

ANALYSIS OF LARGE SYSTEMS SERVICE

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ANALYSIS OF LARGE SYSTEMS SERVICE

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ANALYSIS OF LARGE SYSTEMS SERVICE

ABSTRACT

This report analyzes the performance of leading large systems vendors in the areas of hardware maintenance and system software support. A total of 350 users of such current large systems as IBM 309X, Amdahl 589X, NAS AS/XL, Unisys AXX, and older systems from CDC, NCR, and Honeywell are surveyed concerning their requirements for service and support, versus the level received from their service provider.

Particular attention is paid on system availability, an issue of greatest importance to large systems users. Currently, a significant number (39% of the total sample) of large systems users are realistically expecting 100% system availability, a requirement that is forcing large systems vendors to go beyond the traditional avenues of support to meet this need. According to the 1987 large systems sample, 22% of those users who require 100% system availability receive that level, suggesting that vendor performance has to be improved.

The report also analyzes more traditional indices of service performance, such as mean-time-to-respond and mean-time-to-repair, as well as more subjective analyses of user satisfaction with total service and support.

This report contains 156 pages, including 105 exhibits.



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I INTRODUCTION

I INTRODUCTION

- This report, Large Systems User Service Requirements, is the first deliverable of the Large Systems module of the 1987 Customer Service Program. The report deals with user attitudes about and satisfaction with the service and support that they receive on their large systems (those systems that typically sell fully configured for \$350,000 and more). Exhibit I-1 breaks down the large systems sample by product and vendor.
- After this introduction, the report continues with an Executive Overview (Chapter II) which presents key research findings in presentation format. This Overview is popular with service executives since it provides vital information that facilitates slide-making and other presentation material production.
- Immediately following the Executive Overview is an analysis of the entire large systems sample in Chapter III. This analysis provides an invaluable benchmark to compare with the individual vendor/product analyses found in Chapter IV.
- Chapter IV is the heart of this analysis of large systems user service requirements. In this chapter, individual vendor performance is analyzed versus the specific needs reported by their users. Where possible, the most current model available is targeted for surveying.
- Chapter V provides summary listing of vendor performance data where appropriate. In this chapter, only objective survey results, such as response

EXHIBIT I-1

LARGE SYSTEMS USER SAMPLE BREAKDOWN

MANUFACTURER	MODEL	NUMBER OF INTERVIEWS
AMDAHL	58XX	33
CDC	CYBER	40
HONEYWELL	DPS	41
IBM	309X	50
IBM	308X	51
NAS	AS9XXX	30
NCR	85XX	25
UNISYS (BURROUGHS)	AXX	40
UNISYS (SPERRY)	1100/XX	40
TOTAL		350

times, system availability, and system interruption data as well as customer satisfaction percentages in these areas are presented.

- Lastly, an Appendix provides the questionnaire used for the survey project and a list of definitions of service terminology used in the report.

II EXECUTIVE OVERVIEW

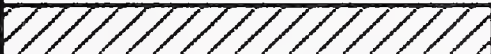



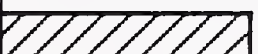

II EXECUTIVE OVERVIEW

- This Executive Overview is designed to help the busy reader quickly review the key findings of this report. The summary is provided in presentation format, with each key point summarized as an exhibit with an accompanying script on the facing page.
- INPUT has been tracking the large systems user service and support market (in this format) since 1983. During this period of time, large systems users have identified key service concerns that as of yet are not being met by their service providers. Most important to these users is the need for 100% system availability, a need that has encouraged many vendors to look at advanced system design (like fault-tolerancy) and support delivery (e.g., remote support, artificial intelligence-based diagnostics) to improve availability. Still, only 56% of the 1987 large systems user sample reports satisfaction with their system availability.
- Other key areas of concern identified by the large systems user sample include spare parts availability (52% of the sample dissatisfied) and software documentation (59% dissatisfied).

A. SYSTEM AVAILABILITY STILL KEY CONCERN

- In the large systems user environment, user requirements for 100% system availability continue to escalate. In fact, 137 of the 350 (or 39% of the sample) large systems users surveyed in 1987 reported that they realistically expected 100% system availability from their vendors. This requirement goes largely unmet since only 22% of those large systems users who required 100% system availability received that level from their vendor.
- Exhibit II-1 presents the system availability performance of five large systems manufacturers (as reported by their users) versus the requirement level reported by each manufacturer's user sample. The manufacturers are ranked in order of their success (or lack of success) in satisfying the needs of their respective users rather than in absolute system availability performance. Because of this, manufacturers with higher system availability actuals, like Amdahl (98.9% system availability), are not included on the exhibit since their users requirements might have been even higher (in Amdahl's case, its users required 99.2% system availability, thus Amdahl satisfied only 52% of its users). The most important measurement of performance here is the ability of the vendor to identify and then meet the needs of its user base.
- Certain vendors have been particularly successful in satisfying the system availability needs of their user bases. NAS, for example, has identified and marketed its large systems as extremely reliable alternatives to IBM products. IBM has traditionally been associated with excellent support delivery, due in large part to its ability to identify the service needs of its users. CDC and Sperry (now Unisys) benefit from lower than average user requirements for system availability. As a point of reference, Honeywell's poor performance, not just in an absolute sense but also in relation to its users' expressed needs, also is provided.

**LEADING LARGE SYSTEMS
SYSTEM AVAILABILITY**

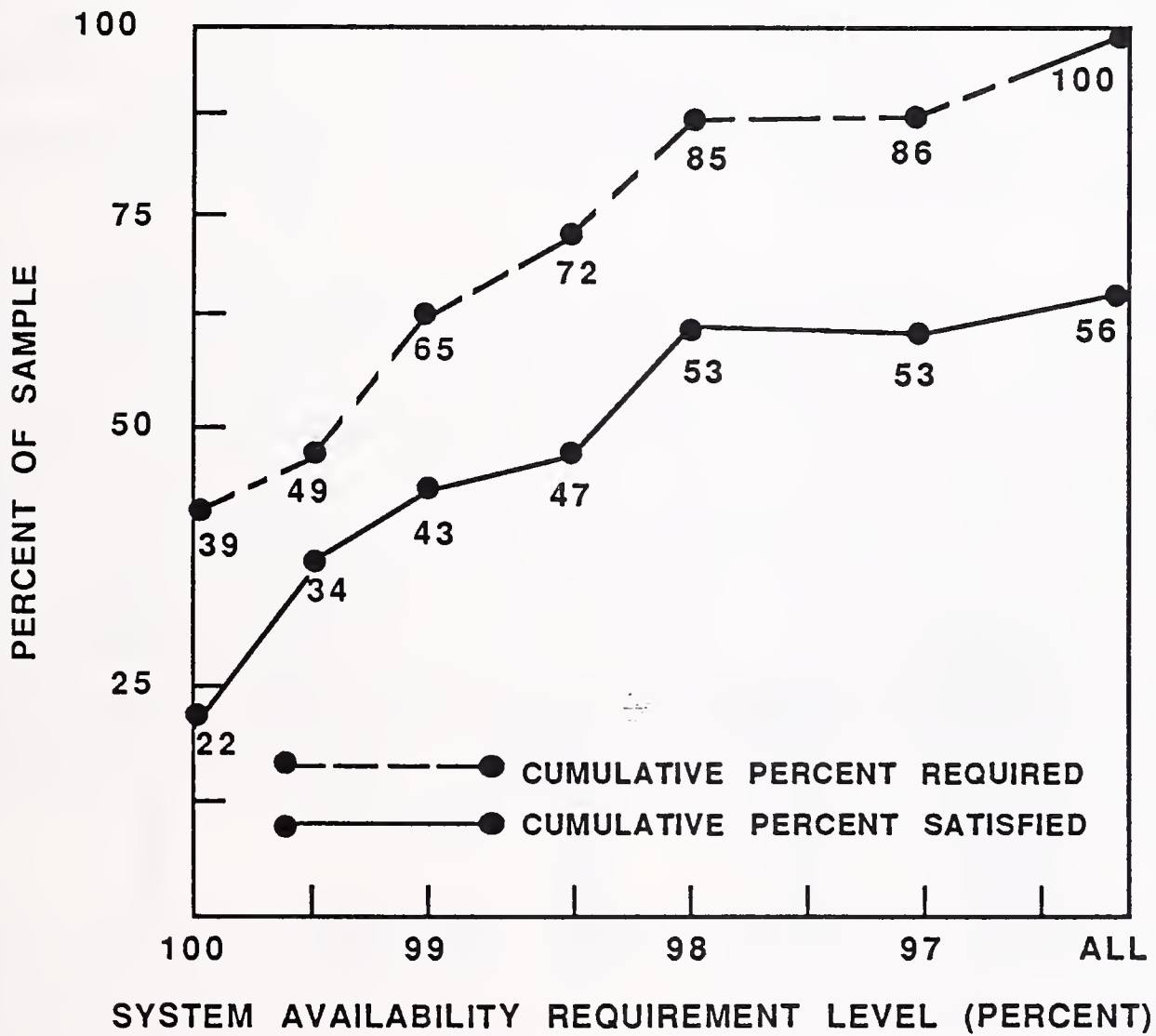
R A N K	VENDOR	SYSTEM AVAILABILITY		USERS (PERCENT SATISFIED)	
		REQUIRED	RECEIVED	50	100
1	NAS	99.3	99.3	 79	
2	IBM	99.3	98.5	 60	
3	CDC	98.4	97.7	 58	
4	SPERRY	97.2	96.4	 57	
9	HONEYWELL	98.7	97.8	 38	
ALL		98.3	97.6	 56	

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B. VENDOR PERFORMANCE FALLS OFF AFTER 99%

- In the large systems arena, system availability requirements have grown steadily to the point where a significant number of users (39% of the 1987 sample) are realistically expecting 100% system availability. While the large systems vendors have been successful at satisfying the majority (56% in 1987) of the overall sample, the vendors' effectiveness fell off dramatically as user requirements for system availability rose beyond the 99% system availability requirement level.
- Exhibit II-2 provides a breakdown of user satisfaction with their system availability at each requirement level. For example, at least 86% of the large systems sample required system availability of at least 97% and the large systems vendors were able to satisfy 53% of those users. At the 98% system availability level (required by at least 85% of the sample), the large systems vendors were equally successful at satisfying 53% of those users.
- Vendor effectiveness falls off dramatically above the 98% system availability requirement level. Between the 99% and 99.5% required levels, user satisfaction drops from 43% satisfied to 34% satisfied. User satisfaction continues to drop as system availability requirements rises, so that the large systems vendors manage to meet satisfy only 22% of those users who require 100% system availability (a level required by 39% of the sample).
- Certain systems, particularly newer systems supplied by Amdahl (589X) and NAS (AS/XL), compete for users that already cannot tolerate any downtime. System reliability (in terms of interruptions per month) is critical, is traditional service performance criteria (MMTRespond, MTTRepair). Large systems vendors will need to continue to develop their service automation activities in order to keep pace with increasing system availability needs of large systems users.

SYSTEM AVAILABILITY SATISFACTION AT SPECIFIC REQUIREMENT LEVELS

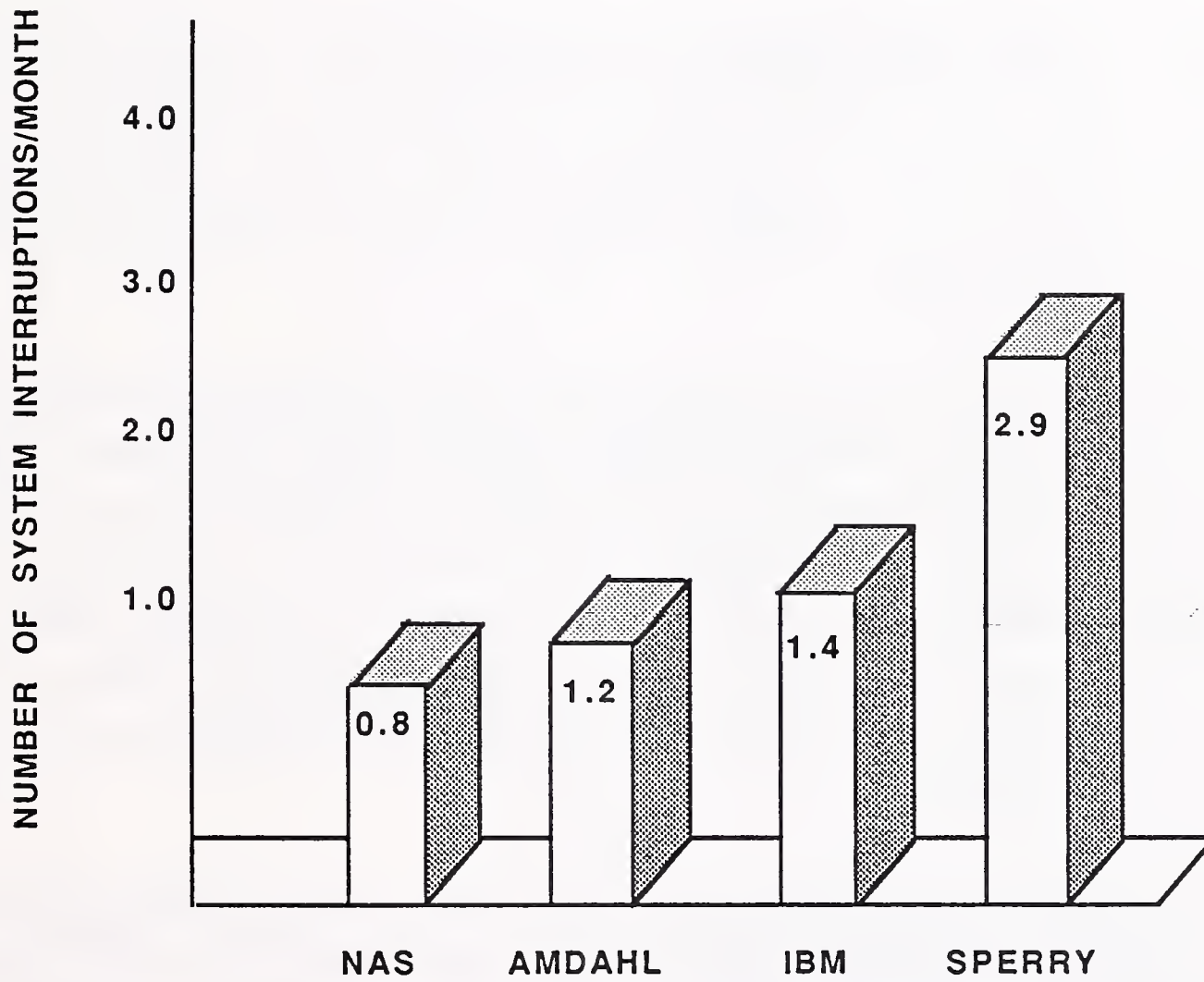


SAMPLE:350

C. FOCUS ON SYSTEM RELIABILITY

- As large systems availability requirements approach the 100% level, service vendors face the reality that improved service performance as measured by decreased response and repair times will have less and less effect on user satisfaction. Already, large systems users are reporting response and repair times of 1.7 hours and 2.4 hours respectively, and nine out of every ten large systems users are satisfied with vendor performance in these areas. Furthermore, significant improvements in response times are not possible, short of dedicated on-site engineers (as utilized by Cray), a practice not feasible for most vendors.
- Instead, manufacturers have to look to technological improvements to meet the growing system availability requirements of their users. Foremost of these are remote support activities, first attributed to IBM in its 438X line of small mainframes and now used extensively by almost all manufacturers. After initial user concerns (such as data security, pricing, and loss of on-site support) were overcome, remote diagnostics significantly reduced problem determination time, thus reduced the mean-time-to-repair (MTTR_{repair}). In addition, remote diagnostics aided in the identification and tracking of needed spare parts, reducing the number of times that a field engineer arrived on-site without immediate access to the correct spare part.
- Remote support is particularly effective when used in tandem with telephone consulting, which provides an avenue for users to assume much of the preliminary fault isolation and determination as well as other, more direct self-maintenance activities. Over one-third of the large systems sample indicated that they would be willing to increase their participation in self-maintenance if they received an appropriate discount. This reflects users' constant concerns about service costs; this also, however, reflects a growing recognition by the users that their involvement is necessary if they are to receive 100% system availability.

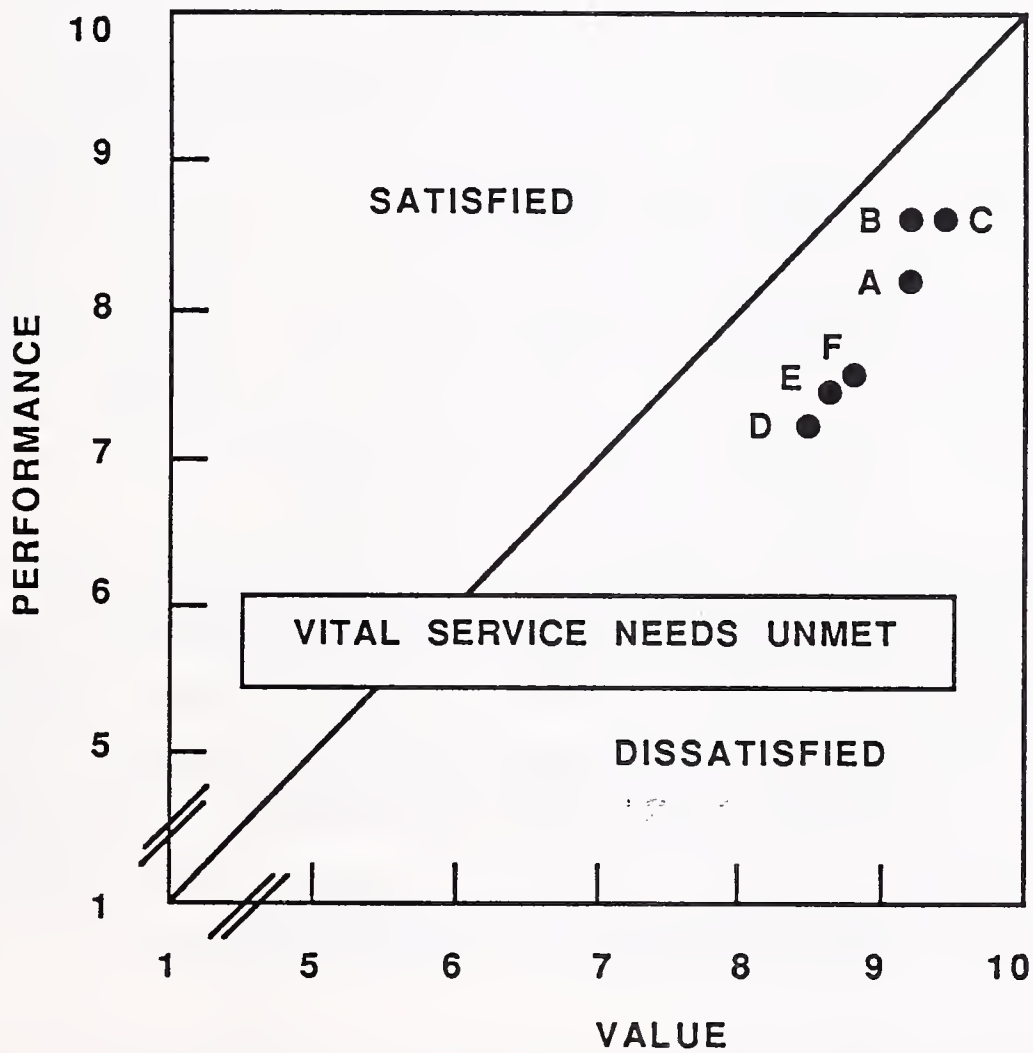
LARGE SYSTEMS RELIABILITY



D. LARGE SYSTEMS USER NEEDS STILL UNMET

- In 1986, INPUT identified six specific service needs that were of greatest importance to users and were, by and large, unmet by the large systems service vendors. Those six (three hardware and three software) service criteria were the following: parts availability, hardware engineer skill level, overall hardware support, software documentation, software engineer skill level, and overall software support.
- In 1987, INPUT measured the perceived value of these six service criteria (as well as two others, training and remote support) versus actual performance as reported by the large systems sample. Exhibit II-4 graphically plots the results of this analysis, indicating the gap between user needs and vendor performance.
- On the hardware side, the already high value placed upon these key services has stayed constant with those ratings of 1986. To the large systems vendors credit, actual performance ratings have improved in overall hardware support and, most significantly, in parts availability. As we will see later, user satisfaction in these areas has improved accordingly--48% of the large systems users were satisfied with parts availability in 1987 (up from 42% in 1986). Still, parts availability continues to be the large systems users' number one concern.
- On the software side, user requirements increased dramatically, as predicted in 1986. Unfortunately, vendor performance did not keep pace with user requirements and, as a result, user satisfaction in these areas continues to remain low. Software documentation continues to be the prime concern of large systems users, although documentation appears to be an industry-wide problem area.

LARGE SYSTEMS USER NEEDS STILL UNMET

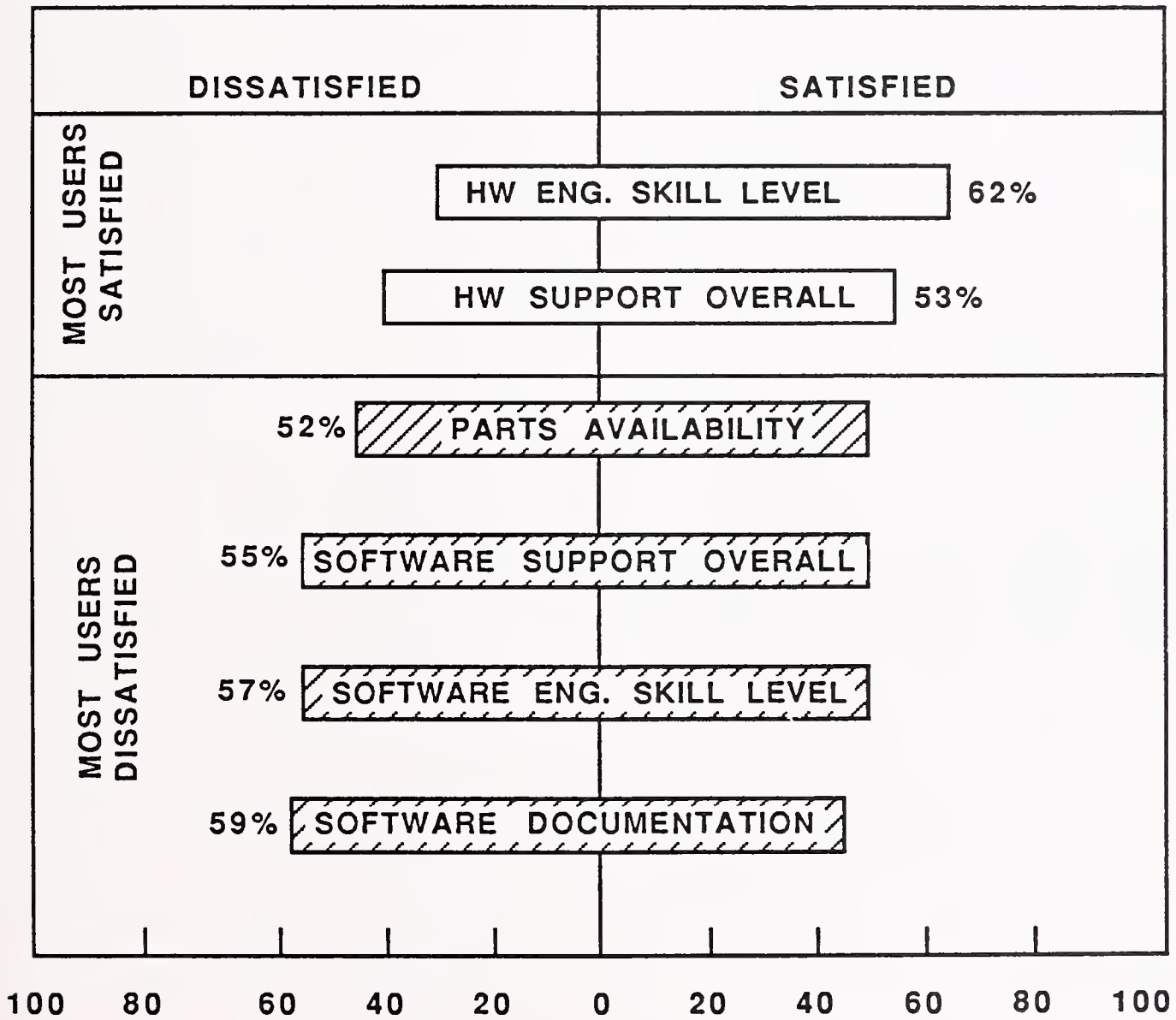


- | | |
|-------------------------------|-------------------------------|
| A = PARTS AVAILABILITY | D = SOFTWARE DOCUMENTATION |
| B = HARDWARE ENG. SKILL LEVEL | E = SOFTWARE ENG. SKILL LEVEL |
| C = OVERALL HARDWARE SUPPORT | F = OVERALL SOFTWARE SUPPORT |

E. SOFTWARE SUPPORT NEEDS OUTSTRIP VENDOR PERFORMANCE

- Software support continues to be a growing problem area for large systems users as vendor performance lags farther and farther behind rapidly increasing user requirements for software support. Exhibit II-5 presents the six most important service and support criteria as reported by the 1987 large systems user sample. Note that while the large systems vendors do well in the area of hardware maintenance (except parts availability), these vendors do not satisfy even one-half of their users needs in any of the three most important software support areas. Furthermore, the percentages of users satisfied show little improvement over last year's analysis, where large systems vendors satisfied only 43%, 44%, and 38% of the large systems user needs in software support overall, software engineer skill level, and software documentation, respectively.
- Only two large systems vendors, Unisys (Burroughs) and NCR, were able to exceed the software support needs of their users, each utilizing different but effective delivery methods. Unisys offers five different levels of software support that emphasize telephone support to its users; as a result, its users can choose the level of support that they need. NCR delivers systems software support primarily through an automated dispatching and service delivery system called CODAR.
- Large systems vendors need to address the growing disparity between user requirements for software support and actual vendor performance since user requirement levels will undoubtedly continue to increase at a rapid rate, particularly as user applications become larger and more complex as hardware aspects become both simplified (e.g., RISC systems) and more reliable.

USER SATISFACTION WITH HIGH-PRIORITY SERVICES



III LARGE SYSTEMS USER SERVICE
REQUIREMENTS - ALL VENDORS

III LARGE SYSTEMS USER SERVICE REQUIREMENTS - ALL VENDORS

- In 1987, INPUT surveyed 350 large systems users concerning their attitudes towards, and satisfaction with, the hardware maintenance and software support that they received from the manufacturer providing their service. This represents a significant increase in sample size (67%) over 1986, when 210 large systems users were surveyed. New products represented include the Unisys (Burroughs) AXX, the IBM 309X, and the NAS AS/XL (in limited numbers). As usual, INPUT targeted MIS directors, data processing managers, and computer operations managers for the survey, all of whom were contacted and interviewed by phone.
- Exhibit III-1 presents the contractual make-up of the entire large systems sample. While the majority of users reported that they receive five-day coverage, the sample's experience with extended service coverages is significant. In fact, the majority of the respondents receive at least two shifts of service coverage for their systems.
- In addition, 17% of the large systems sample is taking advantage of extended (longer than monthly) billing cycles. This benefits both the user, who typically receives a discount for agreeing to quarterly or annual billing, and the vendor, who reduces costs involving billing and collections.
- 1987 numbers show that large systems reliability has improved slightly over 1986 (1.7 system interruptions per month versus 1.9, as shown in Exhibit III-2, in 1986); however, system availability declined to the 1985 level (1987 system

EXHIBIT III-1

SERVICE CONTRACT
ALL LARGE SYSTEMS USERS

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	55
- MONDAY - SATURDAY	7
- MONDAY - SUNDAY	38
• HOURS OF COVERAGE	
- 1-9 HOURS	39
- 10-16 HOURS	21
- 17-24 HOURS	40
• BILLING INTERVAL	
- ANNUAL	11
- QUARTERLY	6
- MONTHLY	83

FULS

EXHIBIT III-2

SERVICE PERFORMANCE
ALL LARGE SYSTEMS USERS

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
- MEAN NUMBER PER MONTH	1.7
- HARDWARE CAUSED (PERCENT)	60.0
- SYSTEM SOFTWARE CAUSED (PERCENT)	22.0
- APPLICATION SOFTWARE CAUSED (PERCENT)	8.0
- OTHER CAUSED (PERCENT)	10.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	97.6
• MEAN RESPONSE TIME (HOURS)	1.7
• MEAN REPAIR TIME (HOURS)	2.4
• MEAN RECOVERY TIME (HOURS)	1.1

availability is 97.6%, 1986 was 98.3%, and 1985 was 97.5%). The primary contributor to this decline was the NCR 85XX sample, whose aging products only provided system availability of 94.7%. By 1988, the newest NCR large systems (the 98XX line) will have been installed long enough to appear in this analysis.

- Response and repair times were slightly higher than 1986 figures (1986 response and repair times were 1.2 hours and 2.7 hours, respectively). At the same time, user satisfaction with response, repair, and recovery times is quite high (89% and higher), as shown in Exhibit III-3. Users are also relatively satisfied with their system availability, as 56% of the large systems sample received at least the system availability that they required.
- Large systems manufacturers' effectiveness in meeting their users' system availability requirements declined after the 98% requirement level, as shown in Exhibit III-4. This effectiveness continues to fall off to the point that only 22% of the 137 respondents requiring 100% system availability actually received that level.
- Exhibit III-5 provides a scatter plot of the large systems sample's system availability requirements versus actuals received. The exhibit reinforces the concentration of system availability requirements at or above the 98% level (256 respondents of the total sample of 350).
- Exhibit III-6 presents large systems service performance versus user-reported ratings of perceived value. It should be noted that the services tested in 1987 were the most important services reported by the users in 1986.
- This is supported by Exhibit III-7, which shows that the large systems vendors were able to satisfy 62% of the large systems user samples in the area of hardware engineer skill level. The vendors were also quite successful in the areas of training, remote support, and hardware support overall.

EXHIBIT III-3

USER SATISFACTION WITH SERVICE PERFORMANCE
ALL LARGE SYSTEMS USERS

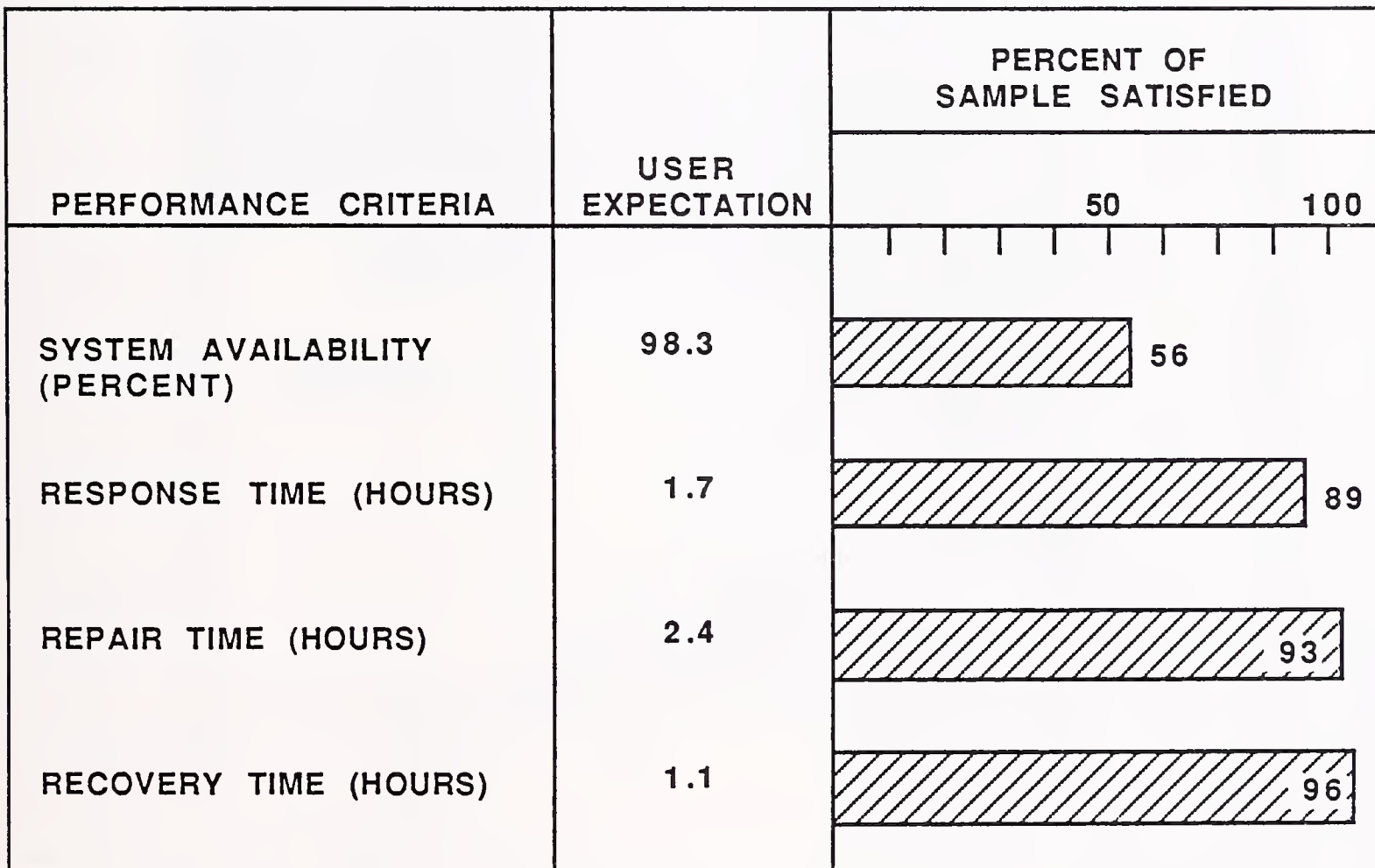
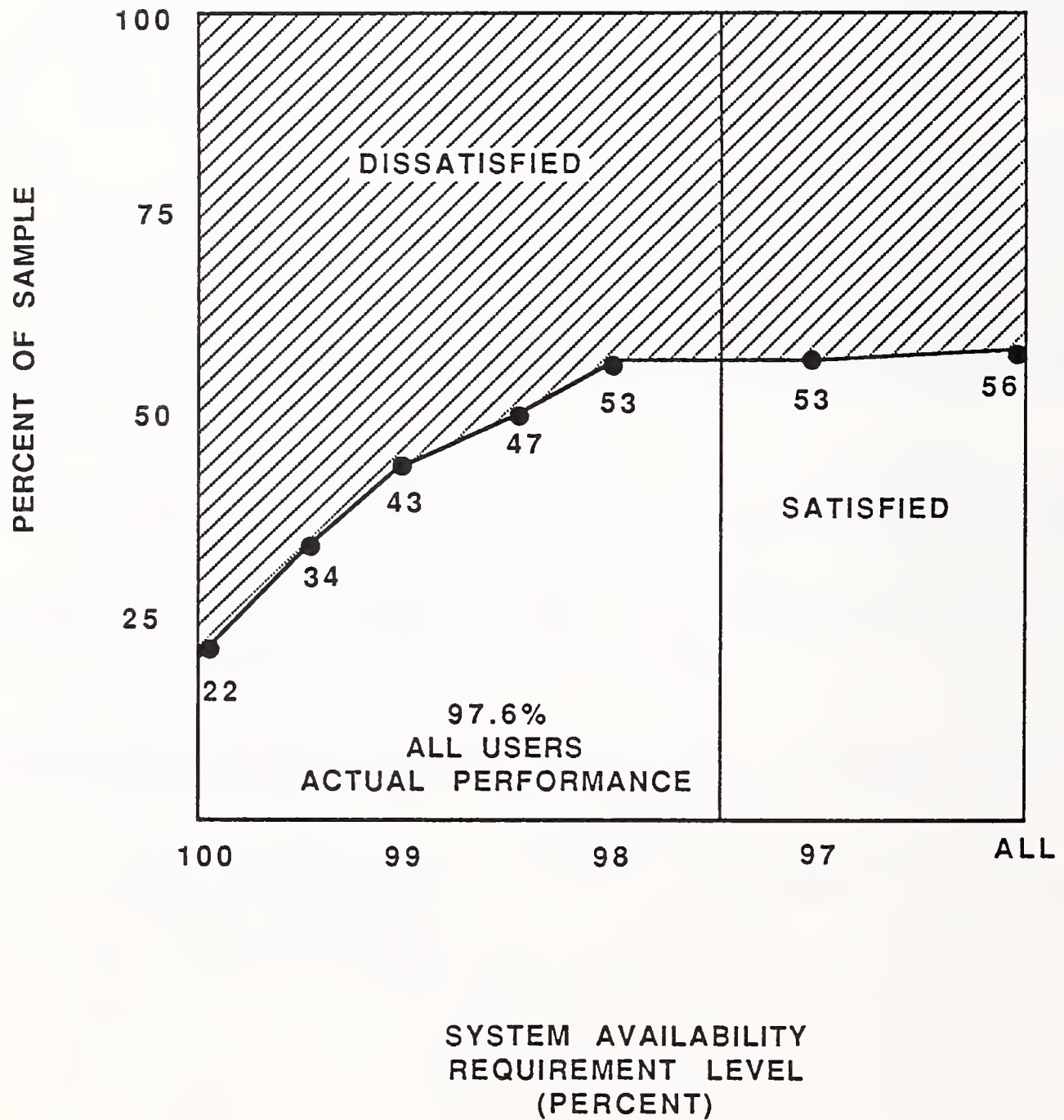


