPENDIX C: USER QUESTIONNAIRE - U.S.

1. a) For your _____, who is the predominant vendor?

   b) Do you have a maintenance contract with them or do you use a time and materials arrangement?

   c) Please rate the quality of the vendor's overall maintenance using a 5-1 scale; 5 being excellent and 1 being poor.

Equipment Classification	Predominant Vendor	Maintenance Vendor	Maintenance Contract or Time and Materials	Rating of Vendor's Maintenance Service
a) Medium and Large Mainframes				
b) Small Business Computers				
c) Other Minicomputers				
d) Peripherals (plug compatible)				
e) Terminals				
f) Software: Systems				
g) Software: Applications				

2. a) For how many shifts per day have you presently contracted maintenance?

_____

b) For how many days a week do you have coverage?

_____

c) Will this coverage change in the future?

☐ Yes ☐ No

Comment: _____

_____

d) Does this coverage vary depending on type of equipment?

☐ Yes ☐ No

If yes, please comment:

_____

_____

_____

_____

3. MINIMUM/CURRENT/DESIRED MEAN TIME TO RESPOND/REPAIR

a) For your _____, what is the minimum acceptable mean time to respond, mean time to repair?

b) What is the current mean time to respond you are receiving? Repair?

c) What would you like to have as the mean time to respond? Repair?

d) What additional amount would you be willing to pay to receive this ideal mean time to respond? Repair?

Equipment Classification	Minimum Respond/Repair	Current Respond/Repair	Ideal Respond/Repair	Percent Willing to Pay
a) Medium and Large Main-frames				
b) Small Business Computers				
c) Other Mini-computers				
d) Peripherals (plug com-patible)				
e) Terminals				
f) Software: Systems				
g) Software: Applica-tions				

4. Rate the importance to you of the following field maintenance characteristics: (5 = highest, 1 = lowest)

Factor	Rating
a) Mean Time to Respond (in person)	
b) Mean Time to Repair (of equipment) (Not include response time)	
c) Regularly Scheduled Preventive Maintenance	
d) Other (specify)	

5. During the past two years have you or are you currently replacing any hardware due to poor maintenance?

a) Yes _____

b) No _____

c) If yes:

- Vendor _____
- Type Machine _____
- Maintenance Vendor _____

6. Over the same period have you or are you replacing any software due to poor maintenance?

   a) Yes _____

   b) No _____

   c) If yes:

   - Vendor _____
   - Type of Software _____
   - Maintenance Vendor _____

7. During the past year how would you rate the quality of the field service engineers that service your installation compared to earlier years?

   _____ Same Quality
   _____ Poorer Quality
   _____ Improved Quality

   Please comment: _____

8. During the past year how would you rate the quality of the field service management that is responsible for your installation compared to earlier years?

   _____ Same Quality
   _____ Poorer Quality
   _____ Improved Quality

   Please comment: _____

9. As a result do you currently perform any of the following maintenance activities?

		Perform		Cost Saving Percent	Consider		Expected Cost Saving
a)	Install equipment	Y	N	_____	Y	N	_____
b)	Perform diagnostics before calling for vendor maintenance	Y	N	_____	Y	N	_____
c)	Perform maintenance on your hardware system	Y	N	_____	Y	N	_____
d)	Perform maintenance on vendor supplied software	Y	N	_____	Y	N	_____
e)	Deliver equipment to vendor maintenance depot for repair or replacement	Y	N	_____	Y	N	_____

10. Do any of your vendors provide a remote diagnostic capability?

☐ Yes ☐ No

a) If yes, which vendor provides this service? _____

If yes, for which equipment type? _____

b) How long has it been provided? _____ months

c) How would you rate the quality of your maintenance service with this remote diagnostic capability?

_____ Same Quality
_____ Improved Service
_____ Poorer Service

Please comment: _____

_____

_____

11. Has this remote diagnostic capability reduced your maintenance costs?

☐ Yes ☐ No

a) If yes, by what percent has your maintenance costs decreased? _____ % decrease

12. Do any of your vendors provide a system support center capability?

☐ Yes ☐ No

a) If yes, which vendor provides this service? _____

b) How long has it been provided? _____ months

c) How would you rate the quality of this system support center capability?

