ANALYSIS OF SMALL SYSTEMS SERVICE

JUNE 1987

Published by
INPUT
1943 Landings Drive
Mountain View, CA 94043
U.S.A.

Customer Service Program (CSP)

Analysis of Small Systems Service

ANALYSIS OF SMALL SYSTEMS SERVICE

ABSTRACT

This report analyzes the performance of leading small systems vendors in the areas of hardware maintenance and systems software support. A total of 360 users of 11 of the top small systems were contacted concerning their requirements for service and support versus the level received from their service provider.

Of particular importance are the dramatic increases seen in the demands mini-computer users are placing on their systems in terms of performance as well as on their vendors in terms of service. Especially pronounced are the increasing system availability requirements reported by minicomputer users, climbing to a high of 97.9% among this year's sample. Drastic improvements in performance are called for, and small systems vendors are looking to the advanced system and support technologies once familiar only to the large systems market.

The report includes traditional system performance and reliability statistics as well as support performance measures relative to specific vendors and the small systems service market as a whole. Subjective analyses of service components are also discussed in terms of user satisfaction.

This report contains 198 pages, including 123 exhibits.

ANALYSIS OF SMALL SYSTEMS SERVICE

CONTENTS

ANALYSIS OF SMALL SYSTEMS SERVICE

EXHIBITS

Page

I INTRODUCTION

I INTRODUCTION

- This report, Analysis of Small Systems Service, is the first deliverable of the 1987 Small Systems Module produced by INPUT's Customer Service Program. The report defines and examines a number of fundamental components of hardware and software support in reference to both vendor performance and user demand.

- In preparation of this report, 360 small systems user sites were contacted and individual samples drawn from 11 of the top minicomputer manufacturers including Data General, DEC, IBM, Tandem, and Wang, to name a few. Exhibit I-1 lists the full spectrum of vendors included and the CPU models targeted, along with the sample sizes of each group, which ranged from 28 to 40 users per vendor (representing a significant increase over last year's analysis).

- The emphasis of the report is not to provide "service score cards" of individual minicomputer manufacturers, but rather to identify key areas of user concern and growth opportunities within the small systems services sector. Trends within individual user groups as well as over the minicomputer user market as a whole are revealed, and recommendations are drawn from the analyzed user data. An Executive Overview of these findings is presented in Chapter II, concisely discussing the major points revealed within the report. The information is provided in a format which facilitates the preparation of presentation materials, such as slides or transparencies.

EXHIBIT I-1

SMALL SYSTEMS USER SAMPLE BREAKDOWN

MANUFACTURER	MODEL	NUMBER OF INTERVIEWS
AT&T	3B	30
CONCURRENT	32XX	30
DATA GENERAL	MV 10,000 & 20,000	30
DEC	VAX 11/780	40
DEC	VAX 8XXX	31
GOULD	CONCEPT 32	30
HEWLETT-PACKARD	3000	31
IBM	SYSTEM/38	40
PRIME	9X5X	30
TANDEM	EXT, TXP, T16	28
WANG	VS	40
TOTAL		360

- An in-depth analysis of the combined small systems sample results is presented in Chapter III, which develops important standards in minicomputer support for comparison to individual vendor/product performances. This performance data is presented for each vendor group in the 11 separate sections of Chapter IV.

- Chapter V provides a summary listing of the objective performance data, allowing a comprehensive look at the performances of the individual vendors among the group. Reference to combined small systems sample averages as well as contrast to other vendor's statistics are often made in the course of the text, and these exhibits provide a summation of the specific data referred to.

- Finally, appended sections A and B include a copy of the actual questionnaire used for the interview project and a list of definitions of the service terminology used within the report.

II EXECUTIVE OVERVIEW

II EXECUTIVE OVERVIEW

- This section of the Small Systems User Service Requirements is designed to present the major findings of the report in an efficient overview format. Each exhibit illustrates a key point revealed by this year's research, and the accompanying text outlines its significance to the small systems market.

- Since INPUT began tracking the small systems service market in 1983, fundamental changes have been occurring in both the requirements minicomputer users are placing on their systems and in the systems themselves. Small systems vendors have developed computing capacities that rival those of lower-end mainframes and have now begun to compete in industries and applications once reserved for the vendors of large systems.

- As the processing power of these small systems has grown, user expectations for reliability and service have followed, leaving many small systems vendors ill-prepared to meet these rapidly rising requirements. As small systems enter increasingly critical applications, user needs are quickly approaching the levels reported by their large systems counterparts. The competitive factor in the small systems market is shifting from computing capabilities to the vendors' ability to sustain those capabilities under increasingly demanding conditions.

A. SATISFACTION WITH SYSTEM AVAILABILITY REACHING CRITICAL LOWS

- The most pronounced increases users have expressed in their small systems needs are in system availability. Uptime requirements have risen from 90.5% in 1984 to a high of 97.9% among this year's sample. At a time when user demands are reaching critical highs, system reliability reported by users has dropped, leaving over 40% of minicomputer users dissatisfied with uptime performance.

- Exhibit II-1 recounts the top availability performances among the small systems vendors sampled. Not coincidentally, all four of these vendors are known for their reliance on advanced support techniques, ranging from remote diagnostics and service to the introduction of fault-tolerance into their systems architecture.

- The demands minicomputer users are placing on their systems are reaching a critical point where improvements in maintenance "after the fact" can no longer provide the needed impact on total system availability. Further improvements in traditionally supplied service are providing too little, too late.

- A point of note is the variance in the system availability demands placed on these top performing vendors, demonstrating that availability performance is not an absolute measure but rather based on the actual level of user need. Although the percentage of small systems users demanding top system availability is on the rise, the attainment of 100% uptime should, obviously, not be the goal of all minicomputer vendors. What is important, however, is that vendors are aware of the availability needs among their targeted user groups and are prepared to meet them.

EXHIBIT II-I

INPUT®

LEADING SMALL SYSTEMS SYSTEM AVAILABILITY

RANK	VENDOR	SYSTEM AVAILABILITY REQUIRED (Percent)	SYSTEM AVAILABILITY RECEIVED (Percent)	USERS (PERCENT SATISFIED)
1	TANDEM	97.7	97.7	89
2	IBM	99.0	98.6	85
3	HP	96.7	96.5	83
4	DEC (8XXX)	97.2	97.2	71
	ALL	97.9	96.9	59

F-USS

B. DRAMATIC RISE SEEN IN HIGH-AVAILABILITY NEEDS

- The recent advances in processing power and capacity seen in small systems has quickly moved minicomputers into applications and industries once dominated by large systems usage. The criticality of needs within these markets are beginning to surface in terms of demands placed on small systems vendors, and for the first time, a majority of the small systems user sample is reporting uptime requirements at the 100% requirement level. Fifty-seven percent of this year's small systems respondents reported 100% system availability needs, representing an increase of over 20% in users demanding top availability over the past year.

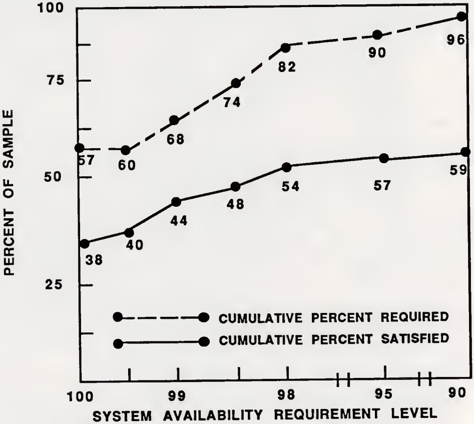
- These rapidly rising needs are remaining largely unmet, as demonstrated in Exhibit II-2, with only 38% of these high-availability users receiving the top uptimes they require. As small systems vendors develop their systems and strategies for these high-requirement markets and applications, concurrent support strategies must also be considered to sustain performance of these advanced systems at the level demanded.

- Small systems vendor performance at each system availability requirement must improve if "networked" superminicomputer systems (such as those offered by DEC) are to successfully supplement traditional mainframe products at large corporate user sites. Small systems vendors should redouble their support efforts (particularly in the software support area) as well as integrate advanced system design into their systems.

EXHIBIT II-2

INPUT®

SYSTEM AVAILABILITY SATISFACTION AT SPECIFIC REQUIREMENT LEVELS



SAMPLE: 360

C. SYSTEM RELIABILITY BECOMES KEY CONCERN

- The reliability of small systems in terms of system interruptions has dramatically improved over the past few years, approaching a level comparable to that of mainframe systems. At the same time, small systems vendors have improved response and repair performance to under the four-hour goal standard in the market. User satisfaction with problem resolution performance has reached all time highs of 90% among small systems users (for both response and repair measures).

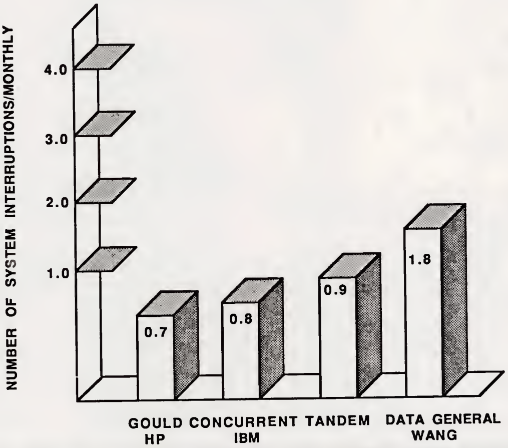
- The importance of the development of alternative support techniques becomes clear when contrasting these statistics with the reported drops in relative system availability performance. As discussed, only 59% of this year's sample received the level of uptime required of their systems, regardless of the commendable response to down situations. Further improvements in resolution times are not feasible within the restrictions of traditional service delivery techniques, nor do users expect such. The foremost concern of small systems users is the increased reliability and availability of their system.

- Small systems vendors must look to the advanced techniques utilized in the large systems market (and to a much lesser extent among small systems manufacturers) under such stringent user demands. A number of small systems vendors have been successful in approaching the levels of system performance demanded by their users, both in terms of increasing uptime and reducing interruptions. Among them, not surprisingly, are leaing users of advanced system design (e.g., fault tolerant Concurrent and Tandem machines) and support delivery (e.g., IBM and Gould system-based diagnostic capabilities). The leading reliability statistics among small systems vendors are presented in Exhibit II-3, along with those of the two lowest performers for comparison.

EXHIBIT II-3

INPUT®

SMALL SYSTEMS RELIABILITY



F-USS

D. HIGH-PRIORITY NEEDS STILL UNMET

- Certain components of systems service have consistently surfaced as high-priority needs among small systems users in past INPUT samples. Continuing analysis of these areas has revealed small systems vendors' performance lagging behind user requirements in both hardware (parts availability, engineer skill, and service overall) and software (documentation, engineer skill, and overall support) components, as illustrated in Exhibit II-4.

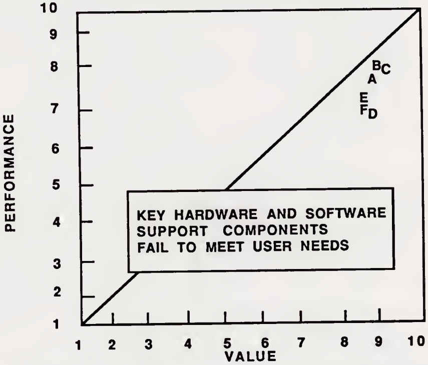
- A persistent complaint heard industrywide is of software documentation, and small systems users are no exception to the rule. A point of common concern, the lack of clear, up-to-date documentation, was expressed by virtually all small systems vendor groups as documentation support remains the farthest from the target user value. The gap between user needs and software support performance overall is nearly as great, the overwhelming dissatisfaction with documentation no doubt impacting user ratings of support in general.

- Since the majority of system interruptions experienced are still due to hardware failures, small systems users placed slightly higher values on the hardware support components evaluated. Vendors were rated somewhat higher in these hardware areas, but performance still falls well below user value, especially in the area of parts availability. With the ready availability of spares commonly considered a key differentiation between manufacturer-supplied and third-party support, small systems vendors should take care not to let this competitive advantage erode.

EXHIBIT II-4

INPUT®

SMALL SYSTEMS SERVICE PERFORMANCE VERSUS USER VALUE



A = PARTS AVAILABILITY

B = HARDWARE ENG. SKILL LEVEL

C = OVERALL HARDWARE SUPPORT

D = SOFTWARE DOCUMENTATION

E = SOFTWARE ENG. SKILL LEVEL

F = OVERALL SOFTWARE SUPPORT

F-USS

E. SATISFACTION IN KEY SUPPORT AREAS FALLING

- Exhibit II-5 reveals a majority of small systems users remain dissatisfied with the level of support provided in nearly all high-priority services. Hardware engineer skill level just barely satisfies over half of the small systems sample, with other key hardware components lagging even further behind, and overall satisfaction falls below last year's reports.

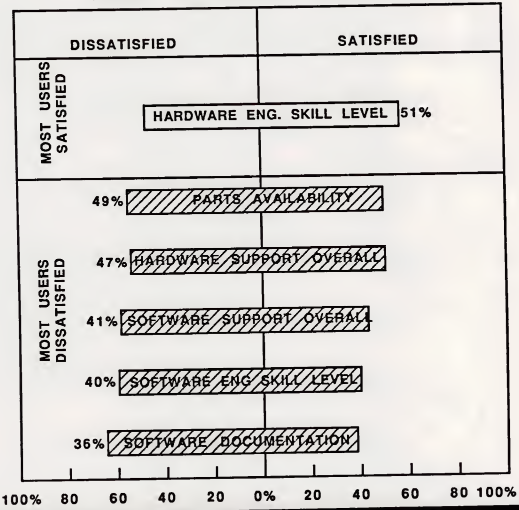
- Dissatisfaction with software services were even more pronounced, leaving 60% or more of the small systems sample disappointed with support. Software documentation remains the greatest of users' concerns, falling from its low of 40% satisfaction in 1986 to 36% this year. All areas of software support show a growing dissatisfaction among small systems users, leaving a ripe target for increasing third-party software maintenance competition.

- Small systems vendors, facing rapid and continuing increases in user service requirements, must turn full attention to fortifying both hardware and software support before futher erosion in satisfaction occurs. Third-party competition is heating up in the small systems hardware maintenance arena, and increasing interest on the software side of minicomputer support makes TPM alternatives increasingly attractive to small systems users.

EXHIBIT II-5

INPUT®

USER SATISFACTION WITH HIGH-PRIORITY SERVICES



F-USS

III SMALL SYSTEMS USER REQUIREMENTS-ALL VENDORS

III SMALL SYSTEMS USER REQUIREMENTS - ALL VENDORS

- Over the course of March and April 1987, INPUT contacted ranking data processing officials at 360 minicomputer sites to discuss the performance and their perceptions of the service received from their system vendor. Individual samples were drawn from eleven of the top small systems manufacturers, including Concurrent, DEC, HP, IBM, Tandem, and Wang. (The results of these individual vendor's analyses are presented in the following chapter.)

- In an effort to allow users to freely discuss their support concerns, the interviews were conducted by phone, each lasting approximately 20 minutes. Respondents were asked to identify certain traditional, objective performance figures (such as system availability, number of interruptions, and mean repair, response, and recovery times) as well as rate their vendor's performance in a variety of key service areas. A number of open ended questions were also posed to users throughout the interview to allow feedback on specific concerns and desires.

- The contractual breakout of the small systems sample is presented in Exhibit III-1, showing the major proportion of small systems users relying on 5-day/8-hour coverage for their systems. Only 17% of users opted for extended 7-day service, and 20% contracted for round-the-clock coverage. A similar portion (18%) of users contracted for 10- to 16-hour per day coverage, the majority of whom were under IBM standard 11-hour maintenance agreements.

EXHIBIT III-1

SERVICE CONTRACT
ALL SMALL SYSTEMS USERS

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	77
- MONDAY - SATURDAY	6
- MONDAY - SUNDAY	17
• HOURS OF COVERAGE	
- 1-9 HOURS	62
- 10-16 HOURS	18
- 17-24 HOURS	20
• BILLING INTERVAL	
- ANNUAL	17
- QUARTERLY	10
- MONTHLY	73

- Nearly three-quarters of small systems users sampled were billed monthly for their support, only 17% take advantage of the usual discounts allowed to annually paying accounts. In recognition of the savings on billing administration (as well as the greater account control security implied), vendors traditionally allow users savings of 3 to 5% on average for prepayment of their contract fees.

- The traditional measures of system and support performance for the small systems sample are examined in Exhibit III-2. The number of system interruptions experienced by minicomputer users has remained constant at an average of 1.2 per month since falling from 2.0 in 1985. System availability, however, after showing increasing improvement between 1984 and 1986 (up from 92.3% in 1984 to a high of 97.4% last year), has fallen below 97% among this year's sample (mean 96.9%).

- This regression in average system availability occurs at a time when small systems users' needs have reached an all-time high of 97.9%, steadily rising from the 90.5% reported in 1984. This increased uptime demand has paralleled the expanding processing capabilities minicomputers have developed over the past few years and reflects the entry of the more powerful small systems into increasingly critical applications. Small systems vendors, while offering the market increased capacity, have not necessarily followed with improved performance.

- User satisfaction with system availability has fallen with uptime performance to a current low of 59% in 1987 (as shown in Exhibit III-3), down drastically from 70% reported by last year's sample. Increasing requirements have surpassed small systems performance, and more minicomputer users' demands are approaching the level of their large systems counterparts, realistically expecting upwards to 100% availability from their systems. The proportion of small systems users expecting full performance has climbed 20% over the past year, with 57% of this year's users holding 100% uptime requirements compared to 35% of the 1986 sample.

EXHIBIT III-2

SERVICE PERFORMANCE
ALL SMALL SYSTEMS USERS

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
- MEAN NUMBER PER MONTH	1.2
- HARDWARE-CAUSED (PERCENT)	66.0
- SYSTEM SOFTWARE-CAUSED (PERCENT)	14.0
- APPLICATIONS SOFTWARE-CAUSED (PERCENT)	6.0
- OTHER CAUSED (PERCENT)	14.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	96.9
• MEAN RESPONSE TIME (HOURS)	3.6
• MEAN REPAIR TIME (HOURS)	3.6
• MEAN RECOVERY TIME (HOURS)	1.1

EXHIBIT III-3

USER SATISFACTION WITH SERVICE PERFORMANCE
ALL SMALL SYSTEMS USERS

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED (50 / 100)
SYSTEM AVAILABILITY (PERCENT)	97.9	59
RESPONSE TIME (HOURS)	3.7	90
REPAIR TIME (HOURS)	3.4	90
RECOVERY TIME (HOURS)	1.0	97

F-USS

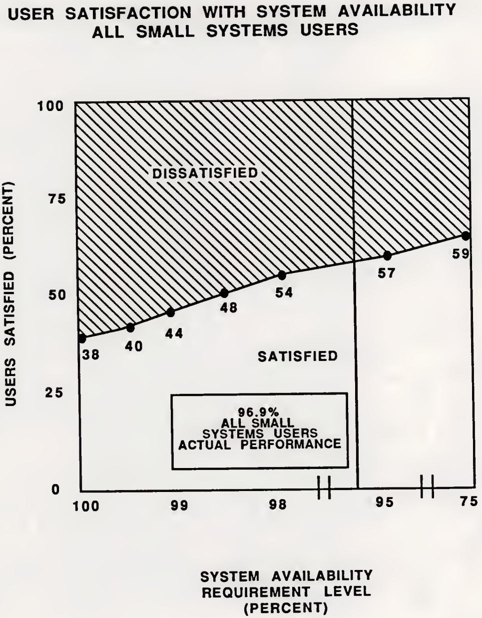
- Exhibit III-3 also shows users expressing a high degree of satisfaction with problem resolution performance, response, and repair times satisfying 90% of users, and recovery times, 97%. Vendors have, overall, stayed on top of user demands in these areas, providing prompt response to trouble calls (within 3.6 hours on average) and effecting repair in under 4 hours (3.6 mean time to repair, shown in Exhibit III-2).

- The contrast of these figures with the low satisfaction expressed in the area of system availability signals a significant change in the needs of small systems users. Increasing uptime demands are surpassing the point where improvements in maintenance performance "after the fact" can provide needed impact on total system availability. Users are not expecting better service performance, but rather are demanding improved reliability performance from their system.

- Many small systems vendors are taking note of the techniques used by their large systems predecessors, employing enhanced remote diagnostic and repair techniques as well as introducing certain levels of redundancy into their systems architecture in efforts to meet these increasing user uptime demands. Small systems users' requirements are quickly approaching those of mainframe users, and, if minicomputer manufacturers intend to stay competitive in the expanding high end of their market, they will need to be prepared to provide system performance at these levels.

- Exhibit III-4 reinforces this notion, demonstrating that only 59% of all small systems users were provided system performance that met their needs. Heavily weighting this cumulative percentage was the growing group of users demanding top system availability, only 38% of these users satisfied with uptimes received. This low percentage takes on even greater significance when considering that, for the first time, the majority of small systems users fall into this high-availability group; 59% of the small systems sample demanded 100% system availability.

EXHIBIT III-4



F-USS

- These rising uptime needs of small systems users is clearly illustrated in Exhibit III-5, as the density of user points increases along with system availability requirements along the vertical axis. The number of small systems users lying within the area of dissatisfaction jumped from 30% of the sample in 1986 to over 40% this year, due at least in part to this increasing level of user demand.

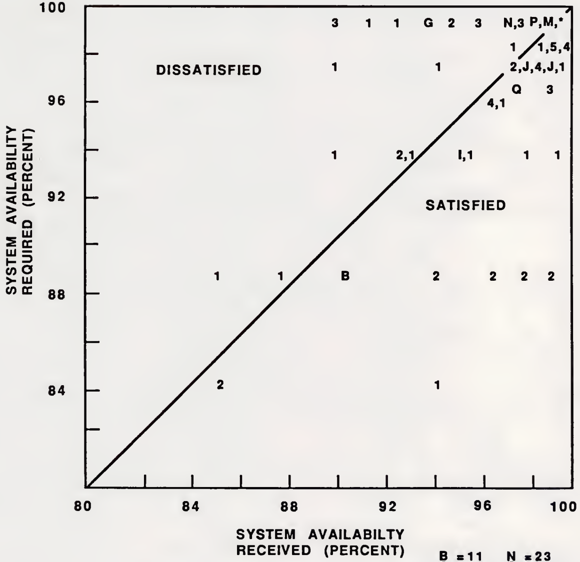
- There were cases of users with availability needs as low as 90%, however, who were also dissatisfied with their system performance. It is obviously not imperative that all small systems users receive 100% availability, but rather that vendors make themselves aware of the expectations of their specific user bases and act on their requirements.

- The major changes seen in small systems user demands are a reflection of the expanding markets minicomputer manufacturers are targeting as advances in processing power are introduced into their product lines. Many small systems vendors can compete by way of processing capacity even among industries defined by highly critical applications, such as the medical or banking sectors. More important, however, is the vendor's ability to sustain that computing capacity under the demanding conditions such applications create. System reliability as well as advanced support delivery techniques will have to be developed along with system capacity if small systems vendors are to remain competitive in this highend of the market.

- Increasing user demand had been observed in terms of specific support components as well, and services defined as most critical by previous samples were focused on in this year's survey. Exhibit III-6 compares small systems vendors' performance to the level of value users place on individual service components. Most striking are the consistent deficiencies seen in all areas of software support, and especially in documentation, mirroring problems reported industrywide.