EXHIBIT III-4

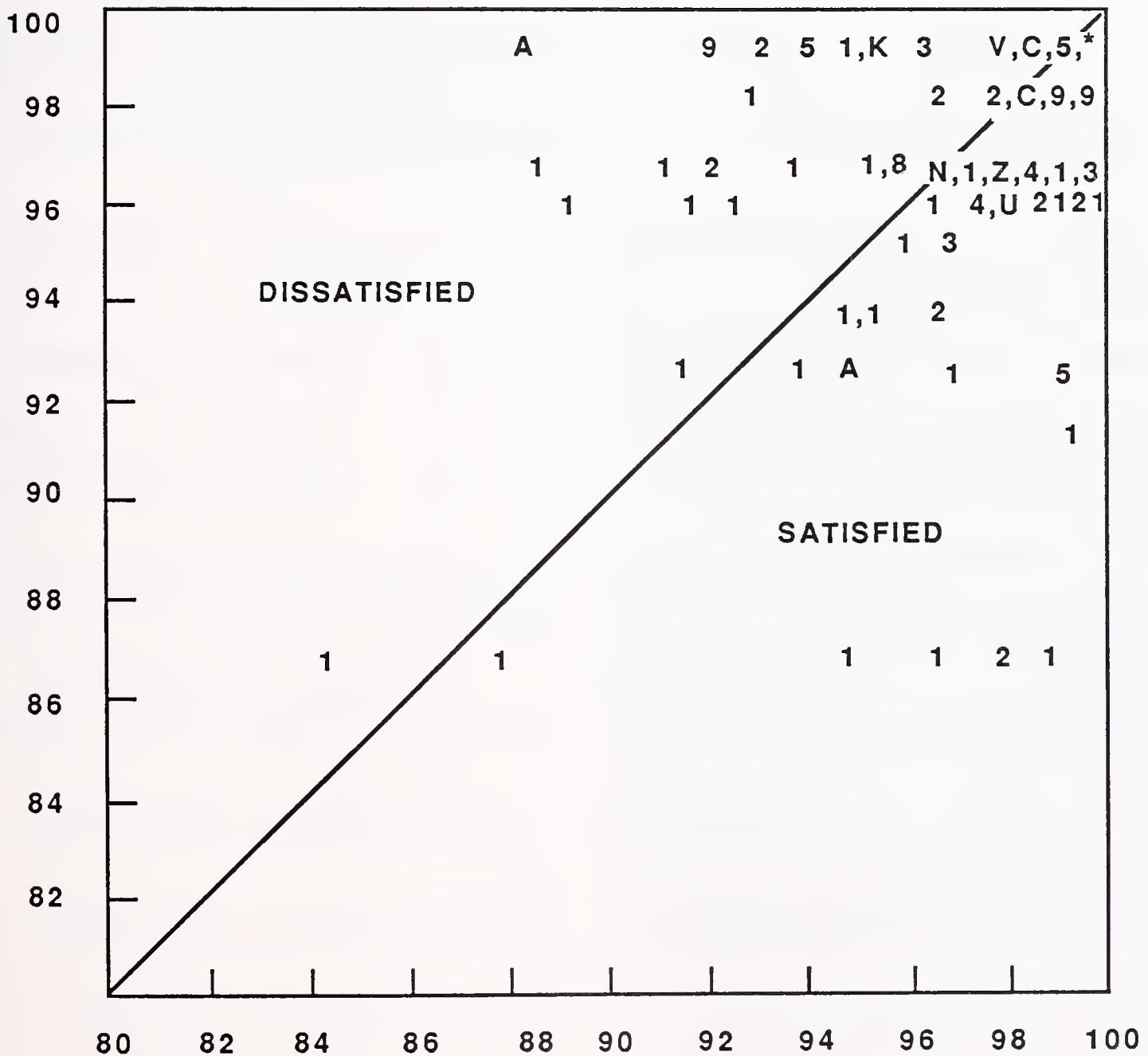
USER SATISFACTION WITH SYSTEM AVAILABILITY
ALL LARGE SYSTEMS USERS



FULS

EXHIBIT III-5

USER SATISFACTION WITH SYSTEM AVAILABILITY
ALL LARGE SYSTEMS USERS



SYSTEM AVAILABILITY
RECEIVED (PERCENT)

KEY: A = 10 U = 30
C = 12 V = 31
K = 20 Z = 35
N = 23 * = 37

TOTAL POINTS PLOTTED: 330

EXHIBIT III-6

USER PERFORMANCE/VALUE LEVELS
ALL LARGE SYSTEMS USERS

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	7.3	7.0	(0.2)
PARTS AVAILABILITY	9.1	8.1	(0.9)
REMOTE SUPPORT	7.6	7.7	0.1
HARDWARE ENGINEER SKILL	9.1	8.5	(0.5)
SOFTWARE ENGINEER SKILL	8.6	7.5	(1.0)
SOFTWARE DOCUMENTATION	8.5	7.1	(1.3)
SOFTWARE SUPPORT OVERALL	8.7	7.6	(1.0)
HARDWARE SUPPORT OVERALL	9.2	8.5	(0.6)

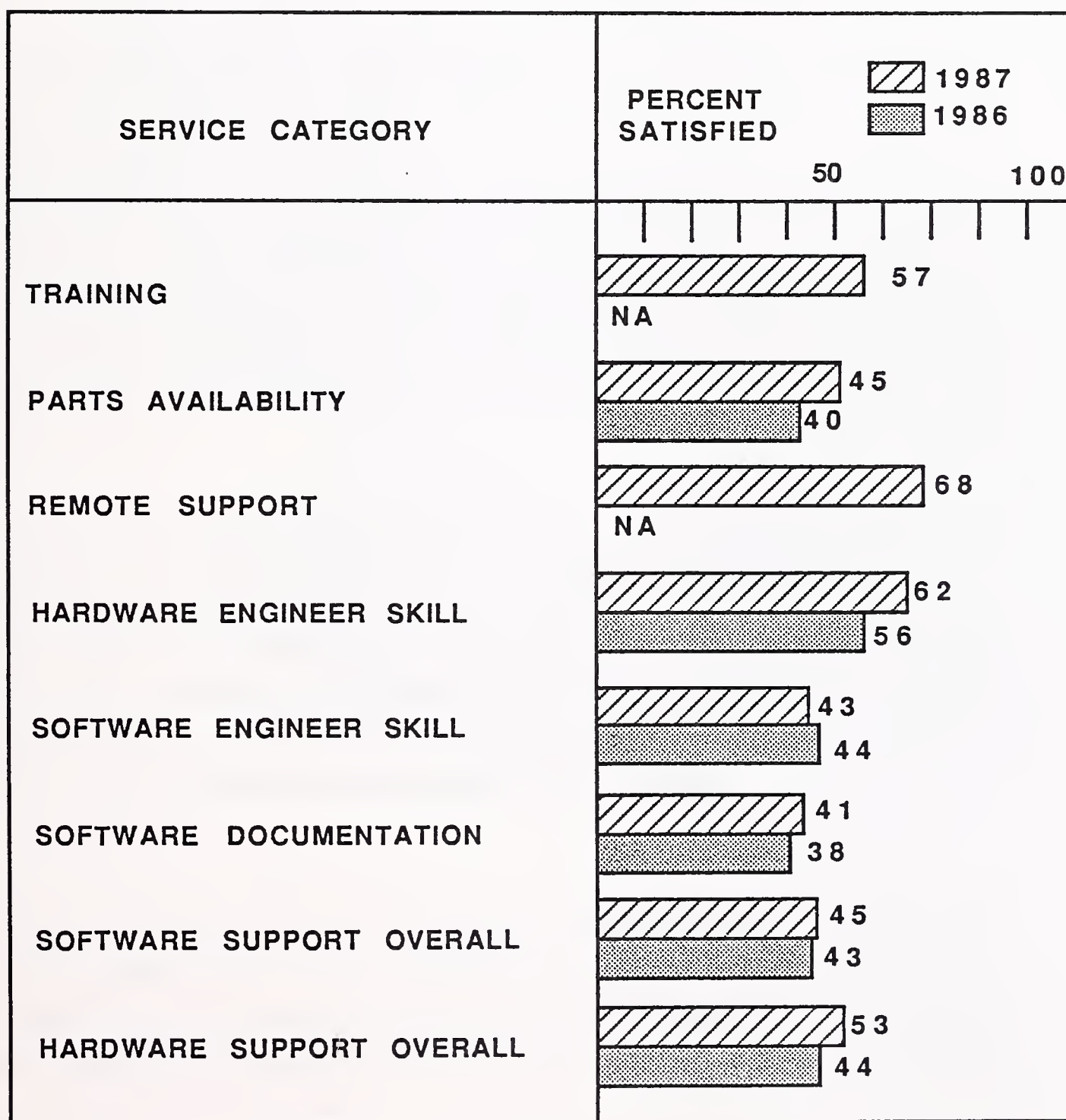
*SCALE: 1=LOW, 10=HIGH

**AVERAGE STANDARD ERROR OF THE MEAN = 0.1

FULS

EXHIBIT III-7

USER SATISFACTION LEVELS
1987 VERSUS 1986
ALL LARGE SYSTEMS USERS



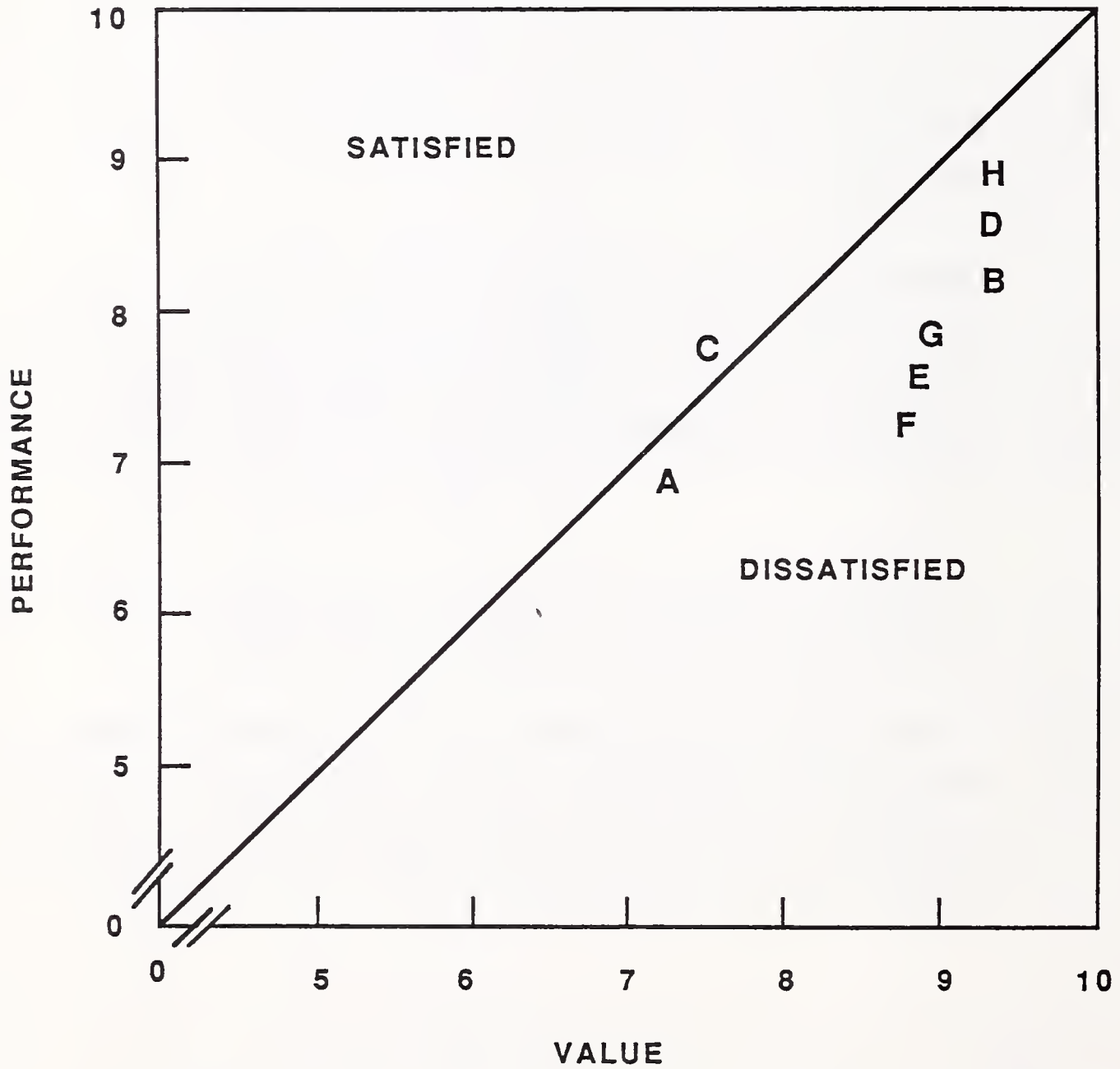
- The vendors were less successful in two critical areas: spare parts availability, where only 45% of the users were satisfied; and software documentation, where only 41% of the users were satisfied.
- Spares availability is a traditional concern of large systems users, who often equate extended downtime periods to the lack of localized spare parts. Users have become increasingly sensitive to situations when an FE has to return (sometimes days later) for a spare part. In fact, the most common response to a subjective question regarding the user's most pressing hardware concern was the lack of available spare parts.
- Software documentation, on the other hand, is an industry-wide problem. Computer users of all types have complained about the clarity or "friendliness" of end-user (operational) documentation. While hardware and software vendors have made efforts to improve quality control (QC) activities to reduce the number of errors and ambiguities in their documentation, problems still remain concerning the functionality of the documentation. The resulting confusion surrounding software documentation increases user misuse (even abuse) of and dissatisfaction with the software. Invariably, software support costs rise in result.
- The exhibit indicates that vendor performance in these areas (in fact all areas) is improving. Increased use of remote support has improved the identification of necessary spares prior to the FEs arrival on-site. Improved service management systems have improved parts tracking. Yet the rapidly increasing per-part cost of spares place a greater burden on service organizations who cannot afford to fully stock local service locations with all spares necessary.
- Improvements in software documentation have been less dramatic. Service organizations must take a more direct role in the design, production, distribution, and support of end-user documentation, if only for the reason that service organizations are the first line of contact for end users who have

problems with the documentation. At the very least, representatives from the service organization should be involved in the testing and QC of all documentation prior to delivery. Until that time, the gap between the value users place upon documentation and the actual performance that they receive from their vendors will continue to be as wide as that shown in Exhibit III-8.

- Interestingly, few users reported that their number one service concern involved price. This is supported by the fact that 89% of the large systems sample felt that they currently received their "money's worth" regarding service. Yet most vendors feel that price is enough of a service issue that many vendors are evaluating or even implementing reduced-service offerings with attached discounts (even IBM with its recent Corporate Service Amendment).
 - Exhibit III-9 measures large systems user willingness to increase their own involvement in self-maintenance if an appropriate discount was offered. Currently, one-third of the respondents appeared willing to increase their participation, typically at discounts ranging from 20-25%.
 - It should be warned that increasing discounting practices increases price sensitivity, since service becomes "de-valued."
 - Furthermore, many users feel that they need more service, not less. Vendors who access these users will need to also provide alternative premium service offerings or risk losing these users to vendors (either TPM or other manufacturers) who will.

EXHIBIT III-8

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
ALL LARGE SYSTEMS USERS



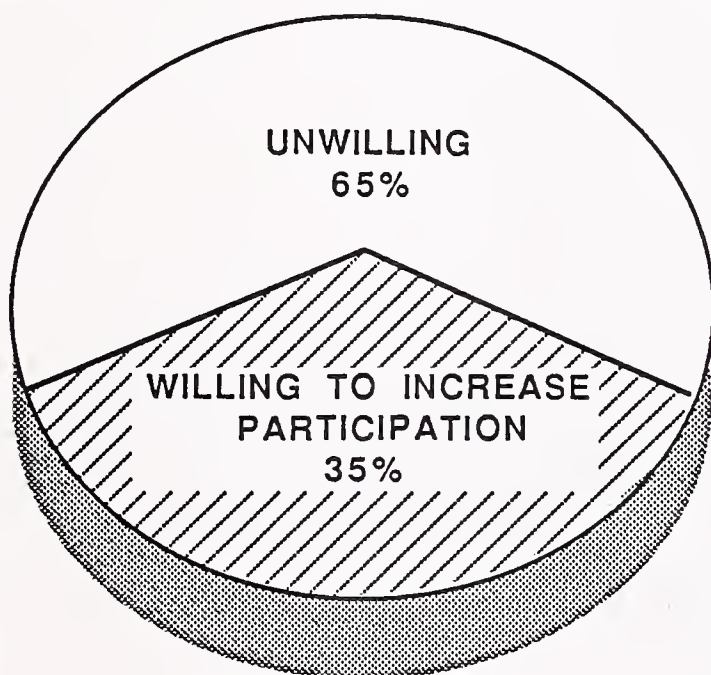
A = TRAINING
B = PARTS AVAILABILITY
C = REMOTE SUPPORT
D = HARDWARE ENGINEER SKILL LEVEL

E = SOFTWARE ENGINEER SKILL LEVEL
F = SOFTWARE DOCUMENTATION
G = SOFTWARE SUPPORT OVERALL
H = HARDWARE SUPPORT OVERALL

FULS

EXHIBIT III-9

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE
ALL LARGE SYSTEMS USERS



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	21	5	19	35	65	83	100
SWAP COMPONENTS	25	1	16	32	52	65	100
SWAP BOARDS	24	1	14	30	51	66	100

*UP TO AND INCLUDING

 OPTIMUM DISCOUNT LEVEL

FULS

IV VENDOR PERFORMANCE ANALYSES

IV VENDOR PERFORMANCE ANALYSES

- In the following chapter, INPUT will analyze large systems user service requirements on a product-by-product basis. Each analysis will begin by analyzing the contractual environment between the service vendor and the system user. Next, system availability and service performance data is presented, with comparison to last year's performance and current user requirements for service. Individual components of service are broken down and analyzed, measuring actual performance versus the value placed upon each service area. Lastly, user attitudes toward service discounts for increased participation in self-maintenance are analyzed.

A. AMDAHL 58XX

- In 1987, INPUT surveyed 33 users of Amdahl's 58XX large systems. The majority of the respondents were large installations (most of the respondents were \$1 billion in sales or larger), not surprising due to the size of the Amdahl systems used. Seven of the respondents were federal government agencies, five were telecommunications companies, and four were from the utilities and business services industries. As usual, INPUT targeted information systems (IS) and operations managers within each company as respondents.
- Amdahl offers twenty-four hour/seven-day-a-week coverage as its standard support offering to users of its 58XX systems. Therefore, it is curious that

seven respondents (22 of the sample) reported that they received either five- or six-day coverage, and five respondents (16% of the sample) reported that they received less than 24-hour coverage contractually. Exhibit IV-1 also indicates that almost 20% of the sample is billed on an annual basis, presumably with some discount.

- Exhibit IV-2 presents actual service performance reported by the Amdahl 58XX sample. The 58XX is extremely reliable, as indicated by the minimal number of system interruptions (only 1.2 per month) and the relatively high system availability (98.9%) reported by the sample. In fact, almost two-thirds of the respondents reported less than one system interruption every two months.
- Amdahl supplements the reliability of their systems with excellent response and repair times that average less than two hours each. Exhibit IV-3 indicates that Amdahl's actual performance in response and repair times more than satisfies requirements of its users, meeting over 90% of the Amdahl respondent needs within all areas of problem resolution time.
- The exhibit also demonstrates the extremely high system availability requirement that Amdahl (and most other large systems) users expect from their systems. Amdahl manages to satisfy 52% of its user's needs for system availability overall. Exhibit IV-4 provides a breakdown of this sample by the satisfaction level at each system availability requirement level:
 - Amdahl meets the needs of those users with system availability requirements of 99% or less just over half of the time.
 - Not surprisingly, Amdahl's success falls off dramatically with those users requiring better than 99% system availability, meeting the 99.5% level 33% of the time and the 100% level only 20% of the time.

EXHIBIT IV-1

SERVICE CONTRACT
AMDAHL 58XX

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	19
- MONDAY - SATURDAY	3
- MONDAY - SUNDAY	78
• HOURS OF COVERAGE	
- 1-9 HOURS	13
- 10-16 HOURS	3
- 17-24 HOURS	84
• BILLING INTERVAL	
- ANNUAL	19
- QUARTERLY	0
- MONTHLY	81

EXHIBIT IV-2

SERVICE PERFORMANCE
AMDAHL 58XX

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
<ul style="list-style-type: none"> • SYSTEM INTERRUPTIONS 	
<ul style="list-style-type: none"> - MEAN NUMBER PER MONTH 	1.2
<ul style="list-style-type: none"> - HARDWARE CAUSED (PERCENT) 	71.0
<ul style="list-style-type: none"> - SYSTEM SOFTWARE CAUSED (PERCENT) 	17.0
<ul style="list-style-type: none"> - APPLICATION SOFTWARE CAUSED (PERCENT) 	7.0
<ul style="list-style-type: none"> - OTHER CAUSED (PERCENT) 	5.0
<ul style="list-style-type: none"> • MEAN SYSTEM AVAILABILITY (PERCENT) 	98.9
<ul style="list-style-type: none"> • MEAN RESPONSE TIME (HOURS) 	1.9
<ul style="list-style-type: none"> • MEAN REPAIR TIME (HOURS) 	1.7
<ul style="list-style-type: none"> • MEAN RECOVERY TIME (HOURS) 	1.5

EXHIBIT IV-3

USER SATISFACTION WITH SERVICE PERFORMANCE
AMDAHL 58XX

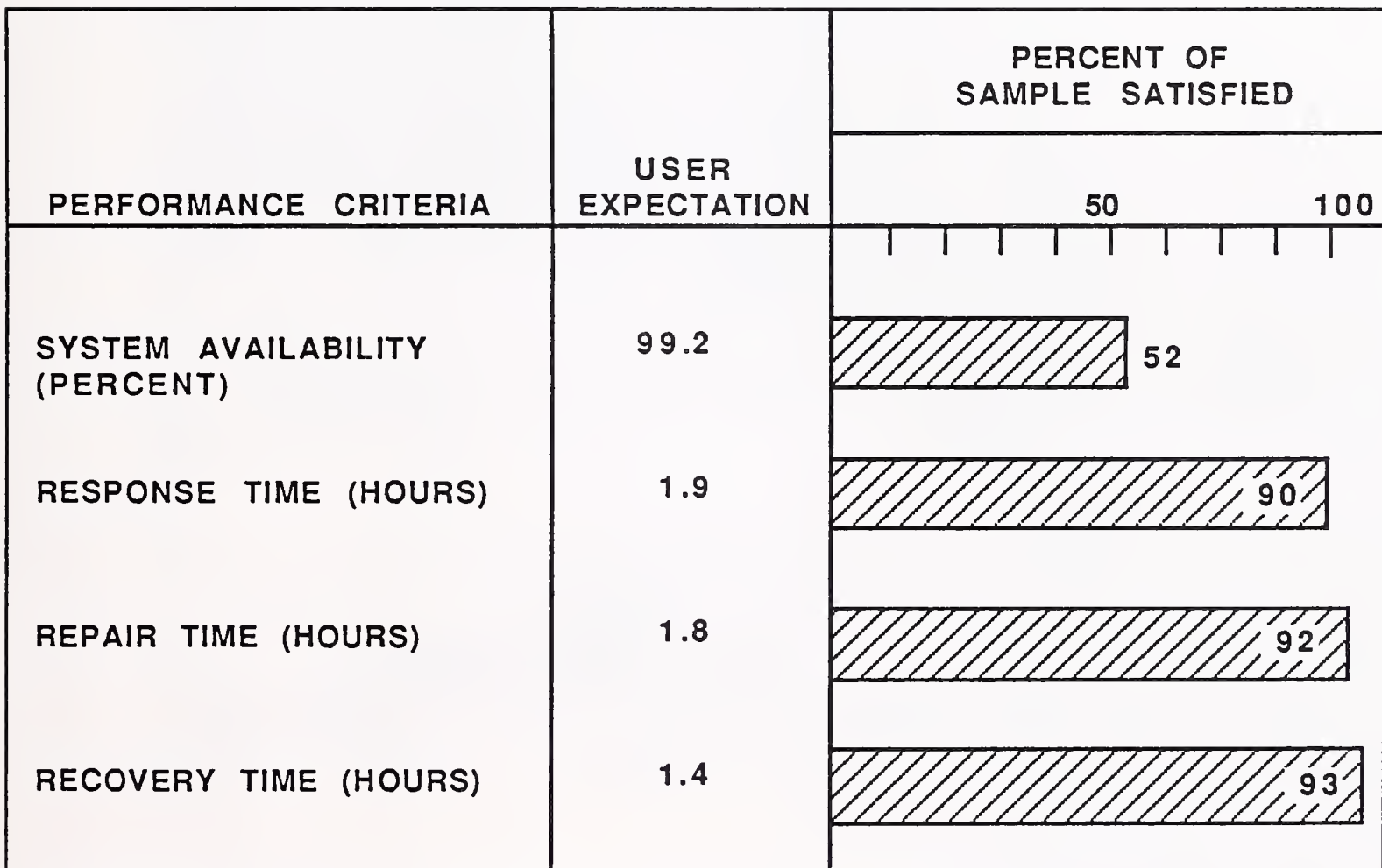
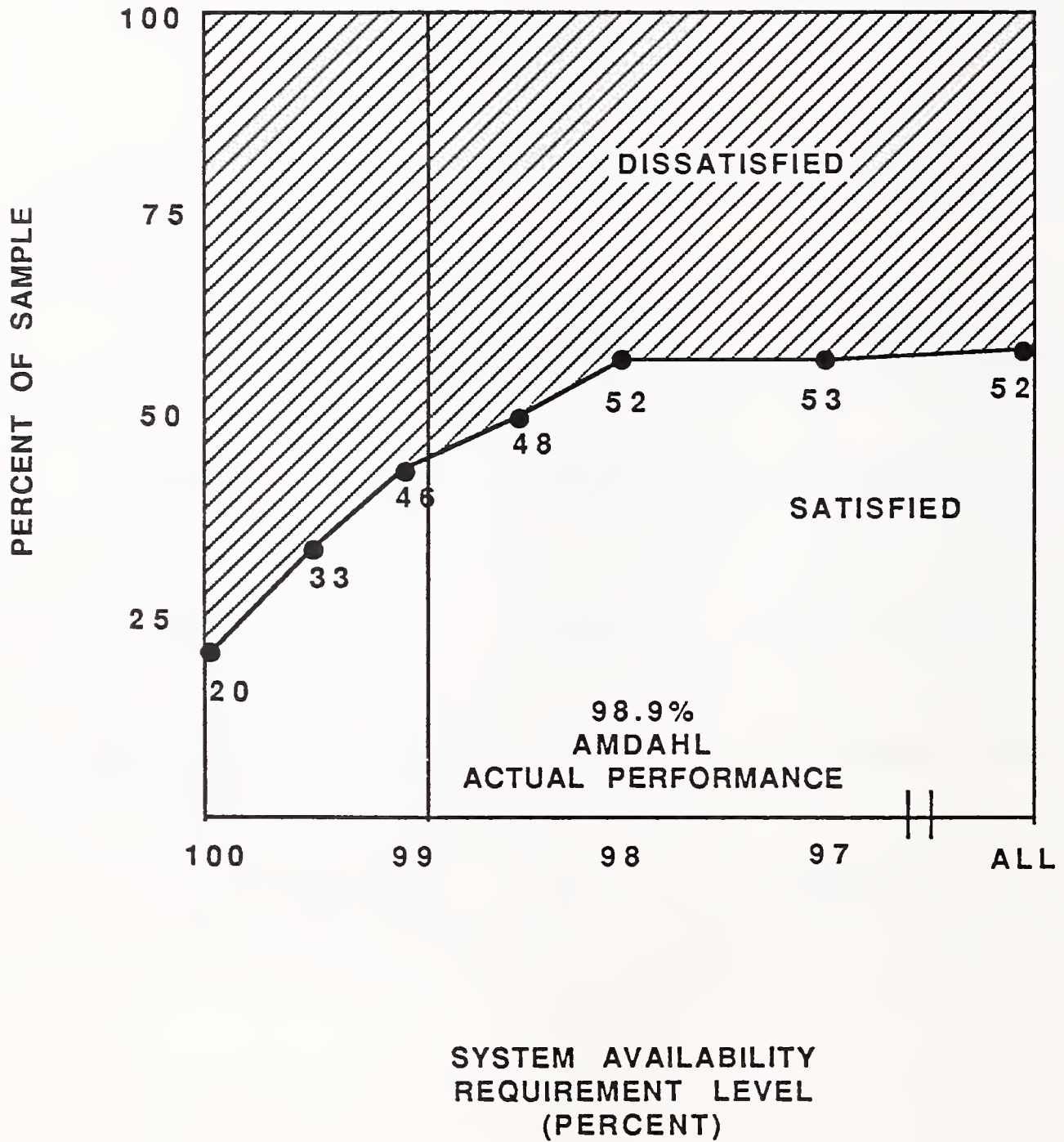


EXHIBIT IV-4

USER SATISFACTION WITH SYSTEM AVAILABILITY
AMDAHL 58XX

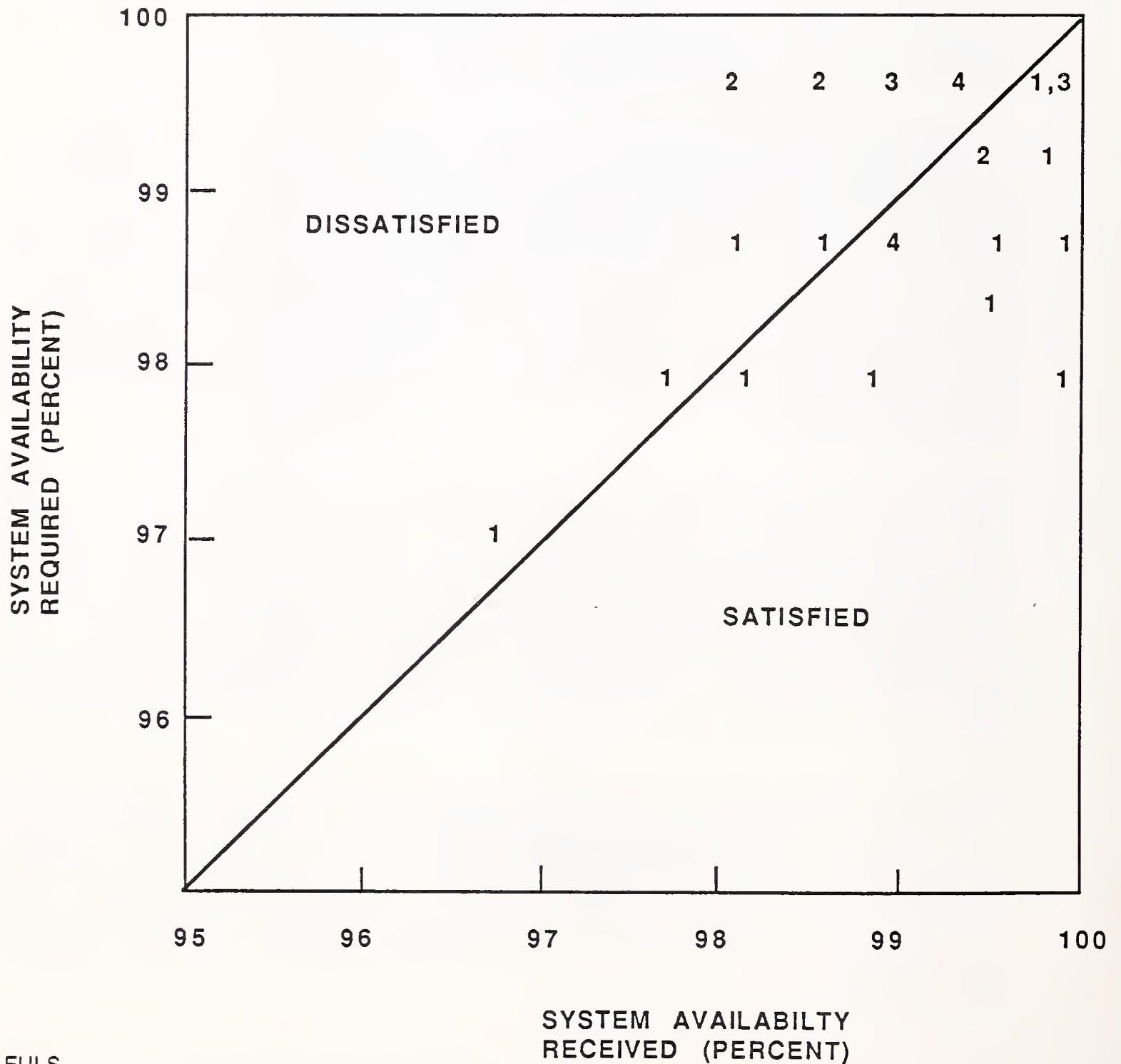


FULS

- The significance of this exhibit is that Amdahl users, as well as many other large systems users, are increasingly expecting 100% system availability (almost one half of the Amdahl sample reported system availability requirements of 100%). Vendors have looked to improved system architecture (remote support implementation, fault-tolerant processors, etc.) to meet this requirement, given the limited impact possible from faster response and repair times.
- Exhibit IV-5 provides a graphic representation of the Amdahl sample's system availability requirements versus what they receive from their system. Note that Amdahl's major area of concern is meeting the needs of those users reporting system availability requirements of 100%, eleven of whom are receiving less than satisfactory performance.
- Amdahl service performance in a number of key support areas is analyzed in Exhibits IV-6 through IV-8. Amdahl users place an extremely high value on a number of service areas, particularly hardware and software engineer skill level, spare parts availability, and overall hardware and software support. The software support areas place Amdahl in a difficult situation since Amdahl users use IBM operating systems software on their systems and thus rely on IBM for that support.
- On the hardware side, Amdahl performs admirably, even in areas on which its users place the highest value. Exhibit IV-7 indicates that Amdahl satisfies almost two-thirds (or better) of users in each high-priority hardware service area; so much so, in fact, that 75% of the Amdahl users were satisfied with their field engineer, up significantly from last year's already commendable 63%.
- Even in the extremely critical area of spare parts availability, where the high cost of certain parts would make volume parts inventory costly, Amdahl satisfies 61% of its users. Amdahl's success can be partially attributed to its use of air freight depots to assure that key spares are always within two hours of a user's site.

EXHIBIT IV-5

USER SATISFACTION WITH SYSTEM AVAILABILITY
AMDAHL 58XX



FULS

TOTAL POINTS PLOTTED: 32

EXHIBIT IV-6

USER PERFORMANCE/VALUE LEVELS
AMDAHL 58XX

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	7.0	7.9	0.9
PARTS AVAILABILITY	9.1	8.7	(0.4)
REMOTE SUPPORT	7.9	8.5	0.6
HARDWARE ENGINEER SKILL	9.4	9.1	(0.3)
SOFTWARE ENGINEER SKILL	9.0	8.6	(0.4)
SOFTWARE DOCUMENTATION	8.5	7.7	(0.8)
SOFTWARE SUPPORT OVERALL	9.2	8.6	(0.6)
HARDWARE SUPPORT OVERALL	9.2	8.8	(0.4)

*SCALE: 1 = LOW, 10 = HIGH

**AVERAGE STANDARD ERROR OF THE MEAN = 0.4

FULS

EXHIBIT IV-7

USER SATISFACTION LEVELS
1987 VERSUS 1986
AMDAHL 58XX

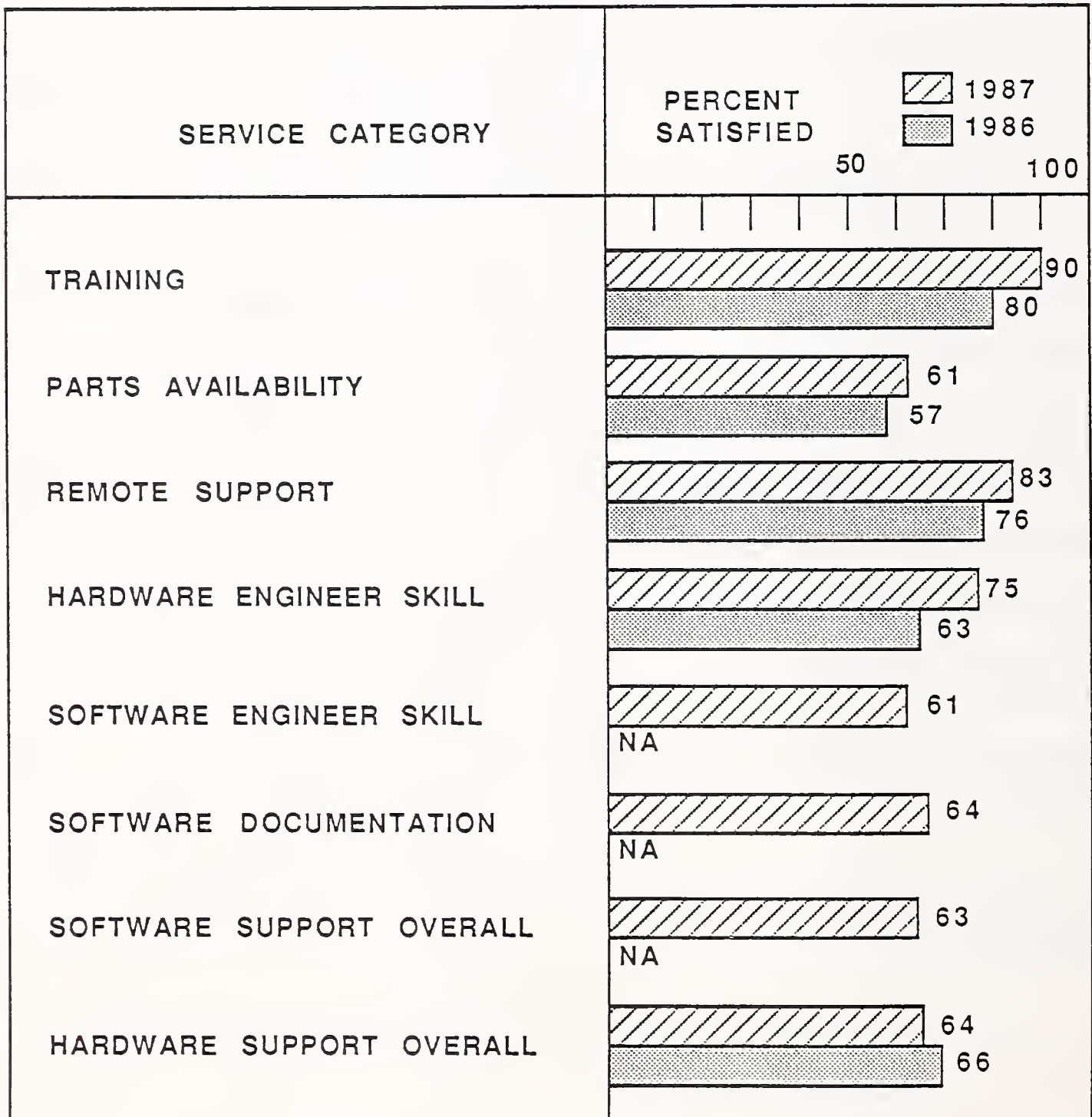
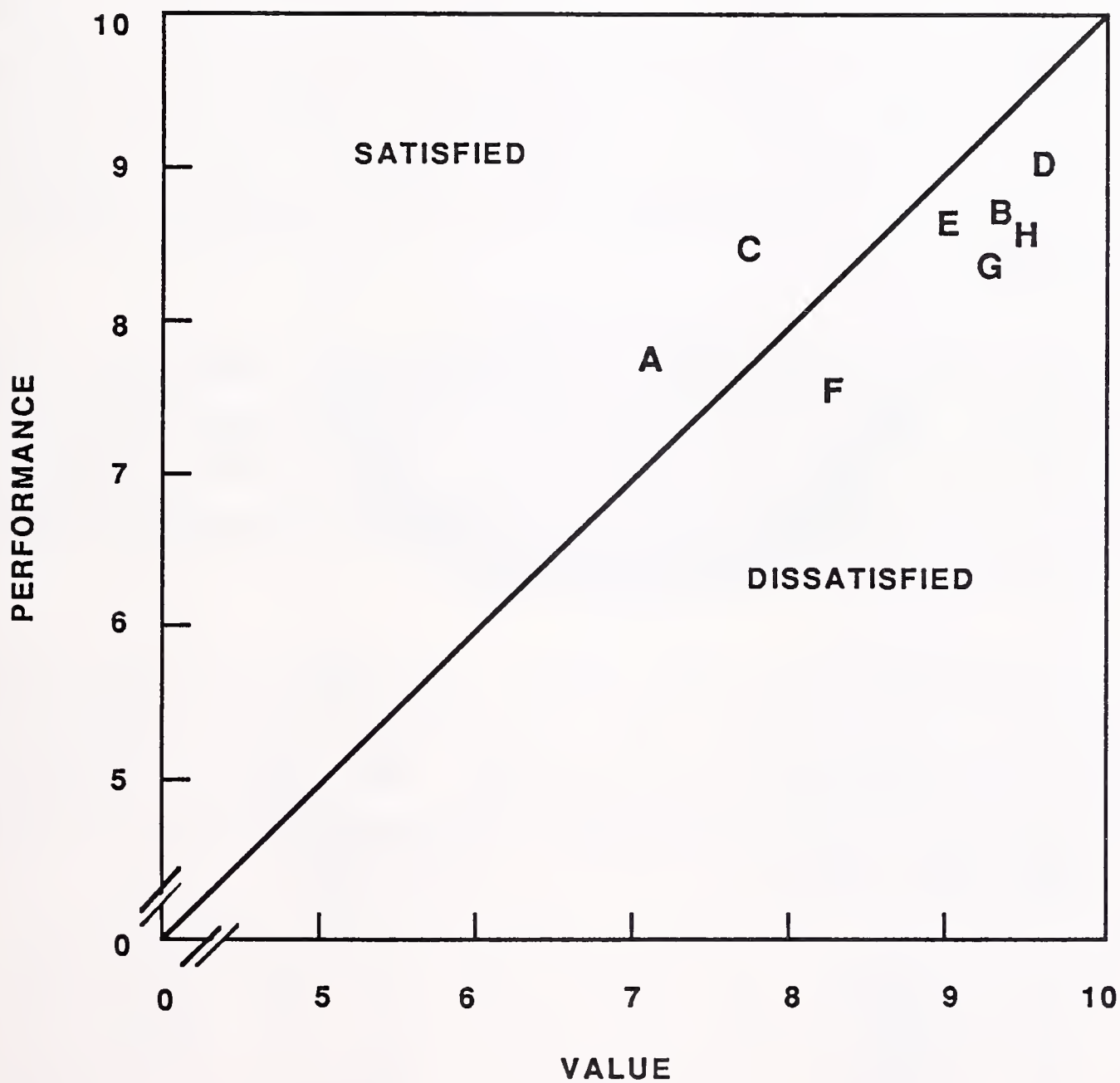


EXHIBIT IV-8

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
AMDAHL 58XX



A = TRAINING
B = PARTS AVAILABILITY
C = REMOTE SUPPORT
D = HARDWARE ENGINEER SKILL LEVEL

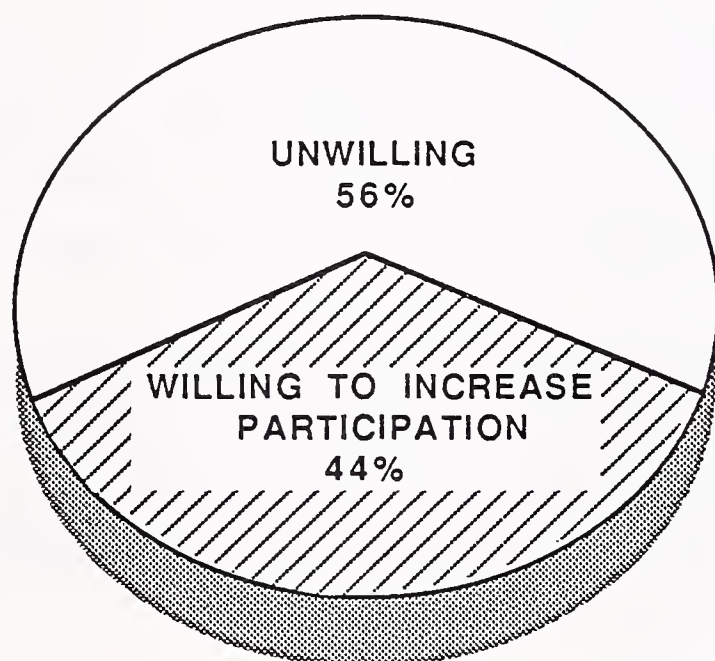
E = SOFTWARE ENGINEER SKILL LEVEL
F = SOFTWARE DOCUMENTATION
G = SOFTWARE SUPPORT OVERALL
H = HARDWARE SUPPORT OVERALL

FULS

- Exhibit IV-8 graphically plots Amdahl performance versus the value of each service as reported by the sample. Note how closely Amdahl performance comes to meeting the requirement (value) levels of each critical service area.
- Amdahl has succeeded in meeting (and exceeding) the service requirements of its users by positioning itself as "premium" service provider by offering around-the-clock coverage in a relatively "bundled" service offering. A number of factors (increased competition, improved hardware reliability, etc.) have increased price sensitivity among users of large systems, even within the high-end of the market in which Amdahl competes. Exhibit IV-1 indicated that some of the Amdahl user sample had contracted for less than standard (24x7) coverage. Exhibit IV-9 suggests that a significant number (almost one-half of the sample) of the Amdahl respondents would be attracted to increasing their participation in service if an appropriate discount was provided.
- Users were most attracted to increasing their involvement in problem diagnosis, with ten out of the thirty-three respondents indicating their willingness. Eight users were willing to increase their involvement by swapping components, while seven Amdahl users were willing to increase their involvement by performing board swaps.
- Not surprisingly, the average discount that Amdahl users would expect to receive if they increased their involvement in problem diagnosis was the lowest of the three categories analyzed. This reflects the Amdahl users recognition of the importance of monitoring system performance in achieving 100% system availability.
- In general, Amdahl user concerns over service costs are increasing, even though almost all (91%) of the sample felt that they received the level of support for which they are paying. A significant number of subjective responses concerning the overall service satisfaction were related to the high price of Amdahl service. The fact that a large proportion of Amdahl users

EXHIBIT IV-9

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE
AMDAHL 58XX



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	19	0	30	60	70	90	100
SWAP COMPONENTS	28	0	25	50	50	50	100
SWAP BOARDS	25	0	29	57	57	71	100

*UP TO AND INCLUDING

 OPTIMUM DISCOUNT LEVEL

FULS

appear willing to increase their participation in self-maintenance provides Amdahl with a way of addressing user price-sensitivity, as long as Amdahl continues to also offer premium service levels for those users who place highest value on 100% system availability.