_____ Same Quality
_____ Improved Service
_____ Poorer Service

Please comment: _____

_____

_____

13. Do any of your vendors provide a formal escalation procedure as part of their maintenance activities?

☐ Yes ☐ No

Vendor _____

Equipment _____

a) If yes, what effect has this had on the maintenance support that has been provided to you?

_____

_____

_____

b) If no, do you believe that a formal escalation procedure would provide improvements over the present level of maintenance support you are receiving?

☐ Yes ☐ No

How would it help? _____

_____

_____

_____

14. Would you prefer to buy products from a vendor who provides a formal escalation procedure as a part of their maintenance activities?

☐ Yes ☐ No

15. What other new maintenance techniques have your vendors introduced in the past year?

_____

_____

_____

_____

a) How effective have they been?

_____

_____

_____

_____

16. What is your current budget for EDP? $ _____

What portion of this is spent on: ($ or %)

	1980	1982	1985
a) Hardware			
b) Software			
c) Personnel			
d) Hardware Maintenance			
e) Software Maintenance			

17. How have your maintenance costs changed in the last 12 months compared to earlier years?

	More (%)	Less (%)	Same
In absolute $			
Relative to value of Equipment			

18. What do you plan to do about rising maintenance costs?

19. At what point does this become a problem?

There have been some recent changes in the manner vendors charge for maintenance services. These changes have been primarily in providing incremental pricing structure where individual maintenance activities are billed separately.

20. For which types of equipment would you prefer maintenance to be billed as a:

a) Fixed monthly maintenance charge? _____

_____

_____
(equipment type)

b) Incremental maintenance charge based on service provided? _____

_____

_____
(equipment type)

Why? _____

_____

_____

21. Would you be willing to pay for on-site spares for your installation?

☐ Yes ☐ No

a) If yes, what advantages?

_____

_____

_____

b) If no, why not?

_____

_____

_____

22. For what percentage of cost saving in your maintenance contract would you eliminate preventive maintenance (PM)? (encircle)

a) Would not consider elimination of PM

b) < 5% of contract cost

c) 5-10% of contract cost

d) 11-20% of contract cost

e) 21-30% of contract cost

f) > 30%

23. If currently using a third party for maintenance, please rate the following reasons for having used a third party for maintenance. (Use a scale of 5-1, 5 being the most important reason, and 1 being the least)

	Hardware	Rating	Software	Rating
a) Thought it would be less expensive Percentage expected savings Percentage actually saved	_____ % _____ %		_____ % _____ %	
b) Manufacturer does not provide adequate maintenance at your location Maximum acceptable response time	_____ Hrs		_____ Hrs	
c) Have a multivendor installation				
d) Other (specify)	_____ _____		_____ _____	

24. If you are not currently using a third party for maintenance, would you consider it?

a) Yes _____

b) No _____

If no, why?

_____

_____

_____

_____

c) If yes, please rate the following reasons for using a third party for maintenance. (Use a scale of 5-1, 5 being the most important and 1 being the least)

	Hardware	Rating	Software	Rating
1) Would expect it to be less expensive Percentage savings expected	_____ %		_____ %	
2) Manufacturer does not provide adequate maintenance at your location Maximum acceptable response time	_____ Hrs		_____ Hrs	
3) Have a multivendor installation				
4) Other (specify)	_____ _____		_____ _____	

25. What, in your opinion, would improve your maintenance service? How important are these?

	H	M	L
_____			
_____			
_____			
_____			
_____			

26. What maintenance needs or service requirements do you have which are not now being met?

APPENDIX D: VENDOR QUESTIONNAIRE - EUROPE

EUROPEAN FIELD SERVICE ANNUAL REPORT
VENDOR QUESTIONNAIRE

Please complete this questionnaire based on local field service operations in

I. FIELD SERVICE ORGANISATION

1. What is the title of your senior corporate executive for field service?

   _____

   a) To whom does he/she report? _____

2. In your company, is the field service organisation treated as a:

   ☐ Profit Center

   ☐ Cost Center

   a) What percent of revenue is your profit objective?

   _____%

   b) If it is currently a cost center, do you see this changing to a profit center?

   ☐ Yes ☐ No

   If yes, when will this occur? _____

3. During the past year have you made any major changes in the structure of your field service organisation?

   ☐ Yes ☐ No

   If yes, what were these changes?

   a) _____

   b) _____

   c) _____

4. What is the current size of your field service organisation?

_____

a) How many of these are field engineers? _____

b) How many are technical support engineers? _____

c) How many are field management? _____

d) How many are administrative? _____

5. During the past year did the size of your field service organisation:

☐ Increase _____%

☐ Decrease _____%

☐ Remain the same

a) What were the primary reasons for these changes?