EXHIBIT III-5

USER SATISFACTION WITH SYSTEM AVAILABILITY
ALL SMALL SYSTEMS USERS



B = 11 N = 23
G = 16 Q = 26
I = 18 P = 36
J = 19 * = 77
M = 22

F-USS

TOTAL POINTS PLOTTED: 343

EXHIBIT III-6

1987 USER PERFORMANCE/VALUE LEVELS
ALL SMALL SYSTEMS USERS

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	6.7	6.4	(0.3)
PARTS AVAILABILITY	9.0	7.9	(1.1)
REMOTE SUPPORT	7.8	7.6	(0.2)
HARDWARE ENGINEER SKILL	9.0	8.1	(0.9)
SOFTWARE ENGINEER SKILL	8.7	7.4	(1.3)
SOFTWARE DOCUMENTATION	8.8	7.2	(1.6)
SOFTWARE SUPPORT OVERALL	8.7	7.3	(1.4)
HARDWARE SUPPORT OVERALL	9.1	8.2	(0.9)

* SCALE: 1 = LOW, 10 = HIGH
** AVERAGE STANDARD ERROR OF THE MEAN = 0.1

- Exhibit III-7 ilustrates an erosion seen in all areas of software support over the past year, each falling to 41% or less satisfaction among small systems users. Users are placing increasing value on software performance as small systems are placed in more critical applications, and these support demands are remaining unmet by their system vendors. This decreasing satisfaction with systems vendors' software services, coupled with the mounting threat of third-party competition within this market, warrants manufacturers' direct attention to these key areas of service.

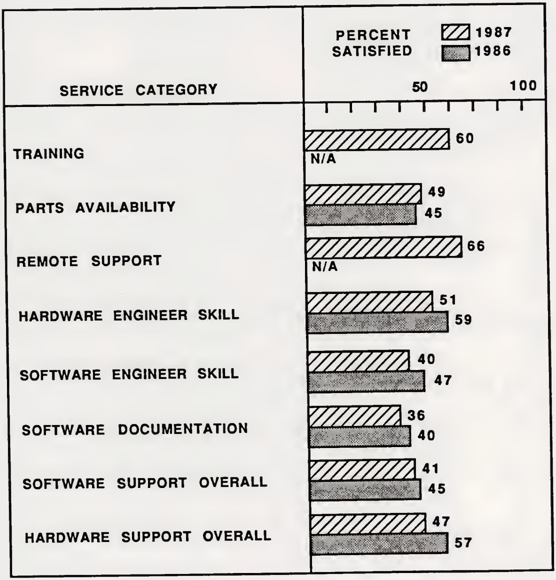
- When discussing software support, users most often cited the lack of clear and up-to-date manuals as their most pressing concern. Users expressed a low perception of the quality of updates and documentation received for their software, feeling the QC and distribution processes were sorely lacking. Software support, especially in these areas, has traditionally been left to the separate corporate division or outside entity producing the applications package sold through the systems vendor.

- Regardless of where these products originate, however, the end result directly impacts users' perceptions of the systems support operation; assuring that users are supplied with timely and useful documentation and updates becomes the responsibility of the support organization by default. Indications are that systems vendors must take a more active role in the creation and distribution of software documentation if user perceptions are to improve in this area.

- Small systems vendors fared slightly better in the traditional hardware service areas, but still failed to satisfy even half of the user sample with parts availability, engineer skill, and service overall. Parts availability surfaced as a major concern among small systems users, with many users expressing insecurities regarding the accessablity of spares in the face of critical down situations. Often considered one of the few tangible advantages of manufacturer-supplied service over TPM support, system vendors should be cautious not to let this differentiation between their service offering and third-party service erode.

EXHIBIT III-7

USER SATISFACTION LEVELS
1987 VERSUS 1986
ALL SMALL SYSTEMS USERS



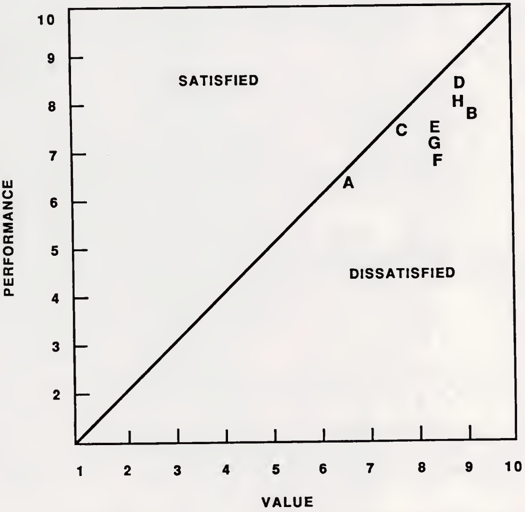
- The disparity between the value users placed on these various areas of support and small systems vendors' overall performance is demonstrated in Exhibit III-8. High-priority services remain farthest from the targeted user value in both hardware and software support. In face of increasing user needs, small systems vendors must keep close tabs on user expectations in efforts to supply satisfactory support.

- All things considered, most small systems users felt they were currently receiving the level of support for which they were paying, despite their rising needs. Eighty-five percent of users felt they received their "money's worth" for their support dollar, but a somewhat greater sensitivity to price was demonstrated as users evaluated discounting associated with increased involvement in support, as discussed in Exhibit III-9. Recognizing the opportunity to decrease support costs as well as directly impact their systems' support performance, 35% of users expressed a willingness to increase their participation in system maintenance.

- Allowing users to increase their participation could provide small systems vendors with a relatively inexpensive avenue to improved user perceptions of support. Increased user participaton in both diagnostics and actual board/component replacement tasks could work to decrease user anxiety in such key areas as parts availability, response, and repair times, and result in increases in system availbility (small systems users' most significant concern).

EXHIBIT III-8

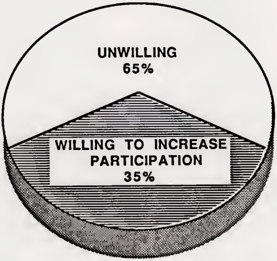
SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
ALL SMALL SYSTEMS USERS



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

EXHIBIT III-9

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE ALL SMALL SYSTEMS USERS



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	25	5	18	31	$\boxed{52}$	66	100
SWAP COMPONENTS	31	2	13	20	33	$\boxed{47}$	100
SWAP BOARDS	32	4	13	17	30	$\boxed{45}$	100

*UP TO AND INCLUDING

▭ OPTIMUM DISCOUNT LEVEL

F-USS

IV VENDOR PERFORMANCE ANALYSIS

IV VENDOR PERFORMANCE ANALYSIS

- In the following chapter, INPUT will present the individual analyses of the 11 small systems user groups interviewed in 1987. Each vendor/product analysis begins by outlining system users' contractual relationships with their vendor. Next, traditional measures of system and support performance are examined, comparing actual vendor performance to current user requirements and determining levels of user satisfaction at various levels of performance and needs.

- Specific aspects of both hardware and software support are then analyzed separately, measuring the level of service provided against users' perceived value of the support component. Eight specific service areas (which last year's analyses determined most critical) are examined, and user satisfaction in each area is compared to the vendor's performance reported in the 1986 report.

- Finally, user willingness to increase participation in support of their system is examined, and the impact and opportunities arising for each vendor from such activities is discussed.

A. AT&T 3B

- In February and March 1987, INPUT interviewed 30 users of AT&T 3B minicomputers regarding their vendor's service performance. The sample was split between users of AT&T 3B5 systems (60%) and users of the 3B2 system (40%). The top data processing official at each site was targeted for response, with the majority of participants in the survey holding DP/MIS director positions. Other respondent titles ranged from Vice President-Technical Services to operations manager and computer engineer.

- The education industry was heavily represented in the sample, constituting 40% of the users contacted. Manufacturing firms comprised 17% of the sample, the service industry 14%, distribution 10%, and transportation 7%. The remaining 12% of the sample was split evenly between the utilities, insurance, medical, and "other industry-specific" categories.

- Exhibit IV-1 profiles the sample's service contract coverage and indicates that the majority (85%) of AT&T users received service during normal business hours, five days a week. The remaining 15% of the sample contracted for extended coverage, seven days a week and up to 24 hours per day. Most users were billed monthly for their service (63%).

- 3B system performance is outlined in Exhibit IV-2, along with service response and repair statistics. The sample reported 1.4 system interruptions occurring each month on average, 68% of which were hardware-caused. Twenty-three percent were software-caused, with 15% the fault of systems software problems, and 8% caused by applications packages. The remaining 9% of the interruptions were due to external causes, such as user error, power failure, and various environmental factors. These figures indicate that a down situation occurred nearly once a month due to hardware failure alone--an especially unacceptable situation for the 56% of users requiring 100% uptime performance. Of the entire small systems user sample, AT&T users received the lowest average system availability.

EXHIBIT IV-1

SERVICE CONTRACT
AT&T 3B

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	85
- MONDAY - SATURDAY	0
- MONDAY - SUNDAY	15
• HOURS OF COVERAGE	
- 1-9 HOURS	85
- 10-16 HOURS	0
- 17-24 HOURS	15
• BILLING INTERVAL	
- ANNUAL	33
- QUARTERLY	4
- MONTHLY	63

EXHIBIT IV-2

SERVICE PERFORMANCE
AT&T 3B

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
- MEAN NUMBER PER MONTH	1.4
- HARDWARE-CAUSED (PERCENT)	68.0
- SYSTEMS SOFTWARE-CAUSED (PERCENT)	15.0
- APPLICATIONS SOFTWARE-CAUSED (PERCENT)	8.0
- OTHER CAUSED (PERCENT)	9.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	94.4
• MEAN RESPONSE TIME (HOURS)	5.7
• MEAN REPAIR TIME (HOURS)	9.3
• MEAN RECOVERY TIME (HOURS)	0.7

FUSS

- Response to these down situations was reported as close to 6 hours on average for 3B users, although responses ranged between 1 and 24 hours within the sample. Repair times reported also varied greatly, from 30 minutes to 24 hours on the average, mean time to repair falling just over 9 hours for the sample as a whole. These responses and repair statistics well exceed the averages of the combined small systems user sample. AT&T mean response time exceeded all users' average by 2.1 hours and repair times exceeded the total sample mean by 5.7 hours. These shortcomings contribute heavily to the reduced system availability reported.

- Comparing performance in these areas with user expectations, Exhibit IV-3 presents user satisfaction with these support factors. Users reported relatively low requirements for response and repair times compared to other minicomputer users surveyed (requiring 3.7 and 3.6 hours, respectively). AT&T users sampled expected response within 6 hours (mean response 5.9 hours) and repair to be completed within an 8-hour period (mean response 7.8). Up against these requirement standards, AT&T fared relatively well in satisfying users in both response and repair areas, meeting the requirements of 78% and 75% of the sample, respectively. Recovery time after repair had been affected was satisfactory for all users sampled.

- Despite meeting users' expectations in response and repair performance, satisfaction with system availability was relatively low among 3B users. Only half of AT&T users were provided with the level of uptime required, their needs exceeding actual 3B performance by 1.7% on the average. Uptime needs ranged between 75% and 100%, while actual performance fell as low as 60% availability. On average with this represents a drop in 3B systems availability of 4.3% from 1986, with users reporting 98.7% uptime last year.

- Exhibit IV-4 revisits the area of system availability, mapping out user satisfaction relative to user requirements on the 3B system. As previously mentioned, over half of the sample required 100% uptime. Of these high-requirement users, only 29% received system performance up to this standard.

EXHIBIT IV-3

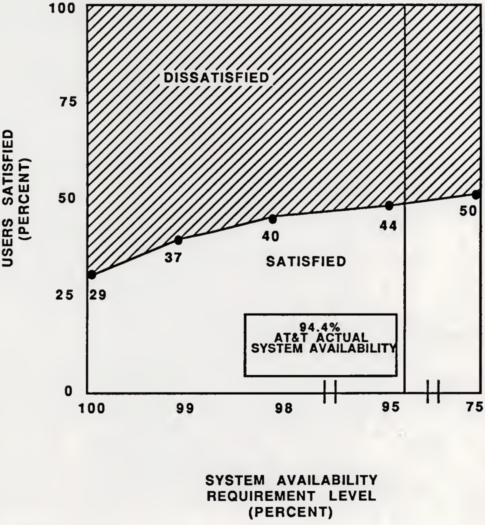
USER SATISFACTION WITH SERVICE PERFORMANCE AT&T 3B

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED
SYSTEM AVAILABILITY (PERCENT)	96.1	50
RESPONSE TIME (HOURS)	5.9	78
RESPONSE TIME (HOURS)	7.8	75
RECOVERY TIME (HOURS)	0.8	100

FUSS

EXHIBIT IV-4

USER SATISFACTION WITH SYSTEM AVAILABILITY
AT&T 3B



F-USS

Actual performance of 3B systems, averaging 94.4%, provides satisfactory uptimes for somewhat less than 50% of users.

- The dispersion of user requirements is plotted in Exhibit IV-5, graphically reinforcing the need of AT&T users for increased system availability. The increasing density of sample points approaching the 100% system availability level clearly illustrates the benefit in terms of customer satisfaction to be gained by increasing system availability for 3B users. Even slight increases in performance can greatly increase customer satisfaction at these levels.

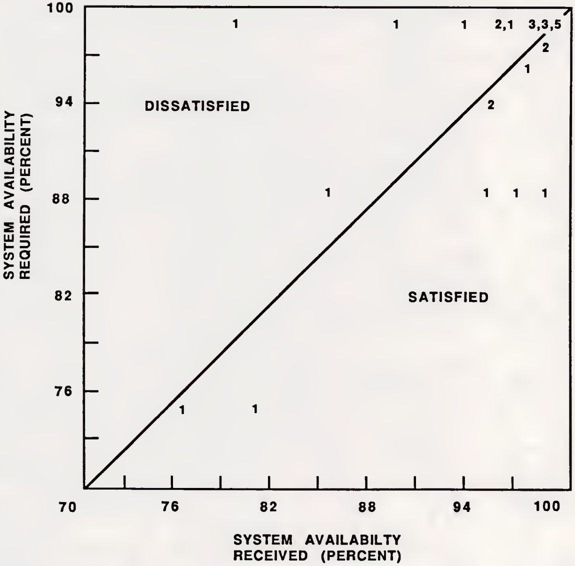
- Various aspects of AT&T support are analyzed in Exhibit IV-6 in terms of both perceived value and AT&T performance within each area. The area in most need of improvement is that of software documentation, a problem common to many systems manufacturers. In this area of highest value to users (rating 8.9), AT&T fails to meet user expectations by a margin of 2.4 points. When asked to identify their most pressing software support concerns, users pointed to software documentation more often than any other aspect of software support, clearly identifying their perception of AT&T's weakness in this area.

- Parts availability is a second area of concern for AT&T users, ratings falling 1.9 points below user value. Users most often mentioned the availability of spare parts as one of the most essential sevices provided within their maintenance contract and valued spare parts access at the same level as hardware support overall. As a key component to satisfaction with hardware service on the whole, the anxiety expressed by users over the ready availability of spare parts must be addressed. Ready availability of spares is often a major consideration of users when weighing vendor support against TPM alternatives. AT&T should be cautioned against neglecting a point in their favor in the battle against TPM penetration into their customer base.

- Exhibit IV-7 compares 1986 user satisfaction in these areas to this year's response. Software documentation, satisfying only 19% of users, is the area in need of greatest attention. Happiness with software support overall, although

EXHIBIT IV-5

USER SATISFACTION WITH SYSTEM AVAILABILITY
AT&T 3B



F-USS

TOTAL POINTS PLOTTED: 28

EXHIBIT IV-6

1987 USER PERFORMANCE/VALUE LEVELS
AT&T 3B

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	5.8	4.6	(1.2)
PARTS AVAILABILITY	8.8	6.9	(1.9)
REMOTE SUPPORT	7.8	7.7	(0.1)
HARDWARE ENGINEER SKILL	8.7	7.1	(1.6)
SOFTWARE ENGINEER SKILL	8.7	7.3	(1.4)
SOFTWARE DOCUMENTATION	8.9	6.3	(2.6)
SOFTWARE SUPPORT OVERALL	8.2	7.1	(1.1)
HARDWARE SUPPORT OVERALL	8.8	7.3	(1.5)

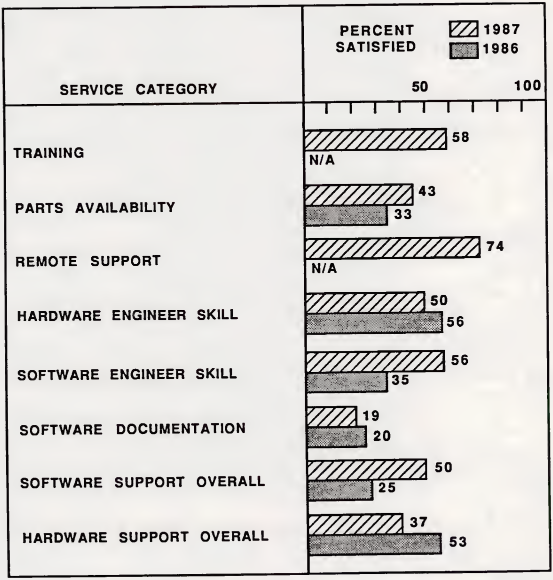
* SCALE: 1 = LOW, 10 = HIGH

** AVERAGE STANDARD ERROR OF THE MEAN = 0.5

F-USS

EXHIBIT IV-7

USER SATISFACTION LEVELS
1987 VERSUS 1986
AT&T 3B



showing marked improvement over the past year, still satisfies only half of the sample respondents, with the issue of documentation weighing heavily upon further improvement. Improvements in software engineer skill seen over the year undoubtedly contributed to increased software support satisfaction.

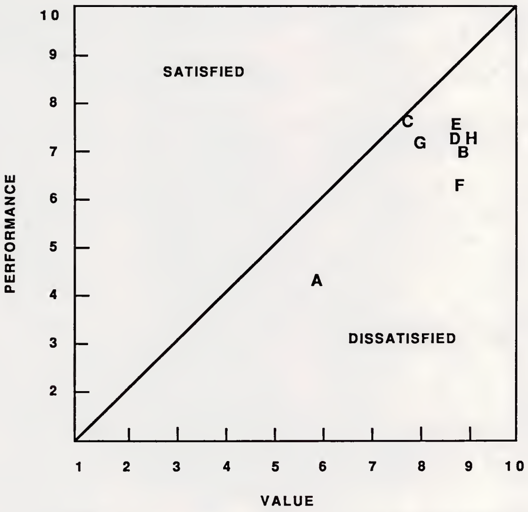
- Conversely, a drop in satisfaction with hardware engineer skill level contributed to the more severe decrease in satisfaction with hardware service overall between 1986 and 1987. Over half of the respondents indicated that hardware maintenance was the aspect of contractual support most important to them; efforts must be taken by AT&T to improve these key components of hardware support--namely parts availability and engineer skill--which continue to fall below user requirement levels.

- Exhibit IV-8 graphically illustrates areas of AT&T support in need of improvement. Again, software documentation, as well as software support overall, fell well below the targeted level of user value. Likewise, parts availability and hardware support overall, two of the highest valued aspects of service, deserve serious attention from the vendor. When asked if they felt they received the level of support for which they were paying, 80% of AT&T users replied "yes." Of the 20% who felt they were not receiving their money's worth, concern was over hardware support in particular. Considering the high priority users assign to hardware service as part of their contract coverage, these shortcomings deserve AT&T's concerted attention to avoid any further erosion of user satisfaction.

- Exhibit IV-9 examines user attitudes toward increased participation in maintenance of their system. Forty percent of the AT&T user sample expressed an interest in increasing involvement, but not without significant discounting of their current maintenance fees. Participation in problem diagnosis was expected to yield an average discount of one-third of contract price, while swapping boards or system components required 45% and 42% discounts, respectively. These discounts represent a significant cost to AT&T for users' assistance with relatively simple maintenance tasks and indicate that AT&T

EXHIBIT IV-8

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
AT&T 3B

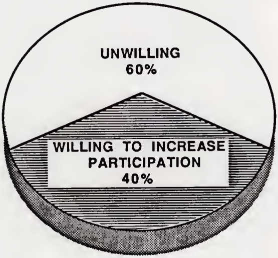


A = TRAINING
B = PARTS AVAILABILITY
C = REMOTE SUPPORT
D = HARDWARE ENGINEER SKILL LEVEL
E = SOFTWARE ENGINEER SKILL LEVEL
F = SOFTWARE DOCUMENTATION
G = SOFTWARE SUPPORT OVERALL
H = HARDWARE SUPPORT OVERALL

FUSS

EXHIBIT IV-9

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE
AT&T 3B



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT — DISCOUNT LEVEL REQUIRED* 5%	10%	15%	20%	25%	25+%
DIAGNOSIS	33	0	0	0	11	$\boxed{56}$	100
SWAP COMPONENTS	42	0	0	0	14	26	100
SWAP BOARDS	45	0	0	0	17	17	100

*UP TO AND INCLUDING

OPTIMUM DISCOUNT LEVEL

F-USS

users prefer and expect their maintenance vendor to facilitate support even down to the diagnostic and board swapping level.

B. CONCURRENT 32XX

- INPUT interviewed key data processing personnel at 30 Concurrent 32XX user sites in March and April of this year regarding the support they received from their vendor. The sampled firms were predominantly manufacturing (36%) and service operations (27%); financial and education industries were each represented by 11% of the sample, and distribution, insurance, medical each comprised 3%. State/local and federal government operations constituted the remaining 6% of the sample.

- Exhibit IV-10 presents the breakout of the Concurrent contract customer-sample. Nearly three-quarters (73%) of respondents received coverage five days a week during normal working hours, and the majority of users (63%) were billed month-to-month for service. Thirty percent of the sample contracted annually for support.

- Concurrent actual system performance is examined in Exhibit IV-11. Users of Concurrent systems reported among the lowest number of system interruptions of the entire small systems sample, with an average of 0.8 interrupts experienced monthly. The number of failures reported ranged from 0.0 to 3.0 per month, but the median response was a low 0.3. One-third of these downtimes were not caused by Concurrent hardware or software failures, but other environmental, user, or planned interruptions. Considering this factor, it can be implied that Concurrent systems failed less than once every two months, by far the best performance among the total small systems sample (which averaged 1.2 interrupts monthly).

EXHIBIT IV-10

SERVICE CONTRACT
CONCURRENT 32XX

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	73
- MONDAY - SATURDAY	3
- MONDAY - SUNDAY	24
• HOURS OF COVERAGE	
- 1-9 HOURS	73
- 10-16 HOURS	10
- 17-24 HOURS	17
• BILLING INTERVAL	
- ANNUAL	30
- QUARTERLY	7
- MONTHLY	63

EXHIBIT IV-11

SERVICE PERFORMANCE
CONCURRENT 32XX

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
- MEAN NUMBER PER MONTH	0.8
- HARDWARE-CAUSED (PERCENT)	48.0
- SYSTEMS SOFTWARE-CAUSED (PERCENT)	10.0
- APPLICATIONS SOFTWARE-CAUSED (PERCENT)	9.0
- OTHER CAUSED (PERCENT)	33.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	99.0
• MEAN RESPONSE TIME (HOURS)	3.0
• MEAN REPAIR TIME (HOURS)	2.3
• MEAN RECOVERY TIME (HOURS)	0.3

- Concurrent users also received the highest system availability among the small systems sample, reporting 99% uptime on average. Quick reponse and action on user calls no doubt contributed to the high reported availability, with users receiving response in 3.0 hours and system repair within 2.5 hours on average. Recovery was affected within an average of 20 minutes of repair, according to the user sample.

- Despite the high system availability reported on average, a very large percentage of Concurrent users remained dissatisfied with their system performance: Exhibit IV-12 shows only 23% of the sample as satisfied with system availability received. A closer look at the response breakdown, however, reveals that an extremely high percentage (83%) of the Concurrent user base required 100% system availability. Nearly every user expressing dissatisfaction with uptime was a part of this high-availability group.

- This concentration of high-availability users is indicative of the increased demands small systems users are placing on their vendors. User requirements rose from 96.8% in 1985 to an overall average of 97.9% this year. Concurrent users' needs have historically been at the high-end of the total sample, and this year was no exception, with 32XX users placing higher demands on their system than any other among our user sample, requiring 99.4% availability on average. Although Concurrent users receive the highest performance among the small systems sample, they expect that and more from their vendor.