B. UNISYS (BURROUGHS) AXX

- In 1987, INPUT contacted 35 users of Unisys (Burroughs) AXX large systems, as well as an additional 5 users of the older B79XX large systems. The companies represented in the sample ranged in size from \$15 million up to \$9.5 billion in annual sales and were most often process manufacturers (with five respondents) and banks (with four). As usual, INPUT contacted ranking information systems officials regarding the survey.
- Exhibit IV-10 indicates that the sample was also diverse in their contractual relationship with Unisys (Burroughs). The sample was fairly evenly split between prime shift (Monday through Friday, 8 a.m. to 5 p.m.) coverage and extended coverage. A substantial majority (84%) of the sample is billed on a monthly basis.
- The newness of the AXX products (the first of the A3 systems was introduced in late 1984 while the majority of the AXX line was introduced later in 1985 and 1986) is reflected in the improved system reliability and performance actuals presented in Exhibit IV-11. System interruption frequency dropped from 3.3 per month (for Burroughs 7900 and 7800 systems surveyed in 1986) to 1.6 per month in 1987.
- On the other hand, system availability also dropped from 98.9% in 1986 to 96.9% in 1987. Prime contributors to this decline in system availability appears to be vendor repair time, which Unisys (Burroughs) reported at 3.0 hours. System availability was also impacted by (the lack of) spare parts availability, as will be shown later in this analysis.

EXHIBIT IV-10

SERVICE CONTRACT
UNISYS (BURROUGHS) AXX

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	55
- MONDAY - SATURDAY	5
- MONDAY - SUNDAY	40
• HOURS OF COVERAGE	
- 1-9 HOURS	50
- 10-16 HOURS	10
- 17-24 HOURS	40
• BILLING INTERVAL	
- ANNUAL	8
- QUARTERLY	8
- MONTHLY	84

EXHIBIT IV-11

SERVICE PERFORMANCE
UNISYS (BURROUGHS) AXX

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
• MEAN NUMBER PER MONTH	1.6
• HARDWARE CAUSED (PERCENT)	60.0
• SYSTEM SOFTWARE CAUSED (PERCENT)	32.0
• APPLICATION SOFTWARE CAUSED (PERCENT)	5.0
• OTHER CAUSED (PERCENT)	3.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	96.9
• MEAN RESPONSE TIME (HOURS)	1.6
• MEAN REPAIR TIME (HOURS)	3.0
• MEAN RECOVERY TIME (HOURS)	0.8

- Still, Unisys (Burroughs) users, as a group, have extremely realistic and achievable requirements for service performance, as shown in Exhibit IV-12. Unisys (Burroughs) meets the relatively low system availability requirement (of 98%) reported by the users around 54% of the time. Furthermore, Burroughs users report a repair time requirement of 2.9 hours, thus Unisys (Burroughs) satisfies 94% of its users needs in this performance area.
- Exhibit IV-13 provides a look at Unisys' (Burroughs') success at satisfying users' needs for system availability at each requirement level. Note that Unisys (Burroughs) performance drops dramatically at the 99% plus requirement level, where the percent satisfied drops from 41% to 24% (at the 99.5% level). At that point, Unisys' (Burroughs') combined response/repair/recovery time will not allow higher system availability time.
- Exhibit IV-14 provides a scatter plot of the Unisys (Burroughs) system availability required versus received. Note that most responses fall near the (diagonal) required line except at the 99.5-100% level.
- Unisys (Burroughs) AXX users also report lower service requirements for a number of post-scale support activities, as shown in Exhibit IV-15. Note that the value assigned to such support services as training, engineer skill level, software documentation, and even spare parts availability is significantly lower than that of other large systems vendors (e.g., IBM, NAS, and Amdahl). While this may make it easier to provide satisfactory levels of service (as shown in Exhibit IV-16), it also can lead to greater price sensitivity if users' support requirements begin to increase.
- A primary area of concern expressed by the AXX users is the availability of spare parts. Currently, only 45% of the sample is satisfied with Unisys (Burroughs) in this area, down significantly from 1986. Eleven users specifically mentioned spare parts availability as their most pressing hardware concern. This concern is also reflected in Exhibit IV-17, which graphically shows the disparity between the value users place on spares availability and the actual performance that they report.

EXHIBIT IV-12

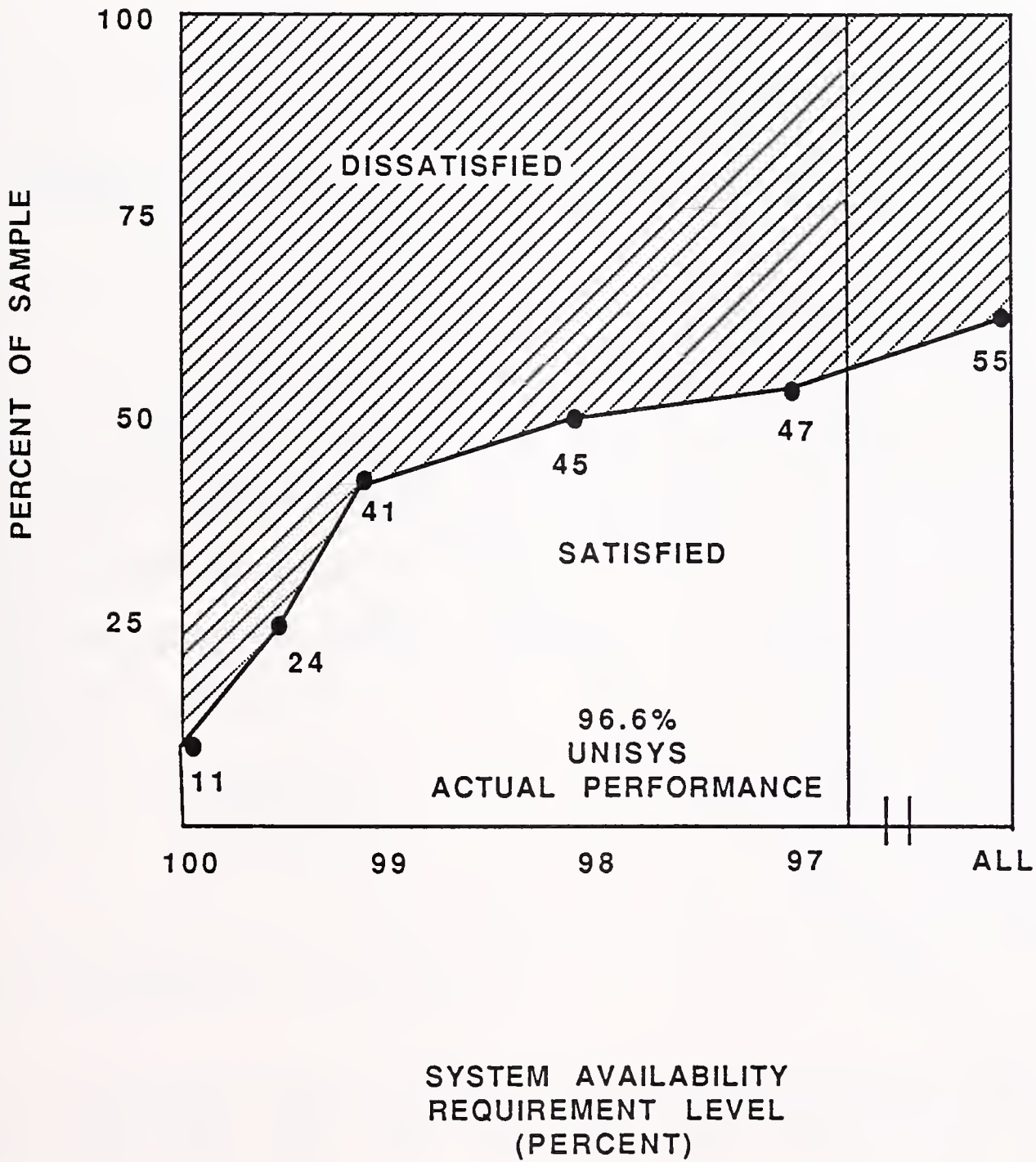
USER SATISFACTION WITH SERVICE PERFORMANCE
UNISYS (BURROUGHS) AXX

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED	
		50	100
SYSTEM AVAILABILITY (PERCENT)	98.2		
RESPONSE TIME (HOURS)	1.5		
REPAIR TIME (HOURS)	2.9		
RECOVERY TIME (HOURS)	0.8		

FULS

EXHIBIT IV-13

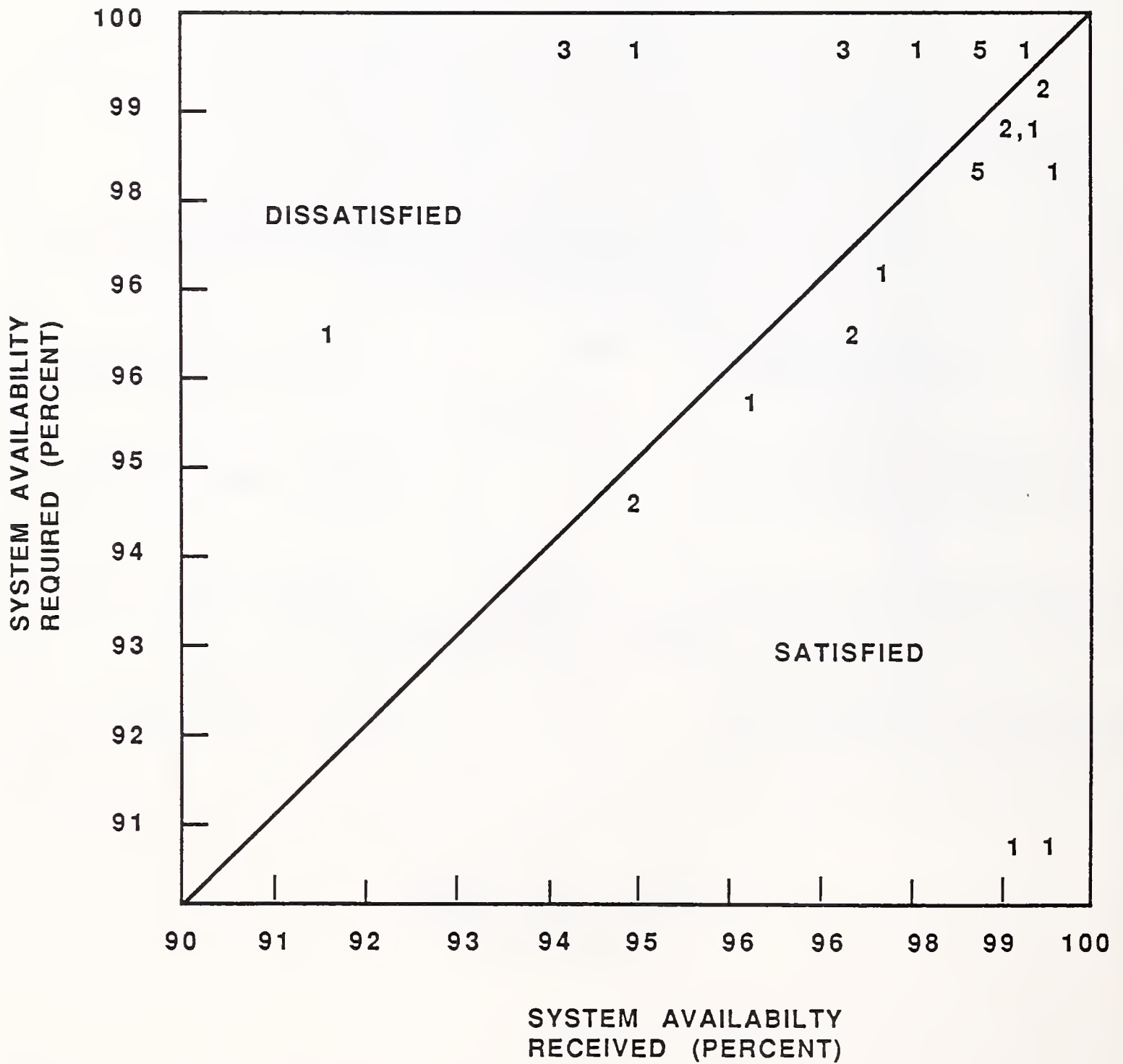
USER SATISFACTION WITH SYSTEM AVAILABILITY
UNISYS (BURROUGHS) AXX



FULS

EXHIBIT IV-14

USER SATISFACTION WITH SYSTEM AVAILABILITY
UNISYS (BURROUGHS) AXX



FULS

TOTAL POINTS PLOTTED: 36

EXHIBIT IV-15

USER PERFORMANCE/VALUE LEVELS
UNISYS (BURROUGHS) AXX

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	5.9	7.0	1.1
PARTS AVAILABILITY	8.8	7.9	(0.9)
REMOTE SUPPORT	6.2	7.8	1.6
HARDWARE ENGINEER SKILL	8.8	8.6	0.2
SOFTWARE ENGINEER SKILL	7.9	7.2	(0.7)
SOFTWARE DOCUMENTATION	7.9	6.8	(1.1)
SOFTWARE SUPPORT OVERALL	8.1	7.3	(0.8)
HARDWARE SUPPORT OVERALL	9.1	8.5	(0.6)

*SCALE: 1 = LOW, 10 = HIGH

**AVERAGE STANDARD ERROR OF THE MEAN = 0.3

FULS

EXHIBIT IV-16

USER SATISFACTION LEVELS
1987 VERSUS 1986
UNISYS (BURROUGHS) AXX

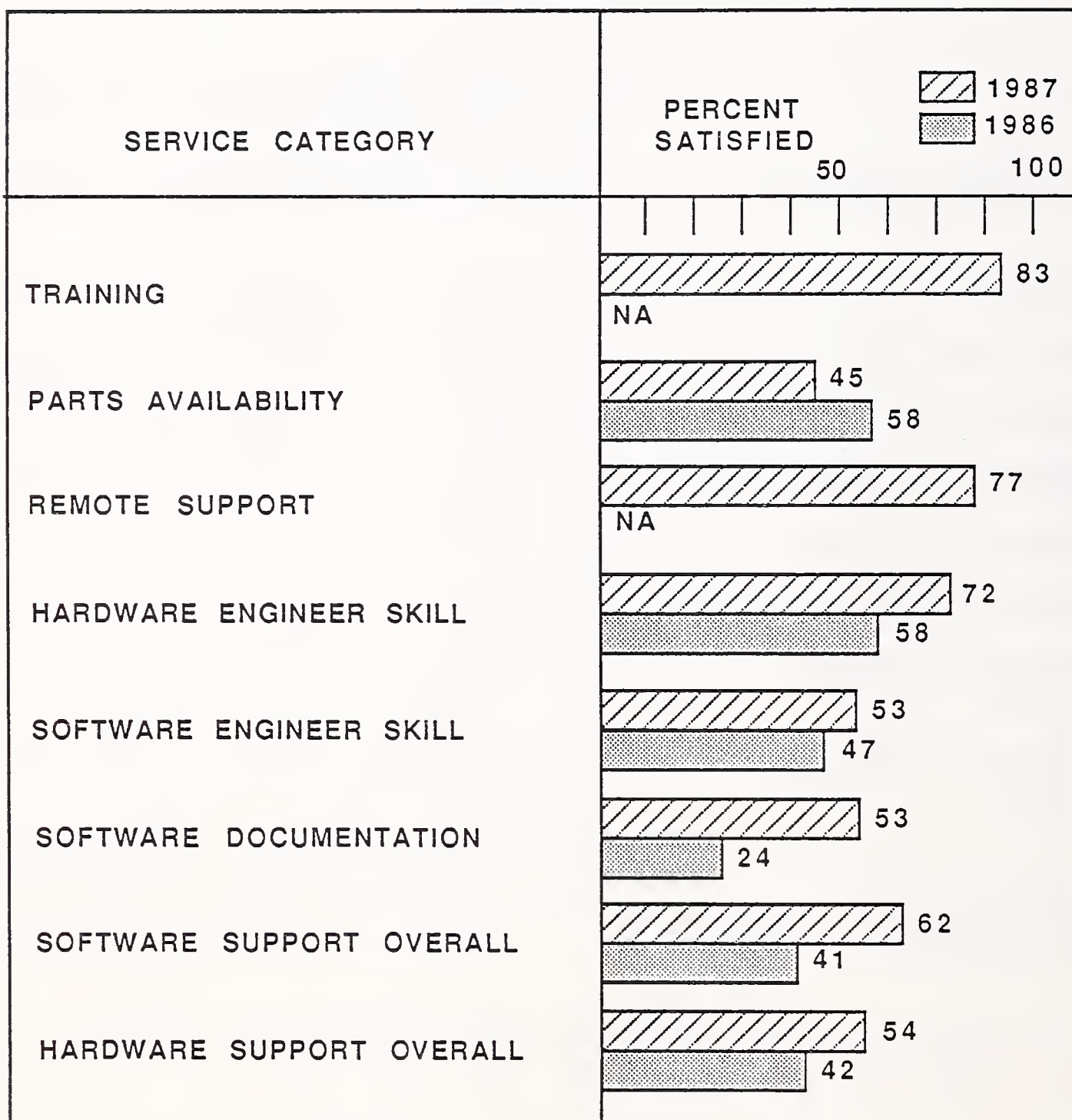
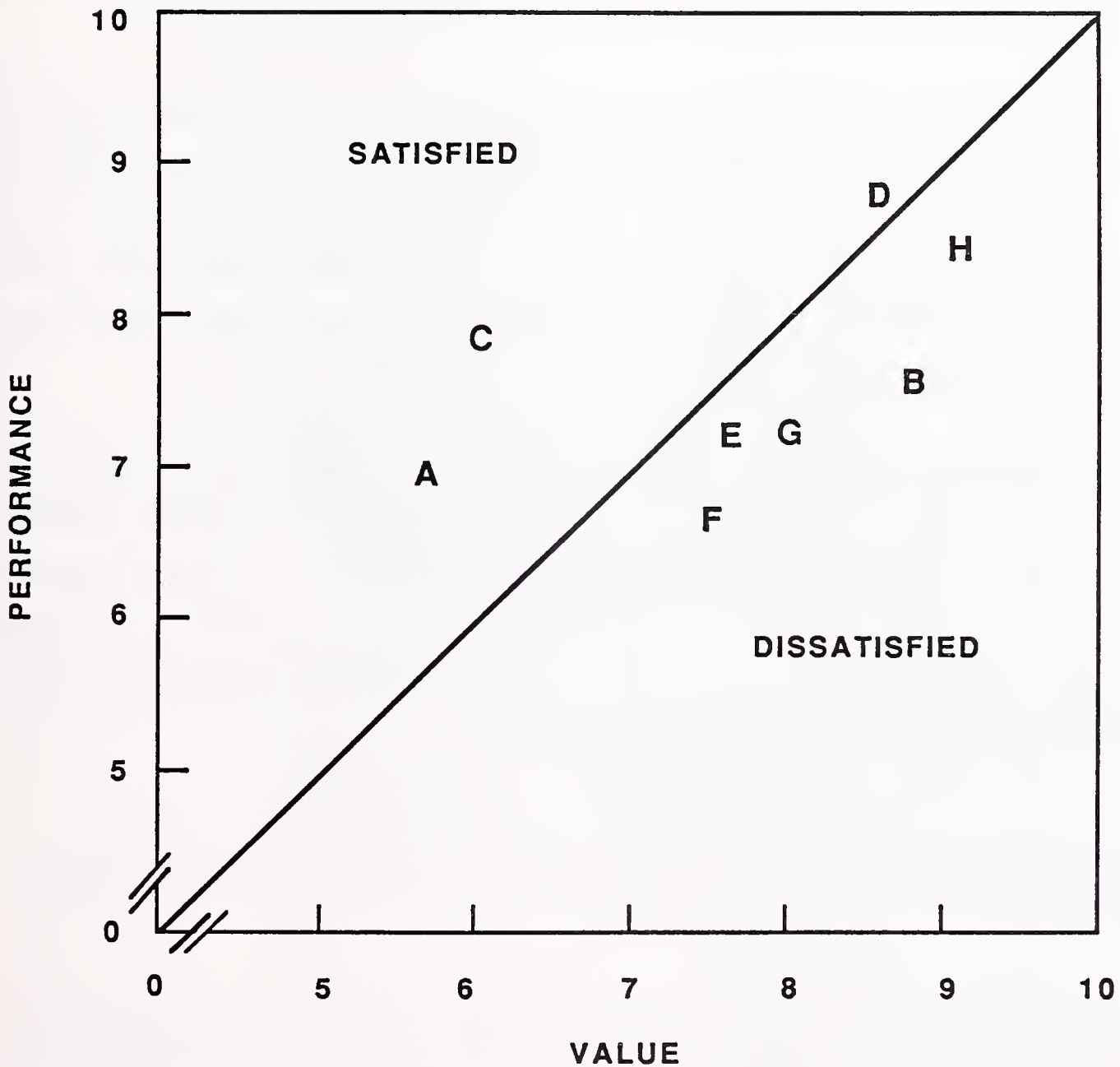


EXHIBIT IV-17

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
UNISYS (BURROUGHS) AXX



- | | |
|-----------------------------------|-----------------------------------|
| A = TRAINING | E = SOFTWARE ENGINEER SKILL LEVEL |
| B = PARTS AVAILABILITY | F = SOFTWARE DOCUMENTATION |
| C = REMOTE SUPPORT | G = SOFTWARE SUPPORT OVERALL |
| D = HARDWARE ENGINEER SKILL LEVEL | H = HARDWARE SUPPORT OVERALL |

FULS

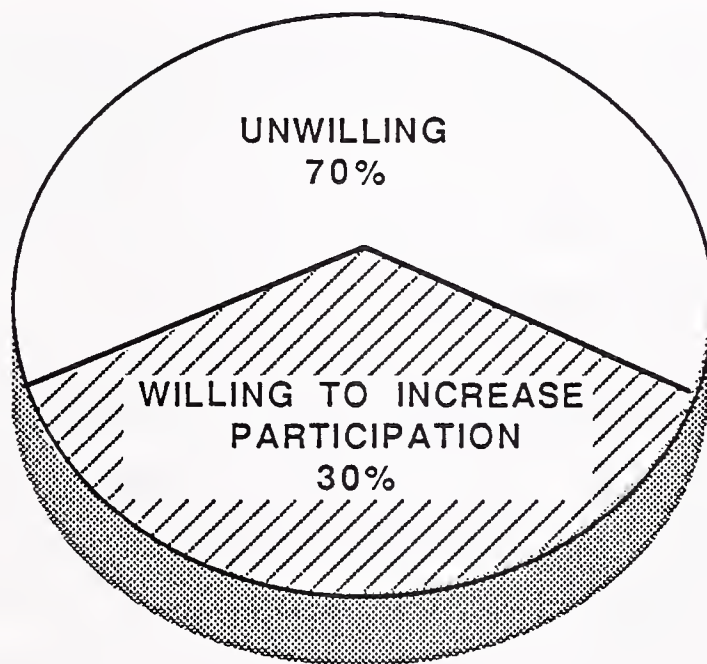
- Spares availability is a key issue for service organizations in all product markets as material costs now outweigh labor costs. This is especially true in the large systems market, as simplified hardware design creates the need for individual boards that are increasingly complex (hence, expensive to manufacture and inventory). Unisys (Burroughs) has the additional challenge of setting up a cohesive parts strategy to cover both Burroughs and Sperry systems. Increased use of and reliance on remote diagnostics will help somewhat (80% of the sample was currently utilizing remote support); however, user sensitivity to spares availability indicates that more attention to current sparing levels and locations needs to be paid.
- Exhibit IV-18 presents users willingness to increase their participation in the support of their own equipment. Unisys (Burroughs) already offers service offerings at various price levels (with corresponding levels of user involvement) which contribute to the relatively small proportion of users (30% of the sample) who would be willing to increase their level of participation in self-maintenance.
- Another limiting factor in this area might be the size of the user organization. Larger users of products this size and complexity often have developed in-house capabilities for supporting their own systems. Smaller organizations usually prefer to have the vendor provide support, particularly involving the host (large) system. The exhibit indicates that the optimal discount level would be 15% all involvement levels.

C. CDC CYBER

- In 1987, INPUT surveyed 40 CDC large systems, split between 11 Cyber 170/XX and 29 Cyber 180/XX. The sample was dominated by respondents from the educational industry (with 13 respondents), business services (9 respondents), and discrete manufacturing (7 respondents). While most

EXHIBIT IV-18

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE
UNISYS (BURROUGHS) AXX



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	20	0	13	38	63	88	100
SWAP COMPONENTS	23	0	14	43	43	71	100
SWAP BOARDS	24	0	13	38	38	63	100

*UP TO AND INCLUDING

 OPTIMUM DISCOUNT LEVEL

FULS

individual contacts were either data processing or computer operations managers, a few of the manufacturing and engineering respondent titles were more technical in nature (e.g., CAD coordinator, manager of engineering).

- Exhibit IV-19 shows that when contracting for maintenance services, the CDC sample predominantly opted for five-day (Monday through Friday) coverage. However, a plurality (48% to 40%) of users receive two shifts of coverage versus just the prime shift of hours covered. This might reflect the fact that many educational systems are set up to allow night students access to the system during the week.
- The Cyber systems surveyed are older than the rest of the large systems sample; although a new line of 180's was announced in mid-1986, CDC has been shipping 180 since April 1984 and 170 previous to that. Thus, the sample's age is reflected in Exhibit IV-20 by the relatively high number of systems interruptions per month.
- System availability actuals reported by the sample also reflect the age of the respondents' systems. CDC manages to satisfy the majority of its users' requirements for system availability, service response time, and actual repair time (shown in Exhibit IV-21) in large part due to the predominance of educational users whose service performance standards are not quite so high. Satisfaction drops significantly when system availability requirements surpass the 99% level, as shown in Exhibit IV-22. This is not a major shortcoming since only twelve of the total CDC sample respondents require system availability in excess of 99% (as shown in the scatter plot of CDC user responses in Exhibit IV-23).
- CDC respondents were less satisfied with the level of service performance that they received in a number of post-scale support categories, particularly spare parts availability, software documentation, software engineer skill level, and end-user training. Exhibit IV-24 presents the 1987 ratings for value placed upon each service category versus the actual performance received by

EXHIBIT IV-19

SERVICE CONTRACT
CDC CYBER

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	90
- MONDAY - SATURDAY	2
- MONDAY - SUNDAY	8
• HOURS OF COVERAGE	
- 1-9 HOURS	40
- 10-16 HOURS	48
- 17-24 HOURS	12
• BILLING INTERVAL	
- ANNUAL	8
- QUARTERLY	2
- MONTHLY	90

EXHIBIT IV-20

SERVICE PERFORMANCE
CDC CYBER

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
• MEAN NUMBER PER MONTH	2.3
• HARDWARE CAUSED (PERCENT)	63.0
• SYSTEM SOFTWARE CAUSED (PERCENT)	14.0
• APPLICATION SOFTWARE CAUSED (PERCENT)	7.0
• OTHER CAUSED (PERCENT)	15.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	97.7
• MEAN RESPONSE TIME (HOURS)	2.6
• MEAN REPAIR TIME (HOURS)	3.9
• MEAN RECOVERY TIME (HOURS)	1.7

EXHIBIT IV-21

USER SATISFACTION WITH SERVICE PERFORMANCE
CDC CYBER

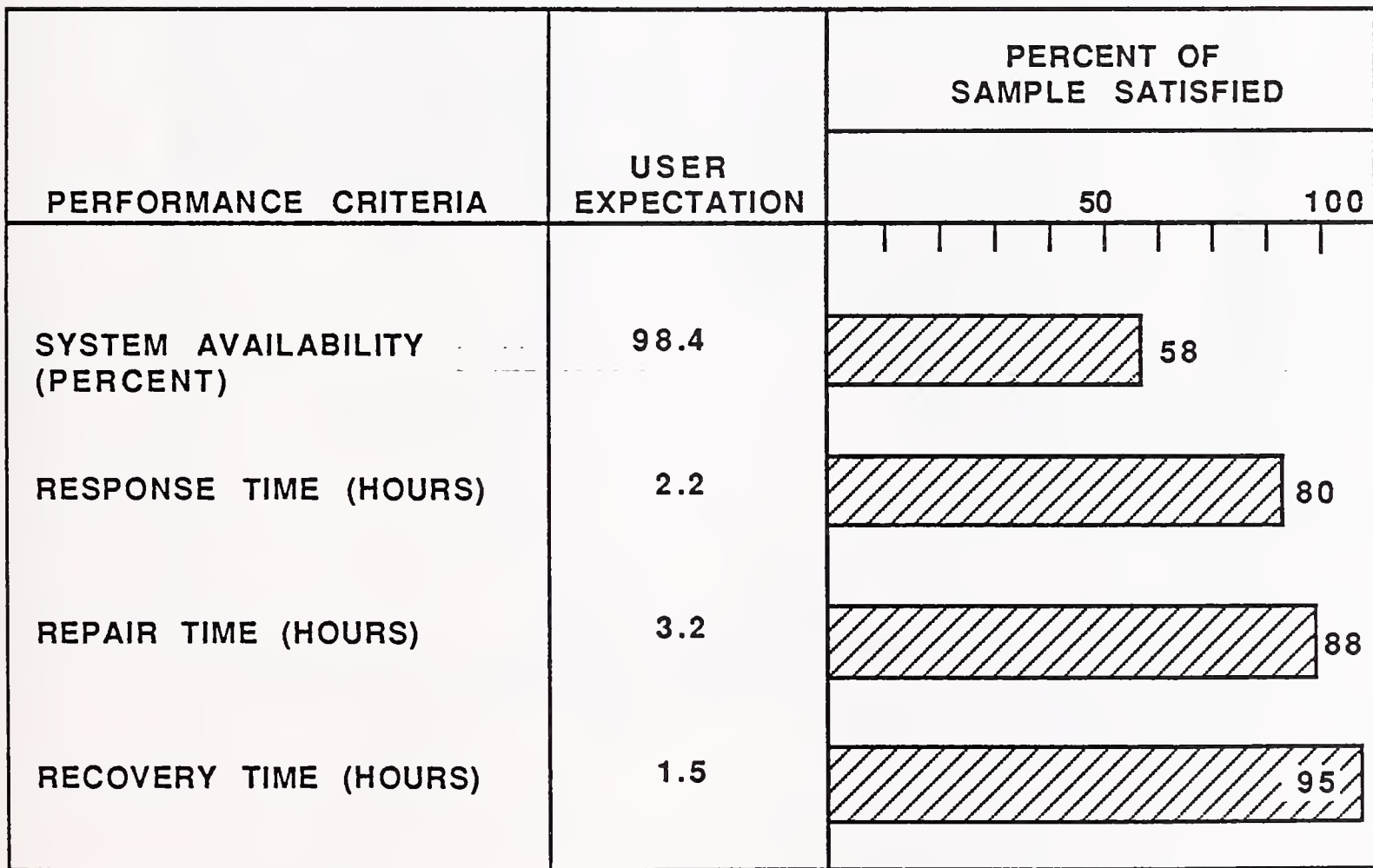
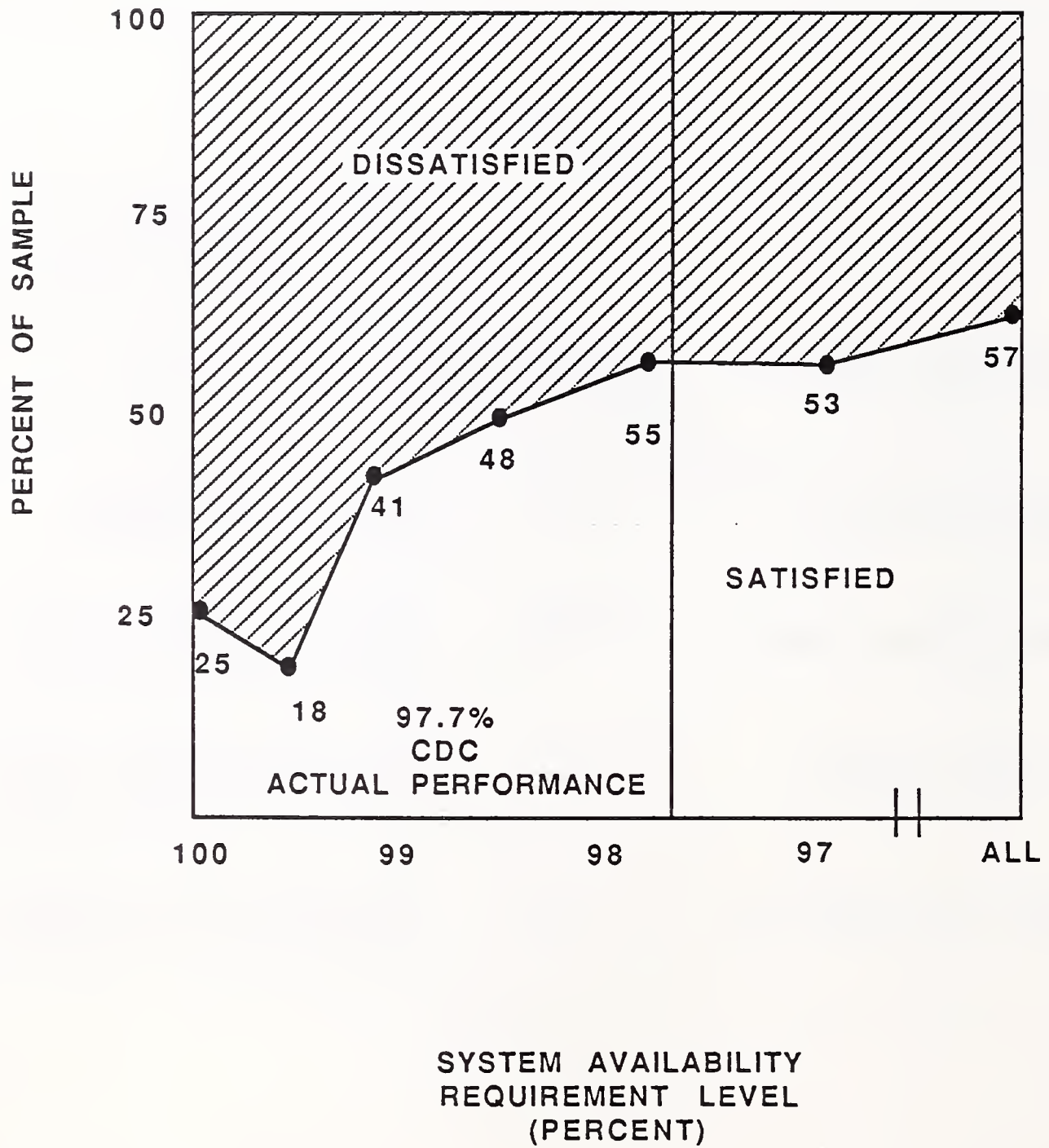