1) _____

2) _____

3) _____

6. a) How many field engineering offices do you presently have?

_____

b) 1) How many sites do you have where engineers are permanently based?

_____

2) Has this changed in the last year?

☐ Increased ☐ Same ☐ Decreased

3) By what number?

_____

7. What percentage of the total maintenance organisation is located at divisional (regional) and headquarters locations?

_____%

8. a) How many field engineers did you hire last year? _____

b) How many field engineers did you lose? _____

9. What were the three most important reasons for losing field engineering personnel?

a) _____

b) _____

c) _____

10. Will the number of field engineers required increase:

			Percent Increase
a) In 1980?	☐ Yes	☐ No	_____%
b) In 1982?	☐ Yes	☐ No	_____%
c) In 1984?	☐ Yes	☐ No	_____%

d) Please comment on the causes of these changes:

_____

_____

_____

_____

_____

11. When you add or replace field service personnel, what are the primary sources? Please rate the following sources on a scale of 1-5 (1 = low, 3 = medium, 5 = high).

Factor	Rating (1980)	Rating (1985)
a) Hire and train yourself (no technical pretraining)	1 2 3 4 5	1 2 3 4 5
b) Recruit from competition	1 2 3 4 5	1 2 3 4 5
c) Recruit from other industries	1 2 3 4 5	1 2 3 4 5
d) Trained, discharged armed forces personnel	1 2 3 4 5	1 2 3 4 5
e) Recruit from other functions within your company (e.g., manufacturing, engineering)	1 2 3 4 5	1 2 3 4 5
f) Trade schools	1 2 3 4 5	1 2 3 4 5
g) Other (describe)	1 2 3 4 5	1 2 3 4 5

12. The following are potential problems associated with field service organisations. Please rate on a scale of 1-5 (1 = low, 3 = medium, and 5 = high).

Factor	Rating
a) Morale of maintenance force	1 2 3 4 5
b) Recruiting field maintenance personnel	1 2 3 4 5
c) Training field maintenance personnel	1 2 3 4 5
d) Reducing labour turnover	1 2 3 4 5
e) Product quality	1 2 3 4 5
f) Adequate diagnostic equipment	1 2 3 4 5
g) Adequate remote diagnostic assistance	1 2 3 4 5
h) Marketing demands	1 2 3 4 5
i) Customer demands	1 2 3 4 5
j) Budget limitations	1 2 3 4 5
k) Competitive salary/compensation	1 2 3 4 5
l) Spare parts shortage	1 2 3 4 5
m) Asset control	1 2 3 4 5
n) Technical competence of engineer	1 2 3 4 5

II. FIELD SERVICE SALARIES

1. For the following general categories of field service personnel, what is the average salary and salary range? How has and how will these change?

	Average Salary	Range			% Increase '78 to '79	% Increase '79 to '80
Trainee	_____	_____	to	_____	_____ %	_____ %
Qualified Field Engineer	_____	_____	to	_____	_____ %	_____ %
Senior Field Engineer	_____	_____	to	_____	_____ %	_____ %

2. What are the primary reasons for salary increases?

a) _____

b) _____

c) _____

3. Do you currently have an incentive program for your field engineers?

☐ Yes ☐ No

Please describe:

_____

_____

_____

_____

_____

III. UNIONS

1. Is your field engineering workforce unionised (or part)?

☐ Yes ☐ No

a) If yes, which union? _____

b) If no, do you see this happening?

☐ Yes ☐ No

When? _____

IV. LEVEL OF SUPPORT

1. What percentage of total field engineering manhours was spent in installing engineering change notices (ECN) during 1979?

_____%

Comments:

_____

_____

_____

_____

_____

_____

2. What is the average number of 'trouble calls' in a month?

_____

a) What percentage of these are 'repeat calls'; i.e., a second call within two weeks about the same problem?

_____%

b) What percentage of total calls had no faults found? _____%

3. Do field engineers currently replace components, boards or units at the user's site?

☐ Components ☐ Boards ☐ Units

a) Are these parts then repaired on-site, at a depot or at the factory?

☐ On-Site ☐ Depot ☐ Factory

b) In 1984 will field engineers replace components, boards or units on-site?

