ASYNCHRONOUS DISPLAY TERMINAL MARKET

VOLUME I:

ASYNCHRONOUS DISPLAY TERMINAL MARKET PERSPECTIVES

CONTENTS

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VOLUME I:

ASYNCHRONOUS DISPLAY TERMINAL MARKET PERSPECTIVES

EXHIBITS

I INTRODUCTION

A. PURPOSE AND SCOPE

- This report was prepared by INPUT as a custom study for IBM Systems Communication Division, Kingston, New York.

- It is an update and in-depth extension of previous studies done by INPUT for IBM in March 1978 and March 1979, examining key areas of the CRT terminal market.

- The objective of this study is to determine the size and growth of the ASCII asynchronous display terminal market by interviewing (a) the leading vendors of this type of equipment and aggregating their nonproprietary shipment data for 1980 and 1981, and (b) buying organizations that reside in the distribution chain between the terminal manufacturer and the ultimate end user.

- The scope of this study is limited to asynchronous display terminals using the ASCII character set.

- This report is published in two volumes.

  - Volume I, Asynchronous Display Terminal Market Perspectives, presents INPUT's analysis of the results of interviews with display terminal manufacturers.

- Volume II, Intermediaries' Requirements for Asynchronous Display Terminals, describes intermediaries' perspectives of the marketplace.

- In Volume I, four major perspectives are developed:

  - Industry structure - including the distribution framework, the pricing levels within the distribution channels, and terminal function differentiations.

  - Vendor perspectives - including major strategies, the sources of supply, and the industry coverage by major vendor.

  - Outlook - including product trends, pricing trends, the timing of major changes in product or pricing, and the impact of other products.

  - Industry statistics - including a nine-year chart of shipments (1978-1986) by functional differentiation, as well as current percentages along the various distribution channels.

- Volume II discusses the product requirements of systems integrators and distributors with regard to asynchronous display terminals.

  - In the asynchronous display terminal marketplace, at least six intermediary buying organizations exist and, for purposes of this study, IBM limited it to two, Systems Integrator (SI) and Value-Added Distributor (VAD), which are defined as:

    . Systems Integrator (SI): A company that purchases display terminals for inclusion in its product or system. This company may or may not manufacture some of its own hardware but most likely adds its own software thereby orienting the system to a particular industry. The system is directed toward the general data processing marketplace.

- Value-Added Distributor (VAD): A company that buys display terminals in bulk quantities from the terminal manufacturer and resells them to the ultimate end user. Value is added by the provision of maintenance service, by the availability of leasing plans or other financing services, and by making the terminals available from stock, providing immediate availability, if required.

- This study analyzes the intermediaries':
  - Applications.
  - Hardware used and typical configurations.
  - End users served.
    - Industry.
    - Geographic constraints.
    - Company size - sales/employees/etc.
  - Purchasing process.
    - Evaluation procedures.
    - Price and brand sensitivity.
  - Service requirements.
  - Product requirements.
    - Functions.

- . Size.
- . Human factors.
- . Reliability.
- . Response time.

- View of the future.
  - . Expansion to new areas.
  - . Outlook for asynchronous displays.
  - . Competition.
  - . New product developments and timing.

B. RESEARCH AND METHODOLOGY

- This study began with on-site planning meetings between IBM Systems Communication Division staff and INPUT staff in Harrison, New York; Saddle Brook, New Jersey; and Kingston, New York.

- Three questionnaires were developed by INPUT and approved by IBM Systems Communication Division to be used as the basis for interviewing the major asynchronous display terminal vendors, systems integrators, and value-added distributors.

  - A total of 43 interviews were conducted, as follows:

.	Display manufacturers	12
.	Systems integrators	20
.	Value-added distributors	11
		43

- The names of the companies interviewed and the titles of the interviewees are listed in Appendix A which appears in Volume I.

- Results of these primary interviews were verified by checking logical consistency of reported figures, comparing various published data, and by supplementary interviews with industry knowledgeable sources.

- Results have been aggregated and shuffled in such a way as to preserve anonymity and confidentiality of sources. In particular, it should be noted that respondents referred to as A,B,C, etc., are shuffled from one exhibit to the next.

- All conclusions should be construed to be the best opinion of INPUT, based on the cumulative effect of the data and analysis described above.

- Chapter III of Volume I and Chapters III and IV of Volume II contain the substance of the oral presentation of findings delivered to IBM staff at Kingston on December 11, 1981, and constitute the major portion of the final report of this study.

(DRAFT)

EXECUTIVE SUMMARY

- This study was limited to asynchronous display terminals which use the ASCII character set.

- There are four basic types of asynchronous display terminals:

  - Level 1, which the industry refers to as a dumb terminal, has no special features other than a numeric keypad on a keyboard which may be detachable.

  - Level 2, referred to as a smart terminal, has full editing, formatting, paging, and other features, but is not programmable.

  - Level 3, which is an intelligent terminal, has all the features of the Level 2 terminal and is programmable by the vendor.

  - Level 4, an intelligent terminal, has all the features of the Level 2 smart terminal and is programmable by the user.

A. FINDINGS

- Shipments of asynchronous display terminals are likely to increase 23% in 1981 to 475,000 units, with independent vendors accounting for 320,000, or 67%, of the total.

- INPUT forecasts a 23% shipment gain in 1982 to 585,000 units. In 1982, independent vendors are likely to increase their market share slightly to 68%.

- The shift in the shipment mix to more features and more intelligence continues, as vendors turn increasingly to 16-bit microprocessors to add more functions.

  - Vendors see limited opportunities for maximizing price competitiveness at the lower end of the product line. Power supply technology, offshore manufacturing, and cheaper casings and enclosures are viewed as possibilities to be explored for overall cost reduction.

  - End users increasingly require more functions, and user price sensitivity appears to be inversely proportional to the degree of functionality incorporated into the product.

- Independent vendors of asynchronous display terminals generally attempt to market their products through intermediaries who are able and willing to commit to high-volume orders on an annual basis.

  - Discount schedules are generally structured to discourage low-volume orders, thereby discouraging end-user orders in favor of orders from intermediaries.

  - Some discount schedules are structured to maximize the profit potential for intermediaries.

- Value-added distributors and (to a lesser extent) systems integrators apparently are becoming more important over time as distribution channels for asynchronous display terminals. Their growing acceptance by end users as direct replacements for the manufacturer's sales and service force is being enhanced by increased product reliability and simplicity of maintenance as typified by carry-in or mail-in depot maintenance and the concept of "throw-away" components such as keyboards.

- Intermediaries have the potential to become as important in the distribution framework for asynchronous display terminals as independent agents have become in the insurance business.

B. LONGER TERM OUTLOOK

o Independent vendors are likely to increase their share of asynchronous display terminal shipments in the 1981-1986 period, at the expense of systems vendors, because they are less constrained by arbitrary systems marketing requirements and are therefore more responsive to market requirements.