- Response, repair, and recovery times satisfied the vast majority of Concurrent users (see Exhibit IV-12), leaving little room for improvement and minimally impacting actual uptime performance. Users are, in general, not expecting better performance from Concurrent's maintenance staff, but rather from the system itself. Concurrent's field engineers come very close to meeting users' expectations in repair times and exceed their requirements in reponse to trouble calls. With response and repair times averaging under three hours already, improvements in these areas will have little impact on the users' actual area of concern--system availability. If user satisfaction

EXHIBIT IV-12

USER SATISFACTION WITH SERVICE PERFORMANCE CONCURRENT 32XX

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED
SYSTEM AVAILABILITY	99.4	23
RESPONSE TIME (HOURS)	4.7	93
REPAIR TIME (HOURS)	2.1	92
RECOVERY TIME (HOURS)	0.3	100

F-USS

with availability is to be improved, Concurrent must concentrate future efforts on actual system reliability. Even though experiencing only 0.8 interrupts per month, the vast majority of concurrent users require complete freedom from interruption. Concurrent users ask for more than quick response to their problems; users are requiring Concurrent not to reduce the time it takes to remedy a problem, but rather to reduce the actual number of problems encountered.

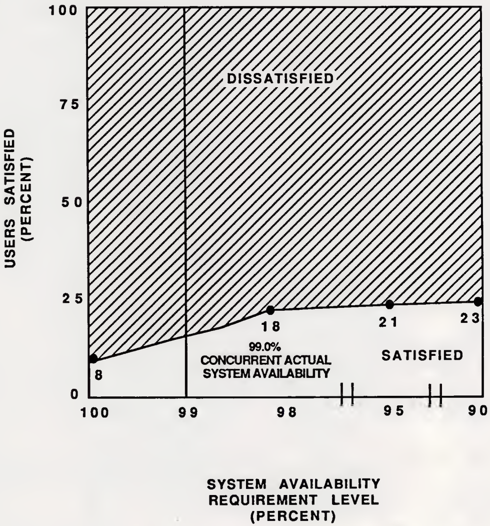
- Exhibit IV-13 illustrates user frustration with the level of system availability received, regardless of the high availbility reported on average. As previously mentioned, the 83% of users requiring 100% system availability experience extremely low satisfaction with uptime, with only 8% of these users' systems performing to their requirements. This high incidence of dissatisfaction heavily weights the cumulative percentages at the lower requirement levels.

- A more specific picture of user needs compared to Concurrent performance is presented in Exhibit IV-14. User expectations are concentrated along the highest level of system availability, with only two users among the group falling in the satisfied category. Although users in this 100% availability group are receiving uptimes between 99% and 100% for the most part, the vast majority of Concurrent users are expecting a technology that affords them uninterrupted service from their system. Advances in remote support technology and fault tolerant architectures offer possible directions for vendors facing such high user requirements.

- Exhibit IV-15 examines individual areas of Concurrent support, comparing user needs to vendor performance. Again, Concurrent users express high expectations in many areas of service, requiring higher levels of support in key areas than did the majority of the total small systems sample. Concern over parts availability was among the highest of the total sample at 9.4, users rating spares support provided by Concurrent at a level of 8.3. Although this performance exceeds what small systems users received on average, it still falls well below demands of Concurrent users. When asked thier most pressing

EXHIBIT IV-13

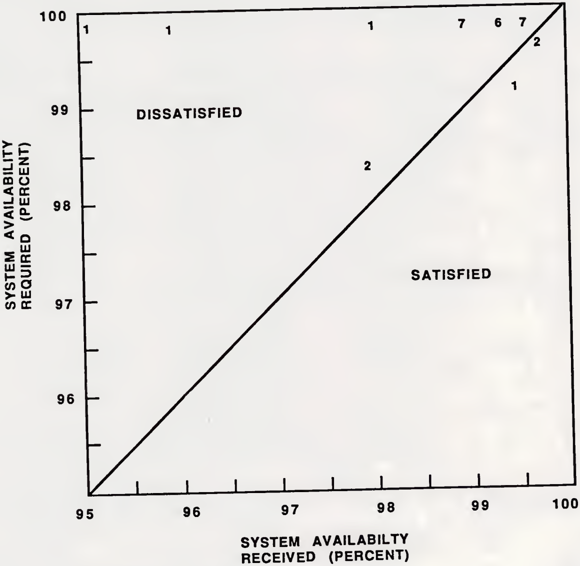
USER SATISFACTION WITH SYSTEM AVAILABILITY
CONCURRENT 32XX



FUSS

EXHIBIT IV-14

USER SATISFACTION WITH SYSTEM AVAILABILITY
CONCURRENT 32XX



TOTAL POINTS PLOTTED: 30

F-USS

EXHIBIT IV-15

1987 USER PERFORMANCE/VALUE LEVELS
CONCURRENT 32XX

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	6.2	5.9	(0.3)
PARTS AVAILABILITY	9.4	8.3	(1.1)
REMOTE SUPPORT	7.8	7.4	(0.4)
HARDWARE ENGINEER SKILL	9.4	8.1	(1.3)
SOFTWARE ENGINEER SKILL	9.5	7.8	(1.7)
SOFTWARE DOCUMENTATION	8.9	7.1	(1.8)
SOFTWARE SUPPORT OVERALL	9.4	7.9	(1.5)
HARDWARE SUPPORT OVERALL	9.4	8.1	(1.3)

* SCALE: 1 = LOW, 10 = HIGH

** AVERAGE STANDARD ERROR OF THE MEAN = 0.4

hardware service concern, users most often mentioned parts availability and frequently alluded to the unavailability of a local spares stock. The consideration of on-site inventories at major account sites in conjunction with providing the "man in the van" with a better stock of commonly needed spares could contribute greatly to improved satisfaction in this area.

- Two other critical areas of support were hardware and software engineer skill levels, which in turn contributed to dissatisfaction with hardware and software support overall. Another common area of comment by users, the competence of field staff, was often questioned, users suggesting additional training and additional personnel could help alleviate their concern. Again, Concurrent users' were among the very highest requirements in both engineer skill categories, and although the level received met or exceeded small systems performance on average, high expectations led to low satisfaction levels among the sample.

- Exhibit IV-16 presents additional information on these individual areas of support, comparing current user satisfaction with last year's results. Parts availability showed the most dramatic improvement over the past year, but, again, was still mentioned most frequently as an area of concern by users. Hardware and software engineer skill, on the other hand, saw considerable drops in satisfaction between 1986 and 1987. Often, the only ongoing interface users have with their vendor is through their field technician, and as users lose confidence in this representative, so do they in the company as a whole and the products themselves. An investment in a field engineer's training can often times equate to an investment in a customer confidence.

- Exhibit IV-17 graphically illustrates the need for improvement in these areas of service. Software documentation, a problem felt industry-wide, is an additional area falling well below user needs. Problems with the clarity and currency of software manuals and documentation were often cited by respondents as a pressing concern. Documentation that is helpful and can be understood by users can save a vendor considerable time and money in the

EXHIBIT IV-16

USER SATISFACTION LEVELS
1987 VERSUS 1986
CONCURRENT 32XX

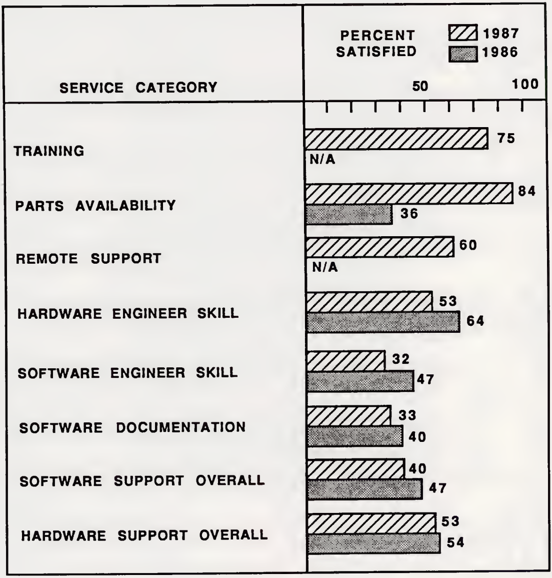
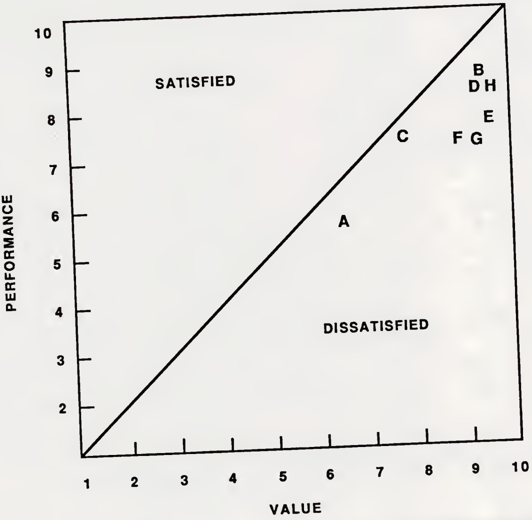


EXHIBIT IV-17

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
CONCURRENT 32XX



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

long run. Users need less assistance from the vendor staff when issues are made clear in a reference document. As users become more advanced in their understanding of their system and software, even greater demands will be made in this area. Most vendors currently rate below user needs in this area, and documentation provides an opportunity for differentiation for vendors willing to invest the effort to bring their documentation up to acceptable levels.

- As Exhibit IV-18 shows, Concurrent users admitted little interest in increasing their participation in actual physical maintenance. In exchange for simple component and board swapping tasks, users expected a discount of 40% off of their contract price on average. Participation in diagnosis, however, was perceived as a much more reasonable area of participation, the majority of users willing to participate for a discount of 20%. The majority of Concurrent users, however, expressed contentment with their service arrangement as it stands, 66% of the sample remaining unwilling to increase their part in support of their system. When asked if users felt they received the level of support they paid for, 83% replied "yes."

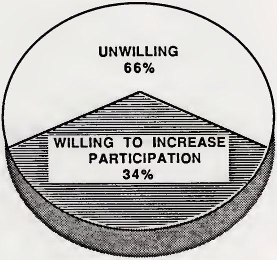
C. DATA GENERAL MV 10,000 and MV 20,000

- Thirty users of DG MV 10,000 and 20,000 minicomputers were contacted during March 1987, regarding the system support they received from Data General. Spread across a number of industry categories, the sample consisted of 26% manufacturing firms, 20% medical institutions, and 14% each of the distribution, education, and services industries. Banking/finance, insurance, federal government, and state/local government sectors were each represented by 3% of the sample.

- The service contract terms of the Data General sample are presented in Exhibit IV-19. The majority of DG MV users received support five days per

EXHIBIT IV-18

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE CONCURRENT 32XX



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	29	0	43	43	57	57	100
SWAP COMPONENTS	40	0	0	0	0	0	100
SWAP BOARDS	40	0	0	0	0	0	100

*UP TO AND INCLUDING

OPTIMUM DISCOUNT LEVEL

F-USS

EXHIBIT IV-19

SERVICE CONTRACT
DATA GENERAL MV 10, 20XXX

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	79
- MONDAY - SATURDAY	14
- MONDAY - SUNDAY	7
• HOURS OF COVERAGE	
- 1-9 HOURS	46
- 10-16 HOURS	33
- 17-24 HOURS	21
• BILLING INTERVAL	
- ANNUAL	12
- QUARTERLY	8
- MONTHLY	80

week (79%), under 9 hours daily in 46% of the cases, from 10 to 16 hours in one-third of the cases, and up to 24 hours in 21% of the cases. Eighty percent of these users were billed month-to-month for these services.

- Exhibit IV-20 examines the performance of the DG MV 10,000 and 20,000 systems and of its support staff in the face of down situations. MV users experienced among the highest number of system interruptions of the entire small systems sample, reporting 1.8 interruptions per month on average. Although the majority (65%) of these interruptions were the cause of hardware failures, 25% were attributable to software trouble, traditionally a problematic area for Data General users which has, however, been showing improvement over the past few years: Users reported 37% of system interrupts as due to software failure last year, down from 46% in 1985.

- Despite this high incidence of failure, the impact of these interruptions on total system uptime were minimized through the prompt response and action of Data General field support. Showing commendable improvements over last year's figures, Data General responded to trouble calls in just over 2 hours, and facilitated system repairs in an average of 3.5 hours. Overall system availability was reported at 98.3%, well above what would be expected when initially considering the number of system interruptions reported each month.

- User expectations are compared to this performance in Exhibit IV-21. Satisfying only 57% of users, actual system availability falls slightly below user needs on average at 98.5%. MV users reported a wide array of system availability requirements (ranging from 90% through 100% uptime needs), but the mean requirement was heavily weighted toward the high end, with well over half of respondents requiring 100% system availability. Actual performance at 98.3% does, however, represent considerable improvement over past Data General performance, since users reported just over 97% uptime in both 1985 and 1986.

EXHIBIT IV-20

SERVICE PERFORMANCE
DATA GENERAL MV 10, 20XXX

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
- MEAN NUMBER PER MONTH	1.8
- HARDWARE-CAUSED (PERCENT)	65.0
- SYSTEMS SOFTWARE-CAUSED (PERCENT)	20.0
- APPLICATIONS SOFTWARE-CAUSED (PERCENT)	5.0
- OTHER CAUSED (PERCENT)	10.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	98.3
• MEAN RESPONSE TIME (HOURS)	2.1
• MEAN REPAIR TIME (HOURS)	3.5
• MEAN RECOVERY TIME (HOURS)	1.3

FUSS

EXHIBIT IV-21

USER SATISFACTION WITH SERVICE PERFORMANCE
DATA GENERAL MV 10, 20XXX

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED
SYSTEM AVAILABILITY	98.5	57
RESPONSE TIME (HOURS)	2.2	90
REPAIR TIME (HOURS)	3.6	93
RECOVERY TIME (HOURS)	1.3	100

F-USS

- When asked to rate the importance of individual aspects of contract service, users most often cited quick response as the most essential component of their agreement, and Data General has targeted this important user requirement well. Mean response and repair times come very close to exactly approximating user requirements of 2.2 and 3.6 hours respectively, both satisfying over 90% of the respondent sample (see Exhibit IV-21). The average recovery time exactly met user needs at 1.3 hours, and every user among the sample reported satisfaction with this performance.

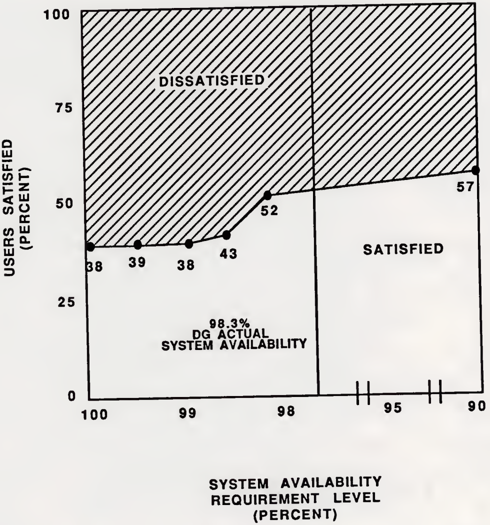
- Exhibit IV-22 reconsiders the problem of user satisfaction with system availability. Dissatisfaction of users requiring between 99% and 100% availability is consistantly low at the 38-39% satisfied level. Even including users expressing the lowest level of need, only 57% are receiving the availability required. As is becoming an emerging trend, vendors like Data General are providing increased support in the form of response to problems while users' availability requirements are surpassing the net effect these improvements can make. Although Data General has shown improvement in the speed with which they deliver service, users are requiring system availabilities at increased rates each year (up to 98.5% this year from 97.4% in 1986).

- Exhibit IV-23 plots system availability requirements against Data General performance and reinforces the importance of increasing uptimes if user satisfaction is to be improved. Also revealed is the potential for those users positioned just within the satisfied segment to slip into the area of dissatisfaction with even a slight upgrade in their availability needs. Although those users are currently expressing satisfaction with the level of uptime they are receiving, their satisfaction with Data General performance cannot be taken for granted when lying that close to the deciding edge.

- Specific aspects of Data General support performance are examined in Exhibit IV-24. Most notably, software support is missing the mark on every aspect discussed--software engineer skill level, software documentation, and support overall. The requirements of Data General users met or exceeded those of

EXHIBIT IV-22

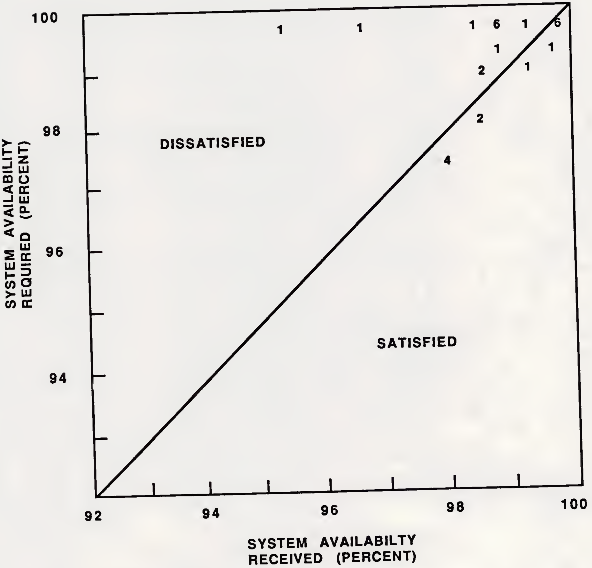
USER SATISFACTION WITH SYSTEM AVAILABILITY
DATA GENERAL MV 10, 20XXX



F-USS

EXHIBIT IV- 23

USER SATISFACTION WITH SYSTEM AVAILABILITY
DATA GENERAL MV 10, 20XXX



F-USS TOTAL POINTS PLOTTED: 27

EXHIBIT IV-24

1987 USER PERFORMANCE/VALUE LEVELS
DATA GENERAL MV 10, 20XXX

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	7.4	6.2	(1.2)
PARTS AVAILABILITY	9.1	7.3	(1.8)
REMOTE SUPPORT	7.8	6.9	(0.9)
HARDWARE ENGINEER SKILL	9.1	8.1	(1.0)
SOFTWARE ENGINEER SKILL	9.1	6.8	(2.3)
SOFTWARE DOCUMENTATION	8.8	7.1	(1.7)
SOFTWARE SUPPORT OVERALL	8.9	6.8	(2.1)
HARDWARE SUPPORT OVERALL	9.3	8.2	(1.1)

* SCALE: 1 = LOW, 10 = HIGH

** AVERAGE STANDARD ERROR OF THE MEAN = 0.4

F-USS

the total small systems sample for all three of these components. Data General support, however, consistently fell below average small systems performance in each of these areas. As mentioned earlier, software reliability has been a problem for Data General and could well be the cause for such high requirements for software support. In light of the increasing penetration third-party maintenance vendors are expected to make in the software support area in the near future, significant attention should be paid to strengthening these areas before competition for the software support dollar increases.

- When asked of their greatest concerns with software support, a common complaint was inability to access the appropriate level of software support personnel. Increasing the knowledge base and experience of the active staff is the most obvious solution to such complaints, but the installation of a more effective escalation procedure may be a more practical route. Some users may be expressing an artificially inflated need when requesting to deal with a higher level software engineer, but a smooth running escalation policy can eliminate real problems of this nature as well accommodate user concerns in this critical area.

- Parts availability is another area showing need for improvement in Exhibit IV-24. Often mentioned as an area of concern by Data General users, performance in this area falls well below small systems users' requirements on average and, again, as an area seen as lacking by Data General users is required at a level above the total user sample. Many users identified parts availability as an essential part of their contract coverage, but performance in this area fell below needs by close to two points. DG should be aware of the importance users place on this aspect of support and not overestimate a manufacturer's advantage over TPM alternatives in spares access. Users often consider parts availability as an advantage to manufacturer-supplied service, and vendors should not let this differentiation between vendor and third-party support erode.

- Exhibit IV-25 reconsiders these areas of weakness in Data General support. Each aspect of software support previously discussed has shown declines in already low user satisfaction. Parts availability, considered a key area of Data General support, has seen even more drastic downturns over the past year, no doubt impacting the deterioration from 50% to 20% satisfaction with hardware support overall. Increasing demands users continue to place on small systems vendors are undoubtedly at the root of the low satisfaction reported by the sample. Between this year and last, requirements rose or remained high for virtually every aspect of hardware and software support.

- Exhibit IV-26 graphically contrasts users' target support levels with Data General performance in each area. Meeting user service requirements is no easy task, especially when the target continues to move, but is a necessity if manufacturers are to compete in today's market. As small systems become increasingly powerful, users are placing those systems in increasingly critical applications where the security of reliable support becomes a neccessity. Small systems vendors must grow their service capabilities along with their machines' capacity in order to keep users satisfied.

- User willingness to increase their participation in support is discussed in Exhibit IV-27. In efforts to improve their maintenance support, 30% of Data General users were willing to increase their involvement in tasks ranging from assisting in diagnosis to physically swapping boards and components. For this assistance, users expected discounts ranging from 10% to 50% on their current contact price, but on average would perform such activities for 23% to 24% reductions. The majority of Data General users (70%), however, remained unwilling to increase participation, preferring to leave support in the hands of their vendor.

EXHIBIT IV-25

USER SATISFACTION LEVELS
1987 VERSUS 1986
DATA GENERAL MV 10, 20XXX

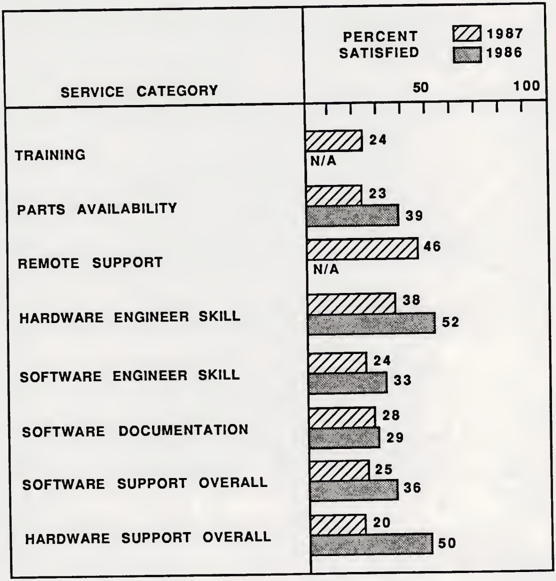
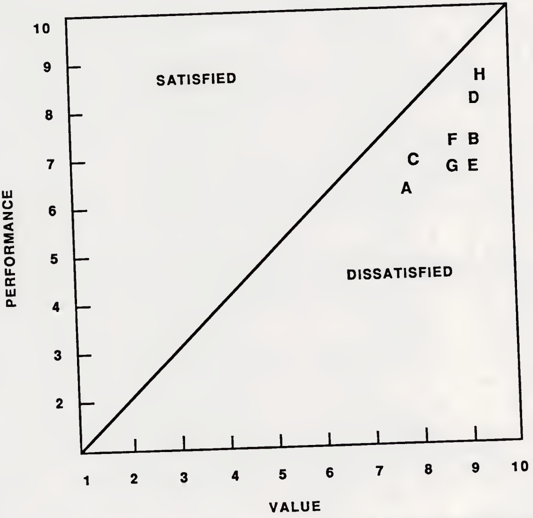


EXHIBIT IV-26

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
DATA GENERAL MV 10, 20XXX

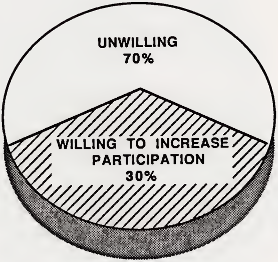


A = TRAINING
B = PARTS AVAILABILITY
C = REMOTE SUPPORT
D = HARDWARE ENGINEER SKILL LEVEL
E = SOFTWARE ENGINEER SKILL LEVEL
F = SOFTWARE DOCUMENTATION
G = SOFTWARE SUPPORT OVERALL
H = HARDWARE SUPPORT OVERALL

F-USS

EXHIBIT IV-27

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE DATA GENERAL MV 10, 20XXX



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT — DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	23	0	11	33	67	78	100
SWAP COMPONENTS	24	0	14	28	57	71	100
SWAP BOARDS	24	0	14	28	57	71	100

*UP TO AND INCLUDING

OPTIMUM DISCOUNT LEVEL

F-USS

D. DEC VAX 11/780

- In March of this year, INPUT contacted 40 users of VAX 11/780 systems regarding the support they received from DEC. Of the sample respondents, 67% held data processing/information systems managerial positions, 15% were operations or technical managers, and 8% were general administrators. By industry, the sample was well distributed over a variety of categories, with the highest concentration in education (25%), manufacturing (23%), and services (23%) firms. Distribution and telecommunications operations each comprised 8% of the sample, federal government 5%, and the remaining 8% was spread evenly among utilities, banking/finance, insurance, and "other industry-specific" categories.