☐ Components ☐ Boards ☐ Units

4. For each type of product offered by your company, what is the:

Equipment Classification	Average Percentage Uptime (Percent)	Average Mean Time Between Failure (Hours)	Average Mean Time to Repair (Hours)	Average Mean Time to Respond (Hours)
a) Medium and Large Mainframes				
b) Small Business Computers				
c) Other Minicomputers				
d) Peripherals (plug compatible)				
e) Terminals				

5. How important do you feel are the following field maintenance characteristics to your users? Please rate on a scale of 1-5 (1 = low, 3 = medium, 5 = high).

Factor	Rating (circle your response)
a) Mean Time to Respond (in person)	1 2 3 4 5
b) Mean Time to Repair (of equipment)	1 2 3 4 5
c) Regularly Scheduled Preventive Maintenance	1 2 3 4 5
d) Stable Engineering Population	1 2 3 4 5
e) Other (please specify)	1 2 3 4 5

6. Do you receive engineering technical support from:

a) U.S.A.

☐ Yes ☐ No

Describe: _____

_____

b) Other European Countries

☐ Yes ☐ No

Describe: _____

_____

7. Where are your engineers trained?

   a) Your Own Country _____%

   b) Other European Countries _____%

   c) U.S.A. _____%

   d) Other _____%

8. Do you have a defined management training program for your engineers?

   ☐ Yes ☐ No

   Describe: _____

   _____

   _____

   _____

VI. REMOTE DIAGNOSTICS

1. Do you provide a remote diagnostic capability as part of your field service support?

   ☐ Yes ☐ No

   a) If yes, when did you begin offering this capability? _____

   _____

   1) What were the primary reasons for implementing it?

   _____

   _____

   _____

   _____

2) Is this remote diagnostic capability for:

☐ Hardware ☐ Software ☐ Both

3) How has this remote diagnostic capability affected your maintenance costs?

☐ Increased _____%

☐ Decreased _____%

☐ Remained the same

4) What has been your customers' reaction to this remote diagnostic capability?

_____

_____

_____

_____

b) If you do not currently have a remote diagnostic capability, do you have any plans to implement one?

☐ Yes ☐ No

1) If yes, when will such a capability be available to your customers?

_____

2) If no, why not?

_____

_____

_____

_____

VII. FORMAL ESCALATION PROCEDURES

1. Within your field service organisation, do you have a formal escalation procedure for handling maintenance calls?

☐ Yes ☐ No

a) If yes, what are the general parameters of this escalation procedure?

_____

_____

_____

_____

b) If no, how are trouble situations that cannot be solved by the local field engineer handled in your organisation?

_____

_____

_____

_____

2. a) What percent of your clients know of these procedures?

_____%

b) Please rate on a scale of 1-5 the importance of these escalation procedures to your client. (1 = low, 3 = medium, 5 = high)

1 2 3 4 5

Comments: _____

_____

_____

_____

VIII. FIELD SERVICE DOCUMENTATION

1. During the past year have you made any major changes in the types of field service documentation provided to your customers?

   ☐ Yes ☐ No

   a) If yes, what were the types of changes made to the documentation and its distribution to customers?

   _____

   _____

   _____

   _____

   b) Why were these changes implemented?

   _____

   _____

   _____

   _____

2. During the next two years will you be providing your customers with:

   ☐ More Documentation

   ☐ Less Documentation

   ☐ Same as Present

   a) Why will these changes be made?

   _____

   _____

   _____

   _____

IX. SPARES INVENTORY

1. What is the percentage distribution of spares among the following locations?

Manufacturing Facility	_____%
Spares Warehouses	_____%
Branch Offices	_____%
Engineer-Held	_____%
Customer Locations	_____%
	100%

2. During the past year has there been an increase in the number of customers who maintain spares at their location?

☐ Yes ☐ No _____% Increase

Why? _____

_____

_____

_____

3. a) Have you actively engaged on an asset reduction program regarding spares holding?

☐ Yes ☐ No

b) Please rate its success on a scale of 1-5 (1 = low, 3 = medium, 5 = high).

1 2 3 4 5

X. MAINTENANCE TECHNIQUES

1. Please rate the impact of the following factors on your current maintenance techniques on a scale of 1-5 (1 = low, 3 = medium, 5 = high).