EXHIBIT IV-22

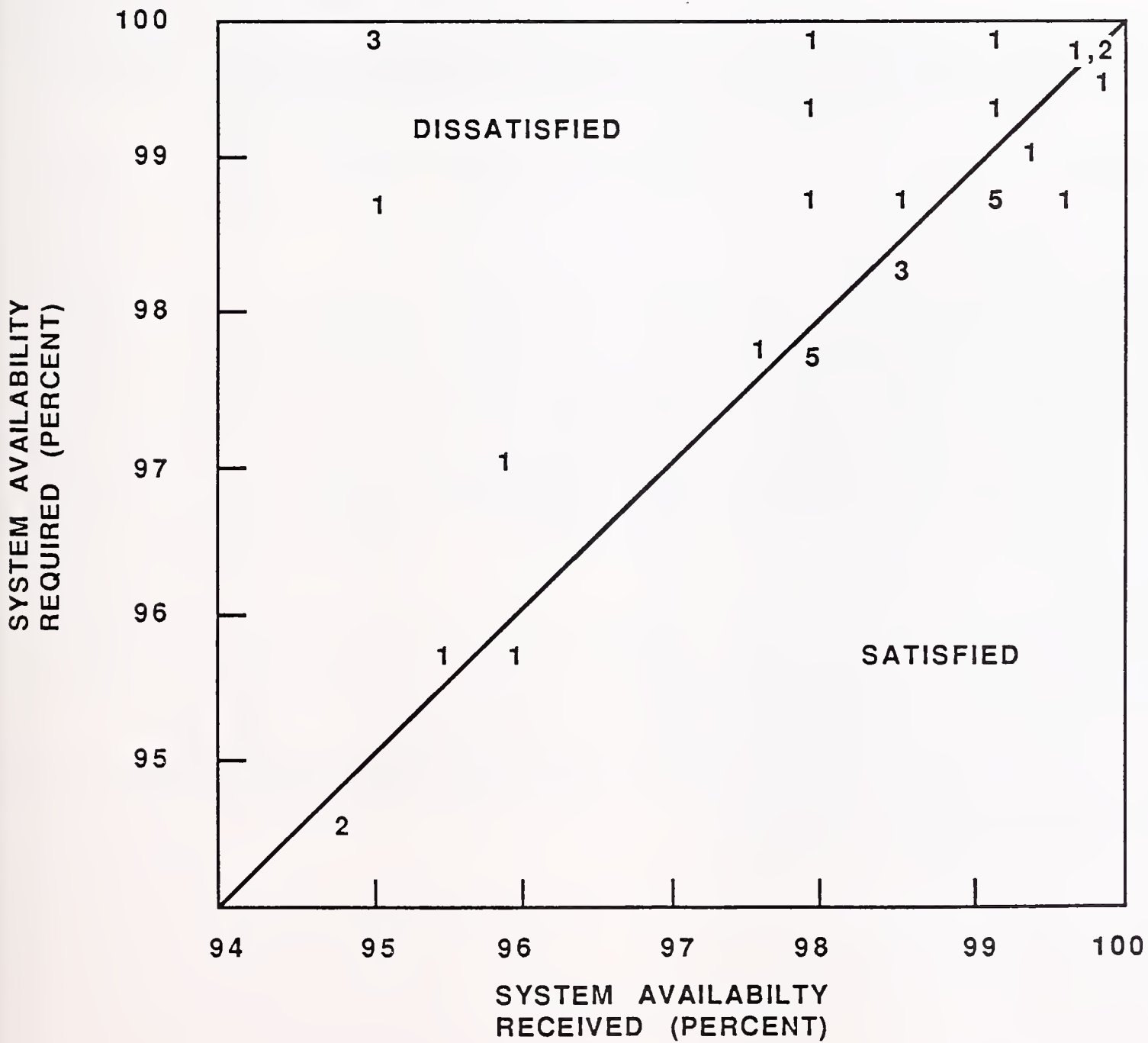
USER SATISFACTION WITH SYSTEM AVAILABILITY
CDC CYBER



FULS

EXHIBIT IV-23

USER SATISFACTION WITH SYSTEM AVAILABILITY
CDC CYBER



FULS

TOTAL POINTS PLOTTED: 38

EXHIBIT IV-24

USER PERFORMANCE/VALUE LEVELS
CDC CYBER

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	8.4	6.5	(1.9)
PARTS AVAILABILITY	9.4	7.7	(1.7)
REMOTE SUPPORT	7.6	6.9	(0.7)
HARDWARE ENGINEER SKILL	9.1	8.4	(0.7)
SOFTWARE ENGINEER SKILL	9.0	7.3	(1.7)
SOFTWARE DOCUMENTATION	8.6	6.5	(1.9)
SOFTWARE SUPPORT OVERALL	8.7	7.1	(1.6)
HARDWARE SUPPORT OVERALL	9.2	8.3	(0.9)

* SCALE: 1 = LOW, 10 = HIGH

**AVERAGE STANDARD ERROR OF THE MEAN = 0.4

FULS

the sample. Note that CDC performance falls short in the services users value most. Exhibit IV-25 reinforces this, highlighting the degree of satisfaction in these key areas.

- Special mention should be made concerning CDC performance in end-user training, usually a service of lesser value to most large systems users. A large proportion of CDC users are educational institutions that usually have high training needs due to the constant turn over of data processing staff. As a result, CDC users place a greater value on ongoing operational training. Exhibit IV-26 visually plots the disparity between user needs and vendor performance.
- Perhaps as a result of these unmet needs, CDC users report a significant amount of willingness to increase their level of participation in maintaining their equipment. Exhibit IV-27 indicates that 41% of the sample is currently willing to increase their involvement, fairly evenly between the three levels analyzed.
- The subjective comments from the CDC sample indicate that they are generally satisfied with hardware service overall, the users are particularly concerned with spares availability (cited as a problem by 17 of the 40 users surveyed) and field engineer expertise. The users identified the lack of localized spares as the prime contributor to the relatively long repair times that they receive.
- The CDC sample is less satisfied with the software support that they receive. Problems cited most often involve software engineer skill level and turnover, documentation clarity, and the quality (freedom from "bugs") of software updates and revisions.

EXHIBIT IV-25

USER SATISFACTION LEVELS
1987 VERSUS 1986
CDC CYBER

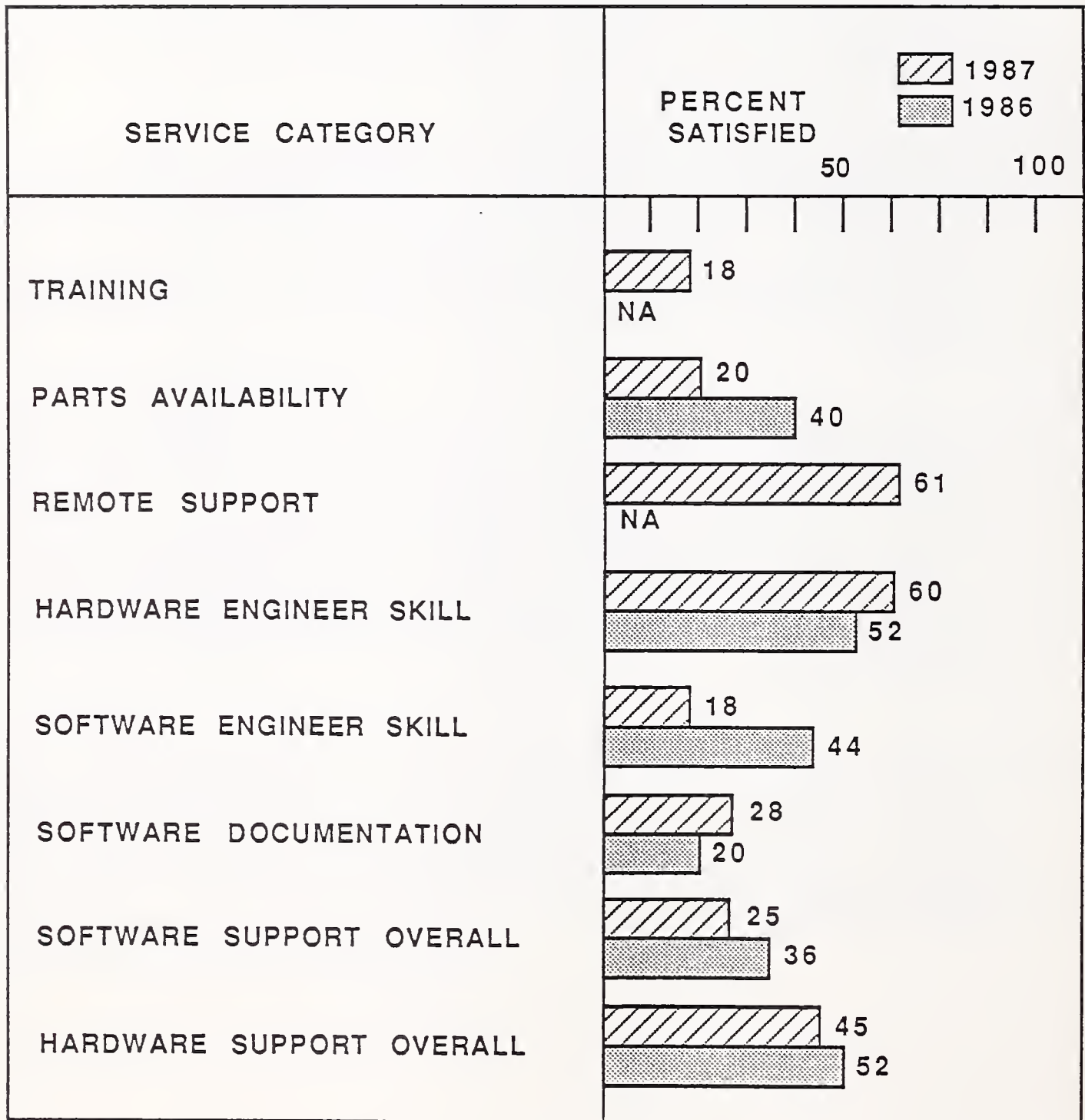
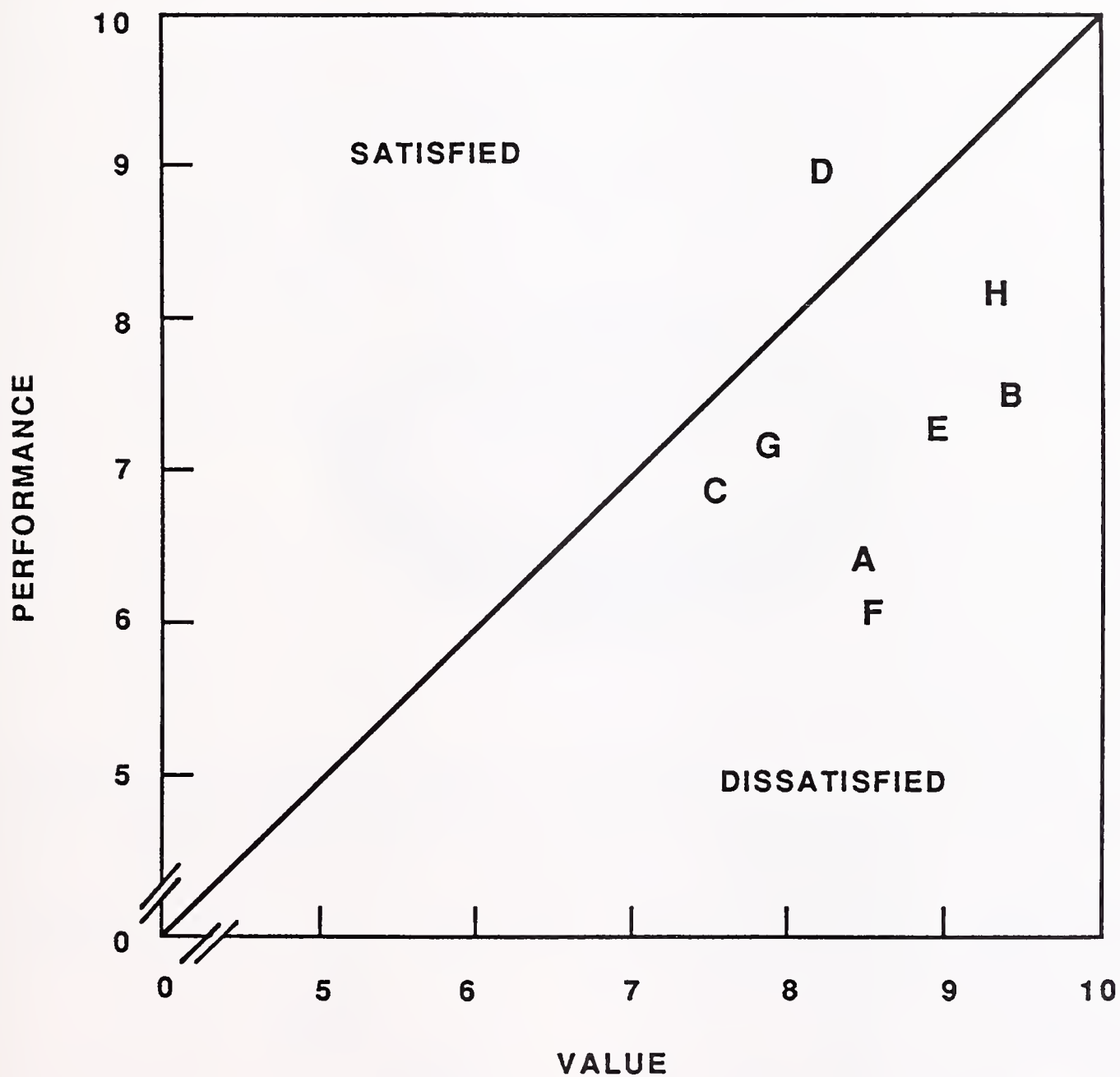


EXHIBIT IV-26

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
CDC CYBER



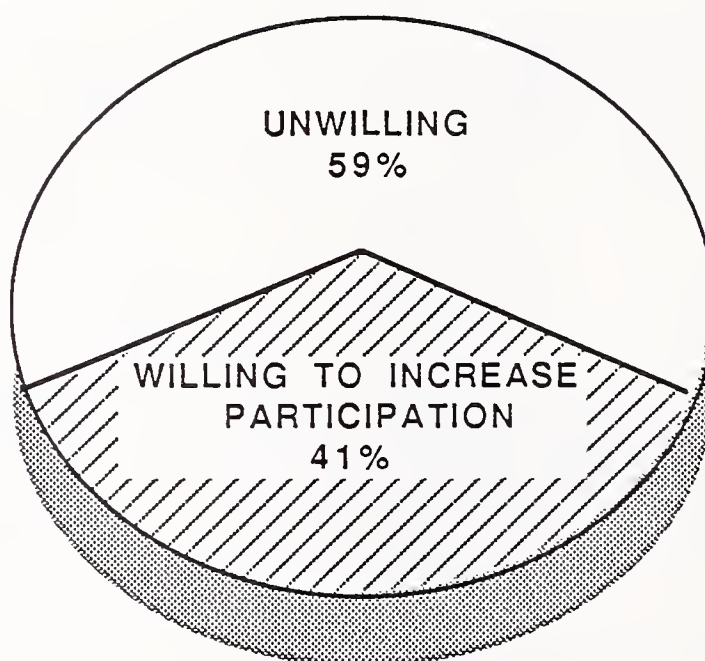
A = TRAINING
B = PARTS AVAILABILITY
C = REMOTE SUPPORT
D = HARDWARE ENGINEER SKILL LEVEL

E = SOFTWARE ENGINEER SKILL LEVEL
F = SOFTWARE DOCUMENTATION
G = SOFTWARE SUPPORT OVERALL
H = HARDWARE SUPPORT OVERALL

FULS

EXHIBIT IV-27

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE CDC CYBER



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	23	0	0	9	64	82	100
SWAP COMPONENTS	22	0	8	25	67	75	100
SWAP BOARDS	22	0	8	25	67	75	100

*UP TO AND INCLUDING

FULS

 OPTIMUM DISCOUNT LEVEL

D. HONEYWELL DPS-8

- INPUT surveyed 41 Honeywell DPS-8 large systems users, representing 11 out of 14 possible industries, with greatest concentrations in government agencies (15 respondents), educational institutions (8 respondents), and business services (6 respondents). The sample was also relatively dispersed in terms of revenue size, with respondents ranging from just over \$1 million to up to \$500 million.
- Contractually, two-thirds of the Honeywell sample receives five-day coverage versus Monday through Saturday or Monday through Sunday provision. Exhibit IV-28 also shows that two-thirds of the sample opt for extended shift coverage. Similar to the CDC sample, the DPS sample has a large concentration of educational users who are attracted to multi-shift coverage to allow night students (protected) access to the school's mainframe. However, the schools (or government agencies) also may need to provide access to the system on Saturdays, Sundays, or holidays.
- According to the Honeywell users surveyed, the DPS-8 systems are extremely reliable, averaging only 1.2 system interruptions per month. Exhibit IV-29 indicates that system availability (97.8%) is impacted by only average response time (of 2.1 hours) and a below average repair time (of 3.4 hours). While Honeywell users appear to be satisfied with vendor response and repair times (as shown in Exhibit IV-30), user satisfaction with system availability is quite low (only 38% of the sample was satisfied with system availability).
- Exhibit IV-31 reinforces this conclusion, showing that Honeywell's ability to satisfy its users' requirements at any system availability level. In Honeywell's defense, the sample exhibited a relatively dispersed set of requirement levels (shown graphically in Exhibit IV-32), which makes it difficult to establish satisfactory standards to aim for.

EXHIBIT IV-28

SERVICE CONTRACT
HONEYWELL DPS-8

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	66
- MONDAY - SATURDAY	7
- MONDAY - SUNDAY	27
• HOURS OF COVERAGE	
- 1-9 HOURS	44
- 10-16 HOURS	22
- 17-24 HOURS	34
• BILLING INTERVAL	
- ANNUAL	10
- QUARTERLY	0
- MONTHLY	90

FULS

EXHIBIT IV-29

SERVICE PERFORMANCE
HONEYWELL DPS-8

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
<ul style="list-style-type: none"> • SYSTEM INTERRUPTIONS <ul style="list-style-type: none"> - MEAN NUMBER PER MONTH - HARDWARE CAUSED (PERCENT) - SYSTEM SOFTWARE CAUSED (PERCENT) - APPLICATION SOFTWARE CAUSED (PERCENT) - OTHER CAUSED (PERCENT) • MEAN SYSTEM AVAILABILITY (PERCENT) • MEAN RESPONSE TIME (HOURS) • MEAN REPAIR TIME (HOURS) • MEAN RECOVERY TIME (HOURS) 	<p style="text-align: center;">1.2</p> <p style="text-align: center;">73.0</p> <p style="text-align: center;">13.0</p> <p style="text-align: center;">4.0</p> <p style="text-align: center;">10.0</p> <p style="text-align: center;">97.8</p> <p style="text-align: center;">2.1</p> <p style="text-align: center;">3.4</p> <p style="text-align: center;">1.1</p>

EXHIBIT IV-30

USER SATISFACTION WITH SERVICE PERFORMANCE
HONEYWELL DPS-8

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED	
		50	100
SYSTEM AVAILABILITY (PERCENT)	98.7		
RESPONSE TIME (HOURS)	2.4		
REPAIR TIME (HOURS)	3.6		
RECOVERY TIME (HOURS)	1.1		

FULS

EXHIBIT IV-31

USER SATISFACTION WITH SYSTEM AVAILABILITY
HONEYWELL DPS-8

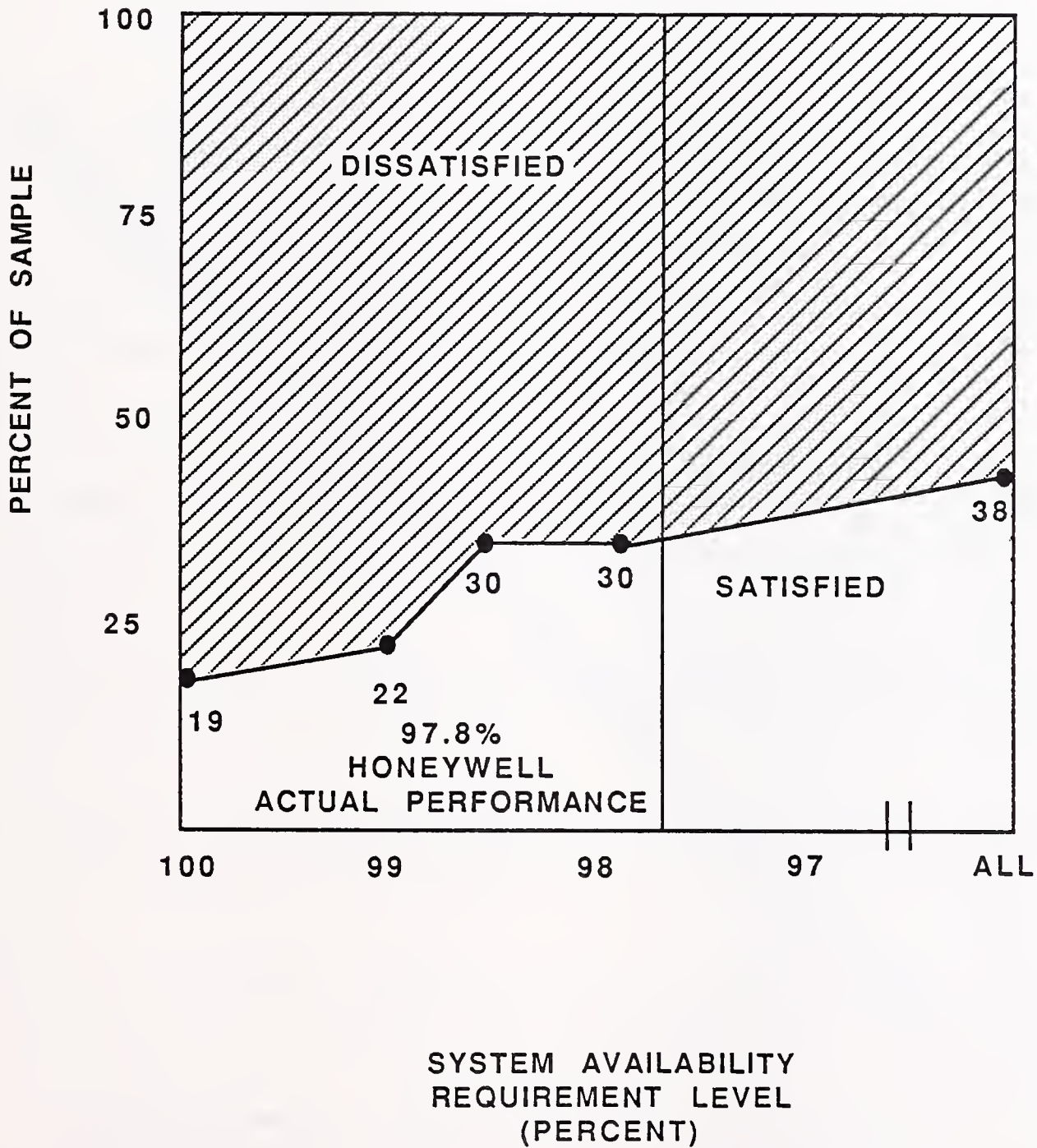
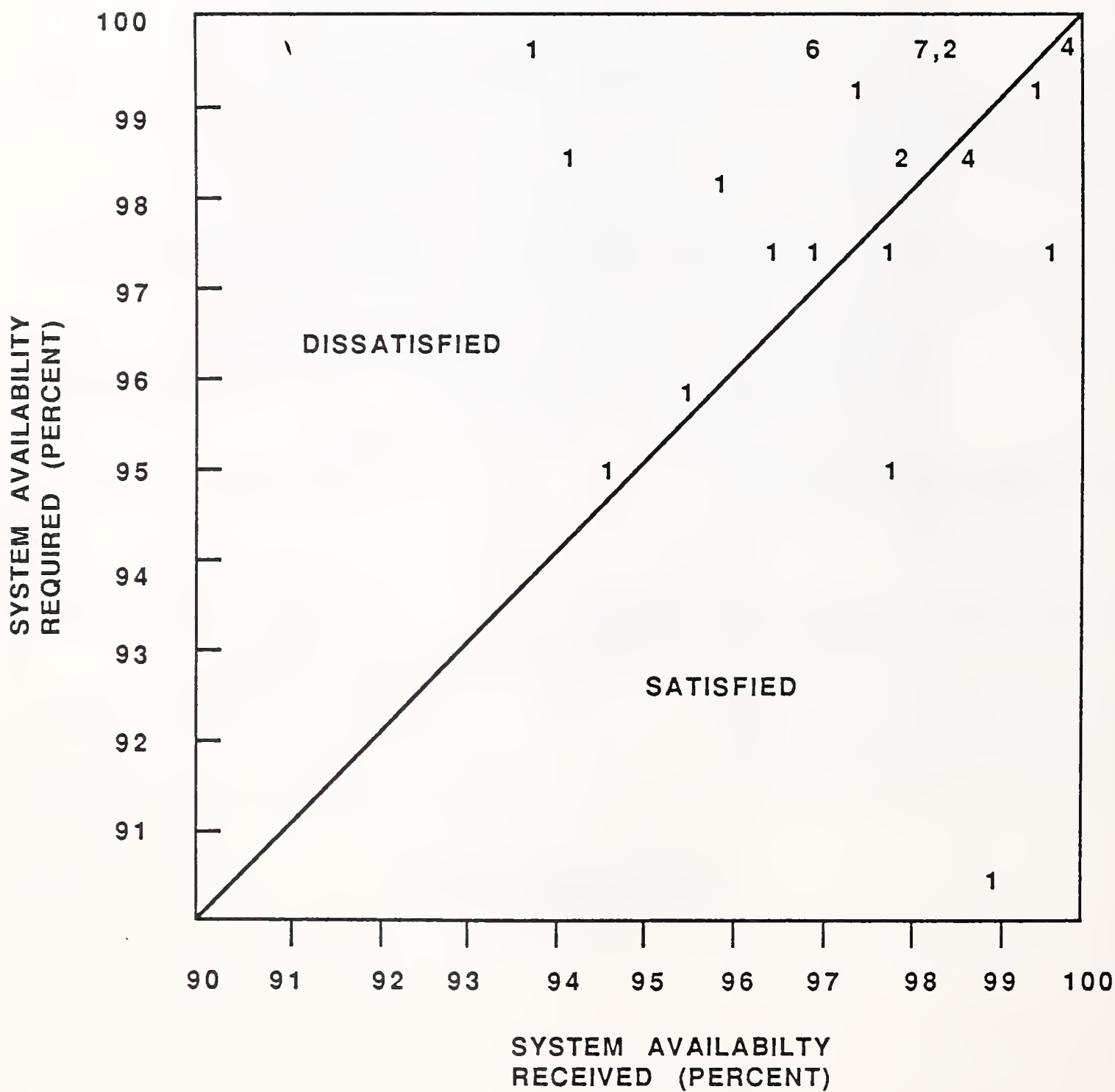


EXHIBIT IV-32

USER SATISFACTION WITH SYSTEM AVAILABILITY
HONEYWELL DPS-8



FULS

TOTAL POINTS PLOTTED: 40

- Exhibit IV-33 presents user ratings for the perceived value of each service area as well as the performance received in each service area. The exhibit indicates that Honeywell performance does not come close to user perceived value in a number of important service areas:
 - Parts availability.
 - Software support overall.
 - Software documentation.
- Not surprisingly, user dissatisfaction with these areas is also greatest, as indicated in Exhibit IV-34. Honeywell fails to satisfy even one-third of its DPS-8 users' requirements in such vital service areas as parts availability and software documentation and satisfies less than one-half of its users in software engineer skill level and overall software support.
- The DPS-8 users' dissatisfaction with spares availability also became apparent when queried concerning their most pressing hardware maintenance concern. Fourteen out of the forty-one DPS-8 users surveyed mentioned spare parts.
- On the software side, documentaton clarity (13 mentions) was by far the most pressing software support concern as reported by the DPS-8 sample.
- Exhibit IV-35 graphically represents the large disparity between vendor performance and the value placed upon these key service areas by the users.
- Not surprisingly, Honeywell users are quite willing to increase their participation in supporting their own equipment, as shown in Exhibit IV-36. Over one-half of the sample (54%) are willing to increase their involvement in self-maintenance to some degree. This willingness is further illustrated by the relatively small discounts (10% for diagnosis and component swaps, 15% for board swaps) expected. Honeywell should look at this willingness as a two-

EXHIBIT IV-33

USER PERFORMANCE/VALUE LEVELS
HONEYWELL DPS-8

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	6.8	6.4	(0.4)
PARTS AVAILABILITY	9.1	7.7	(1.4)
REMOTE SUPPORT	7.7	7.0	(0.7)
HARDWARE ENGINEER SKILL	9.0	8.2	(0.8)
SOFTWARE ENGINEER SKILL	8.4	7.2	(1.2)
SOFTWARE DOCUMENTATION	8.5	6.6	(1.9)
SOFTWARE SUPPORT OVERALL	8.7	7.1	(1.6)
HARDWARE SUPPORT OVERALL	9.1	8.4	(0.7)

* SCALE: 1 = LOW, 10 = HIGH

**AVERAGE STANDARD ERROR OF THE MEAN = 0.3

FULS

EXHIBIT IV-34

USER SATISFACTION LEVELS
1987 VERSUS 1986
HONEYWELL DPS-8

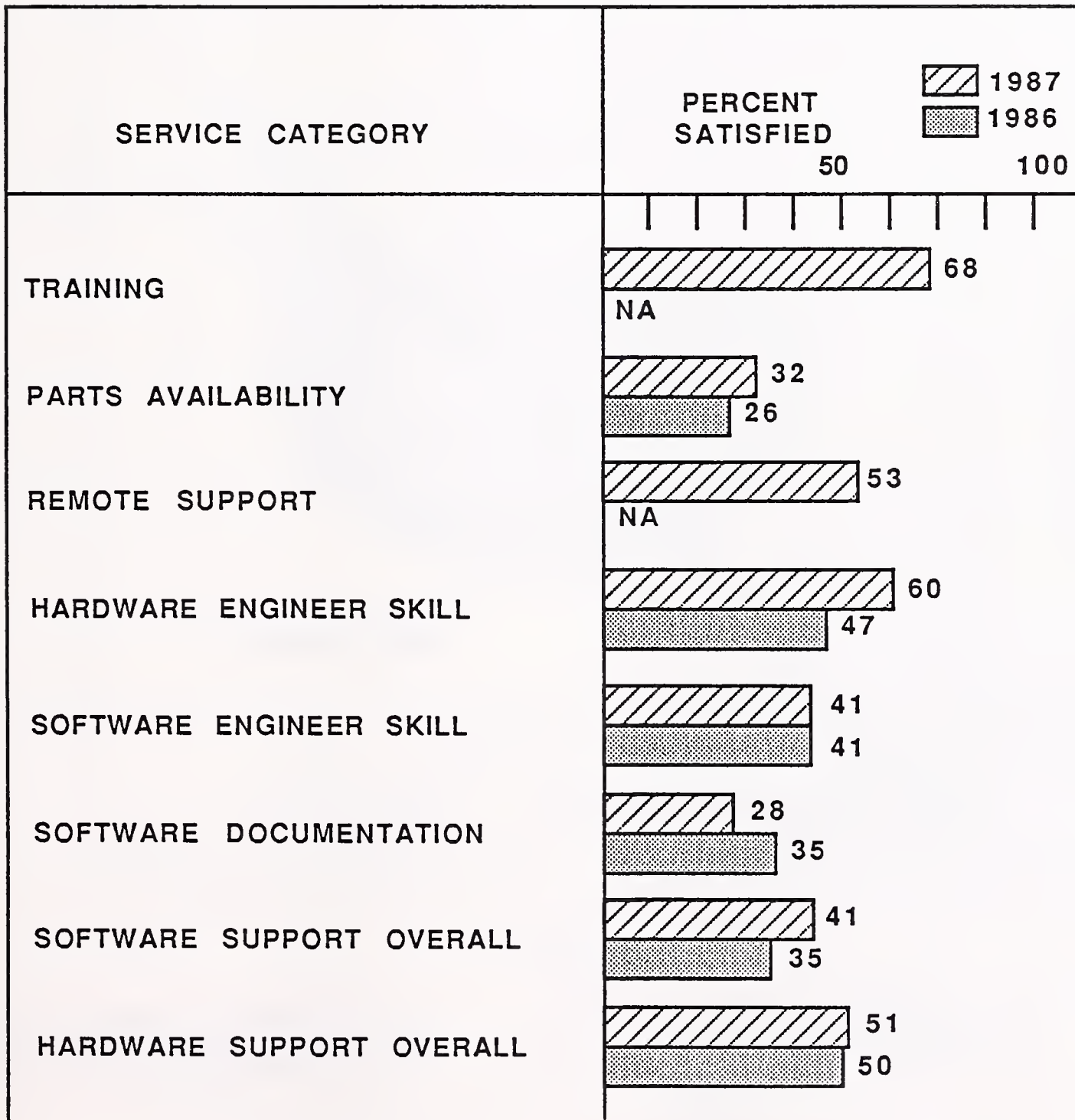
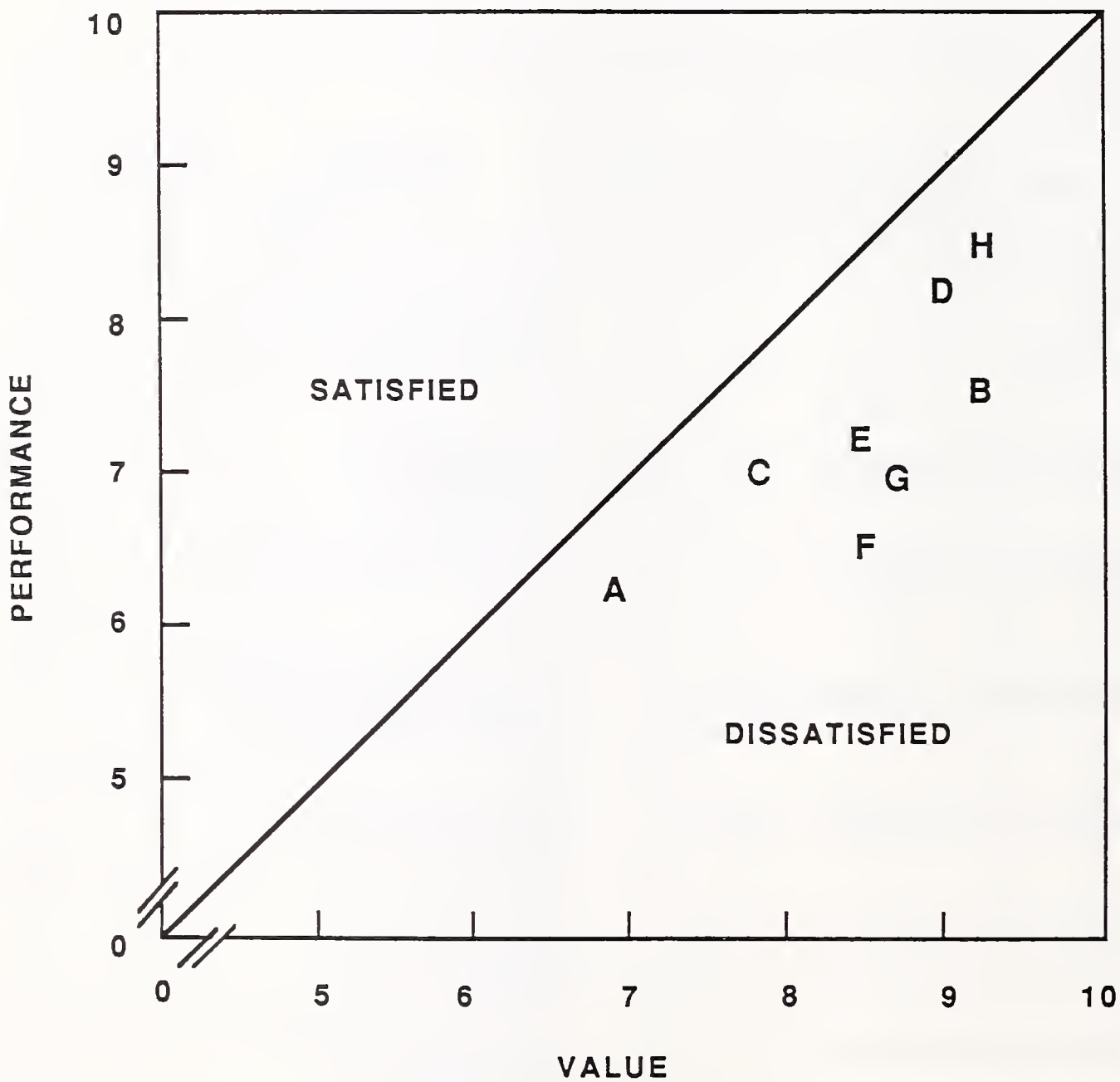


EXHIBIT IV-35

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
HONEYWELL DPS-8



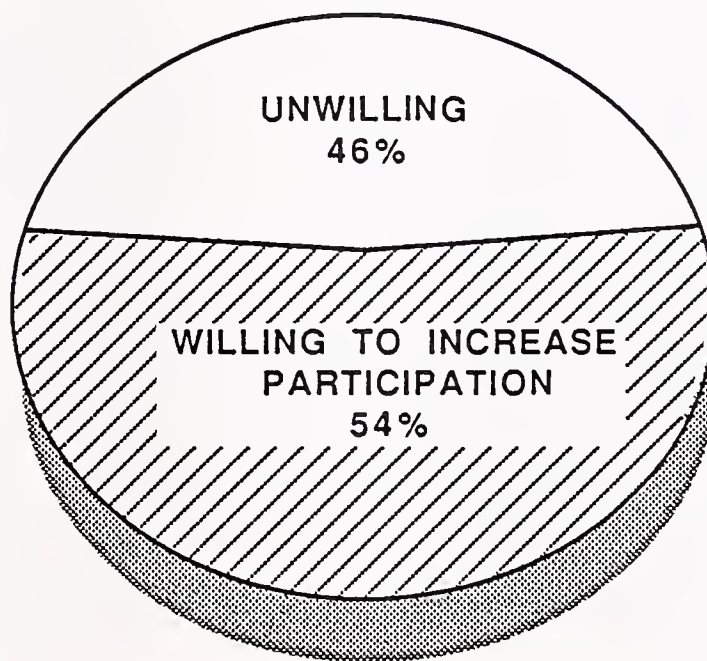
A = TRAINING
B = PARTS AVAILABILITY
C = REMOTE SUPPORT
D = HARDWARE ENGINEER SKILL LEVEL

E = SOFTWARE ENGINEER SKILL LEVEL
F = SOFTWARE DOCUMENTATION
G = SOFTWARE SUPPORT OVERALL
H = HARDWARE SUPPORT OVERALL

FULS

EXHIBIT IV-36

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE
HONEYWELL DPS-8



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	17.4	6	41	47	82	88	100
SWAP COMPONENTS	20.3	0	38	50	63	75	100
SWAP BOARDS	22.3	0	33	47	60	67	100

*UP TO AND INCLUDING

 OPTIMUM DISCOUNT LEVEL

FULS

edged sword: The user may be accepting reduced levels of service (for a discount) that could result in reduced service costs for Honeywell; however, this willingness, coupled with user dissatisfaction with key service areas, might suggest a willingness to consider alternative service (or even product) sources.