- Contract terms of the DEC users surveyed are summarized in Exhibit IV-28. The majority of users contracted annually for support (69%) and received coverage over 5 days (76%), under 9 hours daily (68%). Twenty-four hour coverage was the next most popular option, with 20% of users contracting for the extended support.

- Traditional system and support performance measures for the DEC 11/780 group are outlined in Exhibit IV-29. An average of 1.3 system interruptions per month were experienced by 11/780 users, closely approximating that reported across the entire small systems sample. The majority of the interruptions were attributed to hardware failures, and reflective of this, DEC users valued hardware maintenance service over other components of their support contract.

- A second highly valued aspect of DEC contract service was the guarantee of quick response to maintenance calls. Response times reported were well below DEC's four-hour commitment for 11/780 systems, and at an average of 2.6 hours, fall well below the mean small systems user response. Repair times also beat those of small systems vendors on average, at just over 3 hours (3.1),

EXHIBIT IV-28

SERVICE CONTRACT
DEC VAX 11/780

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	76
- MONDAY - SATURDAY	12
- MONDAY - SUNDAY	12
• HOURS OF COVERAGE	
- 1-9 HOURS	68
- 10-16 HOURS	12
- 17-24 HOURS	20
• BILLING INTERVAL	
- ANNUAL	69
- QUARTERLY	5
- MONTHLY	26

EXHIBIT IV-29

SERVICE PERFORMANCE
DEC VAX 11/780

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
- MEAN NUMBER PER MONTH	1.3
- HARDWARE-CAUSED (PERCENT)	72.0
- SYSTEMS SOFTWARE-CAUSED (PERCENT)	9.0
- APPLICATIONS SOFTWARE-CAUSED (PERCENT)	6.0
- OTHER CAUSED (PERCENT)	13.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	97.4
• MEAN RESPONSE TIME (HOURS)	2.6
• MEAN REPAIR TIME (HOURS)	3.1
• MEAN RECOVERY TIME (HOURS)	0.7

FUSS

as do recovery times at an average of 0.7 hours. In combination, these performance factors resulted in overall system availability above that of the average small systems user, with mean uptime reported by the DEC 11/780 sample at 97.4% compared to 96.9% overall.

- Undoubtedly, DEC 11/780 users received system reliability and support above that provided by most small systems vendors. This performance is, however, offset by a stringent set of user requirements that well exceed the demands of the average small systems user. System availability needs of VAX 11/780 users climbed from 97.7% in 1986 to 98.3% this year, while actual availability dropped from 98.5% to 97.4%. The variance between user needs and DEC performance, coupled with the drop in availability seen over the past year, is reflected in the low incidence of satisfaction among 11/780 users, as shown in Exhibit IV-30.

- User expectations for response and repair times also rose between 1986 and 1987 but were still surpassed by DEC performance in both areas. Satisfaction with repair as well as recovery times remains very high but has slipped slightly in the area of response. This may be attributable to a certain amount of carry-over in expectation from the recently announced 2-hour response commitment made to users of higher-end DEC products. Even though 11/780 users reported no incidence of response times exceeding the four-hour contracted agreement, users expressed expectations ranging from four hours to as low as a two-hour need.

- DEC users reporting these higher demands in response may also be indirectly expressing concern over the below-standard system availability received. From a user's viewpoint, fast reaction to a trouble call may represent a feasible remedy to overall downtime. From a vendor's point of view, however, the effort and resources neccesary to further increase such low response and repair times across the entire user base would be prohibitive. Beyond drastically improving system reliability internally, advances in remote technologies and expanding into redundant architechtures (both areas of particular

EXHIBIT IV-30

USER SATISFACTION WITH SERVICE PERFORMANCE
DEC VAX 11/780

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED
SYSTEM AVAILABILITY	98.3	58
RESPONSE TIME (HOURS)	2.8	88
REPAIR TIME (HOURS)	3.0	93
RECOVERY TIME (HOURS)	0.6	100

F-USS

strength within Digital's larger system products) offer realistic solutions to increasing user satisfaction with system availability.

- This currently low satisfaction with system availability is further investigated in Exhibit IV-31. Only 30% of the most demanding users are receiving the 100% uptime required, and this number takes on additional meaning when considering that 50% of the total DEC sample lies at this high end. The remaining half of the sample required availability between 90.0% and 99.9% but, weighed heavily by this large high-requirement group, the cumulative satisfaction among the group only reaches 85%.

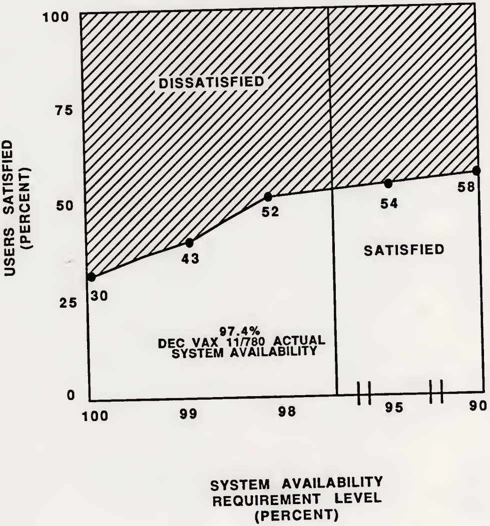
- Exhibit IV-32 reiterates this propensity toward high availability needs among the VAX 11/780 sample as the concentration of users can be seen increasing as requirements rise along the vertical axis. Also worthy of note is the proximity of the vast majority of satisfied users to the area of dissatisfaction. Slight increases in the uptime requirements of these users would easily push them out of the satisfied area.

- Specific components of contractual service were rated by DEC 11/780 users, and results are presented in Exhibit IV-33. Of special concern should be the consistent low ratings in the software area. Many respondents mentioned software documentation/updates among the most important aspects of their contract coverage, and, although DEC 11/780 documentation was rated among the highest of the small systems sample as a whole, the service still falls well below DEC user requirements.

- The skill level of both software and hardware support personnel was also often referred to in user discussions of their most pressing service concerns, and neither area showed effective improvement from last year's ratings. Hardware staff ratings remained consistent in both requirements and performance, and software staff performance, although gaining four points over last year's rating, was offset but a four-point rise in user requirements.

EXHIBIT IV-31

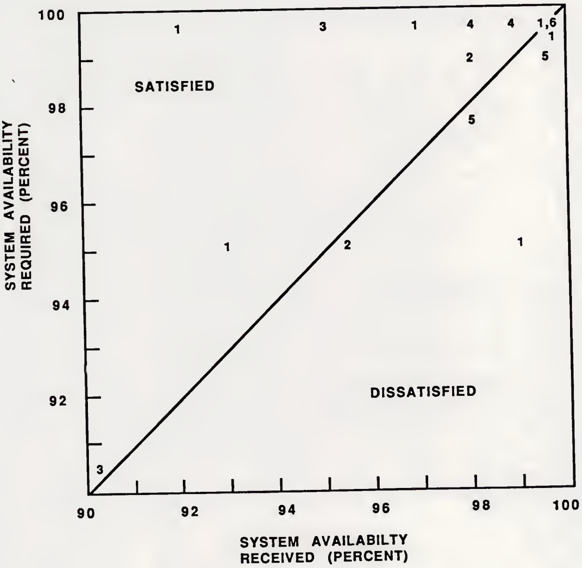
USER SATISFACTION WITH SYSTEM AVAILABILITY
DEC VAX 11/780



F-USS

EXHIBIT IV-32

USER SATISFACTION WITH SYSTEM AVAILABILITY
DEC VAX 11/780



F-USS TOTAL POINTS PLOTTED: 40

EXHIBIT IV-33

1987 USER PERFORMANCE/VALUE LEVELS
DEC VAX 11/780

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	6.5	6.8	0.3
PARTS AVAILABILITY	8.9	8.2	(0.7)
REMOTE SUPPORT	7.8	7.7	(0.1)
HARDWARE ENGINEER SKILL	8.7	7.8	(0.9)
SOFTWARE ENGINEER SKILL	8.7	7.4	(1.3)
SOFTWARE DOCUMENTATION	8.9	8.0	(0.9)
SOFTWARE SUPPORT OVERALL	8.5	7.5	(1.0)
HARDWARE SUPPORT OVERALL	9.1	8.8	(0.3)

* SCALE: 1 = LOW, 10 = HIGH

** AVERAGE STANDARD ERROR OF THE MEAN = 0.3

F-USS

- Exhibit IV-34 reflects this relative consistency in the level of user satisfaction in these two areas, neither component gaining more than 3 percentage points in favor. Software documentation, becoming increasingly important to users of small systems as the application capabilities of minicomputers grow along with their processing power, is weighing heavily on satifaction with software support overall, both losing significant ground with users over the past year.

- Parts availability is another area in need of further fortification, pleasing only 50% of the DEC 11/780 user sample. Availability of spare parts was the single most common hardware support concern of DEC users, not unlike other vendor samples within the small systems group. As Exhibit IV-35 illustrates, DEC is approaching the target requirement area in this aspect of service and has shown some improvement from last year to this (spares availability now rating 8.2, compared to 1986 rating of 7.5). User concern over spare parts is growing industrywide and as a sensitive issue in the market bears close watch by DEC and other contenders in the small systems market.

- Exhibit IV-36 reports on DEC 11/780 users' willingness to increase their participation in their system service. Nearly 40% of the user sample admitted an interest in increasing involvement, but not without recognizing the opportunity to decrease maintenance costs. VAX users held a wide range of expectations for associated discount levels, ranging from 5% to 50% for assisting DEC staff in diagnosis, and between 10 and 50% for more involved tasks of board and component swapping. On the average, however, expectations ran between 25% and 33% for such participation, and the majority (85%) of DEC 11/780 users remained satisfied with service as is, expressing that they feel they receive the level of support for which they are currently paying.

EXHIBIT IV-34

USER SATISFACTION LEVELS
1987 VERSUS 1986
DEC VAX 11/780

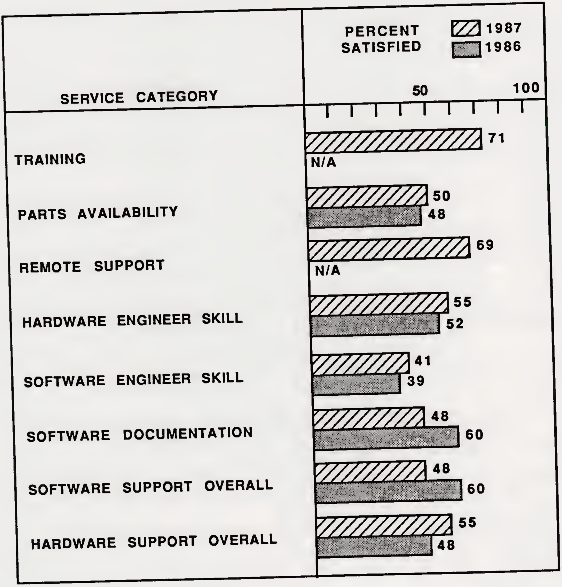
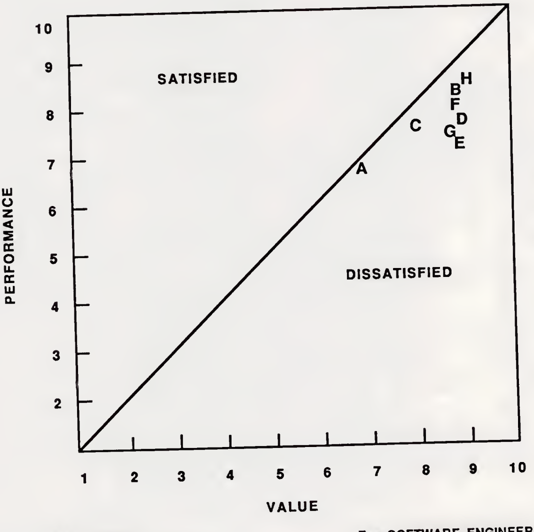


EXHIBIT IV-35

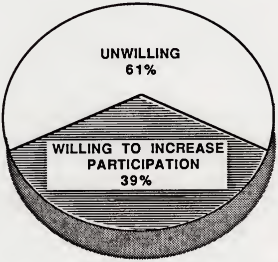
SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
DEC VAX 11/780



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

EXHIBIT IV-36

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE DEC VAX 11/780



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	25	8	15	31	46	54	100
SWAP COMPONENTS	32	0	21	21	29	43	100
SWAP BOARDS	33	0	21	21	21	43	100

*UP TO AND INCLUDING

F-USS

E. DEC 8XXX

- In April of this year, INPUT discussed DEC's system and support performance with top data processing officials at VAX 8XXX sites. A total of 31 users were interviewed, 14 of whom had VAX 8200 systems installed at their site; 8 were users of VAX 8500 units, 4 of 8300s, 3 used 8800 machines, and 2 users at 8600 and 8650 sites were contacted. The sample was well spread over a range of industry categories, most highly concentrated in the education (35%) and services sector (23%), due to the concentration of engineering and scientific applications of the VAX 8XXX series. Manufacturing (17%) and distribution (13%) were well represented, and the remainder of the sample was split by the transportation, telecommunications, banking/finance, and federal government sectors of the market.

- The terms of the DEC maintenance agreements of the 8XXX sample are outlined in Exhibit IV-37. Over three-quarters of the users received support over the normal five-day work week (77%), and most (68%) were covered 8 or 9 hours daily. Nearly as many (65%) were billed for their support month-to-month, only 28% paying annually.

- VAX 8XXX performance is examined in Exhibit IV-38, which shows users receiving 97.2% system availability on average and experiencing 1.6 interrupts in an average month. Even though the VAX 8000 series are younger machines than the VAX 11/780 (see IV-D for 11/780 analysis), users experienced more interrupts and lower availability on the 8XXX units than did 11/780 users. This may be partially attributable to the newness of some of the sample systems, experiencing the normal adjustment phase of installation (especially in the cases of the 8500 and 8800 units which entered the market late last year). Three-quarters of these interrupts were attributable to hardware problems, only 14% due to systems or applications software bugs.

EXHIBIT IV-37

SERVICE CONTRACT
DEC VAX 8XXX

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	77
- MONDAY - SATURDAY	13
- MONDAY - SUNDAY	10
• HOURS OF COVERAGE	
- 1-9 HOURS	65
- 10-16 HOURS	16
- 17-24 HOURS	19
• BILLING INTERVAL	
- ANNUAL	28
- QUARTERLY	7
- MONTHLY	65

EXHIBIT IV-38

SERVICE PERFORMANCE
DEC VAX 8XXX

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
- MEAN NUMBER PER MONTH	1.6
- HARDWARE-CAUSED (PERCENT)	75.0
- SYSTEMS SOFTWARE-CAUSED (PERCENT)	5.0
- APPLICATIONS SOFTWARE-CAUSED (PERCENT)	9.0
- OTHER CAUSED (PERCENT)	11.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	97.2
• MEAN RESPONSE TIME (HOURS)	3.8
• MEAN REPAIR TIME (HOURS)	1.9
• MEAN RECOVERY TIME (HOURS)	2.4

FUSS

- Response times reported by VAX 8XXX users fell just under 4 hours (3.6 mean), and as an average considered over the past year, exceeds the more recently announced 2-hour commitment for the high-end VAX units. Actual responses ranged from half an hour to a full day, but the median response hit the 2 hour point exactly. Repair times also varied considerably (between 0.5 and 6.0 hours), averaging just under 2 hours overall. With the help of DEC's extensive remote capabilities on their higher-end machines (81% of the sample reporting that they receive remote support), this repair performance topped that of any other vendors among the small systems sample.

- Compared to user requirements, performance in these areas rated well, as displayed in Exhibit IV-39. The lowest satisfaction was experienced with system availability among 8XXX users, even though performance on average matched average user needs of 97.2%. This indicates a wide spread of availability requirements within the 8XXX user sample, actual needs ranging from 80.0% up to 100%. Although less than three-quarters of the user sample (71%) reported satisfactory uptimes, this percentage was well above that reported by small systems users on average (59% of the total sample satisfied.) System applications in the education and research fields usually equate to somewhat less critical needs than those of other industry applications, and the lower level availability requirements and greater interruption tolerance expressed by 8XXX users are reflective of this.

- Satisfaction with response, repair, and recovery times was very high among the 8XXX sample, response times closely approaching actual user needs and repair times actually exceeding user expectations. Recovery time, a factor less directly associated with vendor performance, although falling just under the level required by users, was felt to be satisfactory in every sample case.

- User satisfaction with system availability is further examined in Exhibit IV-40, the cumulative percentages of satisfied users demonstrating the relatively low average expectations of 8XXX users. Compared to the entire small systems sample, a very low portion of the 8XXX sample required top

EXHIBIT IV-39

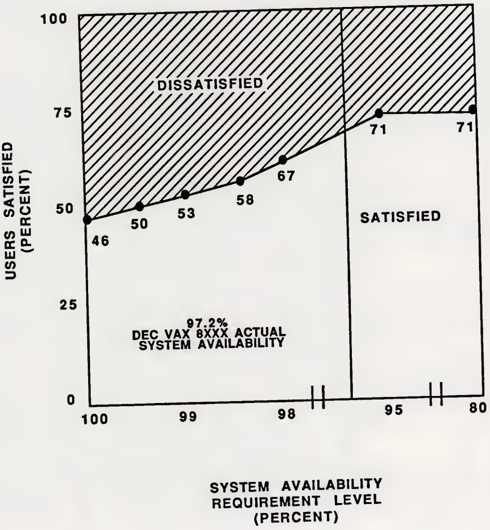
USER SATISFACTION WITH SERVICE PERFORMANCE DEC VAX 8XXX

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED
SYSTEM AVAILABILITY	97.2	71
RESPONSE TIME (HOURS)	3.6	89
REPAIR TIME (HOURS)	2.1	96
RECOVERY TIME (HOURS)	2.2	100

F-USS

EXHIBIT IV-40

USER SATISFACTION WITH SYSTEM AVAILABILITY
DEC VAX 8XXX



F-USS

availability of their system, only 35% of DEC users needing 100% uptime compared to 57% of the entire small systems sample and 50% of DEC 11/780 users. This, again, is reflective of the lower level of performance tolerable in education and services industries, as compared, for instance, to the high requirements placed on systems in medical or manufacturing applications.

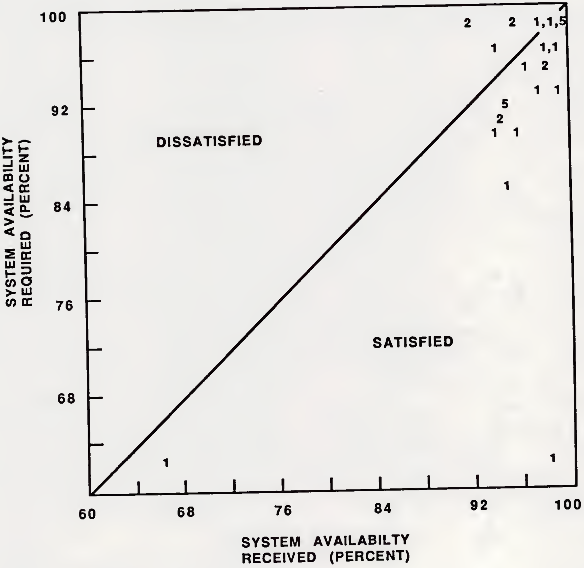
- Exhibit IV-41 clearly shows the spread of user requirements within the VAX sample. 8XXX user needs tend to fall much lower than the average small systems user and, as could be expected, fall more often into the satisfied group. A small group of users are receiving availability well exceeding their needs, but the majority of DEC 8XXX systems approach the level of performance required by their users.

- Specific aspects of DEC service are examined in Exhibit IV-42, comparing user value to vendor performance in a number of support areas. As was also the case with VAX 11/780 service, the weakest components were within software support categories, engineer skill, documentation, and support overall. In every one of these areas, 8XXX user requirements were among the lowest of the total small systems sample, but were still left unmet by DEC software support performance. As revealed in Exhibit IV-43, less than half of users are satisfied with DEC support in these critical software areas and only 52% happy with software service overall.

- On the hardware side, parts availability and engineer skill level were most in need of improvement, again failing to meet already low user requirements (see Exhibit IV-42.) As illustrated in Exhibit IV-43, user satisfaction is at a low 68% in both hardware engineer skill and support overall, while parts availability dropped to 61% satisfaction. Although 8XXX users expressed low requirements of their service vendor, their needs cannot be ignored without eventually reflecting a negative image on the expanding line of 8XXX machines. Service is a key component to the ongoing satisfaction with a system, and its potential effect on future purchase decisions is obvious.

EXHIBIT IV-41

USER SATISFACTION WITH SYSTEM AVAILABILITY
DEC VAX 8XXX



TOTAL POINTS PLOTTED: 31

F-USS

EXHIBIT IV-42

1987 USER PERFORMANCE/VALUE LEVELS DEC VAX 8XXX

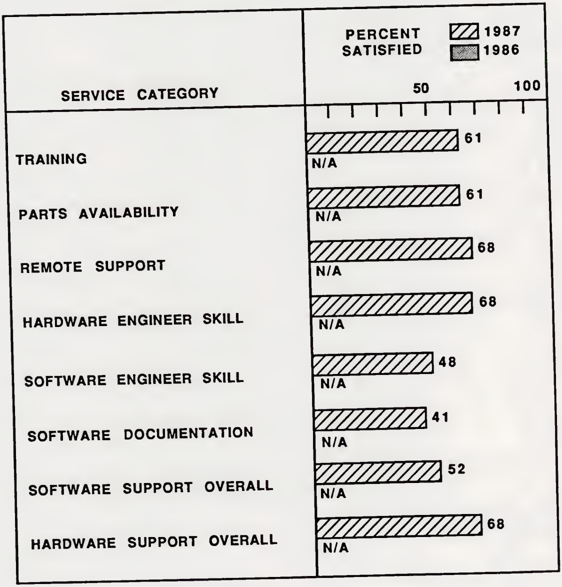
SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	5.7	5.4	(0.3)
PARTS AVAILABILITY	8.5	7.7	(0.8)
REMOTE SUPPORT	7.0	7.0	0
HARDWARE ENGINEER SKILL	8.7	8.3	(0.4)
SOFTWARE ENGINEER SKILL	8.3	7.4	(0.9)
SOFTWARE DOCUMENTATION	8.7	7.6	(1.1)
SOFTWARE SUPPORT OVERALL	8.5	7.1	(1.4)
HARDWARE SUPPORT OVERALL	8.6	8.3	(0.3)

* SCALE: 1 = LOW, 10 = HIGH

** AVERAGE STANDARD ERROR OF THE MEAN = 0.4

EXHIBIT IV-43

USER SATISFACTION LEVELS
1987 VERSUS 1986
DEC VAX 8XXX



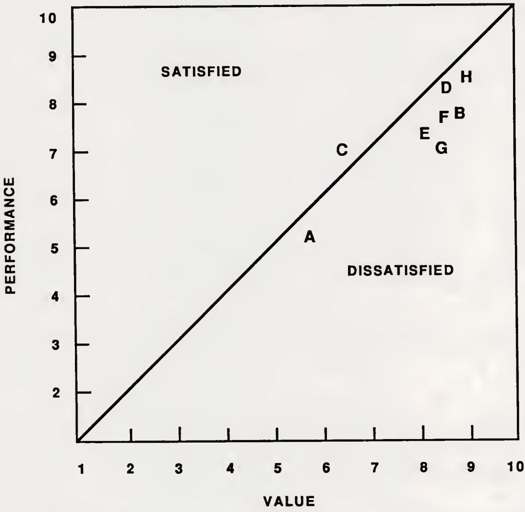
- DEC's positioning in these areas relative to user requirements is examined in Exhibit IV-44. Remote support remains the only component meeting user needs, followed closely by training. It warrants note, however, that these two services are of lowest importance to users, and meeting requirements in these areas has a much lesser effect on user satisfaction with DEC support than would improvements in higher priority services.