Factor	Rating
a) Rising labour costs	1 2 3 4 5
b) Increasing product price performance	1 2 3 4 5
c) User performing own maintenance	1 2 3 4 5
d) User and vendor cooperatively testing transmission or computing equipment	1 2 3 4 5
e) Home or personal computers	1 2 3 4 5
f) Multifunction equipment	1 2 3 4 5
g) Built-in diagnostics	1 2 3 4 5
h) Remote diagnostics (via telecommunications)	1 2 3 4 5
i) Distributed data processing	1 2 3 4 5
j) Advances in technology	1 2 3 4 5
k) Other (describe)	1 2 3 4 5

2. Do you have a local repair facility?

☐ Yes ☐ No

XI. RESEARCH AND DEVELOPMENT

1. As a part of your operating budget do you have an allocation for R&D expenditures for improving maintenance techniques?

   ☐ Yes ☐ No

   a) If yes, what is the approximate percent of this allocation?

   _____%

2. In the development of new products in your company, what is the involvement of the field service organisation?

   _____

   _____

   _____

   _____

XII. MAINTENANCE PRICING

1. During the past year what changes have you made in maintenance prices?

   ☐ Increased _____%

   ☐ Decreased _____%

   ☐ Remained Same

   a) Which of the following reasons was most important in causing maintenance fees to rise?

   1) Inflation ☐

   2) Labour Cost ☐

   3) Parts Cost ☐

   4) Competitor's Pricing ☐

   5) Other _____ ☐

2. During the next year what types of price changes are you planning?

☐ Increase _____%

☐ Decrease _____%

☐ Remain the same

a) Which of the following reasons will be most important in causing maintenance fees to rise?

1) Inflation ☐

2) Labour Cost ☐

3) Parts Cost ☐

4) Competitor's Pricing ☐

5) Other _____ ☐

3. What is the cost of a typical service call? $ _____

a) What percentage of this is for labour? _____%

b) What percentage is for travel? _____%

c) What percentage is for parts and materials? _____%

d) What percentage is for other? _____%

100%

XIII. GENERAL

1. Do you presently use a third party to maintain any of your products?

   ☐ Yes ☐ No

   a) If no, under what conditions would you consider doing so?

   _____

   _____

   _____

   _____

2. Would you consider acting as a third party to maintain other vendors' products?

   ☐ Yes

   ☐ No

   ☐ Currently Do So

3. Have you offered your customers any of the following to increase their participation in maintenance? Were they successful?

		Offered		Successful	
a)	Better Documentation	Y	N	Y	N
b)	Price Reduction	Y	N	Y	N
c)	Faster Response Time	Y	N	Y	N
d)	Promised Higher Up-Time	Y	N	Y	N
e)	Remote Diagnostics	Y	N	Y	N
f)	Easier to Run Diagnostic Routines	Y	N	Y	N
g)	Specialized Instrumentation	Y	N	Y	N
h)	Improved Diagnostic Displays	Y	N	Y	N
i)	Other _____	Y	N	Y	N
	_____	Y	N	Y	N
	_____	Y	N	Y	N
	_____	Y	N	Y	N

4. How do you measure field engineer productivity?

_____

_____

_____

_____

5. What changes would cause the greatest improvement in the maintenance you provide to your users?

6. What programs do you have now or will you initiate in 1980 to improve productivity? (describe)

We would appreciate receiving, in addition to this questionnaire, a copy of your standard maintenance contract and a field service organisational chart.

THANK YOU VERY MUCH!

APPENDIX E: VENDOR QUESTIONNAIRE - U.S.

Please complete this questionnaire based on U.S. field service operations only.

I. FIELD SERVICE ORGANIZATION

1. What is the title of your senior corporate executive for field service?

   _____

   a) To whom does he report? _____

2. In your company is the field service organization treated as a:

   ☐ Profit center

   ☐ Cost center

   a) If it is currently a cost center, do you see this changing to a profit center?

      ☐ Yes ☐ No

      If yes, when will this occur? _____

3. During the past year have you made any major changes in the structure of your field service organization?

   ☐ Yes ☐ No

   If yes, what were these changes?

   a) _____

   b) _____

   c) _____

4. What is the current size of your field service organization?

   _____

   a) How many of these are field engineers? _____

   b) How many are field management? _____

   c) How many are administrative? _____

5. During the past year did the size of your field service organization?

☐ Increase _____ %

☐ Decrease _____ %

☐ Remain Same

a) What were the primary reasons for these changes?