- INPUT forecasts that, by 1986, independent vendor shipments will amount to 855,000 units, representing 78% of total shipments of 1.09 million units.

o Over the next five years, vendors will be striving to provide more functions, at lower cost per function, in response to users' needs.

o Brand sensitivity will continue to exist, to the extent that intermediaries and end users will purchase from vendors whom they perceive to be willing to make a long-term commitment to the market.

o Price sensitivity appears likely to remain high at the low end of the product feature scale and to diminish as functions and flexibility increase.

- Entry-level pricing must therefore reflect acceptance of this reality.

o Vendors and intermediaries agree that continued proliferation of options and features must stabilize into sets of common packages, to keep model inventories manageable.

o Vendors likely will respond to a market requirement for an optional, user selectable display size equivalent to a standard line printer page (132 characters by 66 lines). Users want the option of directing report pages to a line printer

or to a terminal without the need for maintaining two sets of output formatting programs.

- Additionally, a 66-line display is viewed as important in word processing applications.

o High-resolution graphics and color graphics, coupled with a hard-copy option, will become a standard feature of asynchronous display terminals over the next five years, as vendors seek to remain competitive and meet market demand.

- INPUT believes that color by itself will not be as advantageous as the combination of color and graphics.

- The use of color to highlight alphanumeric fields appears to offer only limited incremental value over alternative methods such as reverse video and blinking.

o The benefits of color are most readily apparent in graphic displays of multidimensional data matrices, such as comparative percentage distribution of revenues and profits by product and geographic source over several time periods, presented in bar chart form.

- Implicit in meeting the requirement for high-resolution color graphics is the need for supporting the high bandwidth necessary for both color and graphics.

o Ergonomic considerations will increase in importance in the area of terminal design, especially for vendors planning to market their products in Europe.

- Swedish labor unions have already succeeded in causing legislative standards to be enacted with respect to display terminal characteristics.

- In the United States, the National Institute for Occupational Safety and Health (NIOSH) has focused on the suspicion that prolonged CRT use might cause persons under the age of 65 to develop cataracts.

- Intermediaries point out that end-user discomfort with the system interface tends to alienate end users toward the system.

o The stringency of reliability and maintainability expectations will require vendor support for direct replacement of malfunctioning components.

EXHIBIT 1

DISTRIBUTION FRAMEWORK
VENDOR OPINIONS OF
1980 ASYNCHRONOUS DISPLAY TERMINAL SHIPMENTS
($ thousands)

VENDOR	ESTIMATED 1980 TOTAL SHIPMENTS (Number Of Units)	ESTIMATED SALES		ESTIMATED DISTRIBUTION BY TYPE (Number Of Units)		
		OEM	END USER	LEVEL 1	LEVEL 2	LEVELS 3 AND 4
A	440	$264	$176	150	190	100
B	410	246	164	150	170	90
C	400	320	80	*	*	*
D	400	320	80	150	160	90
E	400	280	120	200	160	40
F	400	240	160	150	160	90
G	400	240	160	150	160	90
H	355	213	142	130	140	85
I	300-350	180-210	120-140	110	120	70
J	300	180-195	105-120	110	120	70
K	**	**	**	*	*	*
Average	381-386	$248-253	$131-134	144	153	89
Percent	100%	65%	35%	38%	40%	23%

* NOT SURE, BUT SEES A GROWING SHIFT TO PROGRAMMABLE TERMINALS
** NO ESTIMATES

EXHIBIT 2

SHIPMENT AND DISCOUNT CHARACTERISTICS

VENDOR	SHIPMENT CHARACTERISTICS BY ORDER SIZE	SHIPMENT DISTRIBUTION PERCENTAGES	DISCOUNT SCHEDULES
A	N/C	1980: 60% Systems Integrators 20 Distributors 20 End Users 1981: N/C	N/C
B	1-25 Units: End Users Over 500 Units: Systems Integrators and Distributors	1980: 50% Systems Integrators 40 Distributors 10 End Users 1981: N/C	N/C
C	N/C	1980: 80% Systems Integrators and Distributors 1981: Same	N/C
D	1-50 Units: End Users Over 500 Units: Systems Integrators and Distributors	1980: N/C 1981: 30% Systems Integrators 40 Distributors 30 End Users	Over 500 Units: 25% 500 or Less: 0
E	Average order is 50-75 Units	1980: 30% Dealers 20 Systems Integrators 30 Distributors 20 End Users 1981: Same	Discounts begin at 300 units
F	N/C	1980: 66% Dealers 20 Systems Integrators 13 Distributors 1 End Users 1981: Same	N/C

N/C = NO COMMENT

Continued

EXHIBIT 2 (Cont.)

SHIPMENT AND DISCOUNT CHARACTERISTICS

VENDOR	SHIPMENT CHARACTERISTICS BY ORDER SIZE	SHIPMENT DISTRIBUTION PERCENTAGES	DISCOUNT SCHEDULES
G	1-50 Units: Systems Integrators and Distributors 51 or More Units: Systems Integrators, Distributors, or End Users	1980: 15% Systems Integrators 45 Distributors 40 End Users 1981: Same	30-40%
H	N/C	1980: 15% Systems Integrators 15 Distributors 70 End Users 1981 5% Systems Integrators 5 Distributors 90 End Users	1-50 Units: 10-20% 51-100 Units: 20% Over 100 Units: 75%
I	Try for minimum order of 250 units annually	1980: N/C 1981: 20% Systems Integrators 80 Distributors	N/C
J	Try for minimum order of 250 units annually	80%+ to OEMs	50 or Less:0 51-100 Units: 30% Over 100 Units: Negotiable
K	200+ Units: Systems Integrators 501+ Units: Distributors 350+ Units: End Users	1980: N/C 1981: 60-70% Distributors	Under 100 Units: 0 101-500 Units:25-30% Over 500 Units: 40%

N/C = NO COMMENT

EXHIBIT 3

VENDOR ESTIMATES OF
LEADING MANUFACTURERS' MARKET SHARE,
1980 SHIPMENTS, AND OEM/END-USER RATIOS

MANUFACTURER	RESPONDENT	ESTIMATED 1980 SHIPMENTS ($ thousands)	ESTIMATED MARKET SHARE (percent)	ESTIMATED OEM/END USER RATIOS (percent)	
				OEM	END USER
Lear Siegler	A	$60	20%	50%	50%
	B	40	9	N/C	N/C
	C	100	25	N/C	N/C
	D	50	12	N/C	N/C
	E	50	14	60	40
ADDS	A	30	10	60	40
	B	32.5	7	N/C	N/C
	C	30-35	8	N/C	N/C
	D	100	25	N/C	N/C
	E	45	10	N/C	N/C
	F	45	10	75	25
DEC	A	70	26	60-70	30-40
	B	30	10	N/C	N/C
	C	152	43	75	25
Hazeltine	A	30-35	7	N/C	N/C
	B	30	10	65-75	25-35
	C	40	10	N/C	N/C
TeleVideo	A	30-40	10	N/C	N/C
IBM	A*	200+	50+	5-10	90-95
	B	10	3	N/C	N/C