- DEC 8XXX users considered hardware service a higher priority than software support (hardware maintenance is cited nearly twice as often as the most essential aspect of contractual service), as reflected by the high value placed on parts availability, hardware engineer skill, and, in turn, hardware support overall. Improvements to the relatively low degree of support currently being provided should not prove a problem to the traditionally effective DEC support staff; rather a realization of this dissatisfaction among their low requirement group should signal a closer watch on the interests of the 8XXX users.

- Finally, the willingness of DEC 8XXX users to increase their participation in service is examined in Exhibit IV-45. Interest was low in user involvement in maintenance tasks such as problem diagnosis, board swapping, and component replacement, with only 32% of respondents indicating a willingness. Average discounts expected for such participation ranged from 24% to 37%, and varied greatly across individual responses, running from as low as 10% to as high as 50% allowance expected. DEC users showed the greatest interest in participation in diagnosis, and half of those willing to increase their involvement would do so at 20% discounts from their current contract fee. Overall, however, users were satisfied with the level of support received under their maintenance agreement, with 90% of users feeling they receive the amount of service for which they are paying.

EXHIBIT IV-44

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
DEC VAX 8XXX

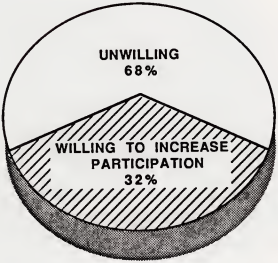


A = TRAINING
B = PARTS AVAILABILITY
C = REMOTE SUPPORT
D = HARDWARE ENGINEER SKILL LEVEL
E = SOFTWARE ENGINEER SKILL LEVEL
F = SOFTWARE DOCUMENTATION
G = SOFTWARE SUPPORT OVERALL
H = HARDWARE SUPPORT OVERALL

F-USS

EXHIBIT IV-45

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE DEC VAX 8XXX



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	24	0	13	13	50	63	100
SWAP COMPONENTS	33	0	20	20	20	20	100
SWAP BOARDS	37	0	20	20	20	20	100

*UP TO AND INCLUDING

OPTIMUM DISCOUNT LEVEL

FUSS

F. GOULD CONCEPT 32

- Thirty users of Concept 32 systems (ranging from the 32/27 through the 32/97) were contacted in March and April of this year regarding the service and support provided to them by Gould. Top data processing personnel were targeted for response to the questionnaire; however, a considerable percentage (26%) of respondents held technical/engineering titles due to the heavy use of Gould systems in the fields of engineering and manufacturing.

- The sample was predominantly composed of manufacturing firms (34%) and service operations (24%). Federal government installations comprised another 13% of respondent sites, the transportation industry 10%, and education 7%. The remaining 12% was split evenly between utilities and telecommunications industries.

- As shown in Exhibit IV-46, the majority of Gould users received coverage over five days per week (70%), most often under 9 hours daily. Between 26% and 30% of users contacted were under extended coverage contracts and received support 7 days per week and over 17 to 24 hours per day, respectively. Most of the respondents were billed monthly (68%) for support; only 21% were under an annual payment agreement.

- The system and support performance of the Gould Concept 32 is presented in Exhibit IV-47. Concept 32 users reported the lowest number of system interruptions (tied with Hewlett-Packard) among the small systems user group, with only 0.7 interrupts experienced per month. The majority of these interruptions were the fault of hardware failures (88%) and only 10% were problems with software, much more skewed percentages than the breakout of the combined small systems sample (with 66% hardware and 20% software failures.)

EXHIBIT IV-46

SERVICE CONTRACT
GOULD CONCEPT 32

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	70
- MONDAY - SATURDAY	4
- MONDAY - SUNDAY	26
• HOURS OF COVERAGE	
- 1-9 HOURS	59
- 10-16 HOURS	11
- 17-24 HOURS	30
• BILLING INTERVAL	
- ANNUAL	21
- QUARTERLY	11
- MONTHLY	68

EXHIBIT IV-47

SERVICE PERFORMANCE
GOULD CONCEPT 32

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
- MEAN NUMBER PER MONTH	0.7
- HARDWARE-CAUSED (PERCENT)	88.0
- SYSTEMS SOFTWARE-CAUSED (PERCENT)	9.0
- APPLICATIONS SOFTWARE-CAUSED (PERCENT)	1.0
- OTHER CAUSED (PERCENT)	2.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	95.3
• MEAN RESPONSE TIME (HOURS)	6.1
• MEAN REPAIR TIME (HOURS)	7.0
• MEAN RECOVERY TIME (HOURS)	0.8

FUSS

- These interruptions, although not frequent, were lasting, reflected by the poor mean system availability of 95.3%, among the very lowest of the small systems sample, and well below overall user average (96.9%). Looking to the service statistics reported by Gould users, prolonged response and repair times are revealed, helping to account for the low incidence and high impact of system down situations. Response was reported of over 6 hours on average, the highest of all user groups surveyed, but ranged from excellent to poor when viewing individual accounts; responses ranged from immediate to 24 hours and, with a median value of 2.0 hours, reflect major inconsistancies among the support being provided by Gould staff.

- Repair times followed the same pattern, reported between 1 hour and a full day with a median value of 2 hours, although average repair times (at 7.0 hours) well exceeded nearly all other small systems user reports. The inconsistancy shown in these figures, however, appear to be expected and accepted by Gould users in general, as is indicated in Exhibit IV-48. User satisfaction with the response and repair times delivered by Gould are among the highest of the overall sample, with from 97% up to 100% of performance meeting user standards, respectively.

- Regardless of acceptance of response and repair performance, users remain extremely dissatisfied with system availability, with only 23% of the sample receiving uptimes satisfying their needs. Availability requirements were reported ranging as low as 75%, but over 70% of the sample required 100% availability on their Concept 32 system. Actual availabilities reported ranged from 70 to 100% uptime, mean availability falling well below the average requirement.

- The disparity shown within the Gould sample responses represents a user group with difficult needs to target. On the one hand, users remain satisfied with the relatively slow response/repair performance of Gould's field staff. On the other hand, users are experiencing an average of nearly 14 hours of downtime (summing mean response, repair, and recovery times) for each interruption

EXHIBIT IV-48

USER SATISFACTION WITH SERVICE PERFORMANCE
GOULD CONCEPT 32

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED
SYSTEM AVAILABILITY	97.5	27
RESPONSE TIME (HOURS)	7.5	97
REPAIR TIME (HOURS)	7.2	100
RECOVERY TIME (HOURS)	0.8	100

F-USS

experienced. The connection between the delay in repairing the problem is not being directly associated with poor availiability measured over time; users aren't expecting more from their support crew, but more from their system itself. Many small systems vendors are approaching this type of situation, where improvements in support delivery can no longer provide sufficient impact on overall performance.

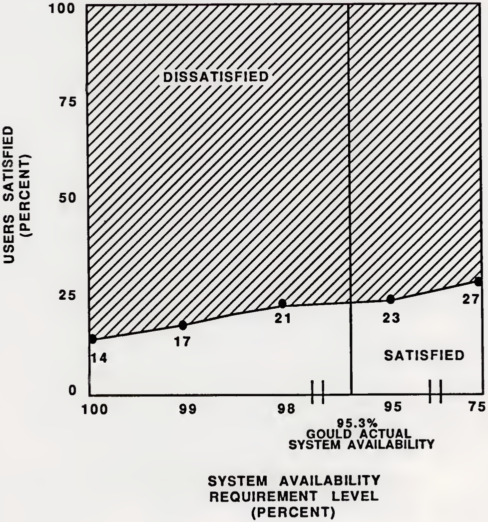
- Increased dependence on remote support technologies may offer the type of performance improvements needed to satisfy Gould users; the current sample reported a very low incidence of remote service, with only 50% of the sample having received remote assistance over the past year's time. Advances being made in remote diagnositics/fixes may be a worthy of Gould's increased attention in response to such low availability reports. Other small systems vendors are additionally exploring and developing redundant architectures in response to this overall increase in the sensitivity of small systems users to system availability. As the demands and applications of minicomputer users advance along with the small systems' computing power, vendors must be prepared to support these systems at levels of performance users call for.

- Problems with system availability are revisited in Exhibit IV-49, plotting cumulative satisfaction at rising availability needs. A low 14% of users who required 100% uptime were satisfied with Gould performance, obviously weighing heavily on the overall average satisfaction figure. Even including users with the lowest of needs, only 27% reported uptimes which meet their requirements. Actual system availability reported in 1987 (at 95.3%) fell sharply from last year's reported 98.0% availability.

- A more specific look at user needs is offered in Exhibit IV-50, plotting requirements against the actual system performance of the Gould sample. The increasing density of user points as requirements rise along the left axis clearly demarcates problem user areas. Even within the satisfied group, many users ride close to the edge, and even a small decrease in availablity is liable to pull them into the area of dissatisfaction.

EXHIBIT IV-49

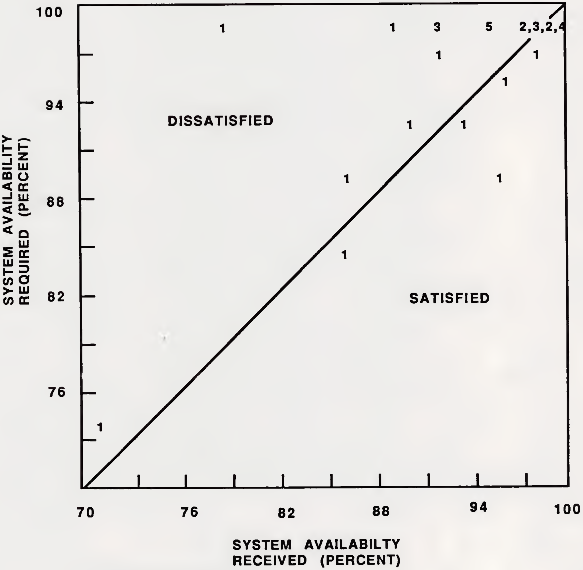
USER SATISFACTION WITH SYSTEM AVAILABILITY
GOULD CONCEPT 32



F-USS

EXHIBIT IV-50

USER SATISFACTION WITH SYSTEM AVAILABILITY
GOULD CONCEPT 32



TOTAL POINTS PLOTTED: 30

- Various components of contract support are examined in Exhibit IV-51, comparing user value to Gould support performance. The most striking problem is with software documentation, falling below user requirements by nearly 3 points. Gould user needs were among the highest of the small systems sample in software support, weighed heavily by the 74% of respondents who required a level of 10 in this area. A majority of users commented on the need for clear and up-to-date manuals when asked of their most pressing software concern, and although Gould has shown improvement in its ratings from 1986 to this year (up to 6.3 from 5.8), the gain has been offset by a larger increase in user needs (from 8.3 to 9.2 this year).

- Ratings of software support overall suffered from this problem with documentation and are also complicated by increasing user requirements over the past year (now at 9.2 compared to 7.7 in 1986). Gould users now require among the highest levels of software support among the small systems sample; in previous years this was considered at a much lower level than the importance of hardware support. The complexity of applications run on new, more powerful minicomputers foster a higher level of concern in users, and demand a higher level of support than did small systems in the past.

- Following this trend, software engineer skill, although remaining stable, was overshadowed by a similar jump in user requirements. Gould users also often expressed concern over the skill level of the software technician assigned to them, reflecting a need for Gould to upgrade software support at every level from manuals and updates to the level of training and knowledge of their SEs.

- User requirements for hardware service increased in a like manner, but more improvements in engineer skill and support overall were seen in the hardware area than in software over the past year. The value of hardware support overall rose from 8.5 in 1986 to 9.5 this year, raising it to one of the highest of small systems user needs. The accent on hardware service needs is echoed in the increases seen in hardware technician skill requirements as well, jumping from 8.5 to 9.7 over the past year and setting it at the highest value among all small systems users sampled.

EXHIBIT IV-51

1987 USER PERFORMANCE/VALUE LEVELS
GOULD CONCEPT 32

SERVICE CATEGORY	1987 AVERAGE USER RATING* VALUE	1987 AVERAGE USER RATING* PERFORMANCE	PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
TRAINING	6.8	7.1	(0.3)
PARTS AVAILABILITY	8.9	8.2	(0.7)
REMOTE SUPPORT	8.6	8.3	(0.3)
HARDWARE ENGINEER SKILL	9.7	8.0	(1.7)
SOFTWARE ENGINEER SKILL	8.9	7.1	(1.8)
SOFTWARE DOCUMENTATION	9.2	6.3	(2.9)
SOFTWARE SUPPORT OVERALL	9.2	7.0	(2.2)
HARDWARE SUPPORT OVERALL	9.5	8.2	(1.3)

* SCALE: 1 = LOW, 10 = HIGH

** AVERAGE STANDARD ERROR OF THE MEAN = 0.5

F-USS

- Although performance in both of these areas was up from last year's user reports, these extremely high requirements reduced users' levels of satisfaction to critical lows (as shown in Exhibit IV-52). Only near half of last year's respondents were satisfied with hardware skill and support overall; hardware satisfaction among this year's users fell to 28% and 30% respectively and was reported as equally low in all areas of software support.

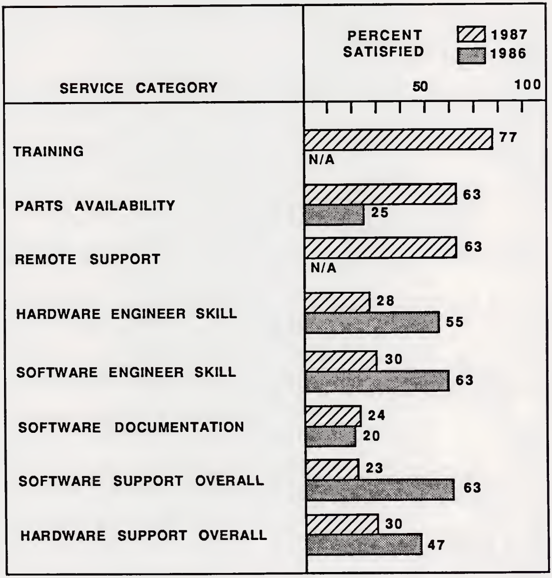
- Exhibit IV-53 plots user requirements against these performances and emphasizes the areas positioned futhest from user needs. Obviously, software services are in need of greatest fortification, but with slightly higher user values, hardware areas are in need of more immediate attention. Training and remote support, although the lowest valued services among the group, come much closer to meeting user needs.

- Interestingly, although only 50% of Gould users were experienced with remote support, the group reported the highest value (refer to Exhibit IV-51) for remote services among the combined small systems group. This may be partially explained as desire of Gould users to better their hardware support and increase satisfaction in overall and engineer skill areas. The utilization of remote support, especially for diagnostic assistance, allows users access to an increased number of people (and the perceived additional skill) a "pool" of engineers provides. It can also increase the individual FE's efficiency and perceived skill level as problems can be prepared for before the engineer leaves the branch office. Users who were experienced with remote service reported relatively high satisfaction with the service (as reported in Exhibit IV-51).

- Exhibit IV-54 reveals that 31% of users would be willing to increase their participation in support in such areas as diagnosis and board and component swapping. Discounts expected ranged from 15 to 50%, but averaged between 33% and 38% of current contract costs. A healthy proportion of these interested users would, however, be willing to offer assistance for a lesser 25% discount, and user involvement in such tasks may provide a partial solution for low ratings and satisfaction discussed above.

EXHIBIT IV-52

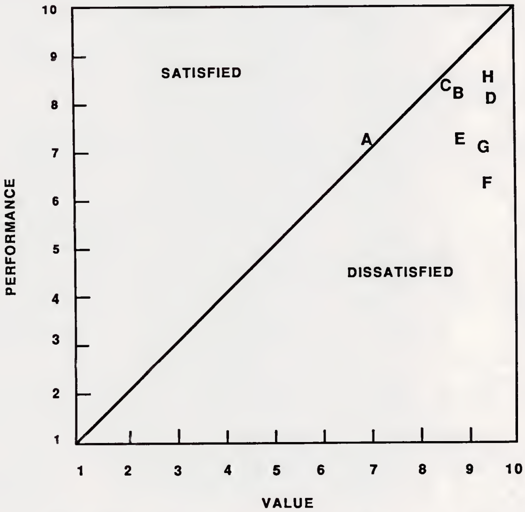
USER SATISFACTION LEVELS
1987 VERSUS 1986
GOULD CONCEPT 32



F-USS

EXHIBIT IV-53

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
GOULD CONCEPT 32

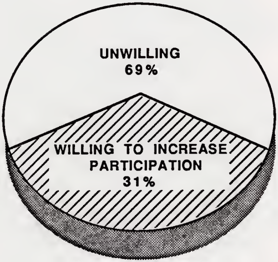


A = TRAINING
B = PARTS AVAILABILITY
C = REMOTE SUPPORT
D = HARDWARE ENGINEER SKILL LEVEL
E = SOFTWARE ENGINEER SKILL LEVEL
F = SOFTWARE DOCUMENTATION
G = SOFTWARE SUPPORT OVERALL
H = HARDWARE SUPPORT OVERALL

F-USS

EXHIBIT IV-54

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE GOULD CONCEPT 32



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT — DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	33	0	0	17	33	50	100
SWAP COMPONENTS	38	0	0	0	0	33	100
SWAP BOARDS	38	0	0	0	0	33	100

*UP TO AND INCLUDING

OPTIMUM DISCOUNT LEVEL

FUSS

G. HEWLETT-PACKARD 3000

- In April of this year, INPUT interviewed 31 users of Hewlett-Packard 3000 series minicomputers regarding the service and support of their system. The sample firms were predominantly manufacturing operations (52%); other industries represented were state/local government (13%), distribution and education (each 9%), banking/finance and services industries (each 7%), and the insurance sector (3%).

- Exhibit IV-55 examines the contract terms of the HP 3000 users sampled. The majority of their maintenance agreements provided coverage over the normal work week (83%); only 7% of users contracting for extended 7-day coverage. A larger percentage (17%) opted for extended hours of coverage (from 17 to 24 hours per day), but the majority of sites were covered for under 9 hours daily. Few of the HP respondents (14%) had annual payment agreements but, much more than other small systems vendor samples, many arranged to pay for support quarterly (43%). An equal number were billed monthly, the most common interval of payment within the total small systems group.

- Measures of traditional system and service performance factors are presented in Exhibit IV-56. HP users reported the fewest system interruptions of any small systems sample (tieing with Gould users), experiencing an average of only 0.7 interrupts per month. The causal breakout of these problems was very similar to the small systems sample overall, with a 68% to 18% proportion of hardware-caused to software-caused failures.

- Despite the infrequency of down situations, 3000 system availability was a relatively low 96.5% on average, down from a high of 98.0% in 1986. Actual uptimes reported varied between 80% and 100% with a median value of 99.0%, indicating a wide range in sample systems' performance. Comparing this performance to actual user requirements, however, reveals just as broad a spread in availability needs, and (as shown in Exhibit IV-57) performance

EXHIBIT IV-55

SERVICE CONTRACT
HEWLETT-PACKARD 3000

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	83
- MONDAY - SATURDAY	10
- MONDAY - SUNDAY	7
• HOURS OF COVERAGE	
- 1-9 HOURS	63
- 10-16 HOURS	20
- 17-24 HOURS	17
• BILLING INTERVAL	
- ANNUAL	14
- QUARTERLY	43
- MONTHLY	43

EXHIBIT IV-56

SERVICE PERFORMANCE
HEWLETT-PACKARD 3000

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
- MEAN NUMBER PER MONTH	0.7
- HARDWARE-CAUSED (PERCENT)	68.0
- SYSTEMS SOFTWARE-CAUSED (PERCENT)	14.0
- APPLICATIONS SOFTWARE-CAUSED (PERCENT)	4.0
- OTHER CAUSED (PERCENT)	14.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	96.5
• MEAN RESPONSE TIME (HOURS)	5.7
• MEAN REPAIR TIME (HOURS)	3.0
• MEAN RECOVERY TIME (HOURS)	1.1

EXHIBIT IV-57

USER SATISFACTION WITH SERVICE PERFORMANCE HEWLETT-PACKARD 3000

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED
SYSTEM AVAILABILITY	96.7	83
RESPONSE TIME (HOURS)	5.8	97
REPAIR TIME (HOURS)	3.0	100
RECOVERY TIME (HOURS)	1.0	94

F-USS

levels on average came relatively close to meeting user expectations of 96.7%. The vast majority of HP 3000 users were satisfied with this level of availability, as 83% of sampled users' uptimes met their needs. Compared to the average small systems user (only 59% of whom were satisfied with system availability), HP 3000 users as a group were very happy with system performance.

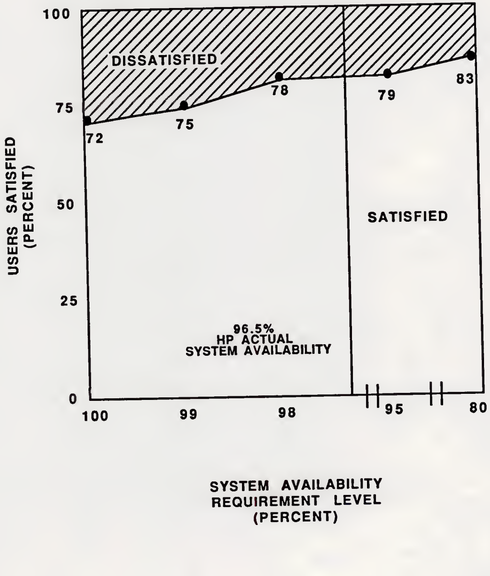
- Support performance in the face of these down situations was also commendable, with HP meeting or beating response, repair, and recovery requirements of an extremely high percentage of respondents. Response times averaging 5.7 hours (see Exhibit IV-56), although high in comparison to the small systems average of 3.6, nearly approximated HP user expectations, and satisfied a high 97% of users. Repairs were facilitated within 3 hours of FE arrival (well under most small systems vendor scores), satisfying sample respondents in every case. Recovery times were within 10 minutes of user expectations on average, meeting 94% of users' expectations.

- HP's ability to meet user requirements is also highlighted in Exhibit IV-58, which presents cumulative factors of user satisfaction with system availability. Even at 100% uptime requirements, which a majority (58%) of HP users expressed, 72% of the 3000 systems under these requirements met top availability needs. Only 17% of the entire HP sample were disappointed with their system's performance.