E. IBM 309X

- INPUT surveyed fifty IBM 309X large systems users concerning their satisfaction with the service that they received. This is the first year that the 309X products were surveyed; therefore, there are no comparisons with 1986 reports presented (an analysis of IBM 308X user requirements follows, with comparisons to 1986 308X results). The companies in the sample tended to be large organizations; although two respondents were smaller than \$10 million in annual sales, the majority of the users surveyed ranged from \$250 million on up to \$5 billion in revenues and between 2,500 to 10,000 in employee counts. The sample was fairly evenly dispersed by industry served, with process manufacturers (ten respondents), banks (7 respondents), and insurance companies (also 7 respondents) most represented.
- The 309X sample tended to contract for extended coverages, as shown in Exhibit IV-37. Almost 60% of the sample contracted for seven-day coverage; 60% of the sample also contracted for around-the-clock service coverage. The size of investment and value of processing performed usually warranted such extensive coverage to these users, who most often ran two and three shifts of usage.
- IBM service performance for the new 309X family is at the expected high level. Exhibit IV-38 indicates that the sample averaged only 1.4 system interruptions per month. Response and repair times were extremely low, averaging 1.1 hours and 1.6 hours respectively. When combined with the

EXHIBIT IV-37

SERVICE CONTRACT
IBM 309X

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	55
- MONDAY - SATURDAY	5
- MONDAY - SUNDAY	40
• HOURS OF COVERAGE	
- 1-9 HOURS	50
- 10-16 HOURS	10
- 17-24 HOURS	40
• BILLING INTERVAL	
- ANNUAL	8
- QUARTERLY	8
- MONTHLY	84

FULS

EXHIBIT IV-38

SERVICE PERFORMANCE
IBM 309X

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
<ul style="list-style-type: none"> • SYSTEM INTERRUPTIONS <ul style="list-style-type: none"> - MEAN NUMBER PER MONTH - HARDWARE CAUSED (PERCENT) - SYSTEM SOFTWARE CAUSED (PERCENT) - APPLICATION SOFTWARE CAUSED (PERCENT) - OTHER CAUSED (PERCENT) • MEAN SYSTEM AVAILABILITY (PERCENT) • MEAN RESPONSE TIME (HOURS) • MEAN REPAIR TIME (HOURS) • MEAN RECOVERY TIME (HOURS) 	<p style="text-align: center;">1.4</p> <p style="text-align: center;">42.0</p> <p style="text-align: center;">35.0</p> <p style="text-align: center;">7.0</p> <p style="text-align: center;">16.0</p> <p style="text-align: center;">98.5</p> <p style="text-align: center;">1.1</p> <p style="text-align: center;">1.6</p> <p style="text-align: center;">0.9</p>

system recovery time of less than one hour, average system availability (as reported by the 309X sample) was 98.5%.

- This performance falls within acceptable requirements reported by users (shown in Exhibit IV-39). The only divergence is in system availability, where the sample requires better than 99% system availability. As a result, IBM satisfies over 90% of the sample's needs in response time, repair time, and recovery time, yet only 57% of the samples needs for system availability. Exhibit IV-40 further illustrates the high system availability requirements of the 309X sample versus IBM's actual performance at each requirement level. Note that IBM performance falls only after the 99.5% requirement level, where the cumulative percentage of the sample that is satisfied drops from 36% to 19% (at the 100% requirement level).
- Exhibit IV-41 also shows the extremely high system availability requirement levels reported by 309X users. Twenty-one out of the total sample of fifty (two respondents received less than 97% and thus fell off the exhibit boundaries) reported system availability requirements of 100%; IBM successfully met the requirements for only four of those users. The exhibit shows that IBM is much more successful at meeting the needs of those users who require less than 99.5% system availability.
- It is interesting to contrast the expectations of the 309X users to the 308X users (covered in Section F that follows immediately). The 308X users are much more concentrated around the 97.5% to 99.0% system availability requirement levels. In fact, only fifteen (out of the fifty) 308X respondents required 100% system availability (IBM satisfied two of those users). The 308X users may be concentrated at this lower requirement level due to greater experience with (hence knowledge about) IBM performance in this area, while the 309X users expect more from their newer systems.
- IBM 309X user requirements for other service areas are also quite high, as shown in Exhibit IV-42. Users place especially high value on parts availability,

EXHIBIT IV-39

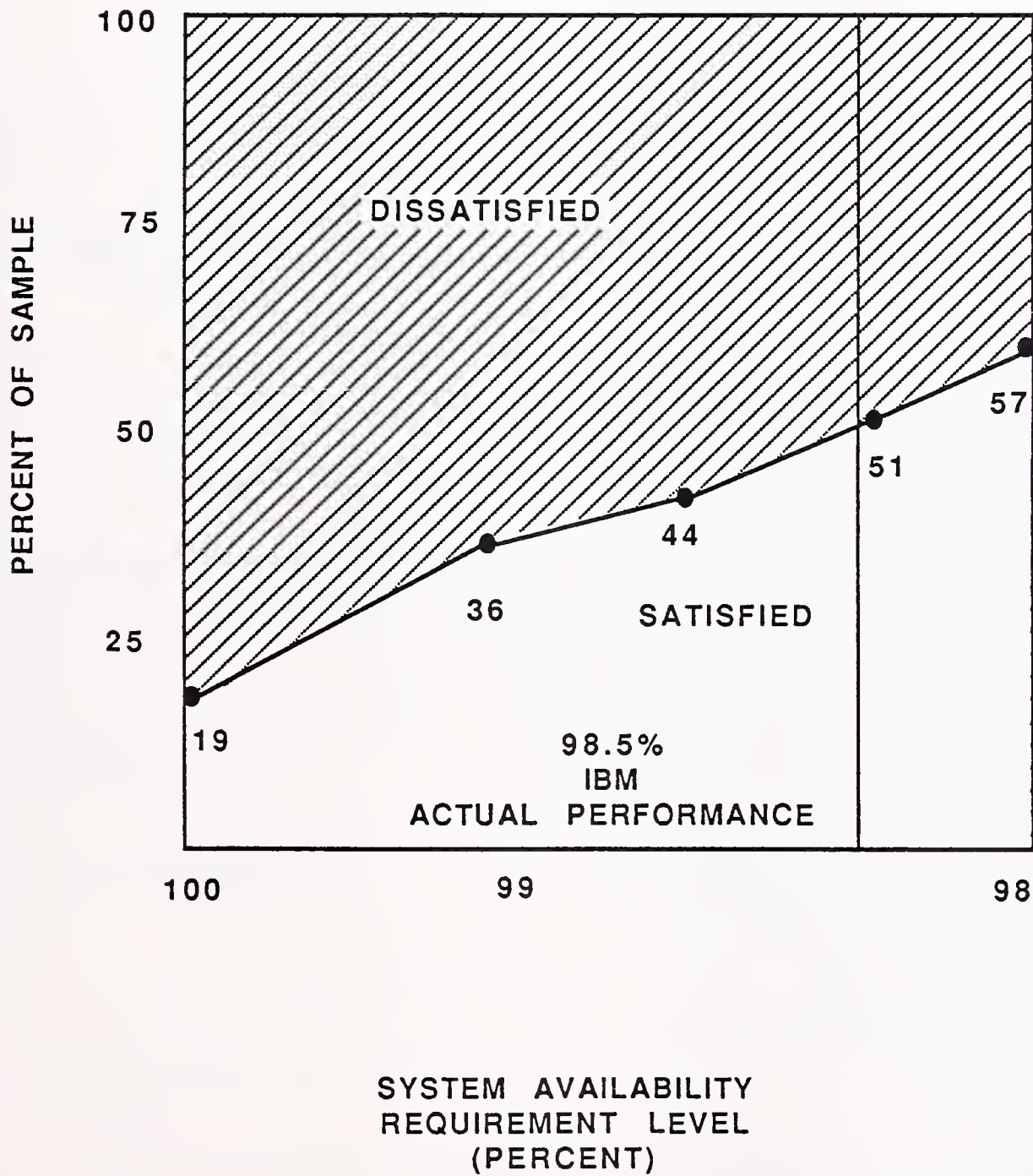
USER SATISFACTION WITH SERVICE PERFORMANCE
IBM 309X

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED	
		50	100
SYSTEM AVAILABILITY (PERCENT)	99.3		
RESPONSE TIME (HOURS)	1.1		
REPAIR TIME (HOURS)	1.5		
RECOVERY TIME (HOURS)	0.8		

FULS

EXHIBIT IV-40

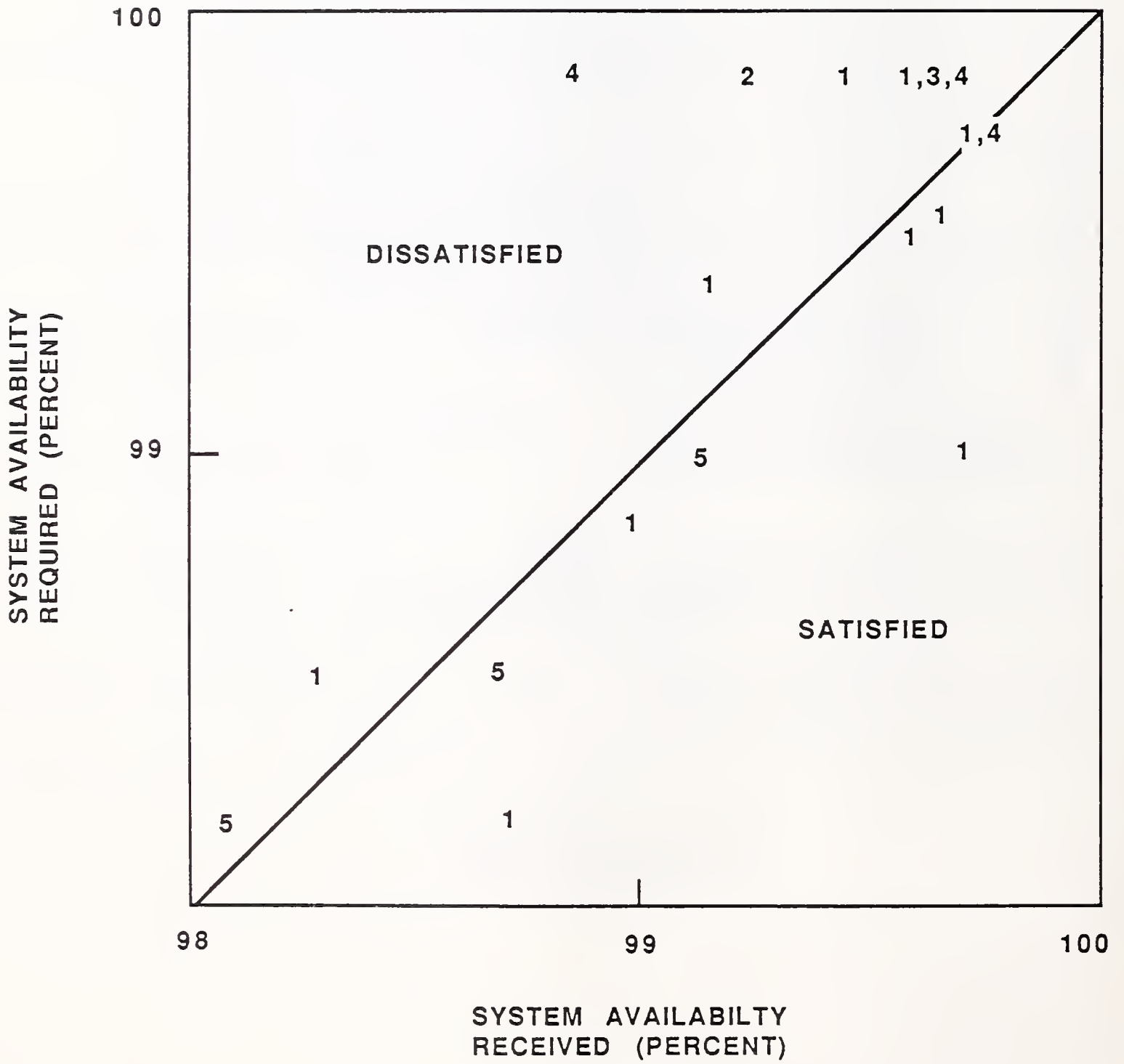
USER SATISFACTION WITH SYSTEM AVAILABILITY
IBM 309X



FULS

EXHIBIT IV-41

USER SATISFACTION WITH SYSTEM AVAILABILITY
IBM 309X



FULS

TOTAL POINTS PLOTTED: 45

EXHIBIT IV-42

USER PERFORMANCE/VALUE LEVELS
IBM 309X

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	8.5	7.6	(0.9)
PARTS AVAILABILITY	9.4	8.8	(0.6)
REMOTE SUPPORT	8.4	8.3	(0.1)
HARDWARE ENGINEER SKILL	9.2	8.4	(0.8)
SOFTWARE ENGINEER SKILL	8.8	7.7	(0.5)
SOFTWARE DOCUMENTATION	9.1	7.5	(1.6)
SOFTWARE SUPPORT OVERALL	8.9	8.1	(0.8)
HARDWARE SUPPORT OVERALL	9.4	8.5	(0.9)

*SCALE: 1 = LOW, 10 = HIGH

**AVERAGE STANDARD ERROR OF THE MEAN = 0.2

FULS

overall hardware support, hardware engineer skill level, and software documentation. It is in this last area (software documentation) that IBM performance falls furthest from user requirement. In fact, only 28% of the sample was satisfied with IBM performance in this area (shown in Exhibit IV-43).

- IBM has traditionally excelled at determining its users' current service and support needs and expectations. As a result, IBM has been effective at satisfying users' needs for service in most areas, even when IBM performance was not significantly better (on an absolute basis) than other vendors. Instead, IBM usually supplied just the amount of service needed by the majority of the users.
- With this 309X sample, it is apparent that the rapidly increased requirement for system availability was underestimated even by IBM. Furthermore, increased user requirement for software support, particularly documentation, also exceeded the performance level of IBM (Exhibit IV-44 shows the disparity between user needs and IBM performance).
- Exhibit IV-45 indicates that IBM users are still hesitant to increase their involvement in service, even if a discount is applied. Only 28% of the 309X sample (and only 16% of the 308X sample) were willing to increase their involvement, usually for discounts that were higher than the industry norm. This suggests that users still prefer to receive IBM service (historically a perk for choosing IBM products), even in light of IBM's recent (and much publicized) Corporate Service Agreements.

F. IBM 308X

- INPUT surveyed 51 IBM 308X large systems users concerning their experience with IBM-supplied hardware maintenance and software support. Thirty-one of

EXHIBIT IV-43

USER SATISFACTION LEVELS
1987 VERSUS 1986
IBM 309X

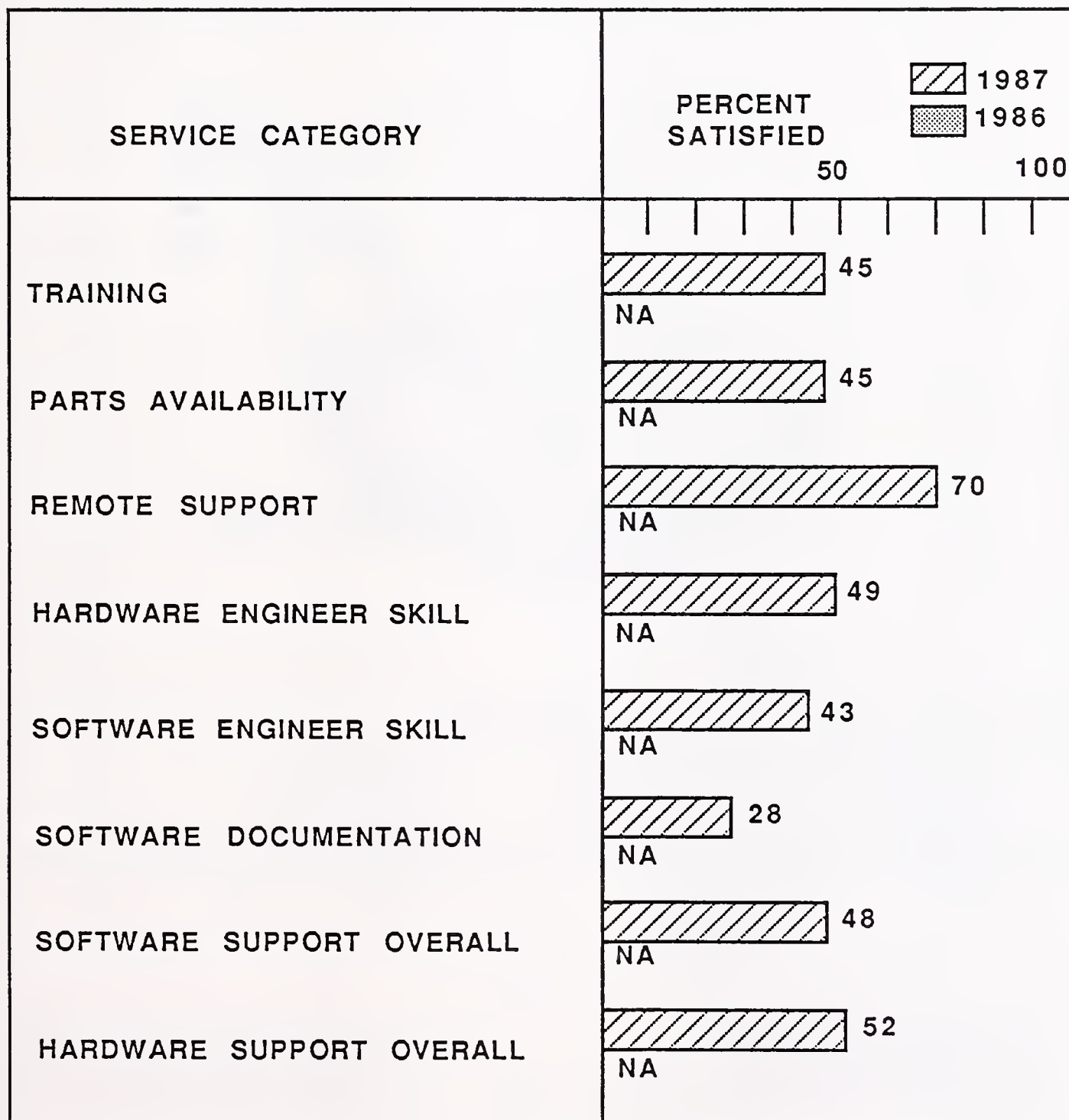
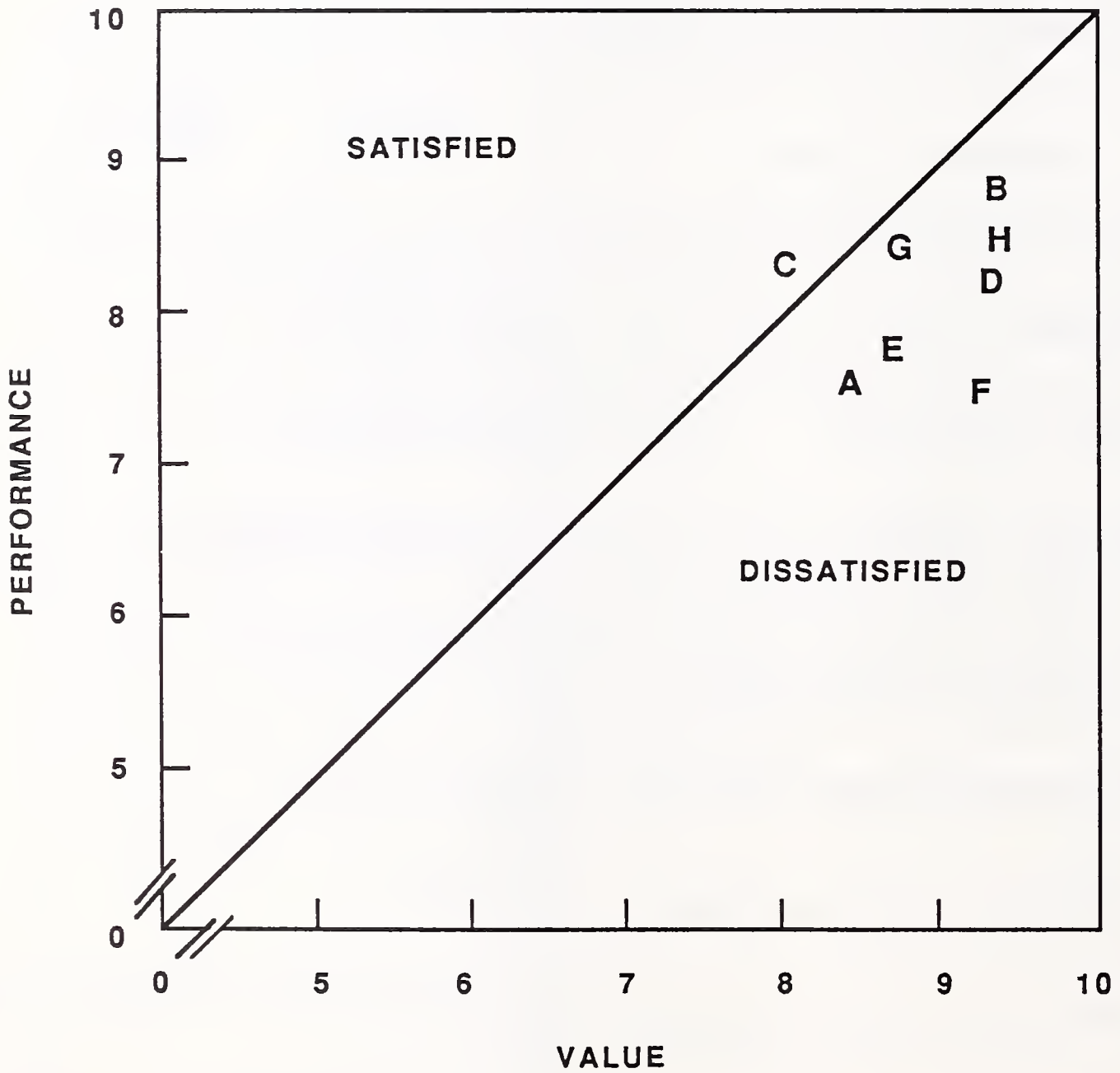


EXHIBIT IV-44

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
IBM 309X



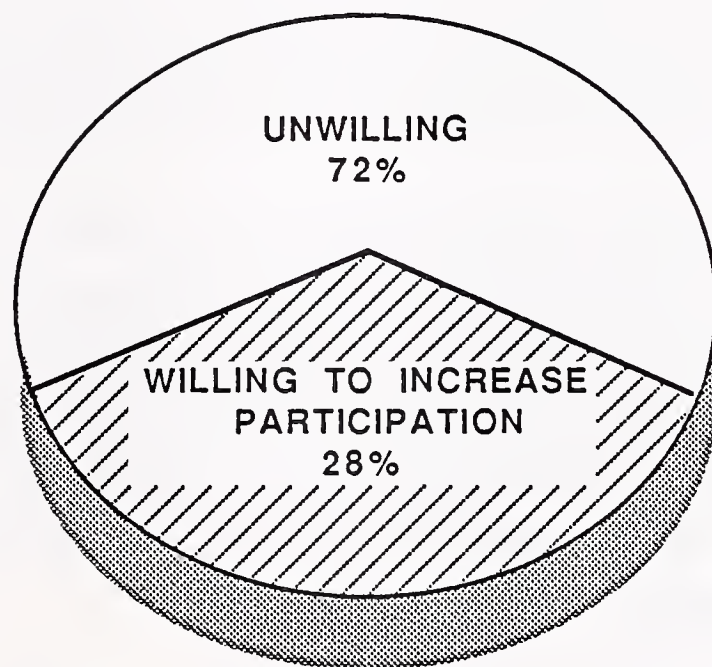
A = TRAINING
B = PARTS AVAILABILITY
C = REMOTE SUPPORT
D = HARDWARE ENGINEER SKILL LEVEL

E = SOFTWARE ENGINEER SKILL LEVEL
F = SOFTWARE DOCUMENTATION
G = SOFTWARE SUPPORT OVERALL
H = HARDWARE SUPPORT OVERALL

FULS

EXHIBIT IV-45

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE
IBM 309X



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	24	0	14	71	86	100	100
SWAP COMPONENTS	33	0	0	17	67	67	100
SWAP BOARDS	31	0	0	33	67	67	100

*UP TO AND INCLUDING

 OPTIMUM DISCOUNT LEVEL

FULS

these systems are the mid-range 3081s, fourteen are the entry-level 3083s, and the remainder are the top-of-the-line (of the 308X family) 3084s.

- The companies in the respondent sample ranged in size from \$50 million in company revenues to \$5.5 billion, with a mean size of \$1.2 billion. Sixteen of the companies were process manufacturers, seven respondents were in business services, six were telecommunications firms, and the rest were scattered across the other industry categories.
- Exhibit IV-46 shows that the 308X users, in contrast to the IBM 309X sample (who tended to contract for extended coverage for service), tended to opt more for "prime" coverage (five-day, nine-hour-a-day coverage). This reflects the age of the 308X machines as much as the size of the systems.
- Exhibit IV-47 also reflects the age of the 308X. An average number of system interruptions for the 308X was 2.0 per month, versus 1.4 per month for the 309X. System availability for 308X was 98.0% versus 98.5% for the 309X. Repair time was slightly higher for the 308X than the 309X (not surprising due to the advances incorporated into the newer machines); even response times were longer on the 308X (perhaps due to the greater product dispersion of the older systems).
- Still, IBM manages to satisfy the majority of the 308X sample in these performance areas, as shown in Exhibit IV-48. IBM satisfies the system availability requirements of 60% of the sample, even though the groups reported a requirement level almost a full percentage point higher than the received level (the mean required versus received levels were biased by three users who reported requirement levels of 100% and received levels of 90%).
- Exhibit IV-49 indicates that IBM performance drops gradually from the 98% to 98.5% system availability requirement levels, and then more significantly at the 99% level. Fourteen users reported that they required 100% system availability (three of which fell out of the boundaries of Exhibit IV-50), IBM satisfied only 13% of these users.

EXHIBIT IV-46

SERVICE CONTRACT
IBM 308X

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
• MONDAY - FRIDAY	56
• MONDAY - SATURDAY	8
• MONDAY - SUNDAY	36
• HOURS OF COVERAGE	
• 1-9 HOURS	42
• 10-16 HOURS	22
• 17-24 HOURS	36
• BILLING INTERVAL	
• ANNUAL	4
• QUARTERLY	9
• MONTHLY	87

EXHIBIT IV-47

SERVICE PERFORMANCE
IBM 308X

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
- MEAN NUMBER PER MONTH	2.0
- HARDWARE CAUSED (PERCENT)	59.0
- SYSTEM SOFTWARE CAUSED (PERCENT)	28.0
- APPLICATION SOFTWARE CAUSED (PERCENT)	6.0
- OTHER CAUSED (PERCENT)	7.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	98.0
• MEAN RESPONSE TIME (HOURS)	1.7
• MEAN REPAIR TIME (HOURS)	2.2
• MEAN RECOVERY TIME (HOURS)	1.0

FULS

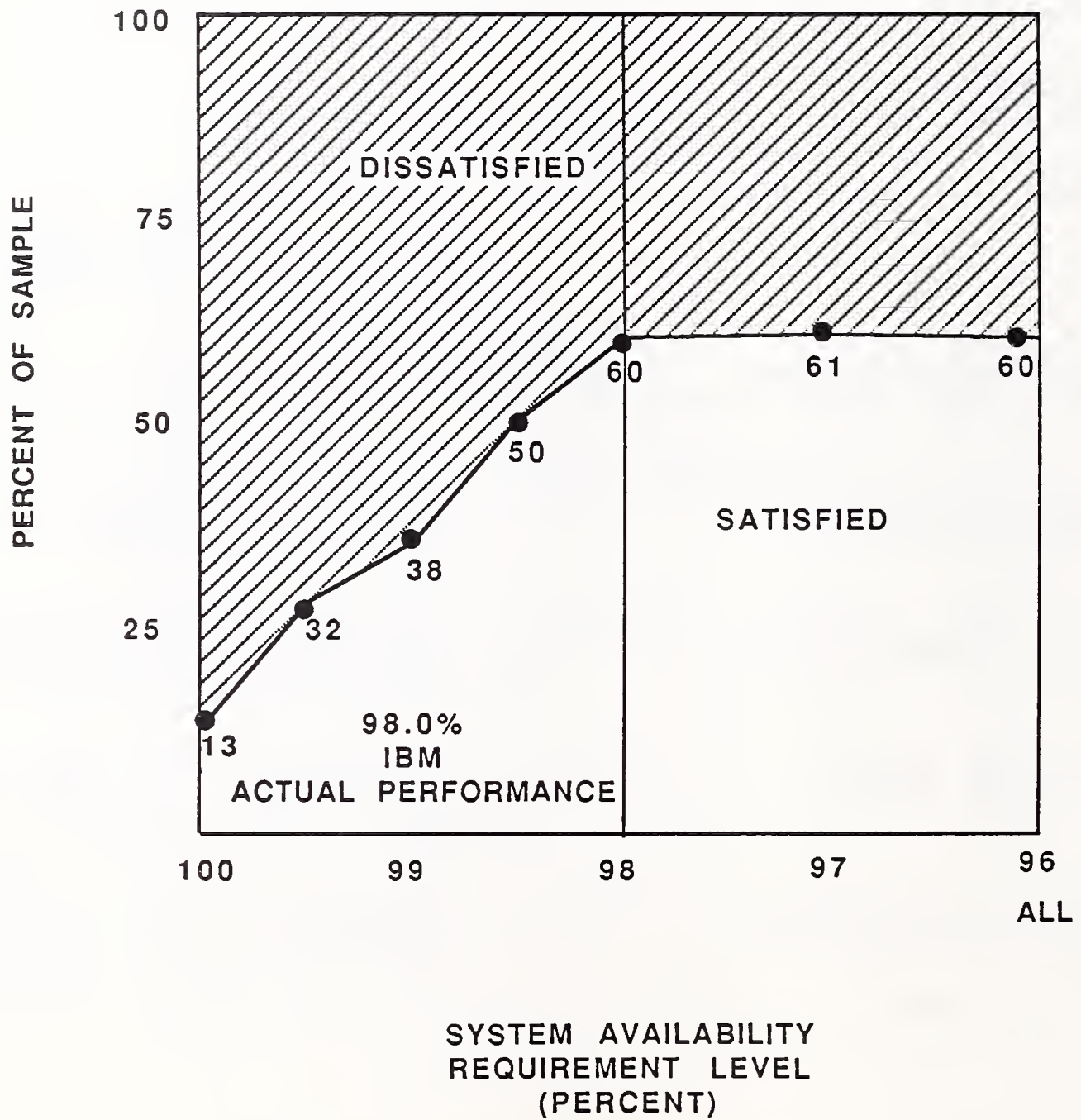
EXHIBIT IV-48

USER SATISFACTION WITH SERVICE PERFORMANCE
IBM 308X

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED	
		50	100
SYSTEM AVAILABILITY (PERCENT)	98.9		
RESPONSE TIME (HOURS)	1.6		
REPAIR TIME (HOURS)	2.3		
RECOVERY TIME (HOURS)	1.0		

EXHIBIT IV-49

USER SATISFACTION WITH SYSTEM AVAILABILITY
IBM 308X

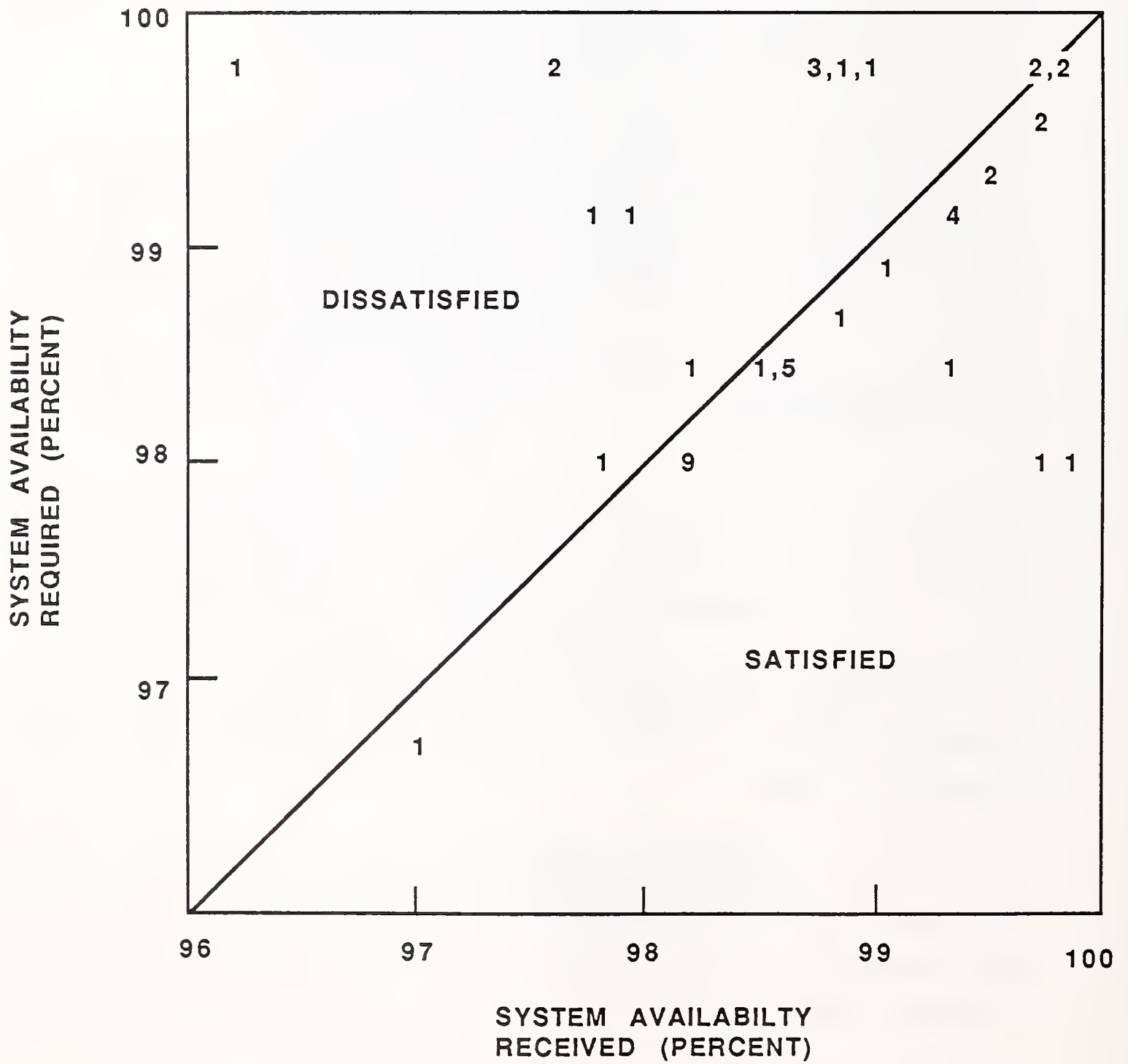


FULS

- It is interesting to compare the system availability scatter plot for the 308X (shown in Exhibit IV-50) to that of the 309X (Exhibit IV-41). Note that the 309X users' needs are more focused, hence the slope of the line (and the responses around that line) is much more vertical. It is conceivable that users of the next generation of IBM large systems (code named Summit) will report system availability requirements focused around the 99.5% level so that the line created will appear almost completely vertical.
- Exhibit IV-51 shows that the 308X user sample placed similar value upon other critical service performance criteria as did the 309X sample, indicating that all IBM large systems users have high expectations for hardware maintenance and (increasingly for) software support.
- According to the 308X sample, software support is an area needing immediate attention, with only 38% of the sample satisfied with documentation, 35% satisfied with the software engineer skill level, and only 29% satisfied with software support overall (shown in Exhibit IV-52). IBM has identified software development as a critical area of growth; as a result, IBM will need to increase and improve its activity in supporting the system software of these large installation users.
- Surprisingly, the 308X users identified end-user (operational) training as a problem area in 1987. IBM has traditionally excelled in this support area for both large and small systems, aiding greatly in the product sales process.
- Exhibit IV-53 graphically plots the disparity between IBM service performance reported by the 308X sample versus those users' ratings of the value assigned to each service area.
- As was true with the 309X sample, the 308X users demonstrate limited willingness to increase their own involvement in the maintenance process. In fact, Exhibit IV-54 shows that only 16% of the 308X sample reported any willingness to become more involved, lowest among all large systems products

EXHIBIT IV-50

USER SATISFACTION WITH SYSTEM AVAILABILITY
IBM 308X



FULS

TOTAL POINTS PLOTTED: 45

EXHIBIT IV-51

USER PERFORMANCE/VALUE LEVELS
IBM 308X

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	8.7	7.9	(0.6)
PARTS AVAILABILITY	9.4	8.4	(1.0)
REMOTE SUPPORT	8.7	8.3	(0.4)
HARDWARE ENGINEER SKILL	9.2	8.5	(0.7)
SOFTWARE ENGINEER SKILL	8.7	7.6	(0.9)
SOFTWARE DOCUMENTATION	8.9	7.9	(1.0)
SOFTWARE SUPPORT OVERALL	9.0	7.8	(1.2)
HARDWARE SUPPORT OVERALL	9.4	8.5	(0.9)