N/C = NO COMMENT
* RESPONDENT'S ESTIMATE IS FOR ALL CRT'S SHIPPED

EXHIBIT 4

VENDOR PERCEPTIONS OF MANUFACTURERS
NOT RANKED IN TOP TEN

Ann Arbor	• Has 5% of Market
Hazeltine	• In Top 20 • 1980 Shipments of 25-30K • 50-50 OEM/End User Sales Ratio
IBM	• Has 5% of Market • In Top 20 Now, Will Be in Top 10 in Two Years
TeleVideo and C. Itoh	• Belong in Top 10
Volker-Craig	• Belongs in Top 25

EXHIBIT 5

VENDOR PERCEPTIONS OF PRODUCT
FEATURE AND OPTION TRENDS
(number of mentions)

ATTRIBUTE	RESPONDENTS' PRODUCT TRENDS THROUGH 1986	BEST SELLING OPTIONS	TRENDS IN OPTIONS AND FEATURES	PRODUCTS PLANNED	MAJOR MARKET TRENDS
Intelligence and/or Programmability	6	–	1	2	5
Color Graphics	3	–	–	–	1
Color	1	3	4	2	2
Graphics	–	2	–	–	1
Standardization of Features	4	–	5	–	–
Emulation	2	1	–	–	1

EXHIBIT 6

VENDORS' PERSPECTIVES ON
MAINTENANCE

VENDOR	WHO MAINTAINS	WHO SELLS CONTRACT	MONTHLY SERVICE CHARGE	
			ON-SITE	DEPOT
A	MFR	MFR	$7.50	$7.50*
B	MFR	MFR	N/A	13% Per Mail-In
C	MFR	MFR	N/C	N/C
D	MFR	REPS	N/C	N/C
E	3rd Party	MFR	1%	Below 1%
F	3rd Party	MFR	N/C	N/C
G	MFR or Distributor	MFR Distributor	N/C	1-1.5%
H	MFR or Representatives	Representatives	0.1%	N/A
I	MFR or Dealer	Representatives	0.1%	N/A
J	MFR or Representatives	Representatives	N/C	N/C
K	MFR, Distributor or 3rd Party	Any	0.1%	Fee Per Mail-In

* = $7.50/MONTH INCLUDES BOTH
N/A = NOT AVAILABLE
N/C = NO COMMENT

EXHIBIT 7

VENDOR PERCEPTIONS OF
FASTEST GROWING COMPETITORS

VENDOR NAME	NUMBER OF MENTIONS
Hazeltine	3
TeleVideo	3
ADDS	2
DEC	2
IBM	2

EXHIBIT 8

VENDOR PERCEPTIONS OF JAPANESE COMPETITION
IN ASYNCHRONOUS DISPLAY TERMINAL MARKET

- Japanese will have very big market
- Japanese could be very strong, as they were with televisions.
- Asians, in general (especially Koreans), will impact U.S. market
- Potential future impact; no impact yet
- Getting bigger every day
- Their features are great
- American companies are too well entrenched
- "How will they service their products?"
- French (Telematique) will also be a factor

4-ASD Tel Pkg:
for
Distributors
(DRAFT)

INTERMEDIARIES' REQUIREMENTS: SUMMARY AND OPINION

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  - Level 1, which the industry refers to as a dumb terminal, has no special features other than a numeric keypad on a keyboard which may be detachable.

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  - Level 4, an intelligent terminal, has all the features of the Level 2 smart terminal and is programmable by the user.

A. CONCLUSIONS

- Pricing of asynchronous display terminals at competitive levels that will enable intermediaries to sell them to end users at a reasonable profit is the key factor in determining a vendor's success in marketing to intermediaries.

- In INPUT's opinion, the evidence supporting this conclusion is overwhelming.

  . Historically, market share at the Level 1 terminal subsector has followed the price leader. Since by definition the Level 1 terminal has no features that can serve to differentiate one competitor's product from another, price is the major attribute by which intermediaries can distinguish one vendor's products from those of competitors.

  . A terminal's price is considered important by both systems integrators and distributors with respect to current and future terminal selection criteria.

- INPUT also believes that vendors of Level 2 terminals have effectively standardized the sets of features offered to the point where product differentiation through features has virtually been eliminated, thereby leaving price again as the major marketing factor.

- The Level 3 and 4 product sector represents the only remaining opportunity to differentiate product sufficiently on a feature basis to justify wide variations in pricing, but the viability of this approach seems limited to five years or less. No historical justification exists to warrant a more optimistic posture.

  . Within five years, most features will be standard offerings or options available at converging prices.

B. INTERMEDIARIES' ATTITUDES AND REQUIREMENTS

o Neither the systems integrators nor the distributors interviewed provided any meaningful industry or application specialization information.

- Purchasing patterns and vendor delivery patterns for intermediaries appear to be fairly similar.

  - Where the intermediary orders terminals in sufficiently large quantities - in lots of 100 units or more each year - the tendency is to place orders on an annual basis and to take delivery of a specific number of units according to a contractual schedule.

  - Distributors who purchase 70 or less units per year, and systems integrators who order 20 or less annually, place their orders on a monthly basis.

  - As might be expected, larger (in terms of revenue) intermediaries can commit to annual order volumes while smaller intermediaries tend to purchase on the basis of short-term requirements.

- Terminal selection criteria ranked as being of more than average importance are reliability, maintenance, and price.

  - Systems integrators also rank ergonomics and human factors as having greater than average importance. The terminal component represents a minor proportion of the total system, but since the terminals represent the interface that the system presents to the end user, it is important that the end user not develop an antipathy toward the interface.

  - To distributors, the manufacturer's identity and reputation are of above average importance. Distributors wish to handle the products of reputable manufacturers, and express a legitimate concern that the manufacturer has made a commitment to the marketplace.

- Price is one of the two top priorities systems integrators and distributors assign to terminal selection criteria.

  - Systems integrators also mention reliability, since they are likely to assume responsibility for maintenance at the customer's site. Excessive maintenance requirements are deleterious to systems integrators' operating costs.

- Terminal features ranked highest by both systems integrators and distributors are ambient light reflection characteristics, a separable keyboard, and screen size.

  - Customers rarely specify that the display screen be glare-free, but quickly recognize that glare and reflections are, at best, annoying.

  - Separability of the keyboard is generally thought to be a desirable feature, as this feature is viewed as a space saver and as something that makes the terminal easier to work with.

    . However, in certain applications a nondetachable keyboard is preferred. Intermediaries have found that customers in the education sector are likely to report thefts of separable keyboards.

  - While most respondents identify a 12-inch CRT with 24 or 25 80-character lines as standard, the Digital Equipment VT-100 with its 132-character line is identified by some as the most popular terminal available.

    . The value of the 132-column width is that it permits the display of line printer report formats without the necessity of horizontal scrolling.

    . In word processing applications, the ability to see a complete 66-line page is important.

    . Some intermediaries believe that an attachment, which would permit projection of the display on a large monitor, would be desirable.

- Systems integrators are more likely to provide on-site maintenance of terminals, while distributors generally tend to provide depot maintenance.