- This high user satisfaction should not be taken for granted, however, as illustrated in Exhibit IV-59. Although the vast majority of user points fall within the area of satisfaction, many are positioned near or on the dividing line, and minor shifts in system performance or user requirements could let these users fall into the dissatisfied area. Although HP user requirements are currently lower than many small systems user groups, the increasing demands of minicomputer users as a whole will no doubt be felt among HP's customer base over time. These increased demands will have to be followed by improved performance if HP is to stave off competition from both the manufacturer and third-party maintenance sides.

EXHIBIT IV-58

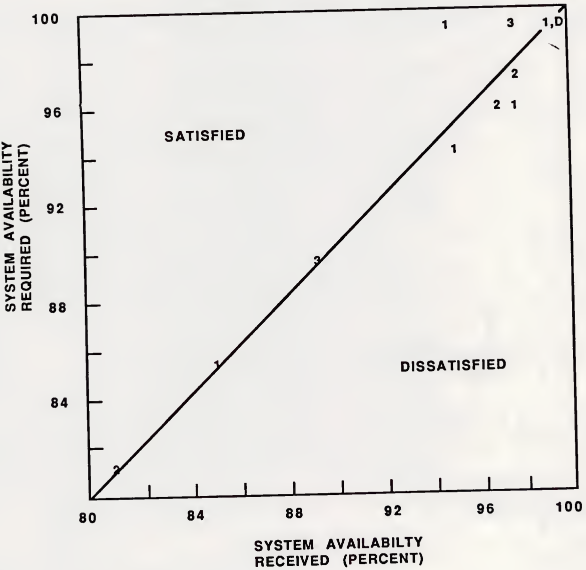
USER SATISFACTION WITH SYSTEM AVAILABILITY
HEWLETT-PACKARD 3000



F-USS

EXHIBIT IV-59

USER SATISFACTION WITH SYSTEM AVAILABILITY HEWLETT-PACKARD 3000



TOTAL POINTS PLOTTED: 30
D = 13

- HP's performance in supplying rapid response to system problems was aided by a high percentage of users (87%) who receive remote support. Although Exhibit IV-60 indicates that user perceived value of remote service is low overall, the continued facilitation and advancement of remote delivery can work to improve HP's performance in actual response and repair times and ultimately increase satisfaction in the high-priority area of system availability. As shown in Exhibit IV-61, users receiving remote support are relatively satisfied and receptive to the delivery mode, and HP should look to take advantage of the opportunity.

- HP user satisfaction with both hardware and software support overall well exceeds that of the average small systems user since only 47% and 41% (respectively) of the combined small systems sample receive service up to their standards in these areas, compared to 77% and 75% of HP users. As displayed in accompanying Exhibit IV-60, HP users expressed low requirements for software support among the entire sample, demanding performance at 7.8, compared to a small systems average of 8.7. In following, software engineer skill level needs were also reported at well below small systems average (7.5 to 8.7 overall), as was software documentation (although labled by some users as unclear and out of date) with HP users requiring 8.3 to all users' 8.8 average.

- Regardless of low demands, HP software support performance still fell below user overall and software engineer skill needs, albeit slightly. Disparity was much greater between users' documentation needs and HP's provision, missing the mark by 1.3 points and pleasing only 39% of users (seen in Exhibit IV-61). HP has somewhat of a less demanding task than most other small systems vendors in meeting their users' documentation demands (with the lower requirement of 8.3), and even with commendable performance in most other categories of support, HP should not let this key area slip.

- Hardware requirements were slightly higher, with overall value of support at 8.7 points, but were still well below its average small systems user's needs.

EXHIBIT IV-60

1987 USER PERFORMANCE/VALUE LEVELS
HEWLETT-PACKARD 3000

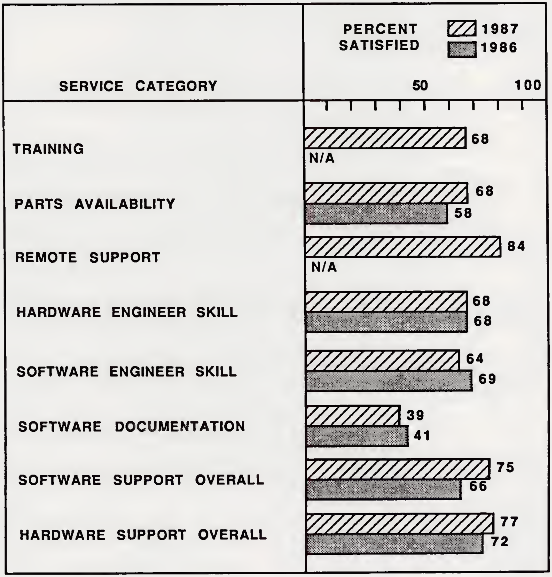
SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	4.9	5.8	0.9
PARTS AVAILABILITY	8.8	8.6	(0.2)
REMOTE SUPPORT	7.6	8.4	0.8
HARDWARE ENGINEER SKILL	8.5	8.4	(0.1)
SOFTWARE ENGINEER SKILL	7.5	7.2	(0.3)
SOFTWARE DOCUMENTATION	8.3	7.0	(1.3)
SOFTWARE SUPPORT OVERALL	7.8	7.7	(0.1)
HARDWARE SUPPORT OVERALL	8.7	8.7	∅

* SCALE: 1 = LOW, 10 = HIGH

** AVERAGE STANDARD ERROR OF THE MEAN = 0.4

EXHIBIT IV-61

USER SATISFACTION LEVELS
1987 VERSUS 1986
HEWLETT-PACKARD 3000



HP very nearly approximated the average user's needs with all components (including parts availability, engineer skill, and overall service) and although showing improvements in user satisfaction in each of these areas (as shown in Exhibit IV-61), must strive to surpass the low demands of average HP users in order to keep the growing base of higher requirement customers.

- Although the status quo appears sufficient to please the average HP user, increasing user demands should be expected and planned for in HP's future service strategy. As illustrated in Exhibit IV-62, HP does come very close to hitting the current target requirements for many components of support. What should not be overlooked, however is the trend toward higher expectations in the minicomputer market, reminding HP not to rest long on its laurels.

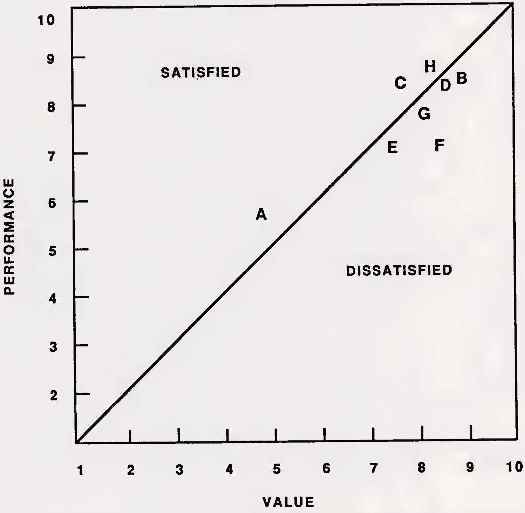
- As discussed in Exhibit IV-63, HP users expressed a willingness to increase their participation in maintenance activities at much lower expected discounts than many small systems user groups. Average expected discounts for participation in diagnostics was 22% and was only slightly higher for more involved tasks of board and component swapping. Half of the interested users could be engaged for 15 to 20% allowances on their contract costs, offering HP an attractive opportunity to offset its rising service costs while very possibly improving users' support. Although the majority of users remained unwilling to increase their participation, acceptance of co-maintenance arrangements at this low discount level may provide HP with an inroad to increased satisfaction for their growing high-requirement group.

H. IBM SYSTEM/38

- Forty users of System/38 minicomputers were contacted in April of this year regarding the service and support provided to them by IBM. The sample was well dispersed over standard industry categories, with the manufacturing

EXHIBIT IV-62

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
HEWLETT-PACKARD 3000

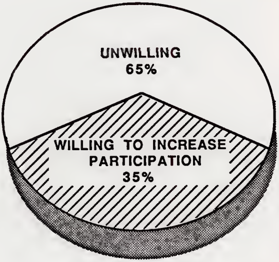


A = TRAINING
B = PARTS AVAILABILITY
C = REMOTE SUPPORT
D = HARDWARE ENGINEER SKILL LEVEL
E = SOFTWARE ENGINEER SKILL LEVEL
F = SOFTWARE DOCUMENTATION
G = SOFTWARE SUPPORT OVERALL
H = HARDWARE SUPPORT OVERALL

F-USS

EXHIBIT IV-63

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE HEWLETT-PACKARD 3000



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	22	0	0	25	50	63	100
SWAP COMPONENTS	23	0	17	50	67	67	100
SWAP BOARDS	23	0	17	50	67	67	100

*UP TO AND INCLUDING

OPTIMUM DISCOUNT LEVEL

F-USS

(35%) and medical (25%) sectors most heavily represented. Education service firms and education composed 8% and 10% of the sample, respectively; state/local government and distribution each comprised 5%. The remaining 12% was evenly split between the following six categories: transportation, utilities, telecommunications, banking/finance, and the federal government sector.

- The contractual composition of the IBM sample is outlined in Exhibit IV-64, showing the vast majority (78%) of System/38 users covered 5 days per week and most (48%) serviced during IBM's standard 11-hour period. A relatively small percentage opted for extended 7-day or 24-hour support, only 20% of the sample covered over the entire week, and 22% receiving 24-hour coverage. Interestingly, none of the users contacted paid for their support on a annual basis, and almost all (95%) were billed quarterly, a much higher percentage than other vendors' bases within the sample. A very small percentage (5%) of IBM users made maintenance payments each month, compared to an average of 73% of the remaining vendors' billed on a month-to-month basis.

- Exhibit IV-65 presents IBM System/38 service performance in terms of both system reliability and support delivery. Sampled users reported an average 0.8 interruptions per month, among the lowest of the small systems sample (averaging 1.2 interrupts each month). Most of these downtimes were due to hardware failures; however, system interruptions attributable to software problems increased to 25%, which refects the increased processing demands minicomputer users are placing on their systems and software. As older System/38 units are upgraded, users have the ability to access more sophisticated applications, in turn introducing more software packages and, consequently, more bugs into the system.

- Overall, system reliability remained quite high at 98.6% on average. Mean response and repair times, both averaging near 2 hours, were among the best within the small systems combined sample and, as reported in Exhibit IV-66,

EXHIBIT IV-64

SERVICE CONTRACT
IBM SYSTEM 38

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	78
- MONDAY - SATURDAY	2
- MONDAY - SUNDAY	20
• HOURS OF COVERAGE	
- 1-9 HOURS	30
- 10-16 HOURS	48
- 17-24 HOURS	22
• BILLING INTERVAL	
- ANNUAL	0
- QUARTERLY	95
- MONTHLY	5

EXHIBIT IV-65

SERVICE PERFORMANCE
IBM SYSTEM 38

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
- MEAN NUMBER PER MONTH	0.8
- HARDWARE-CAUSED (PERCENT)	67.0
- SYSTEM SOFTWARE-CAUSED (PERCENT)	16.0
- APPLICATIONS SOFTWARE-CAUSED (PERCENT)	9.0
- OTHER CAUSED (PERCENT)	8.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	98.6
• MEAN RESPONSE TIME (HOURS)	2.1
• MEAN REPAIR TIME (HOURS)	2.0
• MEAN RECOVERY TIME (HOURS)	1.0

FUSS

EXHIBIT IV-66

USER SATISFACTION WITH SERVICE PERFORMANCE
IBM SYSTEM 38

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED
SYSTEM AVAILABILITY	99.0	85
RESPONSE TIME (HOURS)	1.8	87
REPAIR TIME (HOURS)	2.1	97
RECOVERY TIME (HOURS)	0.9	96

F-USS

satisfied a good proportion of System/38 users. This satisfaction with availability was quite high among small systems users overall (second only to Tandem's fault-tolerant minis), with 85% of users receiving uptimes within their requirements. The degree of requirements, however, varied greatly, ranging from 70% up to 100% needs.

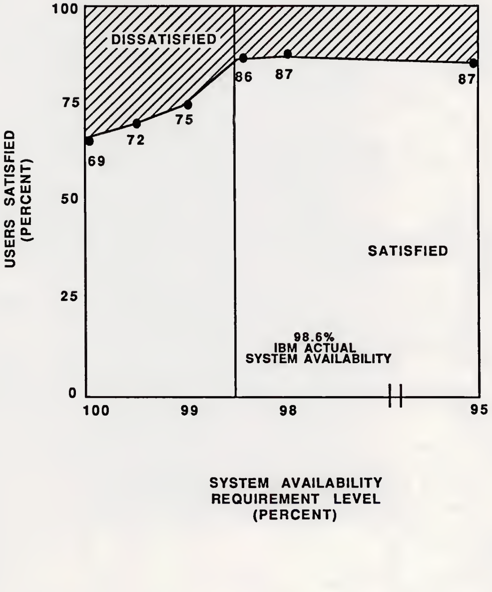
- Repair and recovery times likewise satisfied most all users, very nearly approximating their average need. Response times, although among the best of the small systems group, were met by even more stringent user requirements, ranging from 10 minutes to 3 hours. IBM came close on average to meeting these high goals and satisfied a high 87% of user needs.

- A closer look at availability performance is taken in Exhibit IV-67, plotting cumulative satisfaction against the rising level of user requirements. User uptime needs rose to 99.0% from 95.2% in 1986, and IBM has done a commendable job of keeping pace with escalating requirements. As illustrated, even at the highest level of demand, 69% of the System/38 sample performed to 100% requirements. At the sample's average requirement (99.0%), 75% of users were satisfied with performance. Exhibit IV-68 reinforces this picture of user satisfaction with System/38 system availability.

- IBM now utilizes remote services to a great extent in support of its higher-end machines, but few (35%) of the System/38 sample reported having recieved support remotely over the past year. The further development of these capabilities within IBM's line of minicomputers can help to alleviate user demands to some degree. Small systems user needs are fast approaching a critical stage, however, where improvements in maintenance performance "after the fact" will have little impact on user satisfaction at the level of performance demanded. Of note is the fact that only users of the fully redundant Tandem systems reported greater satisfaction with uptime than did users of the System/38; this may be indicative of the shape of solutions to come.

EXHIBIT IV-67

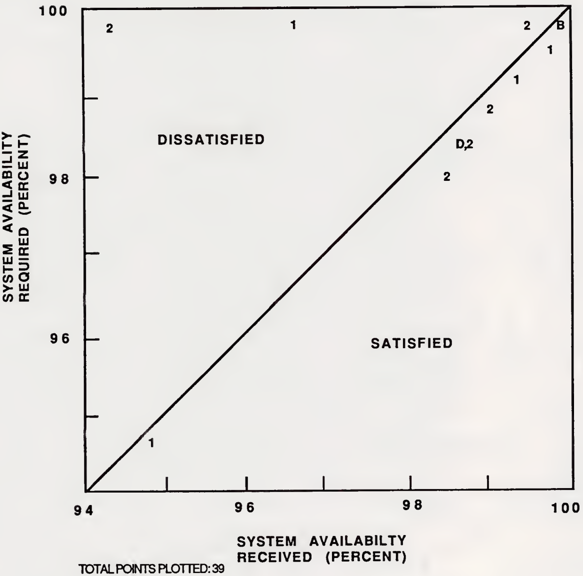
USER SATISFACTION WITH SYSTEM AVAILABILITY IBM SYSTEM 38



F-USS

EXHIBIT IV-68

USER SATISFACTION WITH SYSTEM AVAILABILITY
IBM SYSTEM 38



TOTAL POINTS PLOTTED: 39

B = 11
D = 13

FUSS

INPUT

- Exhibit IV-69 moves on into specific aspects of support, comparing user requirements for each component of service to IBM performance. The consistantly high demands made by IBM users are most notable; System/38 users required performance well above the small systems average in every support category. And although IBM also performed well above the combined sample average in each area, the value IBM users placed upon each support component still exceeded support performance.

- As was common among the small systems sample, the most lacking areas of support were in the software category, with IBM users requiring 1.2 (in software engineer skill) to 1.4 (software support overall) points above current levels of service. Close behind, however, was training (including both hardware and software instruction), significantly more valued by IBM users than other small systems groups (9.1 to an overall average of 6.7).

- These high requirements are to blame for the low incidence of satisfaction (seen in Exhibit IV-70), not only in software and training areas but in virtually every category listed. Of greatest concern to IBM should be the dramatic drop in satisfaction from last year to this. Although IBM had made headway in meeting user requirements set in 1986, the increased expectations expressed by this year's sample far reduced the significance of these improvements in 1987. The vast majority of user needs are now remaining unmet, and IBM must attend to these discrepancies if TPM encroachment is not to accelerate.

- Exhibit IV-71 illustrates the comparative positions of these services and their relative distance from user needs. The components in need of most immediate attention are in the hardware area, including engineer skill level and hardware service overall. IBM users cited hardware support as the most essential aspect of their maintenance contract in most every case and rated these two aspects of service highest among the list. The threat of TPM penetration is the greatest in the hardware arena, and confidence in IBM support must be fortified if this third-party penetration is to be checked.

EXHIBIT IV-69

1987 USER PERFORMANCE/VALUE LEVELS
IBM SYSTEM 38

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	9.1	8.1	(1.0)
PARTS AVAILABILITY	9.4	8.8	(0.6)
REMOTE SUPPORT	***	***	Ø
HARDWARE ENGINEER SKILL	9.5	8.7	(0.8)
SOFTWARE ENGINEER SKILL	9.4	8.2	(1.2)
SOFTWARE DOCUMENTATION	9.3	8.0	(1.3)
SOFTWARE SUPPORT OVERALL	9.5	8.1	(1.4)
HARDWARE SUPPORT OVERALL	9.7	8.8	(0.9)

* SCALE: 1 = LOW, 10 = HIGH

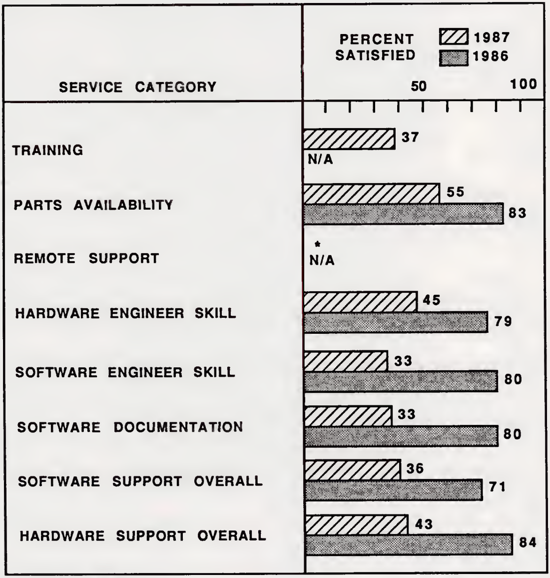
** AVERAGE STANDARD ERROR OF THE MEAN = 0.2

*** INSUFFICIENT RESPONSE

F-USS

EXHIBIT IV-70

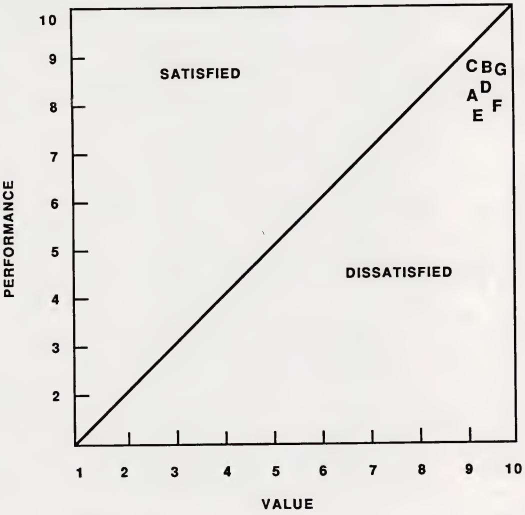
USER SATISFACTION LEVELS
1987 VERSUS 1986
IBM SYSTEM 38



*INSUFFICIENT RESPONSE

EXHIBIT IV-71

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
IBM SYSTEM 38



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

F-USS

- IBM has begun to counter this TPM threat, most notably by way of new discount schedules (i.e., the Corporate Service Amendment) and increased involvement in the support of compatable peripherals that are a part of IBM-supported systems. As third-party involvement in the software market continues to grow, IBM may well find it neccesary to provide such consumer-oriented offerings on the software side as well. Software documentation as well as engineer skill and support overall, while increasing in importance to users, continue to fall away from user requirements. Although IBM enjoyed a quality reputation which served as a strong competitive tool for some time, increasing user demands are quickly eroding this confidence and further steps are neccesary to hold current service-market share.

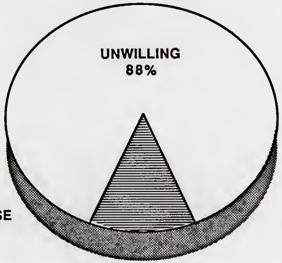
- IBM has also been recently active in increasing user participation in support, introducing a number of problem isolation and resolution procedures (eg., CPAR on peripherals and extensive diagnostic guidelines outlined for CSA customers) serving both to increase the efficiency of IBM support engineers and to decrease the cost of system maintenance. The relative reluctance of users to further increase participation in support, as cited in Exhibit IV-72, is most likely a reflection of this already increased involvment imposed by IBM. Especially in the area of diagnosis, IBM users expected the lowest discount of any of the small systems user groups, many currently involved to some degree under their current agreement.

I. PRIME 32XX

- In April of 1987, INPUT contacted data processing officials at 30 Prime 9X5X sites to discuss the service and support they received from their small systems vendor. By industry classification, manufacturing firms were most common among respondents (30%), while education and service firms each composed 20% of the sample. Distribution, medical, and state/local government sectors were each represented by 7% of respondents; transportation, banking/finance and federal government each comprised 3%.

EXHIBIT IV-72

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE IBM SYSTEM 38



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT — DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	18	0	25	75	75	75	100
SWAP COMPONENTS	32	0	0	33	33	33	100
SWAP BOARDS	33	0	0	0	33	33	100

*UP TO AND INCLUDING

OPTIMUM DISCOUNT LEVEL

F-USS

- 9X5X users' contractual relationship with Prime is examined in Exhibit IV-73, showing 70% of the sample receiving under 5-day coverage and 30% opting for extended 7-day support. Most users received support over normal working hours (40%), but one-third of the sample contracted for 24-hour coverage of their system. The vast majority of Prime users were billed monthly for support (92%), very few paid annually or quarterly.

- Exhibit IV-74 presents Prime system and support performance by the traditional measures of interruptions, availability, and problem resolution performance times. Prime users on average experienced 1.3 interrupts per month, most (62%) attributed to hardware failure, resulting in a mean uptime of 96.3%. Availability performance of the 9X5X machines declined dramatically between this year and last; 1986 users reported an average availability of 98.2%.

- This uptime performance falls well below that of the average small systems users among our sample (at 96.9%) and disappointed 70% of Prime users, as shown in Exhibit IV-75. This is indicative of the sharp increases in user requirements over the past year, echoing the trend seen among small systems users as a group. Rising from 97.2% in 1986 to 98.7% this year, Prime user needs now rank among the highest of the combined small systems sample (requiring 96.9% as an overall average).

- Prime's record of responding to these down situations was somewhat better than this overall system performance, with users reporting response times below the total small systems average (3.1 hours compared to 3.6) and repair times of just under 4 hours (mean time 3.8 hours, as shown in Exhibit IV-74). Actual response times varied between a half-an-hour and a full day, while the mean requirement was 2.4 hours. This resulted in an overall satisfaction level of 83% (see Exhibit IV-73), somewhat lower than that of most small systems vendor groups.