*SCALE: 1 = LOW, 10 = HIGH

**AVERAGE STANDARD ERROR OF THE MEAN = 0.2

FULS

EXHIBIT IV-52

USER SATISFACTION LEVELS
1987 VERSUS 1986
IBM 308X

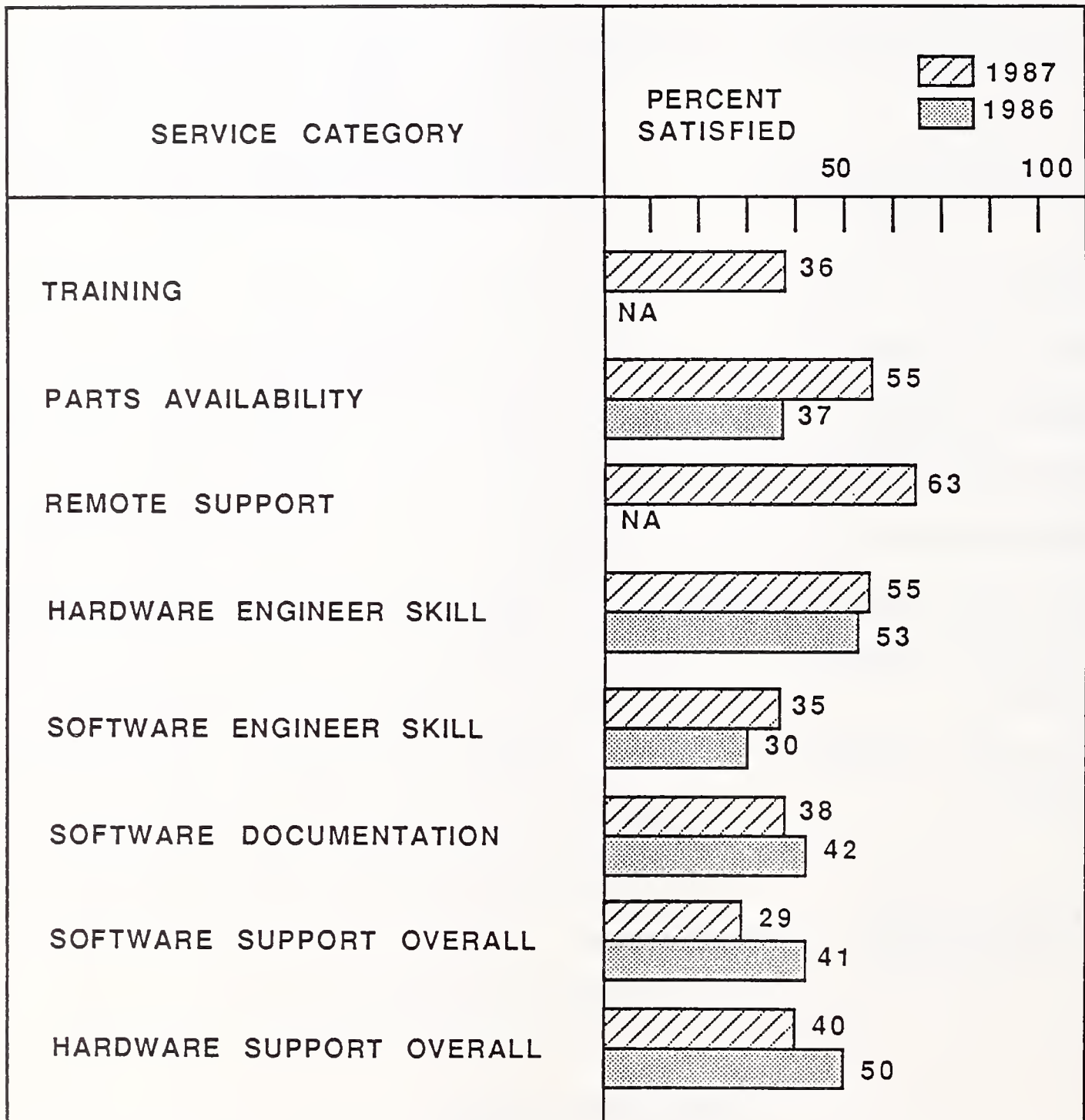
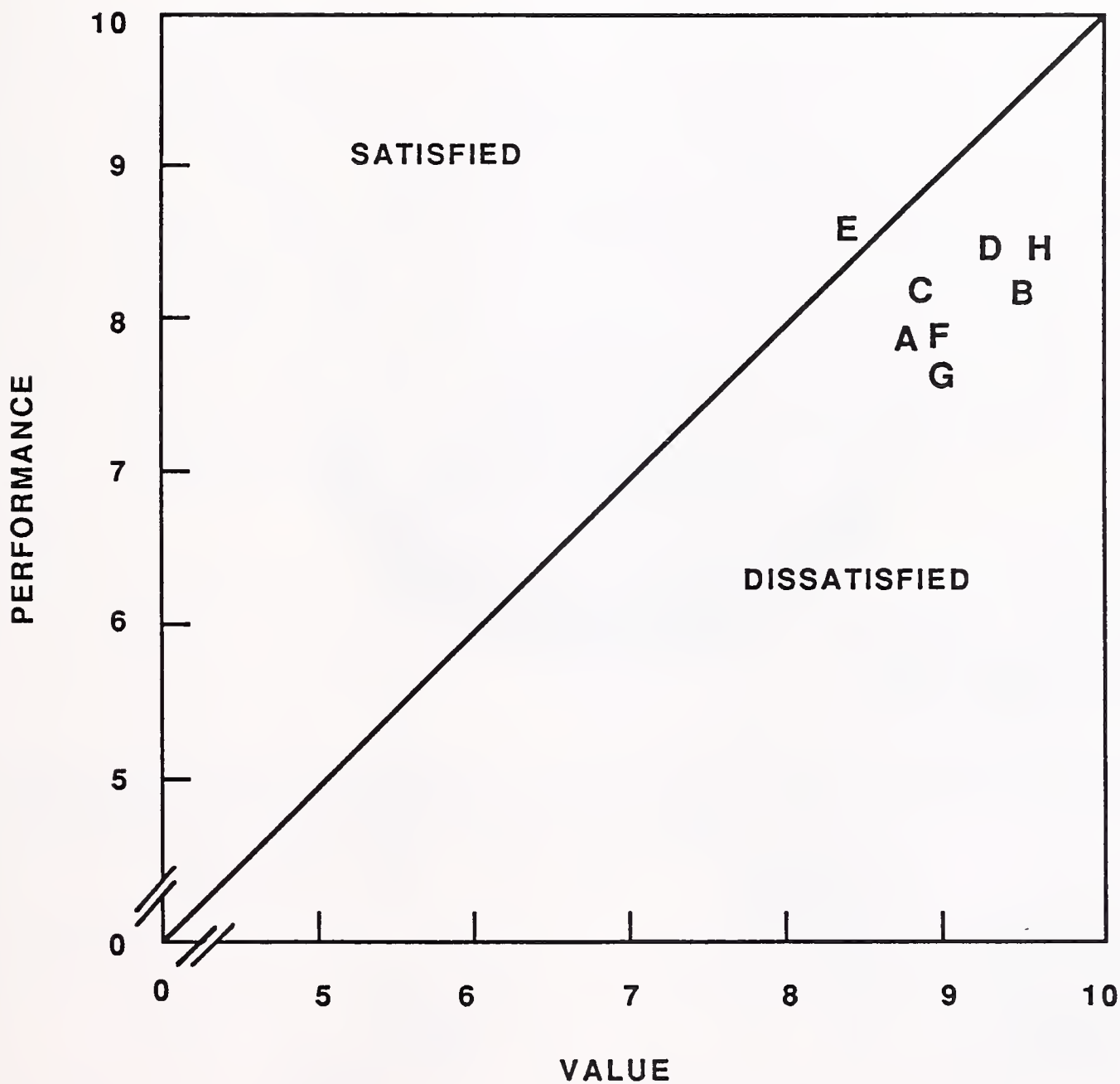


EXHIBIT IV-53

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
IBM 308X

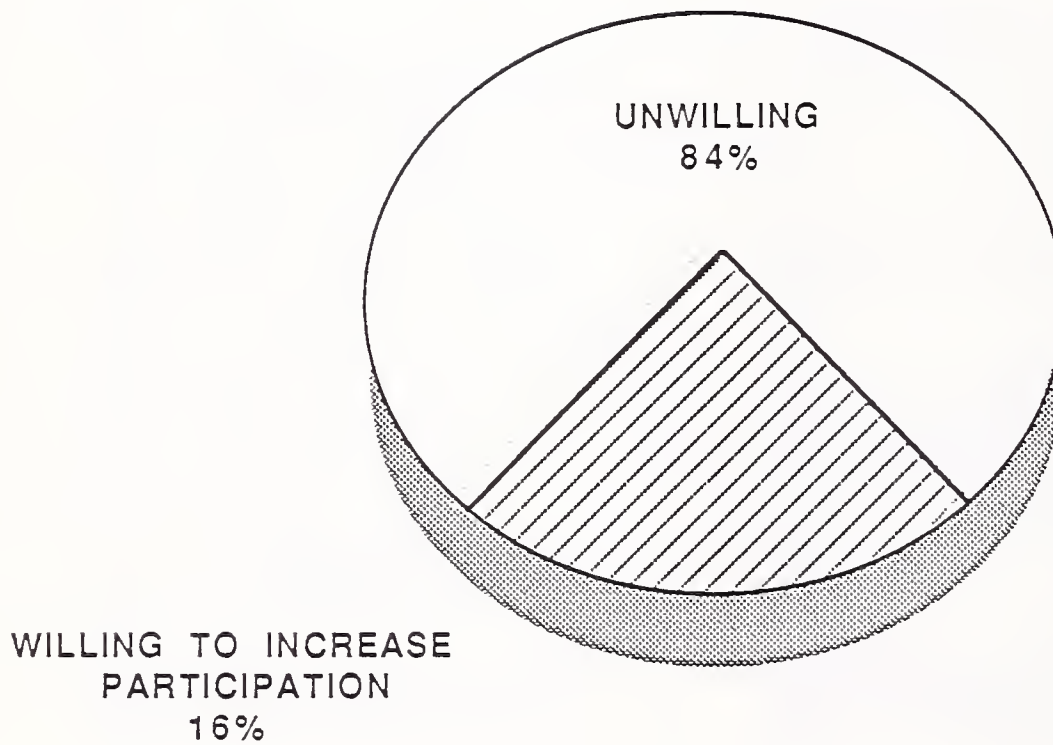


- | | |
|-----------------------------------|-----------------------------------|
| A = TRAINING | E = SOFTWARE ENGINEER SKILL LEVEL |
| B = PARTS AVAILABILITY | F = SOFTWARE DOCUMENTATION |
| C = REMOTE SUPPORT | G = SOFTWARE SUPPORT OVERALL |
| D = HARDWARE ENGINEER SKILL LEVEL | H = HARDWARE SUPPORT OVERALL |

FULS

EXHIBIT IV-54

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE
IBM 308X



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	16	0	14	71	86	100	100
SWAP COMPONENTS	24	0	0	17	67	67	100
SWAP BOARDS	22	0	0	33	67	83	100

*UP TO AND INCLUDING

FULS

 OPTIMUM DISCOUNT LEVEL

analyzed. Users initially choose IBM largely as a result of the reputation of IBM service and support, holding the perception that IBM service is a premium worth paying for. This perception continues even when users' needs are not being completely met (over 90% of the sample still felt that they received their "money's worth").

G. NATIONAL ADVANCED SYSTEMS AS/9XXX

- In 1987, INPUT surveyed 30 NAS large systems users concerning their requirements for and satisfaction with the service that they received from their vendor. The sample systems were divided as follows: three NAS AS/XLs, eight AS/8XXXs, and twenty-one AS/9XXXs. Seven of the respondents were from the business services industry, five were from educational institutions, four each from banks and federal government agencies, two each from state and local government and distribution industries, and one each from discrete manufacturing, process manufacturing, insurance, and medical industry segments.
- Contractually, the NAS sample leaned towards extended service coverages. Exhibit IV-55 indicates that a majority of NAS users receive seven-day coverage with at least two shift coverage. The AS/XL and AS/9XXX users predominantly opted for around-the-clock coverage, while the smaller AS/8XXX users tended to contract for less than three shift coverage. Almost all NAS users pay for support on a monthly basis.
- NAS performed exceptionally in respect to all reliability and service performance criteria analyzed, Exhibit IV-56 indicates that the NAS systems suffered from only 0.8 system interruptions per month, resulting in system availability of over 99%. Both of these figures were the best of all large systems analyzed in 1987.

EXHIBIT IV-55

SERVICE CONTRACT
NAS 9XXX

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	43
- MONDAY - SATURDAY	3
- MONDAY - SUNDAY	54
• HOURS OF COVERAGE	
- 1-9 HOURS	27
- 10-16 HOURS	50
- 17-24 HOURS	23
• BILLING INTERVAL	
- ANNUAL	3
- QUARTERLY	3
- MONTHLY	94

FULS

EXHIBIT IV-56

SERVICE PERFORMANCE
NAS 9XXX

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
<ul style="list-style-type: none"> • SYSTEM INTERRUPTIONS <ul style="list-style-type: none"> - MEAN NUMBER PER MONTH - HARDWARE CAUSED (PERCENT) - SYSTEM SOFTWARE CAUSED (PERCENT) - APPLICATION SOFTWARE CAUSED (PERCENT) - OTHER CAUSED (PERCENT) • MEAN SYSTEM AVAILABILITY (PERCENT) • MEAN RESPONSE TIME (HOURS) • MEAN REPAIR TIME (HOURS) • MEAN RECOVERY TIME (HOURS) 	<p style="text-align: center;">0.8</p> <p style="text-align: center;">55.0</p> <p style="text-align: center;">25.0</p> <p style="text-align: center;">10.0</p> <p style="text-align: center;">10.0</p> <p style="text-align: center;">99.3</p> <p style="text-align: center;">1.4</p> <p style="text-align: center;">1.8</p> <p style="text-align: center;">0.5</p>

- Exhibit IV-57 demonstrates NAS user satisfaction with the reliability and service performance that they received. User satisfaction with system availability (79%) was highest of all large systems user groups (IBM was next at 60%), and that satisfaction was extremely high throughout the range of system availability requirement levels. Exhibit IV-58 shows that NAS satisfies at least 70% of its users up to the 99.5% requirement level and even 54% of the users at the 100% requirement level. Exhibit IV-59 reinforces this by presenting a scatter plot of NAS user system availability requirements versus actuals.
- NAS has historically been successful at satisfying its users' high system availability requirements. NAS users have reported receiving system availability in excess of 99% the last three years, and many large systems users now look to the PCM as a supplier of extremely reliable equipment.
- NAS has also marketed itself as a premium supplier of hardware maintenance and support, and Exhibits IV-60 indicates that NAS users place a high value on most traditional hardware maintenance and software support services and that NAS performance in the hardware areas comes close to meeting their needs (particularly when taking the standard error of the mean into account).
- Since NAS (like Amdahl) is a PCM, NAS does not supply software to the users. Instead, most software is supplied by IBM, who also acts as the primary support source. NAS does provide some level of software support as a Support Agency through an agreement with IBM. NAS provides first level (telephone consulting) support, education and training.
- While user satisfaction for all hardware maintenance was quite high (as shown in Exhibit IV-61), user satisfaction with software support was less satisfactory, particularly in the areas of software documentation and overall software support. It is difficult to gauge how much influence NAS has on overall software support satisfaction, though documentation satisfaction is clearly out of its hands.

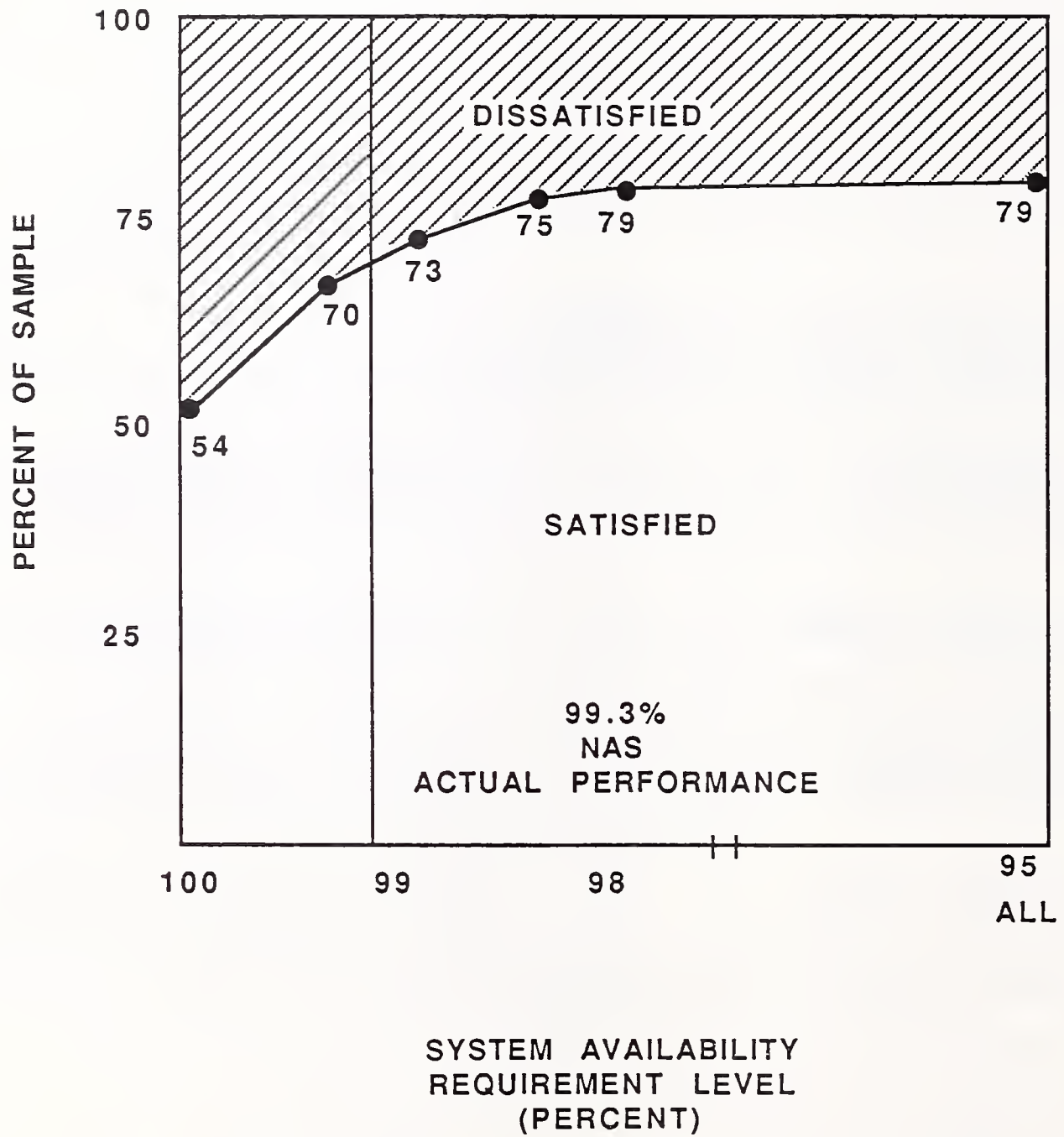
EXHIBIT IV-57

1987 USER SATISFACTION WITH SERVICE PERFORMANCE
NAS 9XXX

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED	
		50	100
SYSTEM AVAILABILITY (PERCENT)	99.3		
RESPONSE TIME (HOURS)	1.4		
REPAIR TIME (HOURS)	1.8		
RECOVERY TIME (HOURS)	0.5		

EXHIBIT IV-58

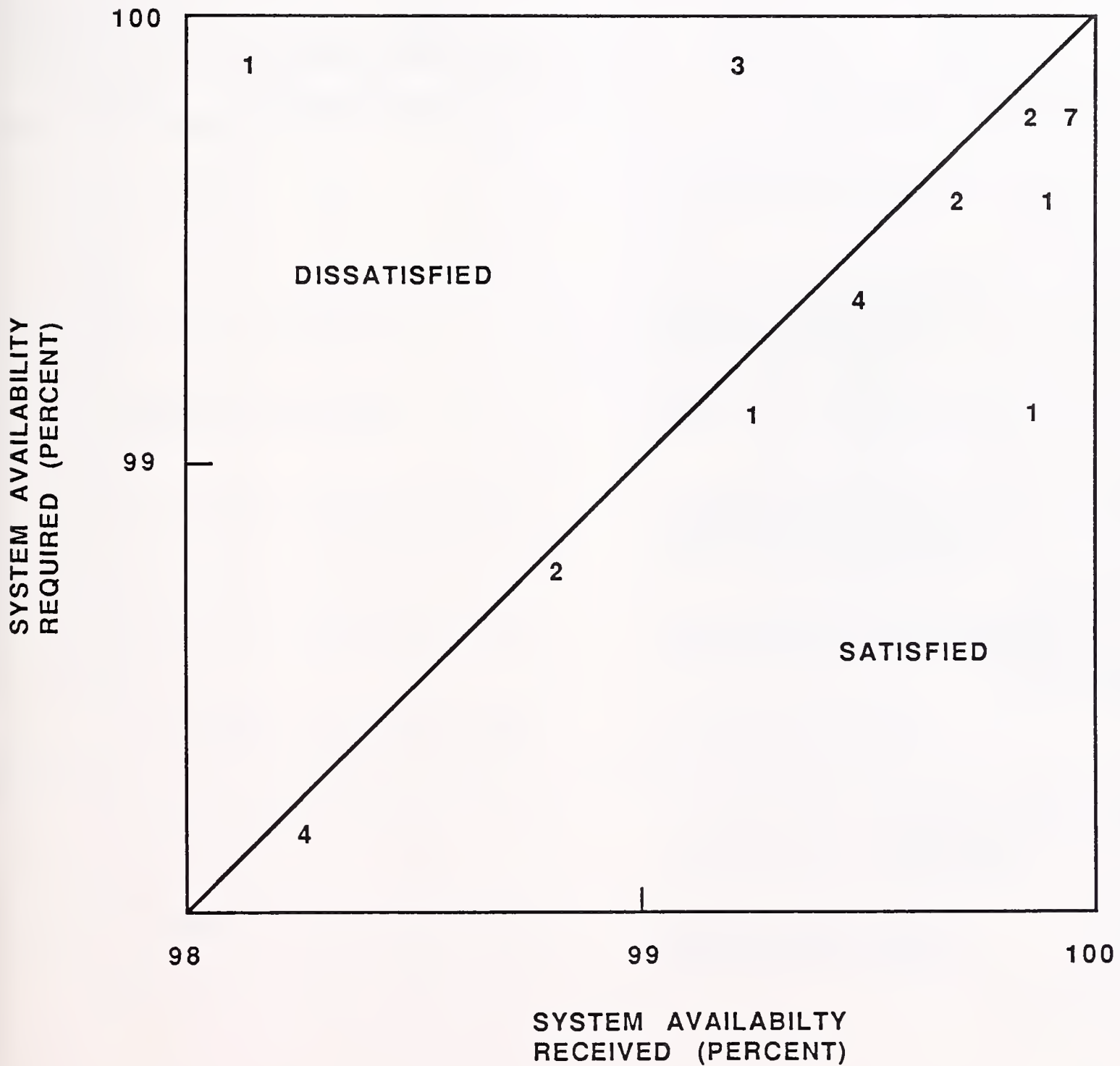
USER SATISFACTION WITH SYSTEM AVAILABILITY
NAS 9XXX



FULS

EXHIBIT IV-59

USER SATISFACTION WITH SYSTEM AVAILABILITY
NAS 9XXX



FULS

TOTAL POINTS PLOTTED: 29

EXHIBIT IV-60

USER PERFORMANCE/VALUE LEVELS
NAS 9XXX

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	7.3	6.9	(0.4)
PARTS AVAILABILITY	9.3	9.0	(0.3)
REMOTE SUPPORT	7.6	8.3	0.7
HARDWARE ENGINEER SKILL	9.3	8.9	(0.4)
SOFTWARE ENGINEER SKILL	8.8	7.8	(1.0)
SOFTWARE DOCUMENTATION	9.0	8.2	(0.8)
SOFTWARE SUPPORT OVERALL	9.2	8.2	(1.0)
HARDWARE SUPPORT OVERALL	9.4	9.1	(0.3)

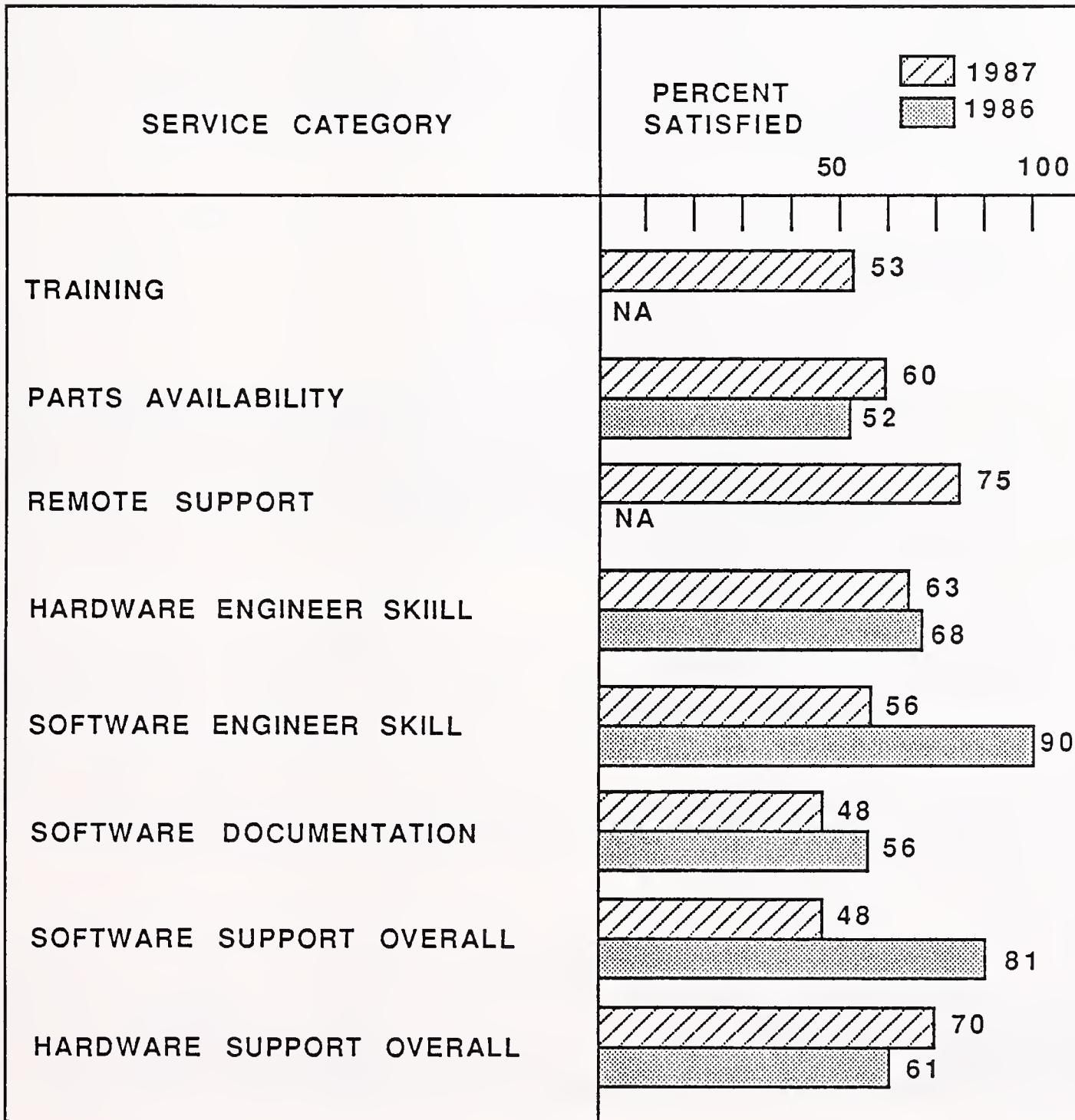
*SCALE: 1 = LOW, 10 = HIGH

**AVERAGE STANDARD ERROR OF THE MEAN = 0.4

FULS

EXHIBIT IV-61

USER SATISFACTION LEVELS
1987 VERSUS 1986
NAS 9XXX



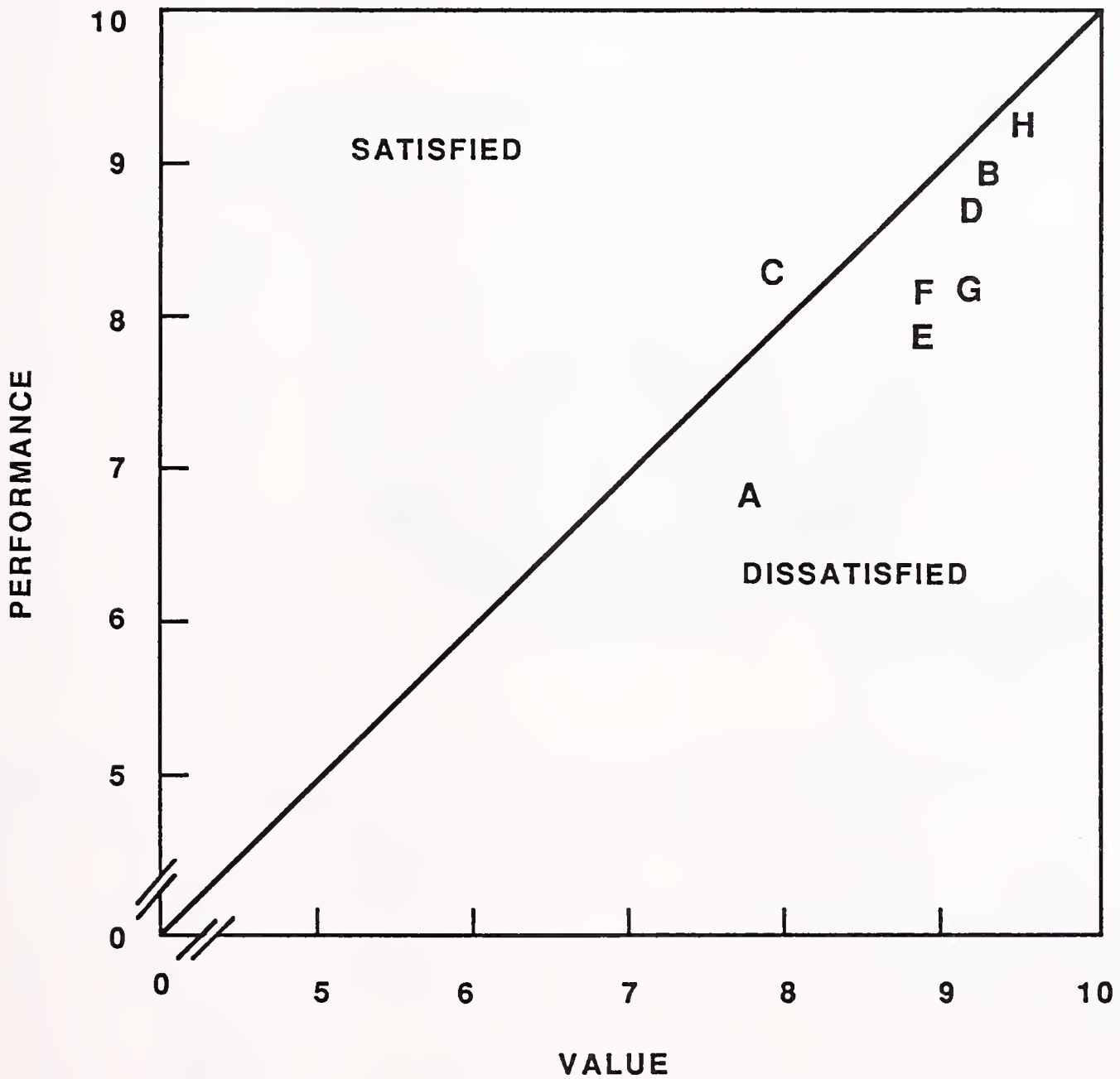
- Thus, when user ratings of service value are plotted against actual vendor performance (in Exhibit IV-62), it is clear that NAS users place an extremely high value in service, inferred from the high premium they place on system availability. Furthermore, it is to NAS's credit that user satisfaction with the service that is required is so consistently high in quality.
- This satisfaction is reflected in the lack of user willingness to increase their own involvement in servicing their own equipment, as shown in Exhibit IV-63. Basically, NAS users are very satisfied with their service, and they feel that they get their money's worth (only one NAS user did not feel that they received their money's worth when asked). NAS has been very successful in presenting its service offering as premium in nature, and users have exhibited little price sensitivity as a result.

H. NCR 85XX

- In 1987, INPUT surveyed 25 users of NCR 85XX large systems concerning their satisfaction with the service that they received from their vendor. Nine systems of the sample were 8555s, eight were 8575s, six were 8565s, and the remaining two were 8545s.
- The sample was dominated by banking and finance users, who made up seven of the twenty-five respondents. Four other industry categories, (discrete manufacturing, process manufacturing, services, and state and local government) were each represented by four respondents. Distribution and education were represented by the final two survey respondents.
- Contractually, the NCR sample reflects the predominance of banking users who would be attracted by prime-only coverage, as shown in Exhibit IV-64. Note the high percentage (in comparison to the industry norm) of NCR users who negotiated for annual billing, versus monthly. This benefits both the user

EXHIBIT IV-62

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
NAS 9XXX

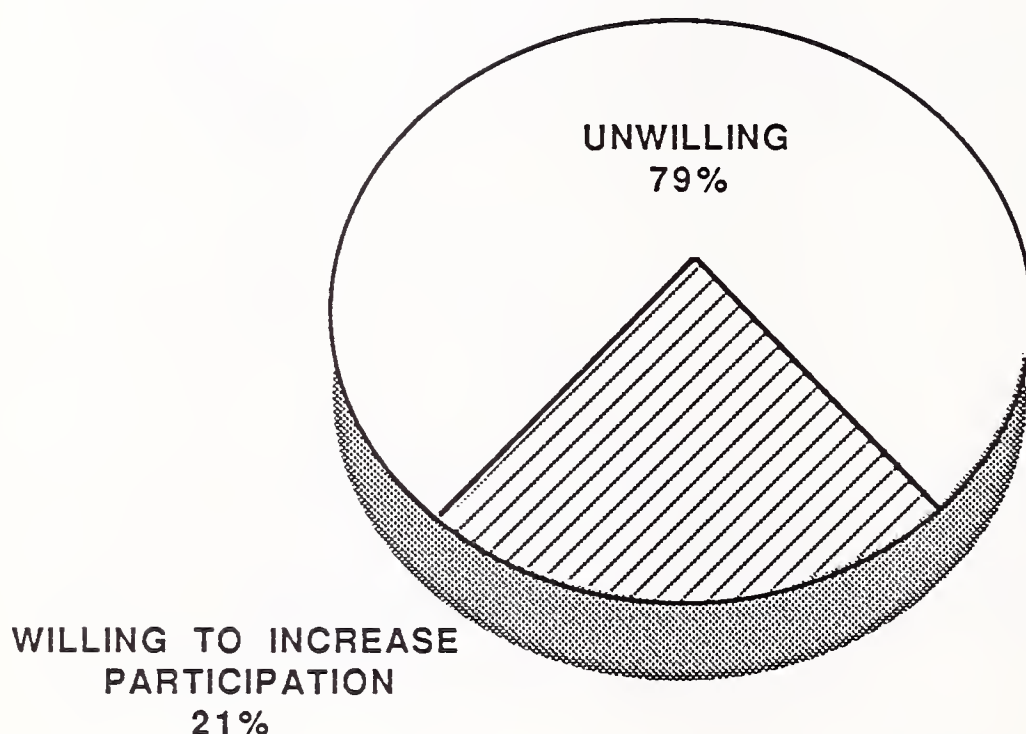


- | | |
|-----------------------------------|-----------------------------------|
| A = TRAINING | E = SOFTWARE ENGINEER SKILL LEVEL |
| B = PARTS AVAILABILITY | F = SOFTWARE DOCUMENTATION |
| C = REMOTE SUPPORT | G = SOFTWARE SUPPORT OVERALL |
| D = HARDWARE ENGINEER SKILL LEVEL | H = HARDWARE SUPPORT OVERALL |

FULS

EXHIBIT IV-63

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE
NAS 9XXX



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	28	0	0	20	20	60	100
SWAP COMPONENTS	30	0	0	25	50	75	100
SWAP BOARDS	25	0	0	0	33	67	100

*UP TO AND INCLUDING
FULS

 OPTIMUM DISCOUNT LEVEL

EXHIBIT IV-64

SERVICE CONTRACT
NCR 85XX

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	68
- MONDAY - SATURDAY	28
- MONDAY - SUNDAY	4
• HOURS OF COVERAGE	
- 1-9 HOURS	44
- 10-16 HOURS	48
- 17-24 HOURS	8
• BILLING INTERVAL	
- ANNUAL	50
- QUARTERLY	33
- MONTHLY	17

and the vendor: the user gets a discount for paying up front while the vendor pays less in invoicing and payment processing.

- In actual performance, the NCR 85XX systems are beginning to show their age. The first systems were delivered in early 1983, upgraded by the multiprocessing 8800s. These products face stiff competition in the banking and retail environments (industries that are very attracted to fault-tolerant, transaction-processing systems) from IBM, Unisys, Honeywell, and Tandem. To improve its competitive position, NCR has released the more powerful 9800 line, which are too new to analyze for this report.
- The age of the 85XX systems surveyed was also reflected by the fact that only 40% of the sample received remote support. Again, the newer 9800 family makes extensive use of remote support features, and, as a result, undoubtedly provides much greater system availability.
- Exhibit IV-65 indicates that the 85XX reliability is still quite high, with the average number of system interruptions (1.6 per month) within the range of most of NCR's chief competitors. Average system availability is relatively low, as five respondents reported system availability actuals below the 90% level (these users' requirement levels were also low). Response and repair times were acceptable, satisfying 68% of the 85XX sample (as shown in Exhibit IV-66). Slight improvements in repair times have been attributed to improvements in spares availability, although users still perceive this area to be a primary contributor to downtime.
- Overall, the 85XX users reported some concern over system availability, as demonstrated in Exhibit IV-67. While NCR was able to satisfy 48% of the total sample, NCR's success falls off at the 98% and higher availability requirement. Exhibit IV-68 demonstrates that 18 out of the 25 85XX users surveyed required system availability equal to or greater than the 98% level, suggesting that NCR needs to address this concern.