- Systems integrators consider software control, high-resolution graphics, and color graphics as important display terminal options. Distributors consider a printer face, large screens, and reverse video options to be important.

- Factors that are likely to cause a systems integrator to consider using a vendor's terminals are price, features, and reliability/maintainability. Distributors most commonly consider price, features, and performance, and the manufacturer's reputation.

- Over the next five years, systems integrators look for greater availability of high-resolution graphics and local intelligence, while distributors anticipate more features, lower prices, computing capability, and better software.

- Price appears most frequently as a factor in selection of terminals, in considering the use of additional terminals, and in intermediaries' expectations of future trends.

- Exhibit I is a summary of intermediaries' most frequent observations about major asynchronous display terminal attributes.

EXHIBIT 1

INTERMEDIARIES' REQUIREMENTS
FOR ASYNCHRONOUS DISPLAY TERMINALS

ATTRIBUTE	INTERMEDIARY	
	SYSTEMS INTEGRATORS	DISTRIBUTORS
Industry Specialization	Not Meaningful	
Purchase and Delivery Patterns	Larger intermediaries tend to place volume orders (100 or more units) on an annual basis, and to take partial deliveries on a monthly basis. Intermediaries who buy in smaller lots (70 or less for distributors, 20 or less for systems integrators) order monthly and take delivery monthly.	
Terminal Selection Criteria:		
Ranking	Reliability Maintenance Price Ergonomics	Reliability Price Manufacturer Maintenance
Priority	Reliability Price	Manufacturer Price
Terminal Features	Ambient Light Reflection Separable Keyboard Screen Size	Ambient Light Reflection Separable Keyboard Screen Size
Maintenance	Usually on site, by the manufacturer and/or the systems integrator	Usually depot maintenance, distributor usually performs
Options	Software Control High Resolution Graphics Color Graphics	Printer Interface Large Screen Reverse Video
Enticing Factors	Price Features Reliability	Price Features and Performance Manufacturer
Future Trends	High Resolution Graphics More Local Intelligence	More Features Lower Prices Computing Capability Better Software

EXHIBIT 2

VENDORS WHOSE TERMINALS
ARE CARRIED BY DISTRIBUTORS

VENDOR NAME	NUMBER OF RESPONDENTS
Digital Equipment Corporation	6
Hazeltine	5
Datamedia	4
Lear Siegler	4
Applied Digital Data Systems	2
IBM	2
Perkin-Elmer	2

EXHIBIT 3

RANKING OF TERMINAL SELECTION CRITERIA
BY DISTRIBUTORS

CRITERION	AVERAGE RANK*
Reliability	1.4
Price	1.5
Display Manufacturer	1.8
Maintenance	1.9
Response Time	2.9
Ergonomics/Human Factors	3.2
Terminal Size	3.4
Financing	3.7

* 1 = VERY IMPORTANT, 5 = NOT IMPORTANT

EXHIBIT 4

PRIORITY ASSIGNMENT OF
TERMINAL SELECTION CRITERIA
BY DISTRIBUTORS

CRITERION	AVERAGE PRIORITY
Display Manufacturer	2.0
Price	2.2
Reliability	3.1
Maintenance	3.9
Terminal Size	5.3
Response Time	5.4
Ergonomics/Human Factors	5.6
Financing	7.1

EXHIBIT 5

PURCHASE AND DELIVERY PATTERNS FOR DISTRIBUTORS

RESPONDENT	DISTRIBUTORS' ORDERING PATTERNS		VENDORS' DELIVERY PATTERNS		DISTRIBUTORS' TYPICAL CUSTOMER ORDER (UNITS)
	AVERAGE ORDER SIZE (UNITS)	ORDER PERIOD	NUMBER OF UNITS	SHIPPING INTERVAL	
A	2,000	Annually (Ongoing)	75-80	Biweekly	5-10
B	125	Monthly	125	Monthly	100
C	Ongoing	(Ships Approx. 2,000 a Year)			3-4
D	500	Annually	40	Monthly	1-20
E	500	Annually	40	Monthly	1-20
F	70	Monthly	70	Monthly	3
G	30-50	Monthly	30-50	Monthly	4
H	10-30	Monthly	10-30	Monthly	10

EXHIBIT 6

RELATIVE IMPORTANCE OF
TERMINAL FEATURES TO DISTRIBUTORS

FEATURE	AVERAGE RANK*
Ambient Light Reflection	1.9
Separable Keyboard	2.0
Screen Size	2.1
Blinking Cursor	2.2
Tilt and Swivel	2.2
Reverse Video	2.4
Phosphor Color	2.5
Cursor Type	2.5
Audible Keystroke	2.7

* 1 = VERY IMPORTANT, 5 = NOT IMPORTANT

EXHIBIT 7

DISTRIBUTORS' COMMENTS ON
IMPORTANCE OF TERMINAL FEATURES
AND SELECTION FACTORS

Screen Size (1 Mention)	• Large Size Preferred, Especially For Graphics Applications
Separable Keyboard (2 Mentions)	• Important to Many
Price (2 Mentions)	• Often Major Determinant
Maintenance (3 Mentions)	• Ease of Maintenance Is Usually More Important Than Price
	• User Generally Stocks Spares
Display Manufacturer (2 Mentions)	• Deal Only With Reputable Manufacturers
	• Customers Specifically Ask For Brand Names
	• Manufacturer's Commitment and Resources Are Important

EXHIBIT 8

DISTRIBUTOR OPINIONS ON IMPORTANCE OF OPTIONS

	TODAY		IN 1986	
OPTION	NUMBER	PERCENT	NUMBER	PERCENT
Printer Interface	5	45%	4	36%
Large Screen	4	36	0	0
Reverse Video	2	18	1	9

EXHIBIT 9

TERMINAL MAINTENANCE RESPONSIBILITY

MAINTAINER	HOW PROVIDED			TOTALS	
	DEPOT ONLY	ON-SITE ONLY	BOTH	NUMBER	PERCENT
Distributor Only	-	1	3	4	36%
Distributor and Third Party	1	-	2	3	27
Manufacturer and Distributor	1	-	1	2	18
Manufacturer Only	1	-	-	1	9
All Three	1	-	-	1	9
Total: Number	4	1	6	11	-
Total: Percent	36%	9%	55%	100%	100%

EXHIBIT 10

OTHER SERVICES PROVIDED BY DISTRIBUTORS

RESPONDENT	INSTALLATION	TRAINING	CUSTOMIZE	OTHER
A	Yes	Yes	Yes	No
B	Yes	Yes	Yes	No
C	Yes	Rarely	Rarely	No
D	Yes	Rarely	Rarely	No
E	Yes	Yes	No	No
F	Yes	Not Needed	Rarely	No
G	Yes	Yes	Yes	No
H	Yes	Yes	Yes	No
I	Yes	No	Yes	No
J	Yes	Yes	No	No
K	Yes	Yes	No	Yes (Software)
Total*: Number	11	9	8	1
Total*: Percent	100%	82%	73%	9%