1) _____

2) _____

3) _____

6. How many field engineering locations do you presently have? _____

a) Has this changed during the last year?

☐ Yes ☐ No

b) By what percentage has this changed?

Increased _____ %

Decreased _____ %

7. What percentage of the total maintenance organization is located at divisional (regional) and headquarters locations?

_____ %

8. a) How many field engineers did you hire last year? _____

b) How many field engineers did you lose? _____

9. What were the three most important reasons for losing field engineering personnel?

a) _____

b) _____

c) _____

10. Will the number of field engineers required increase:

			Percent Increase
a)	In 1980? ☐ Yes	☐ No	_____
b)	In 1982? ☐ Yes	☐ No	_____
c)	In 1984? ☐ Yes	☐ No	_____

d) Please comment on the causes of these changes.

_____

_____

_____

_____

11. When you add or replace field service personnel what are the primary sources? Please rate the following sources either high (H), medium (M), or low (L).

Factor	Rating (1980)	Rating (1985)
a) Hire and train yourself (No technical pretraining)		
b) Recruit from competition		
c) Recruit from other industries		
d) Trained discharged Armed Forces personnel		
e) Recruit from other functions within your company (e.g.: manufacturing, engineering)		
f) Trade schools		
g) Other (describe)		

12. The following are potential problems associated with field service organizations. Please rate them either high (H), medium (M), or low (L) as they pertain to your company.

Factor	Rating
a) Morale of maintenance force	
b) Recruiting field maintenance personnel	
c) Training field maintenance personnel	
d) Reducing labor turnover	
e) Product quality	
f) Adequate diagnostic equipment	
g) Adequate remote diagnostic assistance	
h) Marketing demands	
i) Customer demands	
j) Budget limitations	
k) Salary administration	
l) Spare parts shortage	

II. FIELD SERVICE SALARIES

1. For the following general categories of field service personnel, what is the average salary and salary range? How has and how will these change?

	Average Salary	Range		% Increase '78 to '79	% Increase '79 to '80
Trainee	_____	_____	to _____	_____ %	_____ %
Qualified field engineer	_____	_____	to _____	_____ %	_____ %
Senior field engineer	_____	_____	to _____	_____ %	_____ %

2. What are the primary reasons for salary increases?

a) _____

b) _____

c) _____

3. Do you currently have an incentive program for your field engineers?

☐ Yes ☐ No

Please describe:

_____

_____

_____

_____

_____

III. AFFIRMATIVE ACTION/EEO

1. What percent of new hires are required to meet affirmative action guidelines?

_____ %

2. Has this requirement had any impact in the following areas?

a) Recruiting costs ☐ Yes ☐ No _____ % increase

b) Training costs ☐ Yes ☐ No _____ % increase

c) Size of field service organization ☐ Yes ☐ No _____ % increase

3. What other problems, if any, has it caused your field service organization?

_____

_____

_____

_____

IV. LEVEL OF SUPPORT

1. What percentage of total field engineering manhours was spent in installing engineering change notices (ECN) during 1979?

_____ %

Comments:

_____

_____

_____

_____

_____

_____

2. What is the average number of "trouble calls" in a month? _____

   a) What percentage of these are "repeat calls," a second call within two weeks about the same problem?

   _____ %

   b) What percentage of total calls had no faults found? _____ %

3. Do field engineers currently replace components, boards, or units at the user's site?

   ☐ Components ☐ Boards ☐ Units

   a) Are these parts then repaired on-site, at a depot, or at the factory?

   ☐ On-Site ☐ Depot ☐ Factory

   b) In 1984 will field engineers replace components, boards, or units on-site?

   ☐ Components ☐ Boards ☐ Units

4. For each type of product offered by your company, what is the:

Equipment Classification	Average Percentage Uptime (Percent)	Average Meantime Between Failure (Hours)	Average Meantime to Repair (Hours)	Average Meantime to Respond (Hours)
a) Medium and Large Mainframes				
b) Small Business Computers				
c) Other Minicomputers				
d) Peripherals (plug compatible)				
e) Terminals				

5. How important do you feel are the following field maintenance characteristics to your users? Please rate them either high (H), medium (M), or low (L).