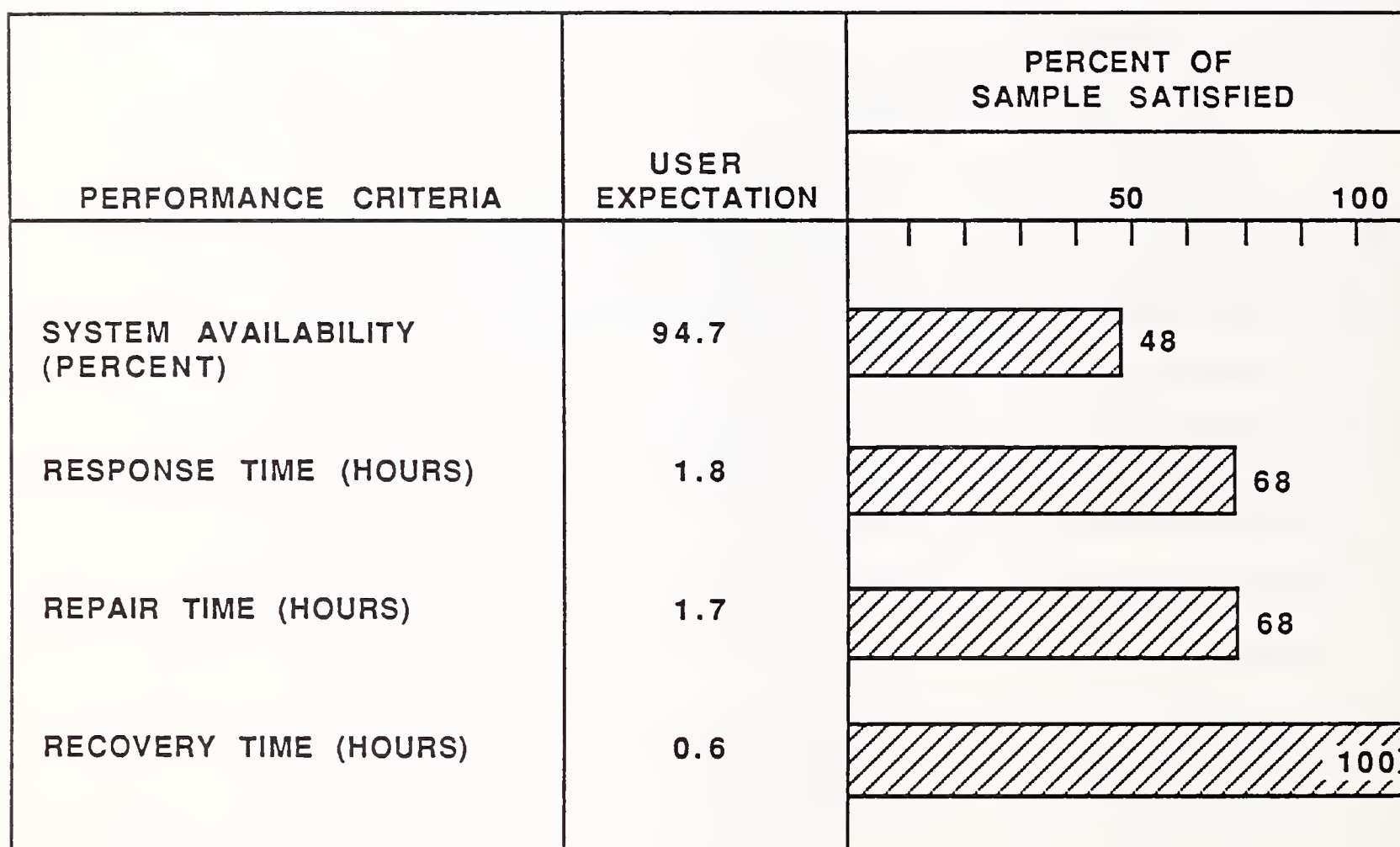
EXHIBIT IV-65

SERVICE PERFORMANCE
NCR 85XX

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
- MEAN NUMBER PER MONTH	1.6
- HARDWARE CAUSED (PERCENT)	68.0
- SYSTEM SOFTWARE CAUSED (PERCENT)	9.0
- APPLICATION SOFTWARE CAUSED (PERCENT)	10.0
- OTHER CAUSED (PERCENT)	13.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	93.6
• MEAN RESPONSE TIME (HOURS)	1.8
• MEAN REPAIR TIME (HOURS)	1.8
• MEAN RECOVERY TIME (HOURS)	0.7

EXHIBIT IV-66

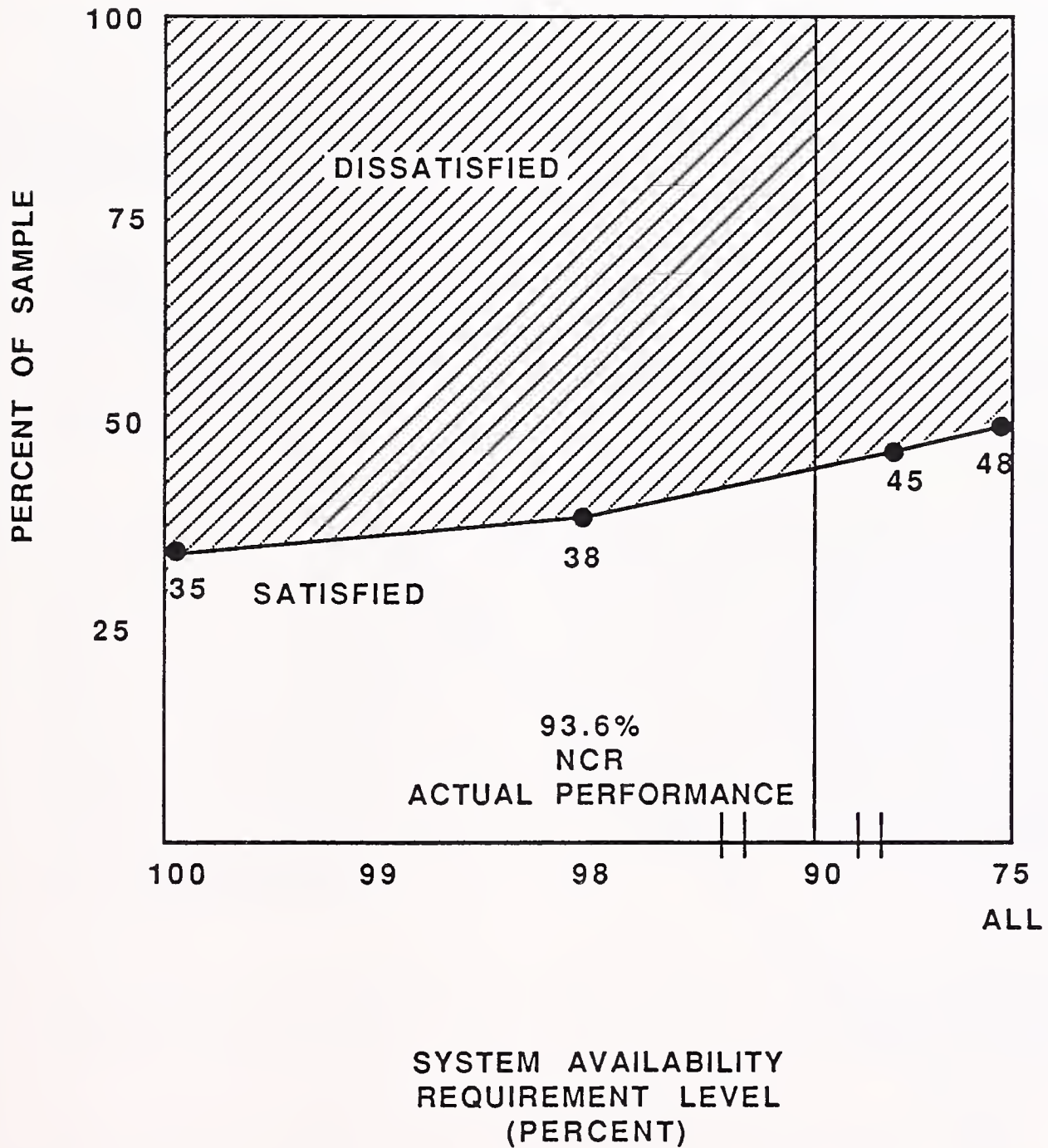
USER SATISFACTION WITH SERVICE PERFORMANCE
NCR 85XX



FULS

EXHIBIT IV-67

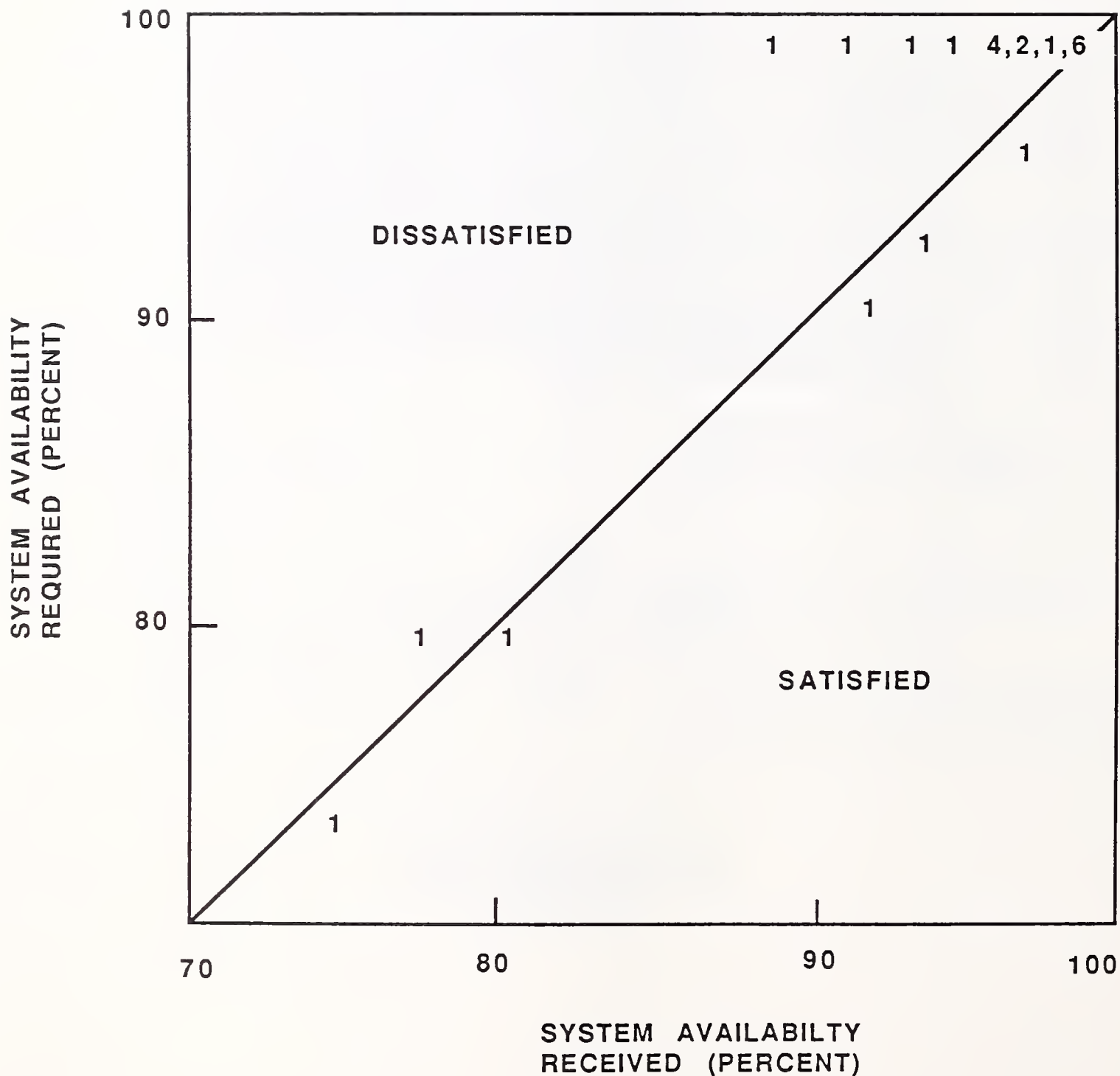
USER SATISFACTION WITH SYSTEM AVAILABILITY
NCR 85XX



FULS

EXHIBIT IV-68

USER SATISFACTION WITH SYSTEM AVAILABILITY
NCR 85XX



FULS

TOTAL POINTS PLOTTED: 25

- NCR users, on the average, have low expectations for many of the services delivered by large systems service vendors. While most other large systems product user samples reported requirement levels in the low- to mid-nines, NCR users reported requirement levels in the mid-eights and lower (as shown in Exhibit IV-69). This low perception of value has made it (relatively) easier for NCR to meet the service requirements of its user base in a number of the service areas (NCR succeeds in satisfying the majority of its users in all areas presented in Exhibit IV-70).
- On the other hand, this lower perception of the value of service can lead to greater price sensitivity. Only 76% of the NCR sample felt that they received their "money's worth," a very low percentage when you consider that user satisfaction with service is so high.
- Exhibit IV-71 provides a scatter plot of NCR 85XX actual performance in comparison to user perceived value. Note that user requirements (perceived value) for each service is lower than virtually all other large systems products analyzed.
- Exhibit IV-72 indicates that NCR users are quite willing to increase self-maintenance activities on their own equipment. Encouraging increased user involvement in self-maintenance can benefit the service vendor by reducing service costs, particularly on "low-level" service activities (preliminary diagnosis, simple board swaps, etc.). However, encouraging increased self-maintenance also increases price sensitivity, since users begin to rely less on the vendor for support, causing the user to question why he/she pays so much for support.
- To counter this, vendors such as NCR must provide additional services (e.g., consulting and training) to maintain a high level of perceived value.

EXHIBIT IV-69

USER PERFORMANCE/VALUE LEVELS
NCR 85XX

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	5.4	6.3	0.9
PARTS AVAILABILITY	8.2	6.8	(1.4)
REMOTE SUPPORT	7.4	7.8	0.4
HARDWARE ENGINEER SKILL	8.6	8.0	(0.6)
SOFTWARE ENGINEER SKILL	7.7	6.7	(0.9)
SOFTWARE DOCUMENTATION	7.0	6.5	(0.5)
SOFTWARE SUPPORT OVERALL	7.3	6.6	(0.7)
HARDWARE SUPPORT OVERALL	8.6	7.9	(0.7)

*SCALE: 1 = LOW, 10 = HIGH

**AVERAGE STANDARD ERROR OF THE MEAN = 0.6

FULS

EXHIBIT IV-70

USER SATISFACTION LEVELS
1987 VERSUS 1986
NCR 85XX

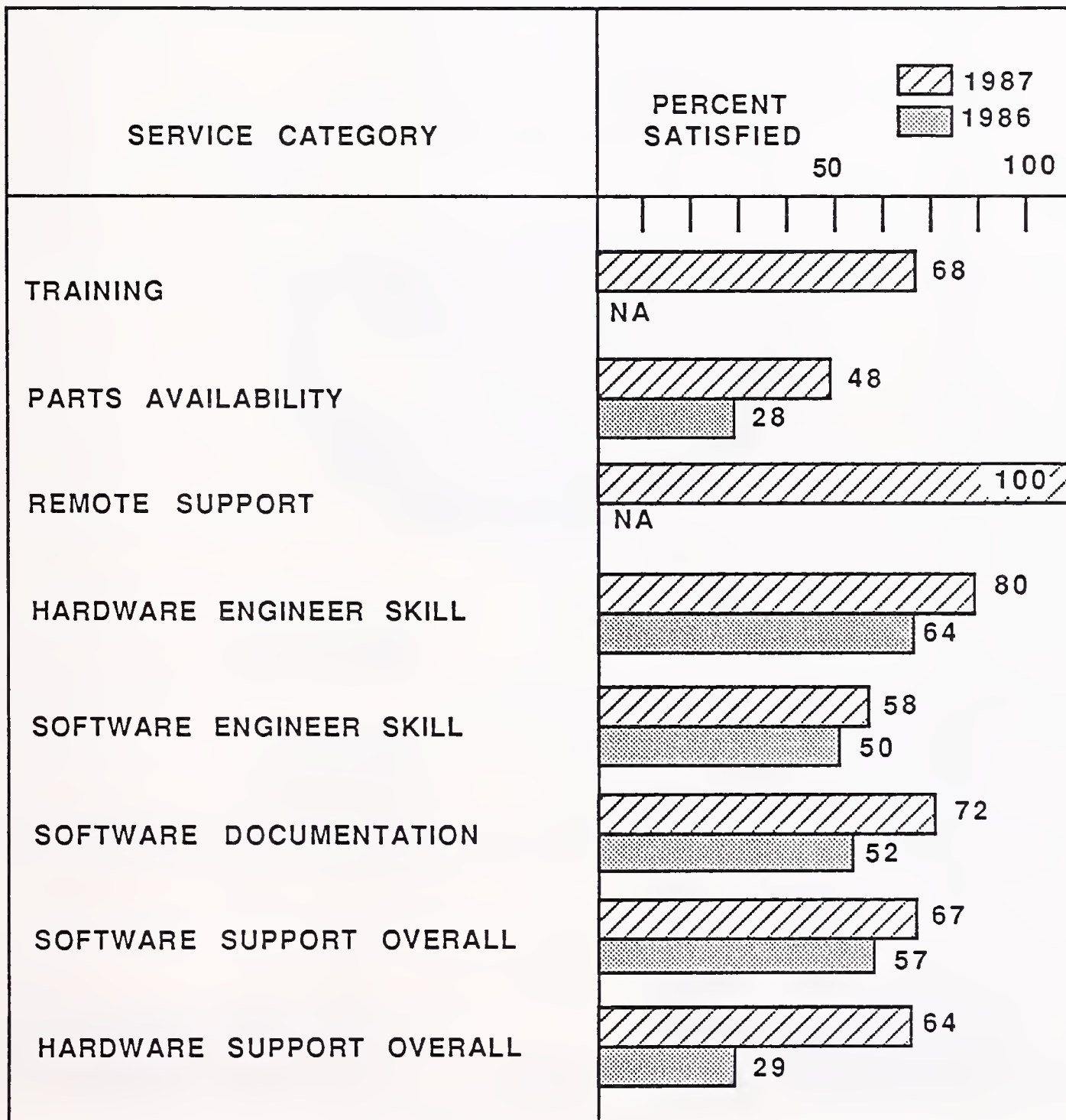
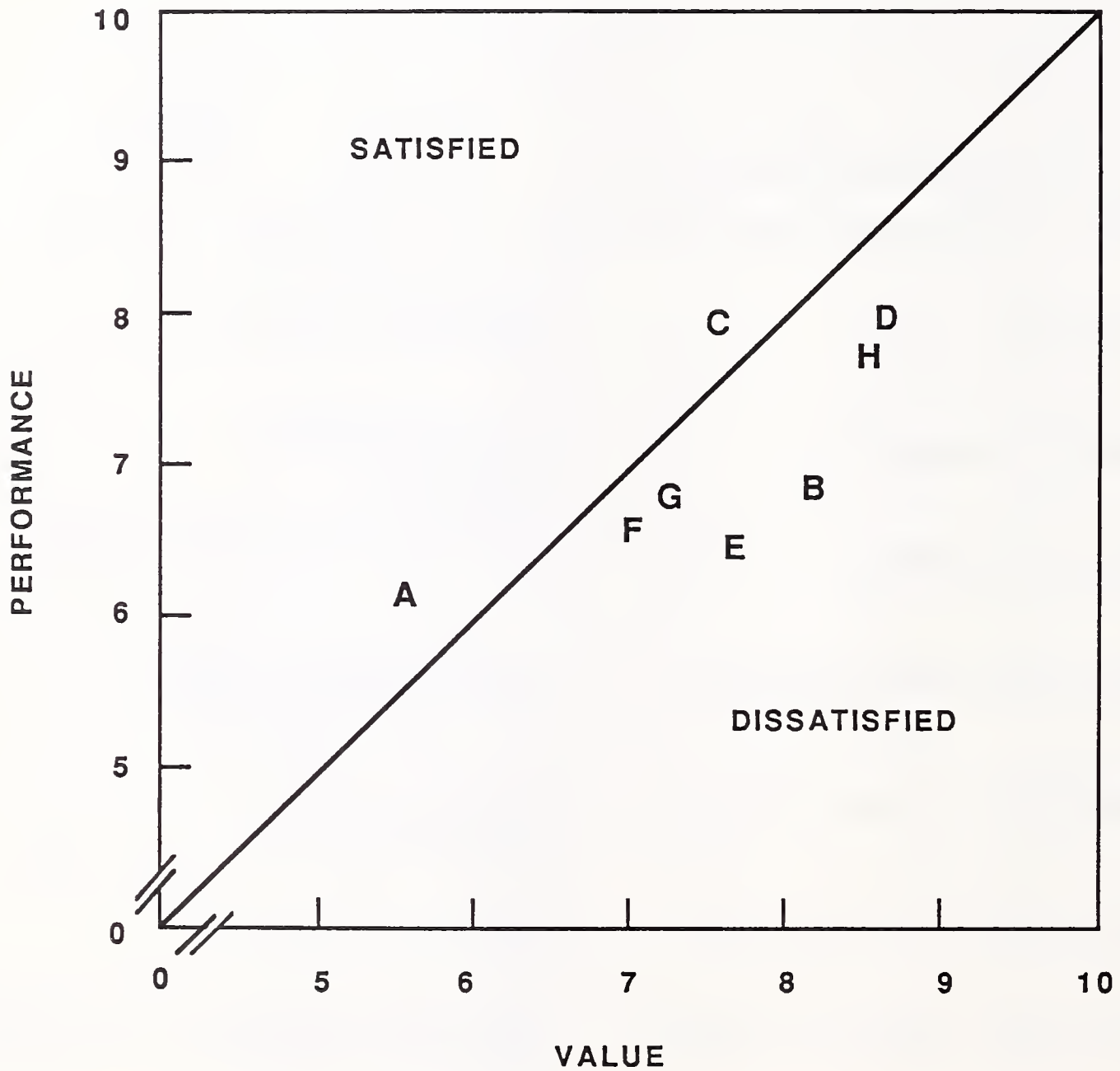


EXHIBIT IV-71

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
NCR 85XX



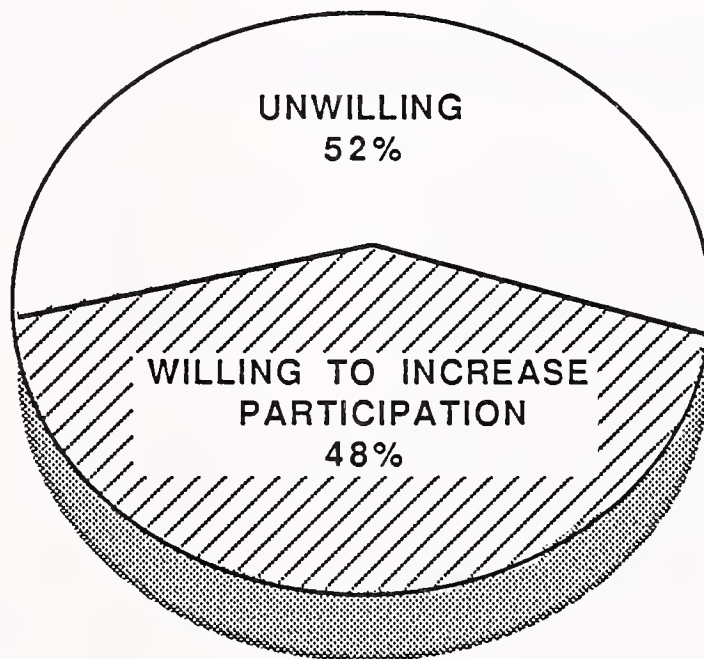
A = TRAINING
B = PARTS AVAILABILITY
C = REMOTE SUPPORT
D = HARDWARE ENGINEER SKILL LEVEL

E = SOFTWARE ENGINEER SKILL LEVEL
F = SOFTWARE DOCUMENTATION
G = SOFTWARE SUPPORT OVERALL
H = HARDWARE SUPPORT OVERALL

FULS

EXHIBIT IV-72

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE
NCR 85XX



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	20	11	11	22	78	89	100
SWAP COMPONENTS	20	11	11	56	78	89	100
SWAP BOARDS	20	11	11	22	78	89	100

*UP TO AND INCLUDING

 OPTIMUM DISCOUNT LEVEL

FULS

I. UNISYS (SPERRY) 1100/XX

- INPUT interviewed forty Unisys (Sperry) 1100/XX large systems users concerning the hardware maintenance and operating systems software support that they received from their vendor. One of Sperry's past strengths was the government market; thus, it is not surprising that eleven respondents in the 1100/XX sample were federal or state/local governments. Another ten companies were manufacturers, with the remaining nineteen companies fairly evenly distributed between other industries. Since so many respondents were government agencies, revenue information was difficult to get; however, most respondents fell into the \$20 to \$200 million range.
- Contractually, the 1100/XX sample reflects the government representation in the respondent mix, as Exhibit IV-73 shows that the majority of the users receive prime shift (Monday through Friday, 8 am to 5 pm) service coverage.
- The age of the 1100/XX product line was reflected in system and service performance data presented in Exhibit IV-74. The 1100/60s in the sample (a total of seven) were first introduced in 1979, and no significant changes have been made to the line in over two years. Even the newest models within the 1100 family, the 1100/91, 92, 93, and 94s, are at least a few years old now. Thus, it is not surprising to see that the 1100/XX sample reports an extremely high number of systems interruptions (2.9 per month). System availability is also low at just over 96%, even though Unisys (Sperry) response and repair times are quite good. It is obvious that the number of system failures coupled with relatively lengthy system recovery time (of 1.3 hours) are most directly responsible for system availability that is passable at best.
- Unisys (Sperry) users are quite accepting of this performance, as shown in Exhibit IV-75. The 1100/XX users only expected 97% system availability, hence, Unisys (Sperry) was still able to satisfy 57% of the sample in this area. Exhibit IV-76 shows that Unisys (Sperry) performance falls off

EXHIBIT IV-73

SERVICE CONTRACT
UNISYS (SPERRY) 1100/XX

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	60
- MONDAY - SATURDAY	2
- MONDAY - SUNDAY	38
• HOURS OF COVERAGE	
- 1-9 HOURS	53
- 10-16 HOURS	9
- 17-24 HOURS	38
• BILLING INTERVAL	
- ANNUAL	6
- QUARTERLY	6
- MONTHLY	88

EXHIBIT IV-74

SERVICE PERFORMANCE
UNISYS (SPERRY) 1100/XX

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
- MEAN NUMBER PER MONTH	2.9
- HARDWARE CAUSED (PERCENT)	61.0
- SYSTEM SOFTWARE CAUSED (PERCENT)	19.0
- APPLICATION SOFTWARE CAUSED (PERCENT)	13.0
- OTHER CAUSED (PERCENT)	7.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	96.4
• MEAN RESPONSE TIME (HOURS)	1.1
• MEAN REPAIR TIME (HOURS)	2.4
• MEAN RECOVERY TIME (HOURS)	1.3

FULS

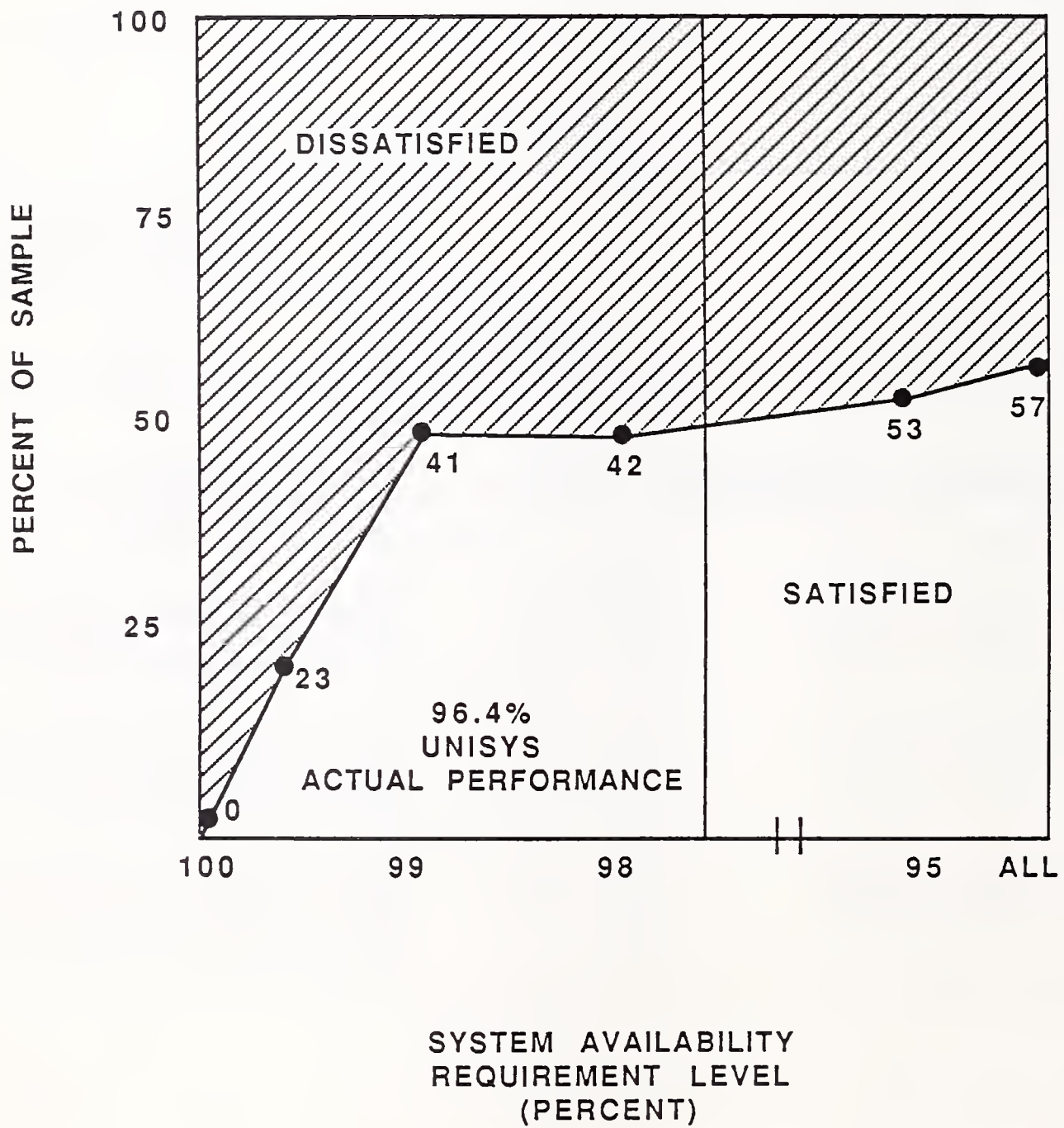
EXHIBIT IV-75

USER SATISFACTION WITH SERVICE PERFORMANCE
UNISYS (SPERRY) 1100/XX

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED	
		50	100
SYSTEM AVAILABILITY (PERCENT)	97.2		
RESPONSE TIME (HOURS)	1.2		
REPAIR TIME (HOURS)	2.3		
RECOVERY TIME (HOURS)	1.1		

EXHIBIT IV-76

USER SATISFACTION WITH SYSTEM AVAILABILITY
UNISYS (SPERRY) 1100/XX



FULS

dramatically at the 99% and higher systems availability levels (Unisys satisfies 41% of the 1100/XX users who require 99% and only 23% of those who require 99.5% system availability). Luckily, only nine of the forty 1100/XX users surveyed, (23% of the sample) reported system availability requirements of 100%, since no user surveyed reported 100% availability of their system.

- Exhibit IV-77 presents a scatter plot of the 1100/XX sample's requirements versus the availability levels that they received. Note the wide dispersion of responses, perhaps reflecting the range of product age of the 1100/XX family of large systems. Also, compare this scatter plot to that of IBM's 309X mainframe (Exhibit IV-41), whose greater system availability requirement levels create a much more vertical plot of responses. It has been said that the 1100/XX family successfully competes with the older IBM 3080 processors (even though the entry level 309X system is comparable in price). The similarity between the IBM 308X scatter plot (Exhibit IV-50) and the 1100/XX plot tends to support this conclusion.
- The 1100/XX sample also demonstrated lower than average service expectations in a number of other service areas, as shown in Exhibit IV-78. User ratings of the perceived value of almost all hardware maintenance and software support services analyzed were significantly lower than average. Again, this might reflect either the age of the machines or the industry/applications that the processors are being used in.
- User satisfaction in most hardware areas is relatively high, falling below the 50% satisfied mark in only two (although critical) areas--parts availability (44% satisfied) and overall satisfaction with hardware support (48% satisfied), as shown in Exhibit IV-79. Almost two-thirds of the users were satisfied with their hardware engineer and remote support, and 80% of the sample was satisfied with operational training.

EXHIBIT IV-77

USER SATISFACTION WITH SYSTEM AVAILABILITY
UNISYS (SPERRY) 1100/XX

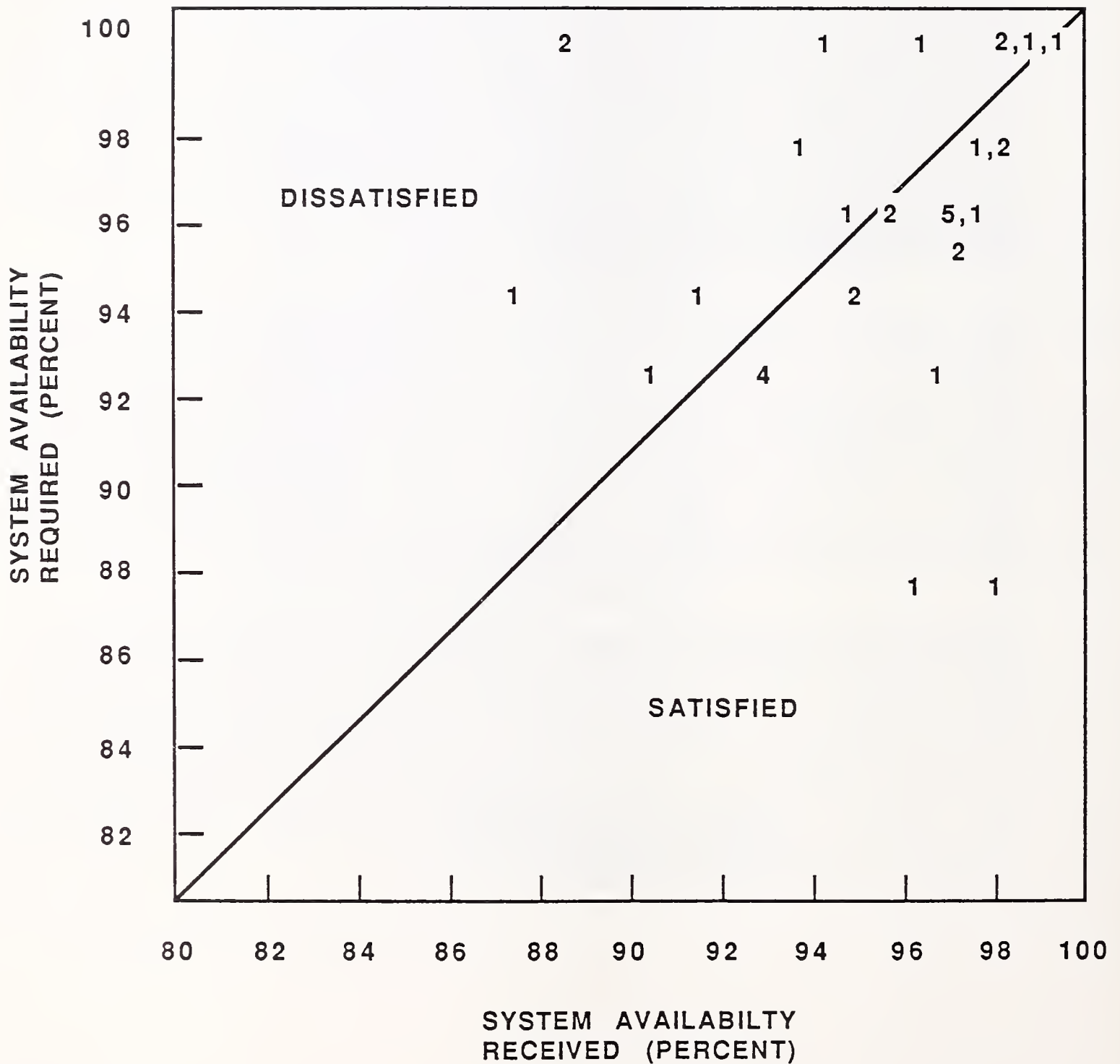


EXHIBIT IV-78

USER PERFORMANCE/VALUE LEVELS
UNISYS (SPERRY) 1100/XX

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	5.3	5.7	0.4
PARTS AVAILABILITY	8.5	7.3	(1.5)
REMOTE SUPPORT	6.7	6.5	(0.2)
HARDWARE ENGINEER SKILL	8.9	8.2	(0.7)
SOFTWARE ENGINEER SKILL	8.5	7.4	(1.1)
SOFTWARE DOCUMENTATION	7.9	6.2	(1.7)
SOFTWARE SUPPORT OVERALL	8.5	7.2	(1.3)
HARDWARE SUPPORT OVERALL	8.9	8.2	(0.7)

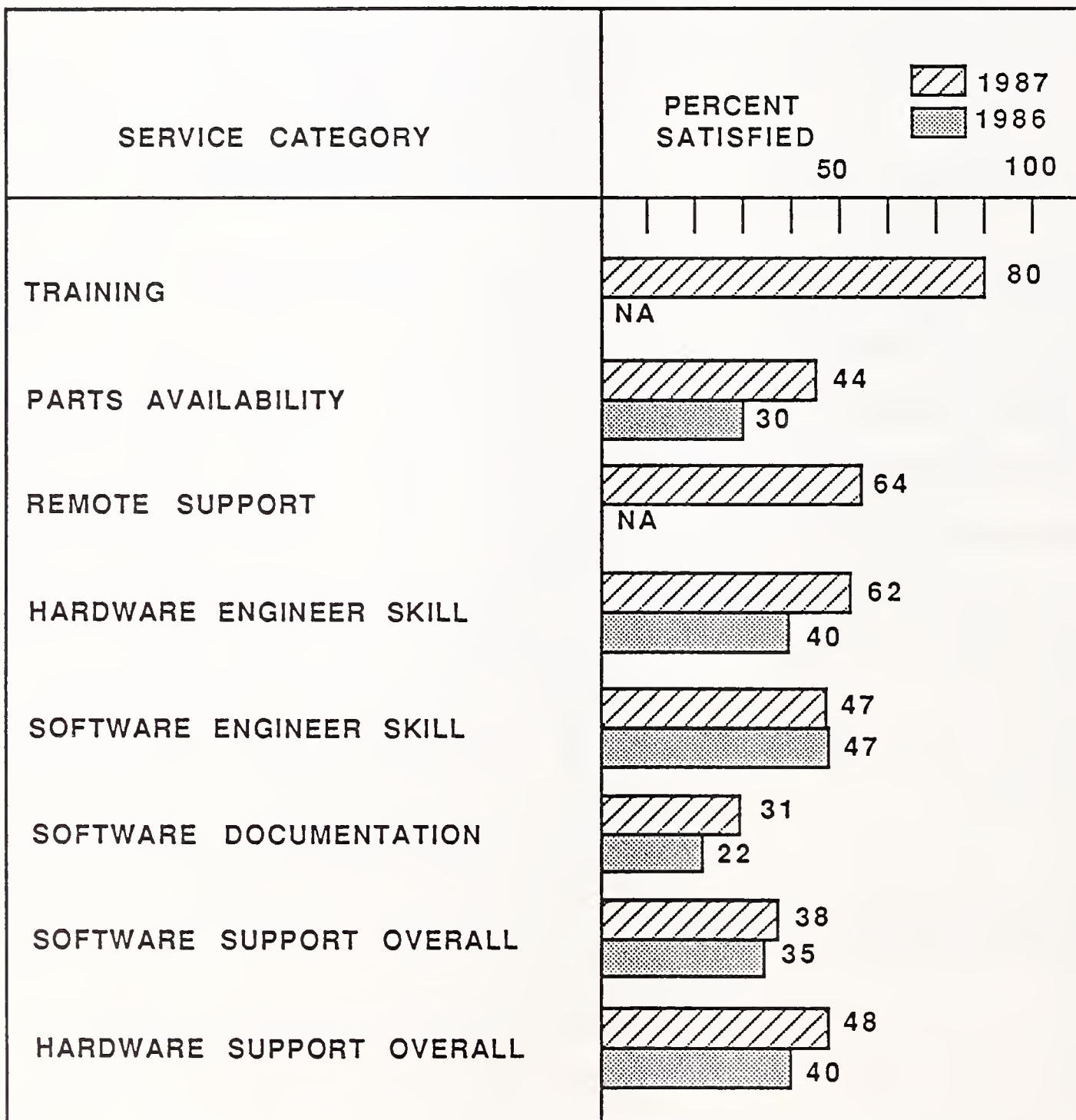
*SCALE: 1 = LOW, 10 = HIGH

**AVERAGE STANDARD ERROR OF THE MEAN = 0.3

FULS

EXHIBIT IV-79

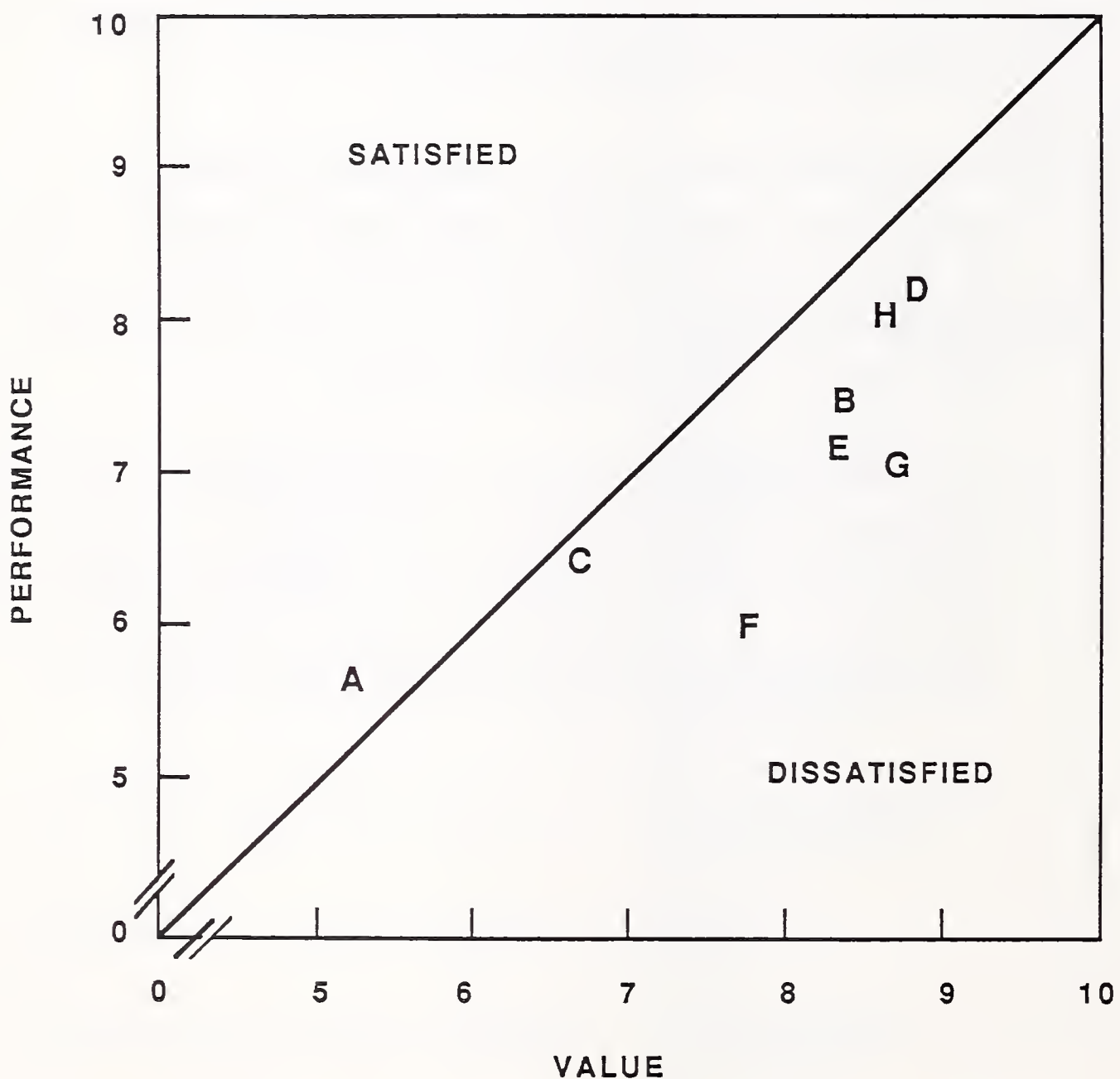
USER SATISFACTION LEVELS
1987 VERSUS 1986
UNISYS (SPERRY) 1100/XX



- The 1100/XX users were fairly split on their most pressing hardware service needs. The sample most often mentioned parts availability, uptime needs, increased preventive maintenance visits, and pricing concerns.
- On the software side, Unisys (Sperry) did not fair as well, failing to satisfy even a third of the sample in the critical support area of software documentation and managing only slightly better in overall satisfaction with software support. Users also expressed concern with the frequency and quality of software updates and overall quality of the software in general. Exhibit IV-80 graphically plots the disparity between 1100/XX software support performance and user perceived value.
 - Eighty-seven percent of the Unisys (Sperry) users felt that they received their "money's worth." This number was always in the nineties for the other large systems products analyzed. This percentage can be considered low when you consider that these same users report that they receive satisfactory (hardware) service.
 - Fifty-one percent of the 1100/XX users were willing to increase their involvement in maintaining their own equipment at relatively high discount levels (shown in Exhibit IV-81). This can be compared to the IBM samples, who always prefer to have IBM provide the service since IBM is perceived as a "premium" service provider.