* NUMBER RESPONDING YES

EXHIBIT 11

FINANCIAL SERVICES PROVIDED BY DISTRIBUTORS

RESPONDENT	INSTALLMENT PURCHASE	LEASING	RENTING
A	Yes	Yes	Yes
B	Yes	Yes	Yes
C	Yes	Yes	Yes
D	Yes	Yes	Yes
E	Rarely	Yes	Yes
F	No	Yes	Yes
G	No	No	Yes
H	No	No	No
I	No	No	No
J	No	No	No
K	No	No	No
Total*: Number	5	6	7
Total*: Percent	45%	55%	64%

* NUMBER RESPONDING YES

EXHIBIT 12

FACTORS ENHANCING ATTRACTIVENESS
OF ASYNCHRONOUS DISPLAY TERMINALS
TO DISTRIBUTORS

FACTOR	RESPONDENTS	
	NUMBER	PERCENT
Price	7	64%
Features, Performance	6	55
Manufacturer's Reputation	5	45
Reliability	2	18
Graphics	2	18

EXHIBIT 13

DISTRIBUTORS' PERCEPTIONS
OF MARKET SECTOR TRENDS,
1981-1986
(Number Of Mentions)

- More Features (5)
- Lower Prices (3)
- Local Computing Capability (3)
- Better Software (2)
- Larger Screens (1)
- 132 Columns (Characters) Per Line (1)
- Tilt Screens (1)
- Nondetachable Keyboard (1)

4-ASD TU Pkg.
for
Sys. Integrators
(DRAFT)

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- This study was limited to asynchronous display terminals which use the ASCII character set.

- There are four basic types of asynchronous display terminals:

  - Level 1, which the industry refers to as a dumb terminal, has no special features other than a numeric keypad on a keyboard which may be detachable.

  - Level 2, referred to as a smart terminal, has full editing, formatting, paging, and other features, but is not programmable.

  - Level 3, which is an intelligent terminal, has all the features of the Level 2 terminal and is programmable by the vendor.

  - Level 4, an intelligent terminal, has all the features of the Level 2 smart terminal and is programmable by the user.

A. CONCLUSIONS

- Pricing of asynchronous display terminals at competitive levels that will enable intermediaries to sell them to end users at a reasonable profit is the key factor in determining a vendor's success in marketing to intermediaries.

- In INPUT's opinion, the evidence supporting this conclusion is overwhelming.

  . Historically, market share at the Level 1 terminal subsector has followed the price leader. Since by definition the Level 1 terminal has no features that can serve to differentiate one competitor's product from another, price is the major attribute by which intermediaries can distinguish one vendor's products from those of competitors.

  . A terminal's price is considered important by both systems integrators and distributors with respect to current and future terminal selection criteria.

- INPUT also believes that vendors of Level 2 terminals have effectively standardized the sets of features offered to the point where product differentiation through features has virtually been eliminated, thereby leaving price again as the major marketing factor.

- The Level 3 and 4 product sector represents the only remaining opportunity to differentiate product sufficiently on a feature basis to justify wide variations in pricing, but the viability of this approach seems limited to five years or less. No historical justification exists to warrant a more optimistic posture.

  . Within five years, most features will be standard offerings or options available at converging prices.

B. INTERMEDIARIES' ATTITUDES AND REQUIREMENTS

o Neither the systems integrators nor the distributors interviewed provided any meaningful industry or application specialization information.

- Purchasing patterns and vendor delivery patterns for intermediaries appear to be fairly similar.

  - Where the intermediary orders terminals in sufficiently large quantities - in lots of 100 units or more each year - the tendency is to place orders on an annual basis and to take delivery of a specific number of units according to a contractual schedule.

  - Distributors who purchase 70 or less units per year, and systems integrators who order 20 or less annually, place their orders on a monthly basis.

  - As might be expected, larger (in terms of revenue) intermediaries can commit to annual order volumes while smaller intermediaries tend to purchase on the basis of short-term requirements.

- Terminal selection criteria ranked as being of more than average importance are reliability, maintenance, and price.

  - Systems integrators also rank ergonomics and human factors as having greater than average importance. The terminal component represents a minor proportion of the total system, but since the terminals represent the interface that the system presents to the end user, it is important that the end user not develop an antipathy toward the interface.

  - To distributors, the manufacturer's identity and reputation are of above average importance. Distributors wish to handle the products of reputable manufacturers, and express a legitimate concern that the manufacturer has made a commitment to the marketplace.

- Price is one of the two top priorities systems integrators and distributors assign to terminal selection criteria.

  - Systems integrators also mention reliability, since they are likely to assume responsibility for maintenance at the customer's site. Excessive maintenance requirements are deleterious to systems integrators' operating costs.

- Terminal features ranked highest by both systems integrators and distributors are ambient light reflection characteristics, a separable keyboard, and screen size.

  - Customers rarely specify that the display screen be glare-free, but quickly recognize that glare and reflections are, at best, annoying.

  - Separability of the keyboard is generally thought to be a desirable feature, as this feature is viewed as a space saver and as something that makes the terminal easier to work with.

    - However, in certain applications a nondetachable keyboard is preferred. Intermediaries have found that customers in the education sector are likely to report thefts of separable keyboards.

  - While most respondents identify a 12-inch CRT with 24 or 25 80-character lines as standard, the Digital Equipment VT-100 with its 132-character line is identified by some as the most popular terminal available.

    - The value of the 132-column width is that it permits the display of line printer report formats without the necessity of horizontal scrolling.

    - In word processing applications, the ability to see a complete 66-line page is important.

    - Some intermediaries believe that an attachment, which would permit projection of the display on a large monitor, would be desirable.

- Systems integrators are more likely to provide on-site maintenance of terminals, while distributors generally tend to provide depot maintenance.

- Systems integrators consider software control, high-resolution graphics, and color graphics as important display terminal options. Distributors consider a printer face, large screens, and reverse video options to be important.

- Factors that are likely to cause a systems integrator to consider using a vendor's terminals are price, features, and reliability/maintainability. Distributors most commonly consider price, features, and performance, and the manufacturer's reputation.

- Over the next five years, systems integrators look for greater availability of high-resolution graphics and local intelligence, while distributors anticipate more features, lower prices, computing capability, and better software.

- Price appears most frequently as a factor in selection of terminals, in considering the use of additional terminals, and in intermediaries' expectations of future trends.

- Exhibit I is a summary of intermediaries' most frequent observations about major asynchronous display terminal attributes.