Factor	Rating
a) Mean Time to Respond (in person)	
b) Mean Time to Repair (of equipment)	
c) Regularly Scheduled Preventive Maintenance	
d) Other	

V. SYSTEM SUPPORT CENTERS

1. Do you provide a system support center as part of your field service support?

☐ Yes ☐ No If no, go to page 10(b).

a) If yes, when did you begin offering this capability? _____

1) What were the primary reasons for implementing this?

_____

_____

_____

2) Is this system support center for:

☐ Hardware
☐ Software
☐ Both

3) How many people are located there? _____

4) How has the establishment of a system support center affected the number of engineers required in the field?

☐ Increased _____ %

☐ Decreased _____ %

☐ No Affect

Comment:

_____

_____

_____

_____

5) How has this system support center affected your maintenance costs?

☐ Increased _____ %

☐ Decreased _____ %

☐ Remain Same

Comment:

_____

_____

_____

_____

6) What has been your customer's reaction to this system support center?

_____

_____

_____

_____

b) If you do not currently have a system support center, do you have any plans to implement one?

☐ Yes ☐ No

1) If yes, when will such a capability be available to your customers?

_____

How would you expect it to affect the number of engineers required in the field?

☐ Increase _____ %

☐ Decrease _____ %

☐ No Affect

2) If you do not plan to implement a system support center, please comment.

_____

_____

_____

_____

VI. REMOTE DIAGNOSTICS

1. Do you provide a remote diagnostic capability as part of your field service support?

☐ Yes ☐ No

a) If yes, when did you begin offering this capability? _____

1) What were the primary reasons for implementing it?

_____

_____

_____

2) Is this remote diagnostic capability for:

☐ Hardware
☐ Software
☐ Both

3) How has this remote diagnostic capability affected your maintenance costs?

☐ Increased _____ %
☐ Decreased _____ %
☐ Remain Same

4) What has been your customers reaction to this remote diagnostic capability?

_____

_____

_____

_____

b) If you do not currently have a remote diagnostic capability, do you have any plans to implement one?

☐ Yes ☐ No

1) If yes, when will such a capability be available to your customers?

_____

2) If no, why not?

_____

_____

_____

_____

_____

VII. FORMAL ESCALATION PROCEDURES

1. Within your field service organization do you have a formal escalation procedure for handling maintenance calls?

☐ Yes ☐ No

a) If yes, what are the general parameters of this escalation procedure?

_____

_____

_____

_____

b) If no, how are trouble situations that cannot be solved by the local field engineer handled in your organization?

_____

_____

_____

_____

2. Do you believe that a formal escalation procedure is an important factor in the marketing and sales of your company's products?

☐ Yes ☐ No

Comment: _____

_____

_____

_____

VIII. FIELD SERVICE DOCUMENTATION

1. During the last year have you made any major changes in the types of field service documentation provided to your customers?

   ☐ Yes ☐ No

   a) If yes, what were the types of changes made to the documentation, and its distribution to customers?

   _____

   _____

   _____

   _____

   b) Why were these changes implemented?

   _____

   _____

   _____

   _____

2. During the next two years will you be providing your customers with:

   ☐ More Documentation

   ☐ Less Documentation

   ☐ Same as Present

   a) Why will these changes be made?

   _____

   _____

   _____

   _____

IX. SPARES INVENTORY

1. What is the percentage distribution of spares among the following locations?

Headquarters	_____ %
Depots	_____ %
Branch Offices	_____ %
Customer Locations	_____ %
	100%

2. During the past year has there been an increase in the number of customers who maintain spares at their location?

☐ Yes ☐ No _____ % Increase

Why? _____

_____

_____

_____

X. MAINTENANCE TECHNIQUES

1. Please rate the impact of the following factors on your current maintenance techniques either high (H), medium (M), or low (L).

Factor	Rating (H,M,L)
a) Rising labor costs	
b) Increasing product price performance	
c) User performing own maintenance	
d) User and vendor cooperatively testing transmission or computing equipment	
e) Home or personal computers	
f) Multi-function equipment	
g) Built-in diagnostics	
h) Remote diagnostics (via telecommunications)	
i) Distributed data processing	
j) Advances in technology	
k) Other (describe)	

XI. RESEARCH AND DEVELOPMENT

1. As a part of your operating budget do you have an allocation for R&D expenditures for improving maintenance techniques?

☐ Yes ☐ No

a) If yes, what is the approximate percent of this allocation?