EXHIBIT IV-80

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
UNISYS (SPERRY) 1100/XX

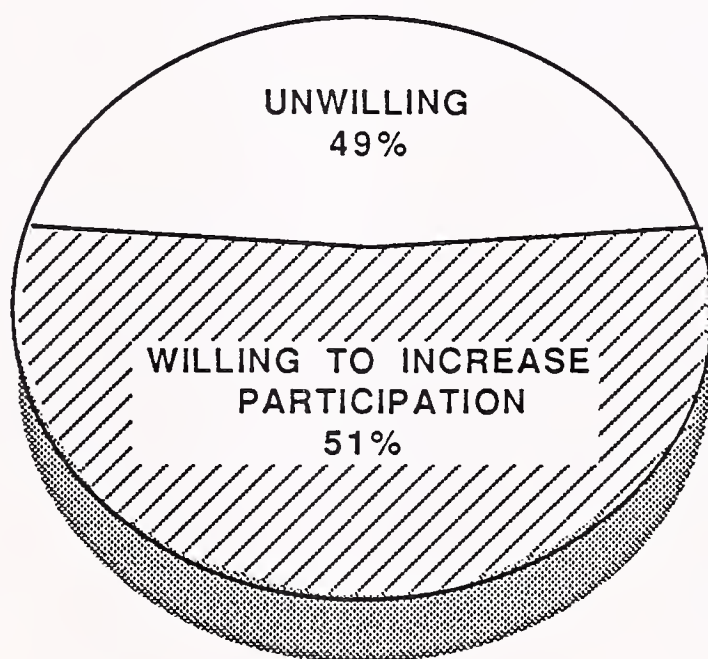


- | | |
|-----------------------------------|-----------------------------------|
| A = TRAINING | E = SOFTWARE ENGINEER SKILL LEVEL |
| B = PARTS AVAILABILITY | F = SOFTWARE DOCUMENTATION |
| C = REMOTE SUPPORT | G = SOFTWARE SUPPORT OVERALL |
| D = HARDWARE ENGINEER SKILL LEVEL | H = HARDWARE SUPPORT OVERALL |

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EXHIBIT IV-81

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE
UNISYS (SPERRY) 1100/XX



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	24	13	20	20	40	60	100
SWAP COMPONENTS	27	0	14	14	36	58	100
SWAP BOARDS	28	0	7	7	29	29	100

*UP TO AND INCLUDING

 OPTIMUM DISCOUNT LEVEL

FULS

V LARGE SYSTEMS SUMMARY DATA

V LARGE SYSTEM SUMMARY DATA

- In this chapter, INPUT presents selected data from the 1987 large systems user service requirements analysis in summary charts, allowing the comparison of service performance on a vendor-by-vendor basis. INPUT presents the data only when performance can be compared on an absolute basis, not for subjective (ratings) data. The key to this comparison should always be the ability of each vendor to satisfy the needs of its particular users, rather than the achievement of the "best" individual performance mark, since even the "best" mark may still be lacking if the user requirements exceed it.
- Exhibits V-1 through V-9 provide summarized service performance data as a source of comparison between vendors.

EXHIBIT V-1

LARGE SYSTEMS VENDOR PERFORMANCE
SYSTEM INTERRUPTION

VENDOR	SYSTEM INTERRUPTIONS				
	AVERAGE NUMBER PER MONTH	CAUSED BY (PERCENT)			
		HARDWARE	SYSTEM SOFTWARE	APPLICATION	OTHER
AMDAHL	1.2	71	17	7	5
BURROUGHS	1.6	60	32	5	3
CDC	2.3	63	14	7	5
HONEYWELL	1.2	73	13	4	10
IBM 309X	1.4	42	35	7	16
IBM 308X	2.0	59	28	6	7
NAS	0.8	55	25	10	10
NCR	1.6	68	9	10	13
SPERRY	2.9	61	19	13	7
ALL	1.7	1.0	22	8	10

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EXHIBIT V-2

LARGE SYSTEMS VENDOR PERFORMANCE
SYSTEM AVAILABILITY REQUIRED VERSUS RECEIVED

VENDOR	SYSTEM AVAILABILITY (PERCENT)		
	REQUIRED	RECEIVED	DIFFERENCE (+/-)
AMDAHL	99.2	98.9	- 0.3
BURROUGHS	98.2	96.9	- 1.3
CDC	98.4	97.7	- 0.7
HONEYWELL	98.7	97.8	- 0.9
IBM 309X	99.3	98.5	- 0.6
IBM 308X	98.9	98.0	- 0.9
NAS	99.3	99.3	--
NCR	94.7	93.6	- 0.9
SPERRY	97.2	96.4	- 0.7
ALL	98.3	97.6	- 0.5

FULS

EXHIBIT V-3

LARGE SYSTEMS SYSTEM AVAILABILITY
USER SATISFACTION

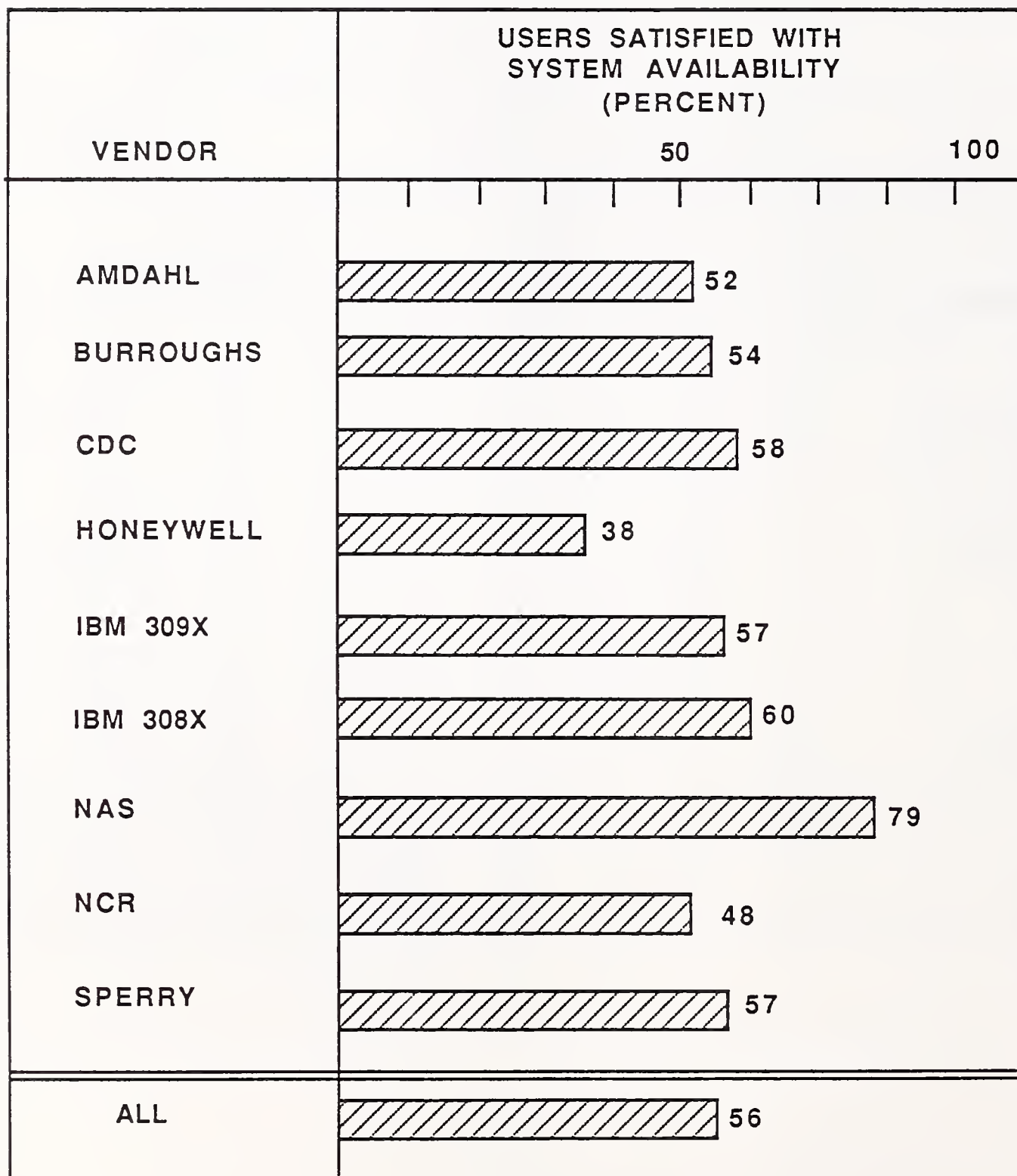


EXHIBIT V-4

LARGE SYSTEMS VENDOR PERFORMANCE
RESPONSE TIME REQUIRED VERSUS RECEIVED

VENDOR	RESPONSE TIME (HOURS)		
	REQUIRED	RECEIVED	DIFFERENCE (+/-)
AMDAHL	1.9	1.9	--
BURROUGHS	1.5	1.6	+ 0.1
CDC	2.2	2.6	+ 0.4
HONEYWELL	2.4	2.1	- 0.3
IBM 309X	1.1	1.1	--
IBM 308X	1.6	1.7	+ 0.1
NAS	1.4	1.4	--
NCR	1.8	1.8	--
SPERRY	1.2	1.1	- 0.1
ALL	1.7	1.7	--

FULS

EXHIBIT V-5

LARGE SYSTEMS RESPONSE TIME
USER SATISFACTION

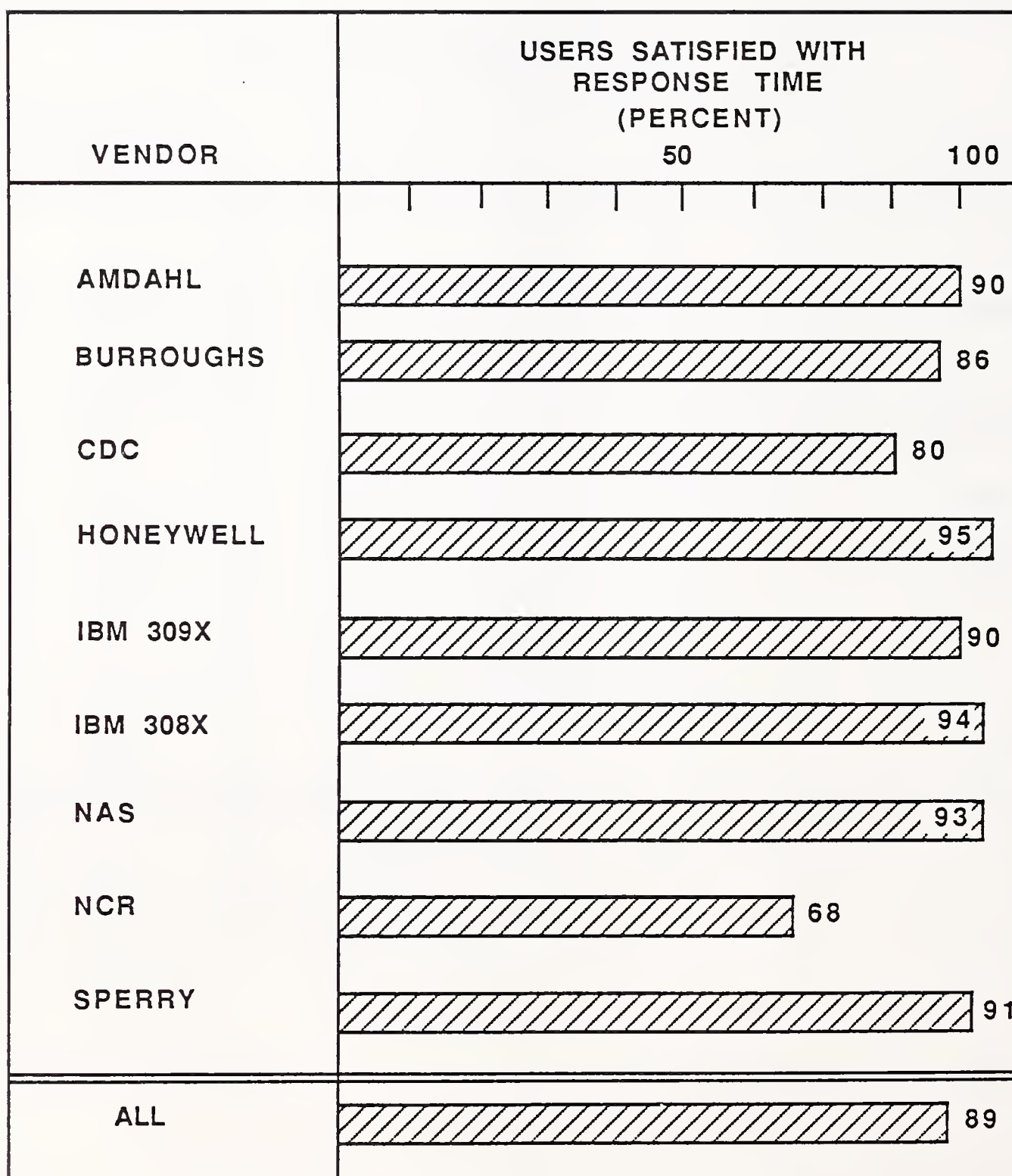


EXHIBIT V-6

LARGE SYSTEMS VENDOR PERFORMANCE
REPAIR TIME REQUIRED VERSUS RECEIVED

VENDOR	REPAIR TIME (HOURS)		
	REQUIRED	RECEIVED	DIFFERENCE (+/-)
AMDAHL	1.8	1.7	- 0.1
BURROUGHS	2.9	3.0	- 0.1
CDC	3.2	3.9	+ 0.7
HONEYWELL	3.6	3.4	-0.2
IBM 309X	1.5	1.6	+ 0.1
IBM 308X	2.3	2.2	- 0.1
NAS	1.8	1.8	--
NCR	1.7	1.8	+ 0.1
SPERRY	2.3	2.4	+ 0.1
ALL	2.3	2.4	+ 0.1

EXHIBIT V-7

LARGE SYSTEMS REPAIR TIME
USER SATISFACTION

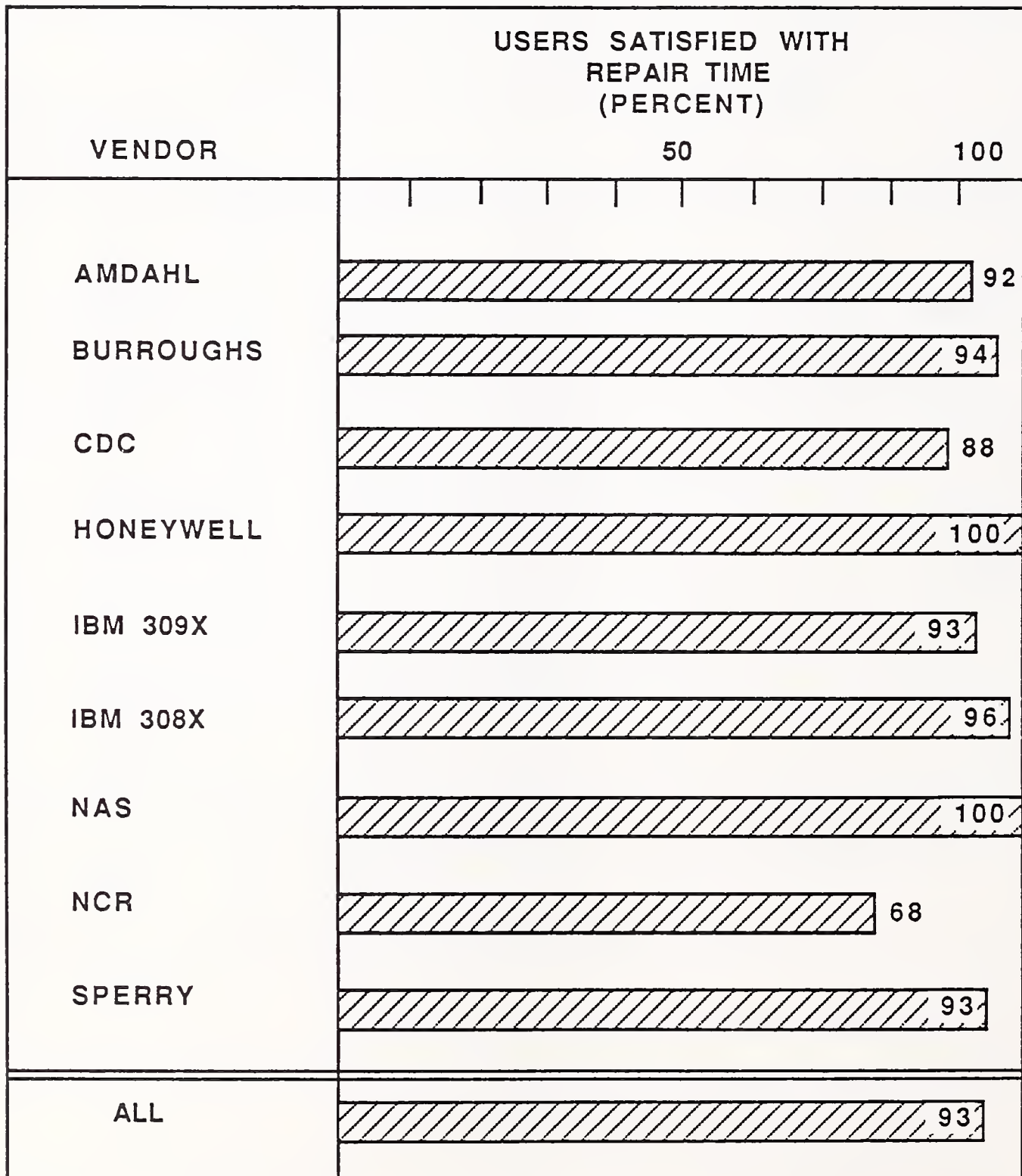


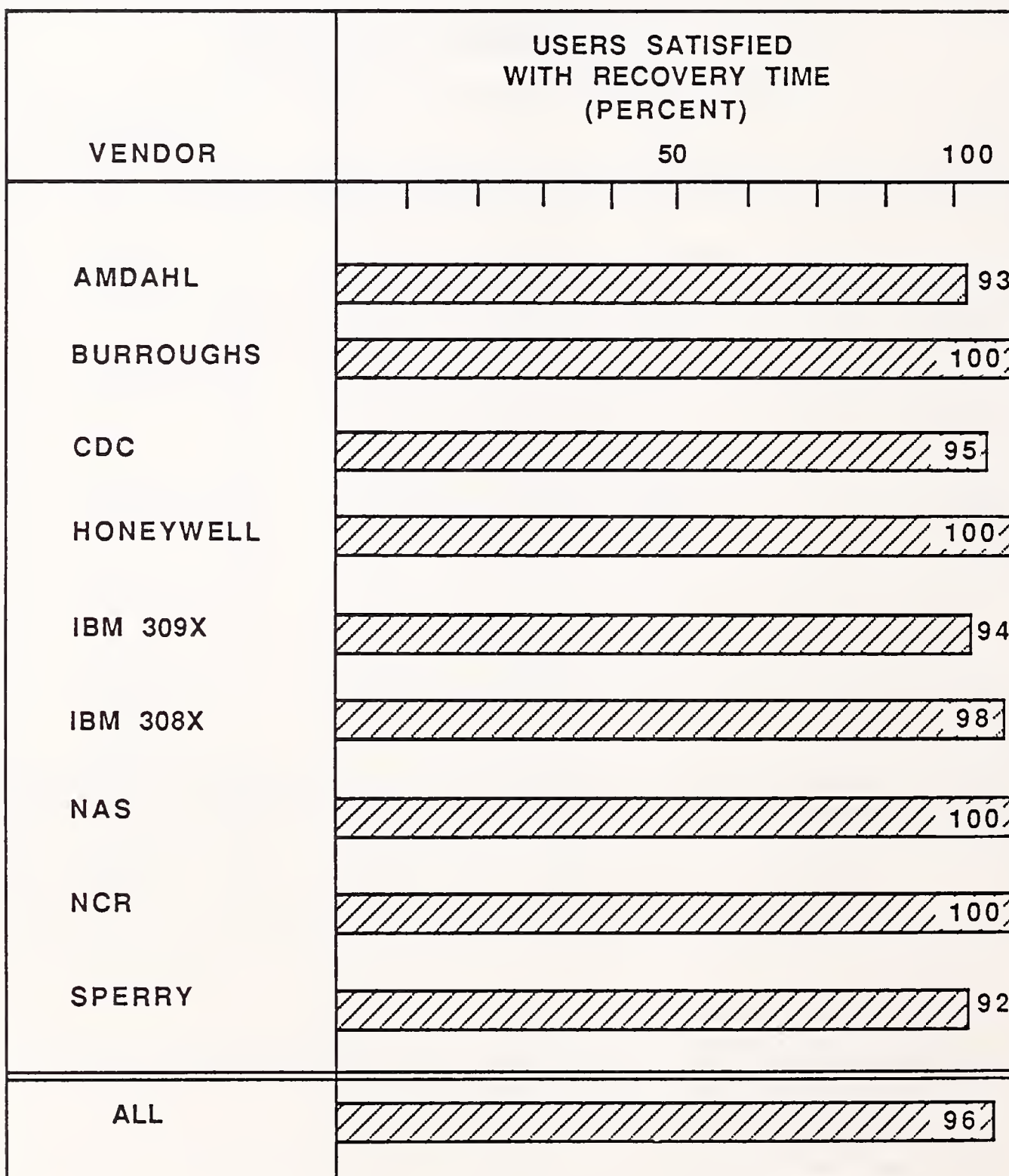
EXHIBIT V-8

LARGE SYSTEMS VENDOR PERFORMANCE
RECOVERY TIME REQUIRED VERSUS RECEIVED

VENDOR	RECOVERY TIME (HOURS)		
	REQUIRED	RECEIVED	DIFFERENCE (+/-)
AMDAHL	1.4	1.5	+ 0.1
BURROUGHS	0.8	0.8	--
CDC	1.5	1.7	+ 0.2
HONEYWELL	1.1	1.1	--
IBM 309X	0.8	0.9	+ 0.1
IBM 308X	1.0	1.0	--
NAS	0.5	0.5	--
NCR	0.6	0.7	+ 0.1
SPERRY	1.1	1.3	+ 0.2
ALL	1.0	1.1	+ 0.1

EXHIBIT V-9

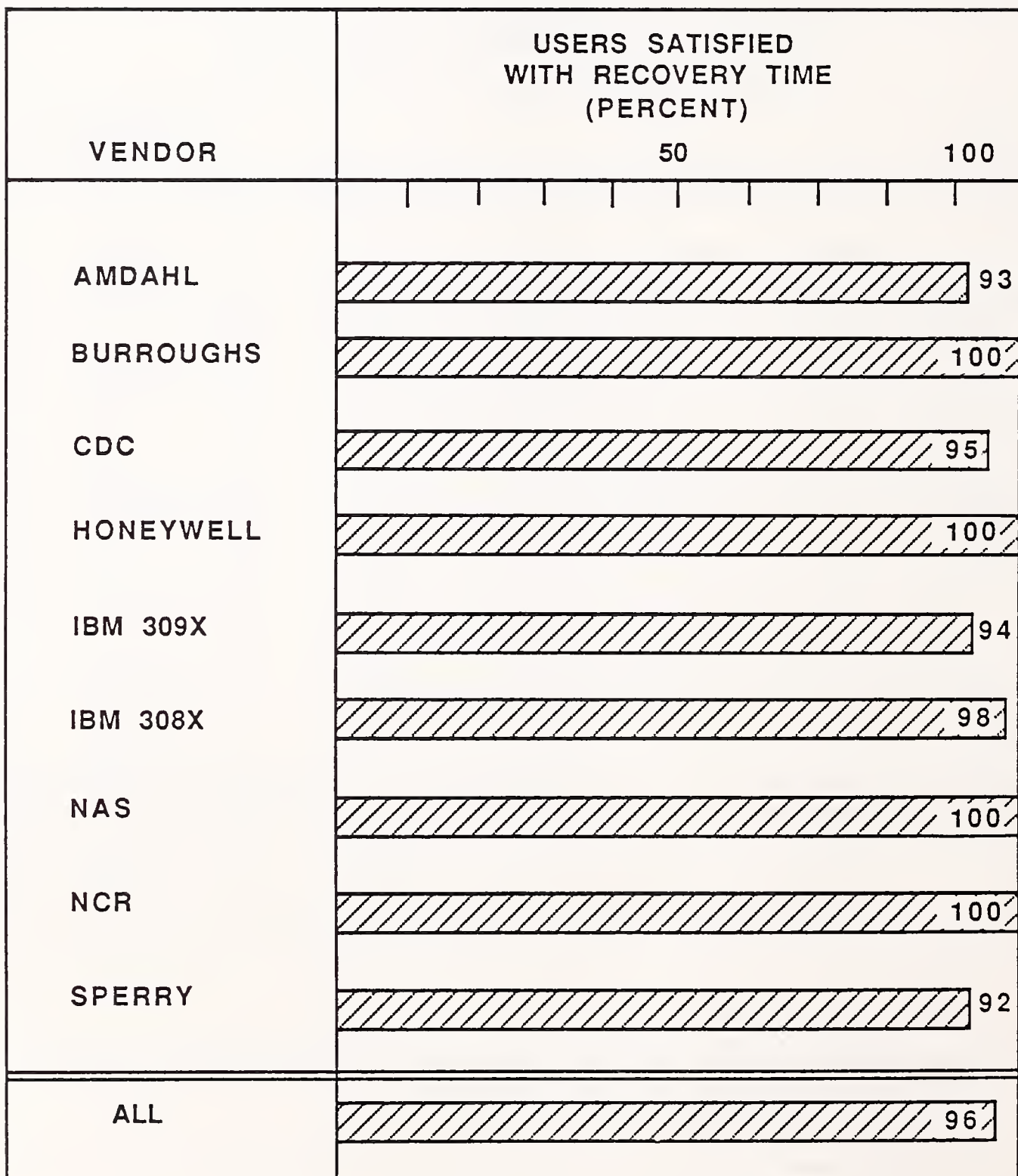
LARGE SYSTEMS RECOVERY TIME
USER SATISFACTION



APPENDIX A: QUESTIONNAIRE

EXHIBIT V-9

LARGE SYSTEMS RECOVERY TIME
USER SATISFACTION



APPENDIX A: QUESTIONNAIRE

APPENDIX A:

CSP USER REQUIREMENTS QUESTIONNAIRE LARGE AND SMALL SYSTEMS 1987

1. a) Manufacturer _____
 b) Model _____

2. SERVICE VENDOR _____ Manufacturer
 _____ Third Party (If TPM, proceed with TPM
 User Questionnaire)

3. SERVICE COVERAGE a) Days of Coverage _____
 b) Hours of Coverage _____

4. Are you billed annually, quarterly or monthly? (A/Q/M) _____

5. Do you receive remote support? (Y/N) _____

6. a) Please rate, on a scale of 1-10, your level of requirement
 for each of the following services.

b) On a scale of 1-10, please rate your current level of satisfaction
 you receive from your service vendor.

	a. (require)	b. (current)
1. Training	_____	_____
2. Parts Availability	_____	_____
3. Remote Support	_____	_____
4. Hardware Engineer Skill Level	_____	_____
5. Software Engineer Skill Level	_____	_____
6. Software Documentation	_____	_____
7. Software Support Overall	_____	_____
8. Hardware Support Overall	_____	_____

7. What three contractual services do you feel are the most essential?
- a) _____
- b) _____
- c) _____
8. What are the three contractual services you find least important?
- a) _____
- b) _____
- c) _____
9. What services would you like to receive that aren't currently included in the contract?
- a) _____
- b) _____
- c) _____
10. a) Do you feel that you receive the level of support for which you're paying? (If yes, skip to 11) _____
- b) (If no), what services would you like to see increased/improved, and how? (limiting responses to three, please)
- 1 (b) _____
- 1 (c) _____
- 2 (b) _____
- 2 (c) _____
- 3 (b) _____
- 3 (c) _____

APPENDIX B: DEFINITIONS

APPENDIX B: DEFINITIONS

- APPLICATIONS SOFTWARE - Software that performs processing to service user functions.
- ARTIFICIAL INTELLIGENCE - The academic discipline involving the study of the processes by which humans perceive and assimilate data (and use reasoning to process this data) for the purpose of duplicating these processes within computer systems. Also, this term refers to the computer systems that accomplish these duplicated processes.
- BOC - Bell Operating Company.
- CONSULTING - Includes analysis of user requirements and the development of a specific action plan to meet user service and support needs.
- DISPATCHING - The process of allocating service resources to solve a support-related problem.
- DIVESTITURE - The action, stemming from antitrust lawsuits by the Department of Justice, which led to the break-up of AT&T and its previously owned local operating companies.
- DOCUMENTATION - All manuals, newsletters, and text designed to serve as reference material for the ongoing operation or repair of hardware or software.

- END USER - May buy a system from the hardware supplier(s) and do own programming, interfacing, and installation. Alternatively, may buy a turnkey system from a systems house or hardware integrator.
- EXPERT SYSTEMS APPLICATIONS - Applications for expert systems--a computer system based on a data base created by human authorities on a particular subject. The computer system supporting this data base contains software that permits inferences based on inquiries against the information contained in the data base. Expert systems is often used synonymously with "knowledge-based systems," although this latter term is considered to be broader and to include expert systems within its scope.
- ENGINEERING CHANGE NOTICE (ECN) - Product changes to improve the product after it has been released to production.
- ENGINEERING CHANGE ORDER (ECO) - The followup to ECNs which include parts and a bill of material to effect the change in hardware.
- ESCALATION - The process of increasing the level of support when and if the field engineer cannot correct a hardware or software problem within a prescribed amount of time, usually two to four hours for hardware.
- FIBER OPTICS - A transmission medium which uses lightwaves.
- FIELD ENGINEER (FE) - For the purpose of this study, field engineer, customer engineer, serviceperson, and maintenance person were used interchangeably and refer to the individual who responds to a user's service call to repair a device or system.

FIELD SERVICE MANAGEMENT SYSTEM (FSMS) - A specialized application program that automates some (if not all) of the following activities of a field service organization: call handling, dispatching, parts inventory and tracking, billing, efficiency reporting, and other functions. Ideally, the system accesses one data base from which each function can use and modify data.

- HARDWARE INTEGRATOR - Develops system interface electronics and controllers for the CPU, sensors, peripherals, and all other ancillary hardware components. May also develop control system software in addition to installing the entire system at the end-user site.
- ISDN - Integrated Services Digital Network. A proposed standard for digital networks providing transport of voice, data, and image using a standard interface and twisted pair wiring.
- LADT - Local Area Data Transport. Data communications provided by the BOCs within local access transport areas (LATA).
- LARGE SYSTEM - Refers to traditional mainframes including at the low end IBM 4300-like machines and at the high end IBM 308X-like machines. Large systems have a maximum word length of 32 bits and a standard configuration price of \$350,000 and higher.
- MEAN TIME BETWEEN FAILURES (MTBF) - The elapsed time between hardware failures on a device or a system.
- MEAN TIME TO REPAIR - The elapsed time from the arrival of the field engineer on the user's site until the device is repaired and returned to the user for his utilization.
- MEAN TIME TO RESPOND - The elapsed time between the user placement of a service call and the arrival at the user's location of a field engineer.
- MICROCOMPUTER - A microprocessor-based single- or multi-user computer system typically priced less than \$15,000. A typical configuration includes an 8- or 16-bit CPU, monitor, keyboard, two floppy disk drives, and all required cards and cables.
- MINICOMPUTER - See Small System.

- OPERATING SYSTEM SOFTWARE (SYSTEMS SOFTWARE) - Software that enables the computer system to perform basic functions. Systems software, for the purposes of this report, does not include utilities or program development tools.
- PBX - Private Branch Exchange. A customer premises telephone switch.
- PERIPHERALS - Includes 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.
- PLANNING - Includes the development of procedures, distribution, organization, and configuration of support services. For example, capacity planning, "installation" planning.
- PLUG-COMPATIBLE MAINFRAME (PCM) - Mainframe computers that are compatible with and can execute programs on an equivalent IBM mainframe. The two major PCM vendors at this time are Amdahl and National Advanced Systems.
- PROFESSIONAL SERVICES - A category services including system design, custom programming, consulting, education, and facilities management.
- RBOC - Regional Bell Operating Company. One of seven holding companies coordinating the activities of the BOCs.
- REMOTE DIAGNOSTICS - Gaining access to a computer from a point physically distant from the computer in order to perform problem determination activities.
- REMOTE SUPPORT IMPLEMENTATION - An extension of remote diagnostics where some level of support delivery is performed from a point physically distant from the computer. Currently, this capability is more common to

software support where problems can be solved or circumvented through downline loading of new code (fixes).

- RESELLER - A marketing organization which buys long-distance capacity for others at wholesale rates, selling services at retail but discounted prices and profiting on the difference.
- SMALL BUSINESS COMPUTER - For the purpose of this study, a system which is built around a Central Processing Unity (CPU), has the ability to utilize at least 20M bytes of disk capacity, provides multiple CRT workstations, and offers business-oriented system software support.
- SMALL SYSTEM - Refers to traditional minicomputer and superminicomputer systems ranging from a small, multi-user, 16-bit system at the low end to sophisticated 32-bit machine at the high end.
- SOFTWARE DEFINED NETWORK - A private network which uses public network facilities and which is configurable on an as-needed basis by the user (see Virtual Private Network).
- SOFTWARE ENGINEER (SE) - The individual that responds (either on-site or via remote support) to a user's service call to repair or patch operating systems and/or applications software.
- 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.
- SUPERMINICOMPUTER - See Small System.
- SYSTEMS INTEGRATION - The action of a single service vendor's design, development, and implementation of a system or subsystem including integration of hardware, software, and communications facilities for a customer.

- SYSTEM INTERRUPTION - Any system downtime requiring an Initial Program Load (IPL).
- SYSTEMS HOUSE - Integrates hardware and software into a total turnkey system to satisfy the data processing requirements of the end user. May also develop system software products for license to end users.
- T-1 - Refers to a standard 1.544 megabit per second digital channel used between telephone company central offices and is now used for microwave, satellite, fiber optics, or other bypass applications.
- THIRD-PARTY MAINTENANCE (TPM) - Any service provider other than the original equipment vendor.
- TRAINING - All audio, visual, and computer-based documentation, materials, and live instruction designed to educate users and support personnel in the ongoing operation or repair of hardware and software.
- TURNKEY SYSTEM - Composed of hardware and software integrated into a total system designed to completely fulfill the processing requirements of a single application.
- VSAT - Very Small Aperture Terminal. A small satellite dish system, usually using Ku-band frequencies.
- VIRTUAL PRIVATE NETWORK - A portion of a public network dedicated to a single user.