EXHIBIT 1

INTERMEDIARIES' REQUIREMENTS
FOR ASYNCHRONOUS DISPLAY TERMINALS

ATTRIBUTE	INTERMEDIARY	
	SYSTEMS INTEGRATORS	DISTRIBUTORS
Industry Specialization	Not Meaningful	
Purchase and Delivery Patterns	Larger intermediaries tend to place volume orders (100 or more units) on an annual basis, and to take partial deliveries on a monthly basis. Intermediaries who buy in smaller lots (70 or less for distributors, 20 or less for systems integrators) order monthly and take delivery monthly.	
Terminal Selection Criteria:		
Ranking	Reliability Maintenance Price Ergonomics	Reliability Price Manufacturer Maintenance
Priority	Reliability Price	Manufacturer Price
Terminal Features	Ambient Light Reflection Separable Keyboard Screen Size	Ambient Light Reflection Separable Keyboard Screen Size
Maintenance	Usually on site, by the manufacturer and/or the systems integrator	Usually depot maintenance, distributor usually performs
Options	Software Control High Resolution Graphics Color Graphics	Printer Interface Large Screen Reverse Video
Enticing Factors	Price Features Reliability	Price Features and Performance Manufacturer
Future Trends	High Resolution Graphics More Local Intelligence	More Features Lower Prices Computing Capability Better Software

EXHIBIT 2

DISTRIBUTION OF SYSTEMS INTEGRATOR RESPONDENTS BY SIZE IN TERMS OF REVENUES, 1981-1982

REVENUE RANGE	NUMBER OF RESPONDENTS	
	1981	1982
Over $20 Million	4	6
$20 Million - $10 Million	5	1
$ 9 Million - $ 5 Million	4	2
$ 4 Million - $ 1 Million	6	4
Under $1 Million	1	0

EXHIBIT 3

INDUSTRY SPECIALIZATION BY SYSTEMS INTEGRATORS

INDUSTRY OR APPLICATION	RESPONDENTS	
	NUMBER	PERCENT
Government (State, Local, Federal)	5	25%
Financial/Accounting/Brokerage	4	20
Distribution	2	10
Legal	2	10
Communications	1	5
Computer-Aided Dispatching	1	5
Construction	1	5
Data Acquisition	1	5
Mailing Lists	1	5
Market Research	1	5
Medical	1	5
Personnel	1	5
Power Utilities	1	5
Process Control	1	5
Publishing	1	5
Software	1	5
Training Systems	1	5

EXHIBIT 4

CORRELATION OF CPU AND TERMINAL SOURCING

RESPONDENT	CPU SOURCE	DISPLAY TERMINAL SOURCE
A	DEC	DEC
B	DEC/IBM	DEC/IBM
C	DEC/Harris/Honeywell/IBM	DEC/Hazeltine/Lear Siegler
D	DEC/IBM	Lear Siegler
E	DEC/Hewlett-Packard/Medcomp	Lear Siegler/ADDS
F	DEC/Others	Depends on Application
G	Data General	Data General
H	Data General/Honeywell	Data General
I	Data General/Ontel	Data General/Ontel
J	Data General	TeleVideo
K	Hewlett-Packard	Hewlett-Packard
L	Hewlett-Packard	Visual Technology
M	IBM	Lear Siegler
N	Datapoint	Datapoint
O	Vector Graphics	Vector Graphics
P	Sperry/Qantel/Digilog	Sperry/Qantel/Digilog
Q	Digidyne	Zentec
R	Intel	Mostek Keyboard, Various Monitors
S	Own Design	TeleVideo/RCA
T	Several	Several

EXHIBIT 5

SOURCE OF TERMINALS PURCHASED BY
SYSTEMS INTEGRATORS

SOURCE	PERCENT OF RESPONDENTS
Manufacturer Only	65%
Manufacturer and/or Price Volume Distributor	20
Price/Volume Distributor Only	15
Value-Added Distributor	0

EXHIBIT 6

SOURCE OF SYSTEM SOFTWARE

SOURCE	PERCENT OF RESPONDENTS
Systems Integrator	50%
CPU Manufacturer	30
Systems Integrator and CPU Manufacturer	10
Other Vendor	10

EXHIBIT 7

PURCHASE AND DELIVERY PATTERNS FOR SYSTEMS INTEGRATORS

SYSTEMS INTEGRATORS' ORDERING PATTERNS			VENDORS' DELIVERY PATTERNS	
RESPONDENT	AVERAGE ORDER SIZE (UNITS)	ORDER PERIOD	NUMBER OF UNITS	SHIPPING INTERVAL
A*	2,400-3,600	Annually	200-300	Monthly
B	500	Annually	As Needed	As Needed
C	400	Annually	As Ordered	Monthly
D	200-300	Annually	As Ordered	As Ordered
E	200-300	Annually	As Ordered	As Ordered (With CPU)
F	200	Annually	As Ordered	As Ordered
G	175	45 Ordered Each Quarter	As Ordered	As Ordered
H	150	Annually	150	45-60 ARO
I*	100	Annually	10	Monthly
J	100	Annually	As Ordered	As Ordered
K	20	Bimonthly	10	Monthly
L	12-15	Monthly	12-15	Monthly
M	32	Annually	As Ordered	As Ordered
N	4	Monthly	4	Monthly
O*	3	Monthly	3	Immediately
P	6	Irregular	6	60 ARO
Q	2-3	Monthly	2-3	Immediately
R	2	Monthly	2	120 ARO
S	20	Annually	As Ordered	As Ordered
T	10	Annually	As Ordered	As Ordered

* THESE RESPONDENTS IDENTIFIED THEMSELVES AS BOTH SYSTEMS INTEGRATORS AND DISTRIBUTORS

EXHIBIT 8

RANKING OF TERMINAL SELECTION CRITERIA
BY SYSTEMS INTEGRATORS

CRITERION	AVERAGE RANK*
Reliability	1.4
Maintenance	1.7
Price	1.8
Ergonomics/Human Factors	1.9
Display Manufacturer	2.6
Response Time	3.3
Terminal Size	3.6

* 1 = VERY IMPORTANT, 5 = NOT IMPORTANT

EXHIBIT 9

PRIORITY ASSIGNMENT OF
TERMINAL SELECTION CRITERIA
BY SYSTEMS INTEGRATORS

CRITERION	AVERAGE PRIORITY
Reliability	1.7
Price	1.9
Display Manufacturer	2.5
Ergonomics/Human Factors	2.8
Maintenance	2.9
Terminal Size	5.6
Response Time	5.7

EXHIBIT 10

OTHER INFLUENCES ON DISPLAY TERMINAL SELECTION
MENTIONED BY SYSTEMS INTEGRATORS

INFLUENCE	RESPONDENTS	
	NUMBER	PERCENT
Reliability/Maintainability	5	25%
Senior Management of Systems Integrator Firm	4	20
Customer Requirement or Choice	3	15
Systems Engineer's Recommendation	3	15
Vendor's Reputation	3	15
Corporate Policy: Deal With One Vendor Only	3	15
Price	2	10
Ease of Programming	1	5
Ergonomics/Human Factors	1	5
Features	1	5
Customer Selection From Systems Integrator's Inventory	1	5