EXHIBIT IV-73

SERVICE CONTRACT
PRIME 9X5X

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	70
- MONDAY - SATURDAY	0
- MONDAY - SUNDAY	30
• HOURS OF COVERAGE	
- 1-9 HOURS	40
- 10-16 HOURS	27
- 17-24 HOURS	33
• BILLING INTERVAL	
- ANNUAL	4
- QUARTERLY	4
- MONTHLY	92

EXHIBIT IV-74

SERVICE PERFORMANCE
PRIME 9X5X

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
- MEAN NUMBER PER MONTH	1.3
- HARDWARE-CAUSED (PERCENT)	62.0
- SYSTEMS SOFTWARE-CAUSED (PERCENT)	20.0
- APPLICATIONS SOFTWARE-CAUSED (PERCENT)	2.0
- OTHER CAUSED (PERCENT)	16.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	96.3
• MEAN RESPONSE TIME (HOURS)	3.1
• MEAN REPAIR TIME (HOURS)	3.8
• MEAN RECOVERY TIME (HOURS)	*

* = INSUFFICIENT RESPONSE

F-USS

EXHIBIT IV-75

USER SATISFACTION WITH SERVICE PERFORMANCE
PRIME 9X5X

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED
SYSTEM AVAILABILITY	98.7	30
RESPONSE TIME (HOURS)	2.4	83
REPAIR TIME (HOURS)	3.6	71
RECOVERY TIME (HOURS)	*	*

*INSUFFICIENT RESPONSE

F-USS

- Satisfaction with repair times was lower yet at 71%, although on average closely approximating users' expectations. Although this indicates that a good number of users were satisfied with the repair performance their branch offered, a smaller group of very dissatisfied users skewed the overall percentage and frequently focused concern on the level of expertise their engineer showed in repair situations. Related complaints regarding the accessability of spares were even more common, users citing breakdowns in communications and the diagnostic process as often resulting in the engineer arriving without the part needed to facilitate repair.

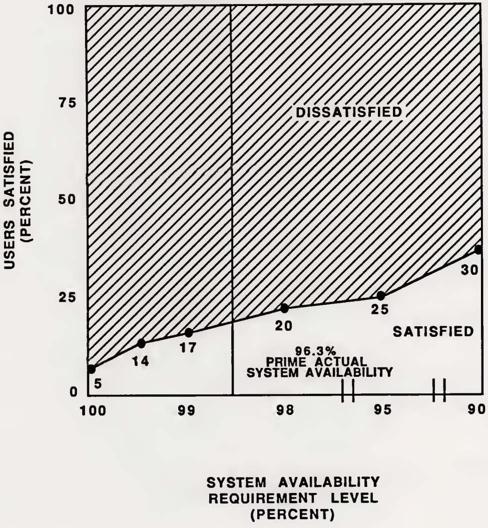
- Although 80% of Prime users reported having received remote support/diagnostics over the past year, the complaint of inefficient diagnostic procedures surfaced often among the sample. Impacting both system performance (prolonging downtimes) and overall support performance (reflecting poorly on the field engineer and service operation as a whole) improvements must be made in this area before user satisfaction slips further. Currently, only 60% of Prime users felt that they were receiving the level of support for which they were paying, a dangerously low level in the face of intensifying third-party and alternative vendor competition.

- Looking closer at the problem of system availability, a suprisingly high percentage of Prime users required top performance of their 9X5X system, with 67% of users expressing 100% system availability needs. This weighed heavily on the low percentage of users satisfied with availability (the 30% shown in Exhibit IV-74); only 5% of this high-requirement group actually received 100% uptimes. The cumulative breakdown of user satisfaction with actual system availability is plotted in Exhibit IV-76, illustrating the descrepancies between user needs and 9X5X performance even at the lower 99.0 and 98.0% availability levels.

- This predominance of high-availability needs is clearly illustrated in Exhibit IV-77 by the concentration of user points along the top of the graph. Minicomputer vendors, Prime among them, must address this upward shift in user

EXHIBIT IV-76

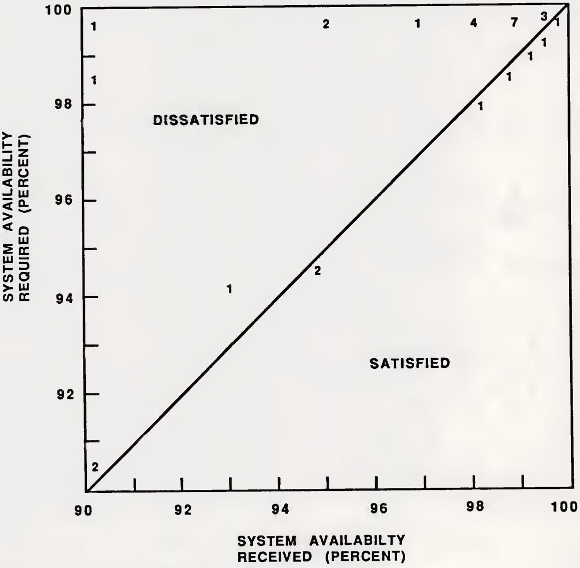
USER SATISFACTION WITH SYSTEM AVAILABILITY
PRIME 9X5X



F-USS

EXHIBIT IV-77

USER SATISFACTION WITH SYSTEM AVAILABILITY
PRIME 9X5X



TOTAL POINTS PLOTTED: 29

needs both in the provision of efficient repair and, more importantly, in the development of high-reliability systems. Advances in fault-tolerant architecture and effective remote support and repair systems make such high user goals attainable and offer small systems vendors feasible solutions for the increasing problem of user requirements.

- A number of specific support components are examined in Exhibit IV-78, where user value is compared to actual performance in each area. The most striking deficiencies occur in software support categories, all three components (engineer skill, documentation, and support overall) lagging well behind user requirements. These ratings closely follow those of the aggregate small systems sample, reflecting the increasing importance all users of minicomputers are placing on software services.

- As shown in Exhibit IV-79, only around 40% of Prime users are receiving support up to their standards in these areas, and although these percentages represent an improvement in software support over the past year, Prime's efforts in this area will have to be accelerated in order to keep up with increasing user demands.

- Among hardware support components, parts availability again surfaces as a problem area, falling 1.3 points below user value (as shown in Exhibit IV-78). Although healthy gains in satisfaction were also made in this area (up from 27% in 1986), Exhibit IV-79 shows over half of Prime users remaining anxious about their spare parts situation. Sensitivity to parts availability no doubt impacted ratings of hardware engineer skill (users indicating FEs often arrived without the needed spares) and hardware support overall, with 60% or more of Prime users expressing dissatisfaction in both of these areas.

- Exhibit IV-80 plots user needs against Prime performance, clearly identifying support areas in need of improvement. Again, software support components are positioned farthest from the (user value) target area, with the issue of parts availability following close behind. Training, an area of relatively low

EXHIBIT IV-78

1987 USER PERFORMANCE/VALUE LEVELS
PRIME 9X5X

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	5.2	5.4	0.2
PARTS AVAILABILITY	8.6	7.3	(1.3)
REMOTE SUPPORT	7.5	7.5	Ø
HARDWARE ENGINEER SKILL	8.6	7.8	(0.8)
SOFTWARE ENGINEER SKILL	8.4	7.3	(1.1)
SOFTWARE DOCUMENTATION	8.8	7.2	(1.6)
SOFTWARE SUPPORT OVERALL	8.6	7.2	(1.4)
HARDWARE SUPPORT OVERALL	8.5	7.7	(0.8)

* SCALE: 1 = LOW, 10 = HIGH

** AVERAGE STANDARD ERROR OF THE MEAN = 0.4

EXHIBIT IV-79

USER SATISFACTION LEVELS
1987 VERSUS 1986
PRIME 9X5X

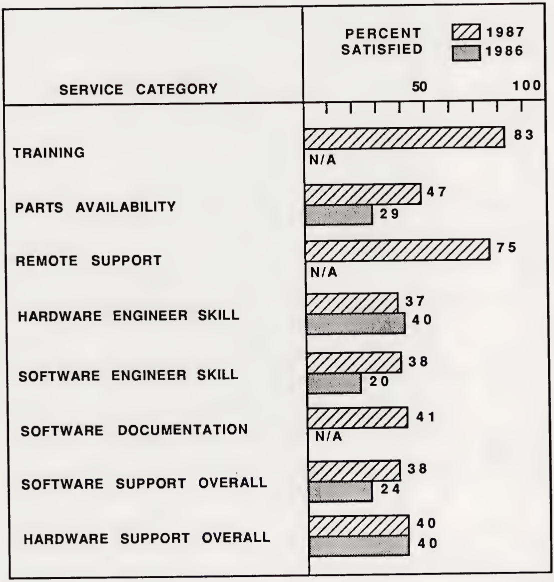
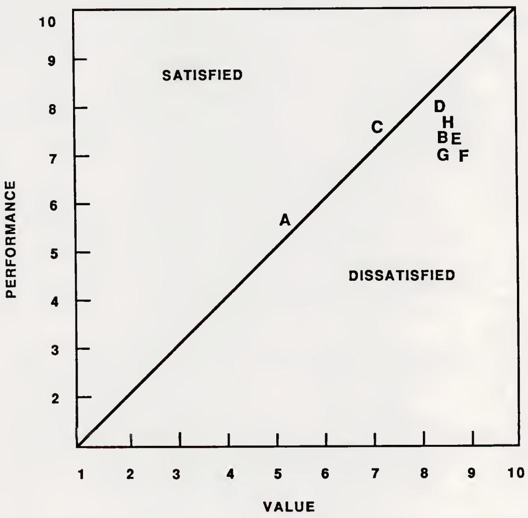


EXHIBIT IV-80

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
PRIME 9X5X



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

F-USS

value to Prime users, is the only aspect of support offered at a level exceeding user needs.

- Exhibit IV-81 represents a significant opportunity open to Prime that could improve service efficiency as well as offer cost savings in the implementation of support. As shown, 57% of Prime users expressed a willingness to increase their participation in support through involvement in initial problem diagnostics and simple board and component swapping. This percentage represented a much higher interest than was indicated by any other of the small systems groups and, if correctly exploited, could work to alleviate the current key user concerns over diagnostics and spare components. Allowing users to be more involved in problem determination would help to improve user perceptions of Prime's diagnositic process; stocking components and boards at user sites would offer a greater level of security about the availability of spares. Allowing users to perform actual swaps would also work to reduce downtimes and serve to increase user satisfaction 9X5X system availability.

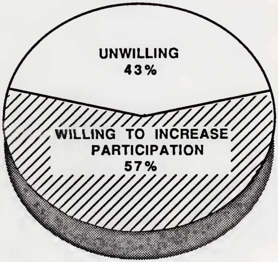
J. TANDEM EXT, TXP, T16

- In March and April of this year, INPUT interviewed a total of 28 Tandem minicomputer users regarding the service and support provided them by their system vendor. The majority of respondents were users of TXP systems (64%); smaller percentages of the responding users had T16 (32%) or newer EXT (4%) units installed at their sites. INPUT targeted top data processing officials at each site for response to the survey.

- The services and manufacturing industries were represented by a majority of the responding firms (comprising 24% and 20% of the sa ple, respectively). Distribution operations comprised 12% of the sample, while transportation, telecommunications, banking/finance, and education organizations each represented 7% of the sample. The remaining 16% was evenly split by

EXHIBIT IV-81

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE PRIME 9X5X



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	25	0	8	33	59	75	100
SWAP COMPONENTS	31	0	0	13	38	63	100
SWAP BOARDS	31	0	0	11	33	67	100

*UP TO AND INCLUDING

OPTIMUM DISCOUNT LEVEL

F-USS

insurance, medical, federal government, and state/local government installations.

- The service contract terms of these users is examined in Exhibit IV-82, indicating that a majority of Tandem systems are covered over the standard 5-day/8-hour period. Only 14% of the sample opted for round-the-clock coverage over a 7-day week, a reflection of the benefits of fault-tolerant systems. The vast majority of users contacted (80%) were billed monthly for their support, with only 2% making a lump-sum payment on their annual agreement.

- Tandem users reported less than one system interruption per month (an 0.9 average), well below the overall small systems user average of 1.2 interrupts. A significant portion of these downtimes were not due to Tandem system failure, however; over a quarter of interruptions were reportedly caused by user, environmental, or scheduled system downs. The majority of system caused interrupts were due to hardware failures; only 19% were the fault of software bugs.

- Overall, availability of the Tandem units was 97.7%, a surprisingly low percentage for fault-tolerant systems, weighed heavily by a very small group of users who experienced 95% availability. A look at Exhibit IV-84 reveals an equally low level of uptime requirements expressed by Tandem users on average and a correspondingly high incidence of user satisfaction with uptime performance. This percentage of satisfied users (89%) was the highest among all small systems user groups sampled and well exceeds the low 59% average of the combined small systems sample.

- Comparing statistics of Exhibit IV-83 and IV-84, Tandem does an equally commendable job targeting user requirements for problem resolution times; response and repair performance even surpassed the already high expectations of its users. Again, the percentages of Tandem users satisfied with response, repair, and recovery times well exceed those of most small systems vendors.

EXHIBIT IV-82

SERVICE CONTRACT
TANDEM EXT, TXP, T16

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	82
- MONDAY - SATURDAY	4
- MONDAY - SUNDAY	14
• HOURS OF COVERAGE	
- 1-9 HOURS	82
- 10-16 HOURS	4
- 17-24 HOURS	14
• BILLING INTERVAL	
- ANNUAL	2
- QUARTERLY	8
- MONTHLY	80

EXHIBIT IV-83

SERVICE PERFORMANCE
TANDEM EXT, TXP, T16

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
- MEAN NUMBER PER MONTH	0.9
- HARDWARE-CAUSED (PERCENT)	55.0
- SYSTEMS SOFTWARE-CAUSED (PERCENT)	13.0
- APPLICATIONS SOFTWARE-CAUSED (PERCENT)	6.0
- OTHER CAUSED (PERCENT)	26.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	97.7
• MEAN RESPONSE TIME (HOURS)	1.7
• MEAN REPAIR TIME (HOURS)	2.9
• MEAN RECOVERY TIME (HOURS)	0.7

EXHIBIT IV-84

USER SATISFACTION WITH SERVICE PERFORMANCE
TANDEM EXT, TXP, T16

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED (50 – 100)
SYSTEM AVAILABILITY	97.7	89
RESPONSE TIME (HOURS)	1.9	96
REPAIR TIME (HOURS)	3.0	92
RECOVERY TIME (HOURS)	0.7	100

F-USS

- Exhibit IV-85 reflects this excellent system and support performance, showing high satisfaction with availability even among the most demanding of Tandem users. Even at 100% uptime requirements, 81% of users received system availability up to their standards. This percentage becomes even more important in view of the fact that over half of the Tandem users sampled (59%) required 100% availability.

- This propensity toward full-system availability needs is highlighted in Exhibit IV-86, illustrated by the concentration of user points at the high end of the requirement scale. Only 2 of these users requiring 100% availability were dissatisfied with their system performance.

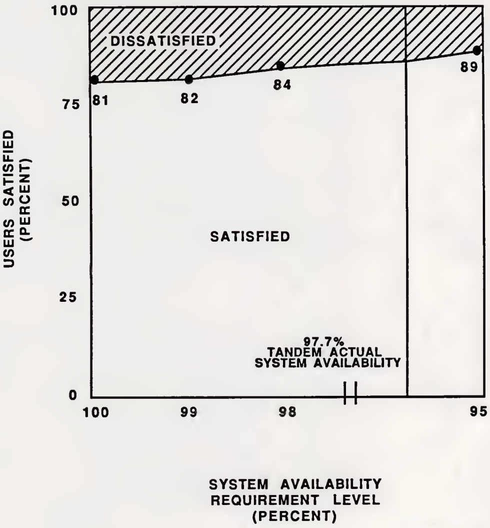
- Specific components of Tandem system service are examined in Exhibit IV-87, comparing support performance to relative user value. Areas of particular concern for Tandem are in the software category; users reporting support received 1.2 to 1.4 points below their needs in documentation, engineer skill, and software support overall. These deficiencies mirror the problems faced by most all small systems vendors as user demands continue to increase with the processing power of the systems. Low satisfaction in these areas (as outlined in Exhibit IV-88) clearly indicates an widespread problem with Tandem's software support provision.

- Another area of concern is that of parts availability, also showing more than half of users dissatisfied with delivery. A common concern among sampled users was the prompt accessibility of spares for their system, many indicating a desire to see more parts stocked locally or at least made more readily available to attending engineers. The value placed on parts availability by the Tandem group was very high (at 9.4), and although Tandem performance in this area was well above small systems vendors on average, these high requirements need to be met before user satisfaction will show improvement.

- Hardware support delivered by Tandem closely matched that of the average small systems vendor (engineer skill and support overall rating near the 8.0

EXHIBIT IV-85

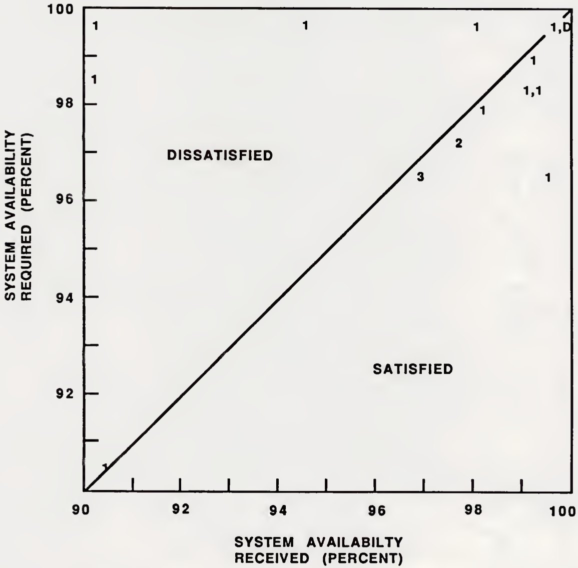
USER SATISFACTION WITH SYSTEM AVAILABILITY TANDEM EXT, TXP, T16



F-USS

EXHIBIT IV-86

USER SATISFACTION WITH SYSTEM AVAILABILITY
TANDEM EXT, TXP, T16



D = 13

TOTAL POINTS PLOTTED: 27

EXHIBIT IV-87

1987 USER PERFORMANCE/VALUE LEVELS
TANDEM EXT, TXP, T16

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	7.1	7.1	Ø
PARTS AVAILABILITY	9.4	8.5	(0.9)
REMOTE SUPPORT	7.4	7.4	Ø
HARDWARE ENGINEER SKILL	8.8	8.1	(0.7)
SOFTWARE ENGINEER SKILL	8.7	7.4	(1.3)
SOFTWARE DOCUMENTATION	8.7	7.3	(1.4)
SOFTWARE SUPPORT OVERALL	8.8	7.6	(1.2)
HARDWARE SUPPORT OVERALL	8.9	8.0	(0.9)

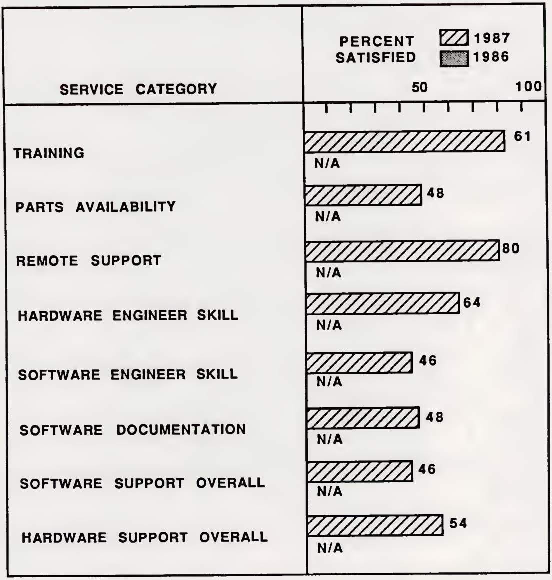
* SCALE: 1 = LOW, 10 = HIGH

** AVERAGE STANDARD ERROR OF THE MEAN = 0.3

F-USS

EXHIBIT IV-88

USER SATISFACTION LEVELS 1987 VERSUS 1986 TANDEM EXT, TXP, T16



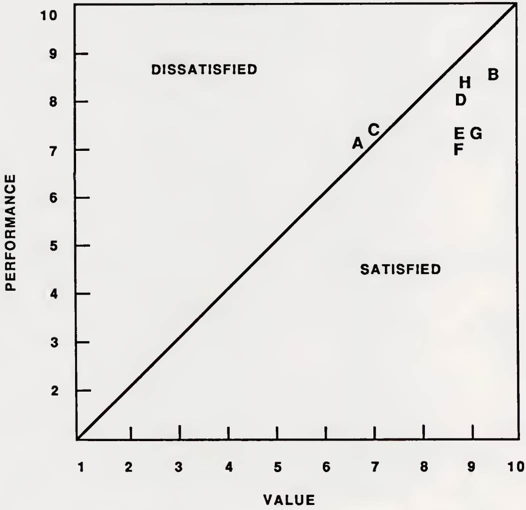
level); Tandem user satisfaction is slightly higher than most small systems vendor groups. Still, just over half (54%) of users received a level of hardware service in 1987 meeting their increasing needs. As minicomputers become more powerful, users are employing the small systems in increasingly critical applications. These higher processing demands are necessarily followed by higher demands for service, and small systems vendors must plan to fortify their support performance along with their system processing performance.

- Exhibit IV-89 graphically illustrates the discrepancies between Tandem service in these categories and users' perceived values of the support. Hardware maintenance services were of high priority to users (hardware engineer skill, support overall, and parts availability rating from 8.8 to 9.4) and should be of first concern to Tandem, followed closely by support in each of the three software areas. Training and remote support were well targeted, both exactly meeting users' lesser requirements; efforts should be concentrating on hitting the target need areas of higher priority services as well.

- Finally, Tandem users' willingness to increase participation in the support of their systems is examined in Exhibit IV-90. A significant percentage of the sample indicated interest in increased involvement, offering Tandem an opportunity to improve service performance in a number of areas without neccessarily prohibitive costs. User participation can often be enlisted for less of an overall cost than comparable operational or technical solutions and often works concurrently to increase user satisfaction in the areas of involvement. Tandem users expected discounts lower than most small systems groups, ranging from 17 to 25%, and significant percentages of the interested group could be engaged for discounts below these average levels, as illustrated in Exhibit IV-90.

EXHIBIT IV-89

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
TANDEM EXT, TXP, T16

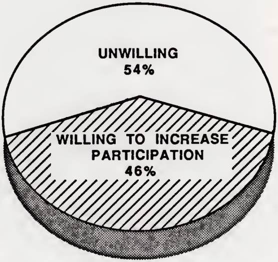


A = TRAINING
B = PARTS AVAILABILITY
C = REMOTE SUPPORT
D = HARDWARE ENGINEER SKILL LEVEL
E = SOFTWARE ENGINEER SKILL LEVEL
F = SOFTWARE DOCUMENTATION
G = SOFTWARE SUPPORT OVERALL
H = HARDWARE SUPPORT OVERALL

F-USS

EXHIBIT IV-90

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE TANDEM EXT, TXP, T16



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	17	29	43	43	57	86	100
SWAP COMPONENTS	24	17	33	33	33	68	100
SWAP BOARDS	21	33	50	50	50	67	100

*UP TO AND INCLUDING

OPTIMUM DISCOUNT LEVEL

F-USS

K. WANG VS

- INPUT contacted 40 users of Wang VS minincomputers in April of this year in attempt to assess the support performance of their vendor. The VS systems installed at the sample sites were predominantly VS-100 models (83% of the sample), but also included VS-90, VS-300, VS-8s and VS-65 models.

- Manufacturing and services were the most common industry categories among the sample (28% and 23% of total respondents, respectively), with distribution and insurance sectors also well represented (at 13% and 10% of the total). State/local government operations comprised 8% of the sample, and federal government and banking/finance were both at 5%. The remaining 8% was evenly split into the transportation, telecommunications, education, and "other industry specific" categories.