_____ %

2. In the development of new products in your company, what is the involvement of the field service organization?

_____

_____

_____

_____

XII. MAINTENANCE PRICING

1. During the past year what changes have you made in maintenance prices?

☐ Increased _____ %

☐ Decreased _____ %

☐ Remained Same

a) Which of the following reasons was most important in causing maintenance fees to rise?

1) Inflation ☐

2) Labor Cost ☐

3) Parts Cost ☐

4) Competitor's Pricing ☐

5) Other _____ ☐

_____

2. During the next year what types of price changes are you planning?

☐ Increase _____ %

☐ Decrease _____ %

☐ Remain Same

a) Which of the following reasons will be most important in causing maintenance fees to rise?

1) Inflation ☐

2) Labor Cost ☐

3) Parts Cost ☐

4) Competitor's Pricing ☐

5) Other _____ ☐

_____

3. What is the cost of a typical service call? $ _____

a) What percentage of this is for labor? _____ %

b) What percentage is for travel? _____ %

c) What percentage is for parts and material? _____ %

d) What percentage is for other? _____ %

100%

4. For the following products offered by your company, what is the:

a) Mainframes

- Average Purchase Price $ _____
- Annual Maintenance Contract $ _____
- Average Monthly Rental/Lease Price $ _____
- Percent of Rental/Lease Allocated to Maintenance _____ %
- Average Time and Materials Hourly Charge for Hardware Maintenance $ _____
- Average Time and Materials Hourly Charge for Software Maintenance $ _____

b) Small Business Computers

- Average Purchase Price $ _____
- Annual Maintenance Contract $ _____
- Average Monthly Rental/Lease Price $ _____
- Percent of Rental/Lease Allocated to Maintenance _____ %
- Average Time and Materials Hourly Charge for Hardware Maintenance $ _____
- Average Time and Materials Hourly Charge for Software Maintenance $ _____

c) Minicomputers

- Average Purchase Price $ _____
- Annual Maintenance Contract $ _____
- Average Monthly Rental/Lease Price $ _____
- Percent of Rental/Lease Allocated to Maintenance _____ %
- Average Time and Materials Hourly Charge for Hardware Maintenance $ _____
- Average Time and Materials Hourly Charge for Software Maintenance $ _____

d) Peripherals

Average Purchase Price $ _____

Annual Maintenance Contract $ _____

Average Monthly Rental/Lease Price $ _____

Percent of Rental/Lease Allocated to Maintenance _____ %

Average Time and Materials Hourly Charge for Hardware Maintenance $ _____

Average Time and Materials Hourly Charge for Software Maintenance $ _____

e) Terminals

Average Purchase Price $ _____

Annual Maintenance Contract $ _____

Average Monthly Rental/Lease Price $ _____

Percent of Rental/Lease Allocated to Maintenance _____ %

Average Time and Materials Hourly Charge for Hardware Maintenance $ _____

Average Time and Materials Hourly Charge for Software Maintenance $ _____

XIII. GENERAL

1. Do you presently use a third party to maintain any of your products?

☐ Yes ☐ No

a) If no, under what conditions would you consider doing so?

_____

_____

_____

_____

2. Would you consider acting as a third party to maintain other vendors' products?

☐ Yes

☐ No

☐ Currently Do So

3. Have you offered your customers any of the following to increase their participation in maintenance? Were they successful?

		Offered		Successful	
a)	Better Documentation	Y	N	Y	N
b)	Price Reduction	Y	N	Y	N
c)	Faster Response Time	Y	N	Y	N
d)	Promised Higher Up Time	Y	N	Y	N
e)	Remote Diagnostics	Y	N	Y	N
f)	Easier to Run Diagnostic Routines	Y	N	Y	N
g)	Specialized Instrumentation	Y	N	Y	N
h)	Improved Diagnostic Displays	Y	N	Y	N
i)	Other _____	Y	N	Y	N
	_____	Y	N	Y	N
	_____	Y	N	Y	N
	_____	Y	N	Y	N
	_____	Y	N	Y	N

4. How do you measure field engineer productivity?

_____

_____

_____

_____

5. What changes would cause the greatest improvement in the maintenance you provide to your users?

6. What programs do you have now or will initiate in 1980 to improve productivity? (describe)

We would appreciate receiving in addition to this questionnaire a copy of your standard maintenance contract and a field service organizational chart.

THANK YOU VERY MUCH!