EXHIBIT 11

RELATIVE IMPORTANCE OF TERMINAL FEATURES
TO SYSTEMS INTEGRATORS

FEATURE	AVERAGE RANK*	RESPONDENTS' COMMENTS
Screen Size	2.3	• 11" x 12" Is Popular • 24 x 80 Characters Is Standard • "Large" Is Preferred • 132 Character Width Is Desirable
Separable Keyboard	2.3	• Preferred Because it Is a Space Saver • Not Always Important
Ambient Light Reflection	2.3	• Ability to See Is Important • Importance Becomes Apparent After Customer Begins Using the Terminal
Blinking Cursor	2.5	• Easy to Distinguish From Underline Character
Reverse Video	2.7	
Tilt and Swivel	3.1	
Audibility of Keystroke	3.1	
Phosphor Color	3.2	
Cursor Type	3.3	

* 1 = VERY IMPORTANT, 5 = NOT IMPORTANT

EXHIBIT 12

FACTORS ENHANCING ATTRACTIVENESS
OF ASYNCHRONOUS DISPLAY TERMINALS
TO SYSTEMS INTEGRATORS

FACTOR	RESPONDENTS	
	NUMBER	PERCENT
Price	12	60%
Expanded Features	9	45
- Color		
- Graphics		
Reliability/Maintainability	8	40
Compatibility	4	20

EXHIBIT 13

SYSTEMS INTEGRATOR OPINIONS
ON IMPORTANCE OF OPTIONS
(Number Of Mentions)

OPTION	IMPORTANT	
	TODAY	HIGHER IN 1986
High-Resolution Graphics	1	5
Color Graphics	1	5
Letter-Quality Printer	1	–
Hard Copy Without Printer	1	–
Greek Character Set	1	–
APL Character Set	–	1
Special Function Keys	1	–
Upper and Lower Case	1	–
Detachable Keyboard	–	1
"Zoom" Feature	–	1
Graphics to Support CAD/CAM	–	2
Voice Response	–	2
Storage Capability	–	1
Software Control	–	6

EXHIBIT 14

TERMINAL HARDWARE MAINTENANCE RESPONSIBILITY

MAINTAINER(S)	RESPONDENTS	
	NUMBER	PERCENT
Manufacturer and Systems Integrator	8	40%
Terminal Manufacturer Only	5	25
Manufacturer and Third Party	4	20
Systems Integrator and Third Party	2	10
Systems Integrator Only	1	5

EXHIBIT 15

TERMINAL HARDWARE MAINTENANCE RESPONSIBILITY
AMONG SYSTEMS INTEGRATORS

MAINTAINER(S)	HOW PROVIDED					TOTALS	
	DEPOT ONLY	ON-SITE ONLY	BOTH	VARIES	DO NOT KNOW	NUMBER	PERCENT
Manufacturer and Systems Integrator	0	4	1	2	0	7	35%
Manufacturer	0	4	0	0	3	7	35
Manufacturer and Third Party	0	0	2	1	0	3	15
Systems Integrator and Third Party	1	0	1	0	0	2	10
Systems Integrator Only	0	1	0	0	0	1	5
Total: Number	1	9	4	3	3	20	-
Total: Percent	5%	45%	20%	15%	15%	100%	100%

EXHIBIT 16

OTHER SERVICES PROVIDED BY SYSTEMS INTEGRATORS

SERVICE	RESPONDENTS	
	NUMBER	PERCENT
End-User Training	16	80%
Programming	12	60
Installation	6	30
Systems Analysis	3	15
Consultation	2	10
Documentation	2	10

EXHIBIT 17

HOW SYSTEMS INTEGRATORS' TERMINAL PRODUCT NEEDS WILL CHANGE OVER THE NEXT FIVE YEARS
(Number Of Mentions)

- Variety of Products (1)
- High Resolution Graphics (5)
- Audio Response (1)
- More Local Intelligence (3)
- Graphic Input ("Writing Pads") (1)
- Terminals for Specialized Applications
  - Greek Characters for Engineering and Scientific Applications (1)
  - APL Character Set (1)
  - 126-Character Line (1)
- Color and Black and White Printers (1)
- Touch Sensitive Keys and Panels (1)
- Light Pens (1)

EXHIBIT 18

SYSTEMS INTEGRATORS' PERCEPTIONS
OF MARKET SECTOR TRENDS,
1981-1986

- Non-intelligent terminals will still be useful as simple input devices - also, users lack the sophistication to use personal computers.
- Microprocessors seen as vehicles for increasing function and flexibility.
- Integration of diskettes and rigid disks into terminals
- Personal computers will not affect the marketplace adversely
- High resolution graphics and color graphics will become available at lower cost

Electronic News
March 8, 1982

Dealers Sweat Out Aging HP 83 Stock

By MARK HALPER

NEW YORK — Dealers for Hewlett-Packard's Model 83 personal computer, which recently was pre-empted by the enhanced Model 87, are sweating out some aging inventory now being subject to price cuts no longer buffered by the factory.

While inventories of the Model 83 never had much opportunity to accumulate because of its relatively cool reception 14 months ago, dealers are nevertheless doubtful they will recover costs on units lingering on the shelves.

HP is attempting to relieve some of the distress by buying up some dealer stock on a spot basis to fill factory orders, but the dealers feel the process will be too slow to burn off available inventory.

HP introduced the 87 with memory and display features not on the 83 at $2,495, about $200 higher than the one it is designed to replace.

'Any Reasonable Offer'

One dealer, when asked last week if he plans to sell his inventoried 83s at cost, said, "Cost? How about a few hundred dollars below cost? How about $1,000 below cost? Any reasonable offer." Dealer cost is around $1,600.

That dealer, Maury Goldberg, director of marketing at MiniMicroMart, Syracuse, N.Y., said he still has the HP 83s he ordered during the unit's life on the market.

"I couldn't sell it for $1000," noted Ed Rames, president of Super Business Machines, New York. "What is it? What does it do?

"I'm stuck with it. They won't price protect, because I bought them over a year ago," he said.

Other product unveilings and price cuts on certain peripherals are further squeezing his margins on the HP product, he noted.

"I'm in the same situation with the graphics plotter, which they replaced. Also with the printer and disks. They cut the price on both of those," he said.

Concurrent with the introduction of the 87, HP brought out the Model 7470, $1,500 graphics plotter, a replacement for the 7225 graphics plotter.

In peripherals, HP slashed the price of its 5¼-inch single flexible disk drive, to $2,200 from $2,500, and its 8-inch dual floppy disk drive to $5,830 from $6,830.

Like the Model 83 computer, the price and product changes in the Series 80 peripherals came after the expiration of the standard 60-day price-protection period.

Without Margins

At The ComputerStore, Inc., Framingham, Mass., Richard Brown, president, also noted that the excess 83 stock leaves him without margins.

"We're not making any money on them," he said, adding that, like his industry counterparts, his losses will be tempered by virtue of a moderate Model 83 booking rate over the last year.

In Cambridge, Mass., Ed Walters, president of CompuMart, said "We don't have that many in stock, but it is taking up space where I could have more valuable product."

Meanwhile, HP says it is still forming a policy that will offer the dealers some compensation for inventoried model 83s and that the policy could involve buying back product as HP receives direct factory orders.

"We are making an effort to move product from one location to another if there is an order to be filled," noted Dan Terpack, general manager of the Personal Computer division in Corvallis, Ore.