- As shown in Exhibit IV-91, most of the VS systems sampled were contractually covered Monday through Friday (80%) for 8 hours daily (75%), with under 20% of Wang users opting for extended support coverage over 7 days or 24 hours. Three-quarters of the sample payed for their support monthly; only 17% take advantage of annual payment discounts offered.

- Wang VS system performance and support delivery measures are presented in Exhibit IV-92. Wang users reported among the lowest of system performance figures of the small systems vendor groups, experiencing almost 2 interrupts (mean 1.8) each month and system availability of only 95.3% on average. This uptime performance fell 2.8% below user required levels (of 98.1%, shown in Exhibit IV-93) on average, but the wide dispersion of availability needs expressed by Wang users (ranging from 80% up to 100%) allowed for a relatively high incidence of users satisfaction with this level of system availability.

EXHIBIT IV-91

SERVICE CONTRACT
WANG VS

CONTRACT COMPONENT	SAMPLE RESPONDING (PERCENT)
• DAYS OF COVERAGE	
- MONDAY - FRIDAY	80
- MONDAY - SATURDAY	2
- MONDAY - SUNDAY	18
• HOURS OF COVERAGE	
- 1-9 HOURS	75
- 10-16 HOURS	5
- 17-24 HOURS	20
• BILLING INTERVAL	
- ANNUAL	17
- QUARTERLY	8
- MONTHLY	75

EXHIBIT IV-92

SERVICE PERFORMANCE
WANG VS

PERFORMANCE CRITERIA	ACTUAL PERFORMANCE
• SYSTEM INTERRUPTIONS	
- MEAN NUMBER PER MONTH	1.8
- HARDWARE-CAUSED (PERCENT)	54.0
- SYSTEM SOFTWARE CAUSED (PERCENT)	25.0
- APPLICATION SOFTWARE CAUSED (PERCENT)	6.0
- OTHER CAUSED (PERCENT)	15.0
• MEAN SYSTEM AVAILABILITY (PERCENT)	95.3
• MEAN RESPONSE TIME (HOURS)	4.4
• MEAN REPAIR TIME (HOURS)	3.6
• MEAN RECOVERY TIME (HOURS)	1.2

FUSS

EXHIBIT IV-93

USER SATISFACTION WITH SERVICE PERFORMANCE
WANG VS

PERFORMANCE CRITERIA	USER EXPECTATION	PERCENT OF SAMPLE SATISFIED
SYSTEM AVAILABILITY	98.1	68
RESPONSE TIME (HOURS)	3.5	76
REPAIR TIME (HOURS)	2.8	83
RECOVERY TIME (HOURS)	1.2	96

F-USS

- Response times reported by Wang users (4.4 hours on average) were also among the poorest of small systems users and exceeded user expectations (of 3.5) by nearly an hour. This low average response, however, is weighted heavily by inconsistancies in Wang performance, actual times reported ranging from immediate to a 24-hour response, with a median value of 2 hours. Despite the relatively poor mean response figure, 78% of users did receive response times meeting their expectations (as shown in Exhibit IV-93).

- Wang users had more stringent requirements for systems repair times, expecting problem resolution within 3 hours (2.8 average); Wang performed to small systems sample standard of 3.6 hours. Actual repair time requirements also varied greatly, resulting in 83% of users satisfied with repair performance despite the discrepancies on average.

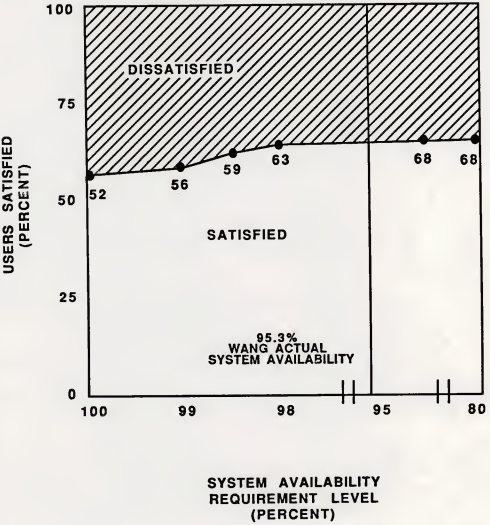
- System availability problems are revisited in Exhibit IV-94, which graphs user requirements against Wang performance at various levels of uptime needs. As shown, only approximately half (52% satisfied) of the Wang users requiring 100% availability received that level of support, and even at the lowest uptime requirements (of 80%), VS systems left nearly 30% of users dissatisfied.

- Most all of these dissatisfied users, however, expected top system availability performance from their VS, as illustrated in Exhibit IV-95. Over half (58%) of Wang users within the sample set 100% availability demands on their VS machines. As Wang attempts to move from the office/wordprocessing environment into other, more demanding marketplaces, system performance as well as support delivery will have to be upscaled to meet the related customer requirements.

- One aspect of service Wang is currently attempting to enhance is software support. Previously considered spotty at best, Wang has expanded software maintenance capabilities over the past year and, much to the chagrin of many users, has begun to assess charges for software assistance. As indicated in Exhibit IV-96, any improvements made have had little positive impact on user

EXHIBIT IV-94

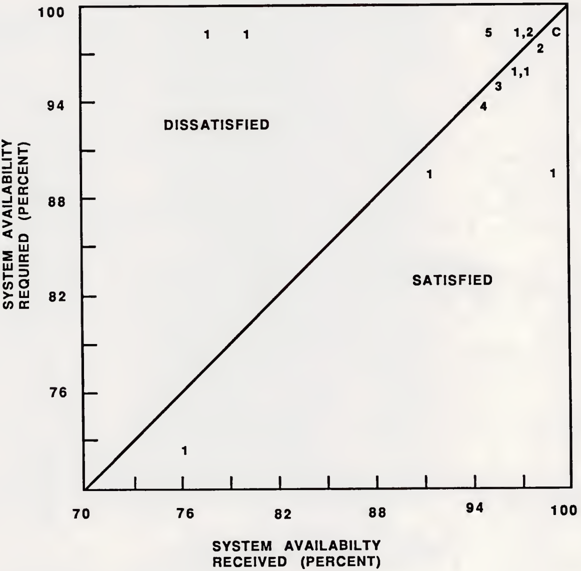
USER SATISFACTION WITH SYSTEM AVAILABILITY
WANG VS



F-USS

EXHIBIT IV-95

USER SATISFACTION WITH SYSTEM AVAILABILITY
WANG VS



TOTAL POINTS PLOTTED: 37

C = 12

EXHIBIT IV-96

1987 USER PERFORMANCE/VALUE LEVELS
WANG VS

SERVICE CATEGORY	1987 AVERAGE USER RATING*		PERFORMANCE EXCEEDS (FALLS BELOW) VALUE
	VALUE	PERFORMANCE	
TRAINING	7.5	6.6	(0.9)
PARTS AVAILABILITY	8.9	7.2	(1.7)
REMOTE SUPPORT	***	***	-
HARDWARE ENGINEER SKILL	9.0	8.0	(1.0)
SOFTWARE ENGINEER SKILL	9.0	7.2	(1.8)
SOFTWARE DOCUMENTATION	8.4	6.6	(1.8)
SOFTWARE SUPPORT OVERALL	8.3	6.5	(1.8)
HARDWARE SUPPORT OVERALL	8.9	7.9	(1.0)

* SCALE: 1 = LOW, 10 = HIGH

** AVERAGE STANDARD ERROR OF THE MEAN = 0.4

*** INSUFFICIENT RESPONSE

F-USS

perceptions of Wang software support, performance in all areas within the category (including documentation, engineer skill, and support overall,) still falling well below the expectations users expressed.

- User satisfaction with these specific aspects of software support (as reported in Exhibit IV-97) remain the lowest of all small systems user groups. Considering the negative perception users have reported in the past regarding Wang's abilities in the software support arena, drastic improvements will be neccesary to avoid customer alienation over the newly imposed charges for service performed at these low levels. Not surprisingly, improvements in software support was a common desire expressed by users of Wang service.

- Wang users expressed concern over service costs more than most vendor groups, listing price as a major concern in both hardware and software support categories. Many users expressing concern over the competency of their attending engineer; over one quarter of users felt they were not receiving the level of support they were currently paying for.

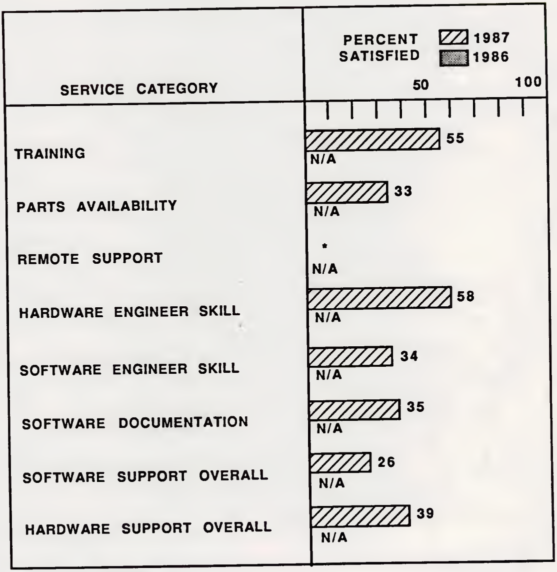
- Parts availability was the area of greatest concern within the hardware service category, with only one-third of users receiving adequate spares support. Even though Wang users expressed lower expectations than most small systems users, parts availability fell 1.7 points below user expectations (as listed in Exhibit IV-96). Hardware support overall was not rated much higher, only 39% of users expressing satisfaction with system maintenance (in Exhibit IV-97).

- The positioning of these individual areas of support relative to the value users place on them is clearly illustrated in Exhibit IV-98. Not surprisingly, the areas falling farthest from the target user needs are software support components.

- Hardware engineer skill, also valued highly and often commented upon by concerned users, is another area of weakness in Wang service. Many

EXHIBIT IV-97

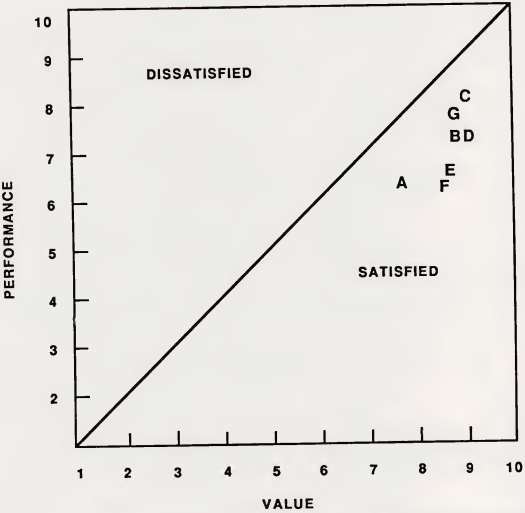
USER SATISFACTION LEVELS
1987 VERSUS 1986
WANG VS



*INSUFFICIENT RESPONSE

EXHIBIT IV-98

SERVICE VENDOR PERFORMANCE VERSUS USER VALUE
WANG VS



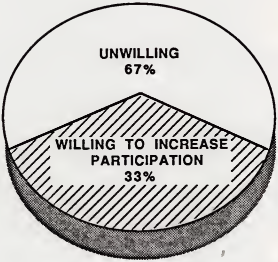
A = TRAINING
B = PARTS AVAILABILITY
C = HARDWARE ENGINEER SKILL LEVEL
D = SOFTWARE ENGINEER SKILL LEVEL
E = SOFTWARE DOCUMENTATION
F = SOFTWARE SUPPORT OVERALL
G = HARDWARE SUPPORT OVERALL

respondents felt that more complete training was needed for FEs as well as an increase in the actual size of Wang's FE pool. Problems ranging from increased system interruptions to poor response times were blamed on the insufficiencies of Wang's hardware engineer staff.

- Exhibit IV-99 examines the willingness of Wang's users to increase their involvement in the maintenence of their VS system. One-third of users expressed an interest in assisting in diagnosis or board/component swapping given an associated discount on their current contract charges. Wang users expected healthy discounts even for involvement in preliminary diagnostics (ranging from 10 to 50%), but on average could be enticed to participate in problem diagnosis for 22% entitlements. Users expected higher rate breaks for more involved tasks of board and component swapping, (the average discount expected between 27 and 31%), but near half of interested users would accept 20 to 25% discounts for this assistance.

EXHIBIT IV-99

USER WILLINGNESS TO INCREASE PARTICIPATION IN MAINTENANCE WANG VS



USER INVOLVEMENT	AVERAGE DISCOUNT EXPECTED (PERCENT)	PERCENT OF USERS REQUIRING DISCOUNT					
		DISCOUNT LEVEL REQUIRED*					
		5%	10%	15%	20%	25%	25+%
DIAGNOSIS	22	0	25	38	75	75	100
SWAP COMPONENTS	27	0	11	22	56	67	100
SWAP BOARDS	31	0	0	0	33	44	100

*UP TO AND INCLUDING

OPTIMUM DISCOUNT LEVEL (shaded: Diagnosis 20%, Swap Components 20%, Swap Boards 25%)

F-USS

V SMALL SYSTEMS SUMMARY DATA

V SMALL SYSTEMS SUMMARY DATA

- In this chapter, INPUT presents selected data from the 1987 small systems user service requirements analysis in summary charts (Exhibits V-1 through V-9), 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 in satisfying the needs of their particular users, rather the achievement of the "best" individual performance mark, since the "best" mark might not be good enough if the user's requirement exceeds it.

EXHIBIT V-1

SMALL SYSTEMS VENDOR PERFORMANCE SYSTEM INTERRUPTIONS

VENDOR	SYSTEM INTERRUPTIONS				
	AVERAGE NUMBER PER MONTH	CAUSED BY (PERCENT)			
		HARDWARE	SYSTEMS SOFTWARE	APPLICATIONS SOFTWARE	OTHER
AT&T	1.4	68	15	8	9
CONCURRENT	0.8	48	10	9	33
DATA GENERAL	1.8	65	20	5	10
DEC 11/780	1.3	73	9	6	13
DEC 8XXX	1.6	75	5	9	11
GOULD	0.7	88	9	1	2
HP	0.7	68	14	4	14
IBM	0.8	67	16	9	8
PRIME	1.3	62	20	2	16
TANDEM	0.9	55	13	6	26
WANG	1.8	54	25	6	15
ALL	1.2	66	14	6	14

F-USS

EXHIBIT V-2

SMALL SYSTEMS VENDOR PERFORMANCE REQUIRED VERSUS RECEIVED SYSTEM AVAILABILITY

VENDOR	SYSTEM AVAILABILITY (PERCENT)		
	REQUIRED	RECEIVED	DIFFERENCE (+/-)
AT&T	96.1	94.4	(1.7)
CONCURRENT	99.4	99.0	(0.4)
DG	98.5	98.3	(0.2)
DEC 11/780	98.3	97.4	(0.9)
DEC 8XXX	97.2	97.2	Ø
GOULD	97.5	95.3	(2.2)
HP	96.7	96.5	(0.2)
IBM	99.0	98.6	(1.6)
PRIME	98.7	96.3	(0.4)
TANDEM	97.7	97.7	Ø
WANG	98.1	95.3	(2.8)
ALL	91.9	96.9	(1.0)

F-USS

EXHIBIT V-3

SMALL SYSTEMS VENDOR PERFORMANCE
REQUIRED VERSUS RECEIVED
RESPONSE TIME

VENDOR	RESPONSE TIME (HOURS)		
	REQUIRED	RECEIVED	DIFFERENCE (+/-)
AT&T	5.9	5.7	(0.2)
CONCURRENT	4.7	3.0	1.7
DG	2.2	2.1	0.1
DEC 11/780	2.8	2.6	0.2
DEC 8XXX	3.6	3.8	(0.2)
GOULD	7.5	6.1	2.4
HP	5.8	5.7	0.1
IBM	1.8	2.1	(0.3)
PRIME	2.4	3.1	(0.7)
TANDEM	1.9	1.7	0.2
WANG	3.5	4.4	(0.9)
ALL	3.7	3.6	0.1

F-USS

EXHIBIT V-4

SMALL SYSTEMS VENDOR PERFORMANCE
REQUIRED VERSUS RECEIVED
REPAIR TIME

VENDOR	REPAIR TIME (HOURS) REQUIRED	RECEIVED	DIFFERENCE (+/-)
AT&T	7.8	9.3	(1.5)
CONCURRENT	2.1	2.3	(0.2)
DG	3.6	3.5	0.1
DEC 11/780	3.0	3.1	(0.1)
DEC 8XXX	2.1	1.9	0.2
GOULD	7.2	7.0	0.2
HP	3.0	3.0	Ø
IBM	2.1	2.0	0.1
PRIME	3.6	3.8	(0.2)
TANDEM	3.0	2.9	0.1
WANG	2.8	3.6	(0.8)
ALL	3.4	3.6	(0.2)

F-USS

EXHIBIT V-5

SMALL SYSTEMS VENDOR PERFORMANCE REQUIRED VERSUS RECEIVED RECOVERY TIME

VENDOR	RECOVERY TIME (HOURS)		
	REQUIRED	RECEIVED	DIFFERENCE (+/-)
AT&T	0.8	0.7	0.1
CONCURRENT	0.3	0.3	Ø
DG	1.3	1.3	Ø
DEC 11/780	0.6	0.7	(0.1)
DEC 8XXX	2.2	2.4	(0.2)
GOULD	0.8	0.8	Ø
HP	1.0	1.1	(0.1)
IBM	0.9	1.0	(0.1)
PRIME	*	*	-
TANDEM	0.7	0.7	Ø
WANG	1.2	1.2	Ø
ALL	1.0	1.1	(0.1)

*INSUFFICIENT RESPONSE

F-USS

EXHIBIT V-6

SMALL SYSTEMS
USER SATISFACTION
SYSTEM AVAILABILITY

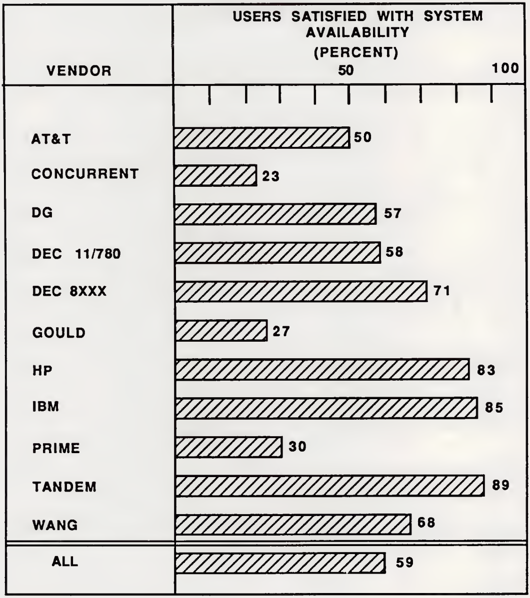


EXHIBIT V-7

SMALL SYSTEMS
USER SATISFACTION
RESPONSE TIME

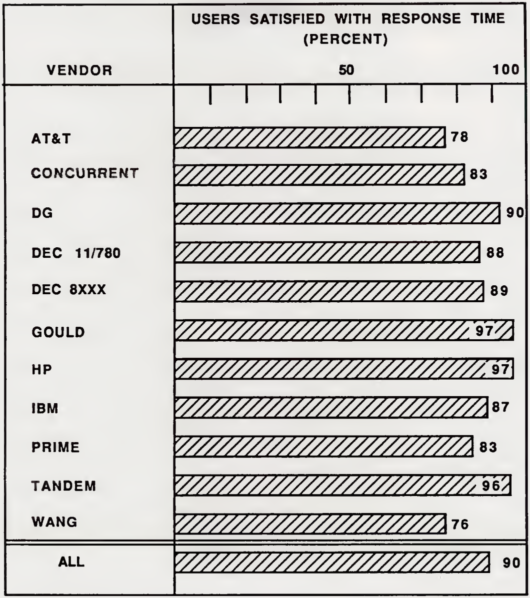


EXHIBIT V-8

SMALL SYSTEMS USER SATISFACTION REPAIR TIME

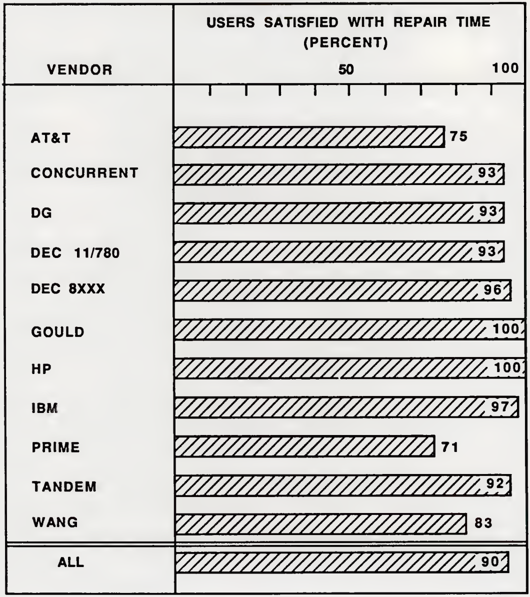
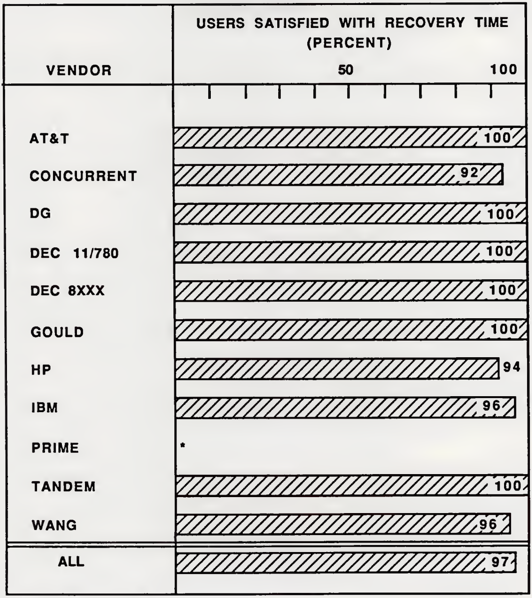


EXHIBIT V-9

SMALL SYSTEMS
USER SATISFACTION
RECOVERY TIME



* INSUFFICIENT RESPONSE

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 the 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	______	______

F-USS

7. What are the three contractual services you feel are the most essential sevices?

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 sevices 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) ______________________________________

11. Would you be interested in increasing your involvement in service

if you received a discount for your participation? (Y/N) ________

If yes: How much of a discount do you expect to receive for:

a) Participate in Diagnosis? ________________ %

b) Swap Components? ________________ %

c) Swap Boards? ________________ %

d) Other (Specify ____________) ________________ %

PERFORMANCE

12. Number of System Interruptions per month ________________ /month

a) percent Hardware-caused ______________ %

b) percent Operating System-Software caused ______________ %

c) percent Applications Software-caused ______________ %

d) percent Other (environment, user caused...) ______________ %

13.

	Required	Received
a) System Availability (%)	______ . ___ %	______ . ___ %
b) Response Time (hours)	______ . ___ %	______ . ___ %
c) Repair Time (hours)	______ . ___ %	______ . ___ %
d) Recovery (hours)	______ . ___ %	______ . ___ %

F-USS

14. Now , speaking generally about your hardware support, what do you see as your three most pressing hardware service concerns? How could they lessened or resolved? (ask for 14b,14d,14f)

14 a) ______________________ 14b) ______________________

______________________ ______________________

14 c) ______________________ 14 d) ______________________

______________________ ______________________

14e) ______________________ 14f) ______________________

______________________ ______________________

15. What do you see as your three most pressing software service concerns? How could they be lessened or resolved (ask for 15b, 15d, 15f)

15 a) ______________________ 15b) ______________________

______________________ ______________________

15 c) ______________________ 15 d) ______________________

______________________ ______________________

15e) ______________________ 15f) ______________________

______________________ ______________________

THANK YOU

F-USS

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 breakup 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 engineeer.

- 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 systems 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 who 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 Lod (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 systems 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 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.