Dealers noted, however, that because the buy-backs will take place piece-meal, they are not optimistic.

"We still have to support the inventory," Mr. Walters noted at CompuMart.

HP estimated to have realized between $5 million and $8 million in Model 83 revenues since introducing the product in January, 1981. The unit contributed a small percentage to the firm's approximately $120 million in Series 80 revenues in 1981, with the bulk coming from Model 85 sales most of the balance coming from peripherals sales.

Based on $8 million in 83 sales, approximately 4,500 units were sold in 1981, using an average margin rate of 32 per cent. HP offers dealers 35 per cent discounts on purchases of 10 or more units, and 30 per cent on smaller volume purchases.

It could not be determined how many Model 83 computers are in stock in Corvallis. Mr. Terpack declined to quantify the inventory, but did say HP is considering slashing the price on its own stock, and may seek an OEM buyer.

"These terminals are, in effect, microcomputers," says Arnold. "We have several projects to use them to take more of the manual work off the people in the offices." At present, none of the offices are equipped with printers, but Terminix is considering adding them. "We're looking at the possibility of putting more and more information through the terminals," says Arnold.

COSTS MOTIVATE AUSTIN

Concern about the cost of communications between dumb terminals and host computers is motivating Austin Information Services, a division of Austin Co., to take a close look at intelligent terminals. Currently, Austin uses some 200 dumb terminals to communicate with its six Hewlett-Packard 3000 minicomputers. But, says Bill Crow, director of systems development there, "it is absolutely essential to move in the direction of intelligent terminals because the dumb terminal interconnect is not one that we will be able to afford."

Crow is looking at microcomputers in his search for new terminals. Like many others in his position, he realizes that managers in his company are buying personal computers for their own use. But he is not happy about the communications capabilities that those computers offer. "We clearly want to give the manager the capacity for local tools that a personal computer offers," he says, "but we would like to do it as an integrated part of our information system. Right now I don't see the box out there that allows us to do that."

While many people like Crow are deterred from using microcomputers as intelligent terminals for this reason, a number of other companies have already taken the plunge. One reason: the price. The average shipping price for a terminal in a cluster system is about $4,000, rising to about $7,000 for a workstation in a highly sophisticated system, according to Quantum. For a standalone intelligent terminal, the average price is about $6,400. A very minimal intelligent terminal could cost slightly under $3,000, while a very advanced terminal could cost as much as $10,000, the company says. Personal computer prices also vary, but systems with a reasonable amount of software and peripherals tend to cost between $4,500 and $5,000.

That kind of pricing provides compelling logic for using personal computers as intelligent terminals, says Dr. Scott Cutler, manager of video systems programs at General Electric's research and development center in Schenectady, N.Y. "The cost is so low and when you get a Radio Shack or an Apple there is a wealth of software available for it," he says. After all, "there is no Visicalc equivalent for intelligent terminals."

GE is currently using some 25 personal computers in its research center for a variety of applications, including data processing, word processing, controlling expenses, and scientific computation. Using the computers as intelligent terminals "provides a less expensive distribution system," says Cutler. "It offloads the need to use the central resource and is often quicker because you can do some processing without going to the host at all."

Brown at Paine Webber is equally sold on the idea of using personal computers as intelligent terminals on the company's information network. Currently, the company is running a pilot test to see how well nine brokers in strategic locations like using TRS-80s as intelligent terminals. Each night Paine Webber's mainframe computer sends to the personal computers the data on stocks that the broker will need the following day. Then each broker can use various applications programs to message the data any way he likes and can come up with sophisticated extra data for clients beyond what Paine Webber usually provides, such as in-depth portfolio analysis and stock analysis.

Paine Webber's 500 brokers already have GTE Quotron terminals which allow them to call up stock prices as needed. But Brown believes that supplying the brokers with Radio Shack machines will add another dimension to what they can do. "This gives them computer power and inquiry power into the books and records of the firm," he says. The company picked the Radio Shack machines for several reasons. They were cheap, were widely available through the company's retail stores, and, says Brown, "the brokers were buying them anyway."

That kind of pragmatic approach could mean that a lot more personal computers will be used as intelligent terminals in the future. More and more data processing managers, aware that managers at their companies are taking data processing into their own hands and buying these machines, are looking for ways to integrate the machines into their networks. "We're pushing to try to take

THE SHIFT TO INTELLIGENT TERMINALS

The terminal market is expected to change significantly over the next few years. Here's a look at how the experts think the market will develop.

QUANTITIES IN UNITS INSTALLED	1981	1985
Total	2.69 million	5.38 million
Single-station nonprogrammable terminals (dumb and smart)	55.9%	63.4%
Single-station programmable (intelligent)	6.5	7.1
Multistation nonprogrammable (dumb and smart)	25.4	15.4
Multistation programmable (intelligent)	12.4	14.1

VALUE IF SOLD AT ORIGINAL PRICE (DOESN'T INCLUDE DISCOUNTS)	1981	1985
Total Installed Value	$8.77 billion	$13.18 billion
Single-station nonprogrammable terminals (dumb and smart)	24.1%	24.8%
Single-station programmable (intelligent)	9.9	11.6
Multistation nonprogrammable (dumb and smart)	53.7	46.4
Multistation programmable (intelligent)	13.3	17.2

MAJOR COMPANIES IN THE STANDALONE MARKET	MAJOR COMPANIES IN THE MULTISTATION MARKET
Datapoint	Four Phase
Beehive	Harris
Burroughs	Honeywell (Incoterm)
Texas Instruments	Mohawk Data Sciences
Zentel	Nixdorf Computer
Ontel	Raytheon Data Systems
Megadata	
Hewlett-Packard	
Northern Telecom	

SOURCE: QUANTUM SCIENCE CORP.

YE Installed base

	80	81	82	83	84	85	86	1981-1986 CGR
Level 1								
Indep.	350	449	547	647	732	792	832	13%
Captive	227	272	302	309	309	309	309	3%
Subtotal	577	721	849	956	1,041	1,101	1,141	10%
Level 2								
Indep.	299	430	592	782	1,012	1,287	1,612	30%
Captive	346	421	526	644	764	874	964	18%
Subtotal	645	851	1,118	1,426	1,776	2,161	2,576	25%
Levels 3 + 4								
Indep.	266	341	446	591	786	1,051	1,391	32%
Captive	92	127	177	252	347	467	612	37%
Subtotal	358	468	623	843	2,909 1,133	1,518	2,003	33%
Grand total								
Independents subtotal	915	1,220	1,585	2,020	2,530	3,130	3,835	26%
Captives Subtotal	665	820	1,005	1,205	1,420	1,650	1,885	18%
Grand total	1,580	2,040	2,590	3,225	3,950	4,780	5,720	23%

Jerry returned your call.
He'll be in all morn
today.

Deb

Falcon

VT-100

SBC-1121

VT 18X

LSI-11

2400

Z80

64K

dual 5½" floppy

CP/M

Mark Steinbrenner