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**Personal Computers in Japan
—An Unabridged Account—**

No. 75



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No. 75



FROM THE EDITOR

The revolution in computer hardware brought about by the introduction of very large scale integration (VLSI) technology has speeded up the development of smaller, more compact computers with increasingly advanced functions. This is making it extremely difficult to accurately classify today's computers according to their size. To date, statistical data compiled on computer installations in Japan have centered around general-purpose computers classified as to their value (i.e. large-scale, medium-scale, small-scale and very small-scale computers).

Recently, however, small-scale computers have been further broken down into minicomputers, small business computers and microcomputers, and analyzed statistically every year in accordance with these classifications by the Japan Electronics Industry Development Association (JEIDA). The personal computer (PC) has recently been included in this grouping as well.

Computer utilization has also undergone a major change, rapidly evolving from the batch processing mode to the online processing mode, the latter of which makes use of telecommunications technology. The terminals used with host computer systems have evolved too, pro-

gressing from dumb terminals that were capable of performing input/output operations only to intelligent terminals and workstations that can process information locally as well. With the development of the Software Industrialized Generator and Maintenance Aids (SIGMA) workstation and the recent appearance of engineering workstations, the functions built in to workstations have progressed significantly.

The appearance of all these different types of machines has thrown the computer market into a tizzy. Although each classification of computer carries its own definition, the distinctions among the definitions used to describe these various types of machines are extremely ambiguous. The spread of PCs equipped with powerful telecommunications functions is likely to exacerbate this situation. Therefore, in order to get a statistical handle on the PC market in Japan, we should probably revise the current classification for these machines to come up with a clear definition of just what a PC is. But no matter how good a definition we might come up with, all the user really wants is a user-friendly computer with more advanced functions.

The popularity of the PC has spread

exceedingly fast in Japan lately. According to JEIDA figures, approximately 2 million PCs were shipped here during fiscal 1987. The office automation (OA) boom, that began here with the introduction of word processors into the office, is being propelled rapidly forward thanks to the installation of PCs and workstations, and the systematic linking together of these machines by means of local area networks (LANs).

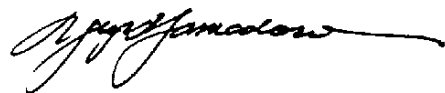
PC utilization is flourishing in the Japanese home as well. Most home computers are used for playing electronic games, and therefore feature limited functions. But the Family Computer game machine is enjoying fantastic popularity among younger generation users. These same young people will gradually require machines with more advanced functions, and this in turn will lead to the further spread of PCs. The commercialization of PC networks is also helping to spur on sales of these machines.

Up until just recently, most Japanese people have had little opportunity to use keyboards. As a result, middle-aged and older Japanese are apt to suffer from what might be called keyboard phobia, i.e. their unfamiliarity with these devices tends to make them afraid of using them. Younger Japanese do not have this problem. As members of the electronic game

generation, young people in Japan jump at the chance to learn how to operate word processors and PCs. Consequently, most management level corporate personnel still tend to shy away from sitting down at the computer keyboard themselves, preferring to rely on their subordinates to operate these devices. At the same time, however, there is a trend among retired persons to try and develop new skills, and one area these elderly citizens are exhibiting very high interest in is PCs. This is creating a situation here in which PC usage is polarized, with young people making up the one pole and senior citizens accounting for the other. In future, however, this situation can be expected to correct itself as today's young people become tomorrow's corporate managers and heads of households, creating demand for PCs that extends across all age groups.

This edition of the Japan Computer Quarterly takes up the topic of PCs in Japan, covering everything from market trends to the latest in technological developments, utilization methods and the spread of PC networks.

We sincerely hope the information presented in the following pages proves both informative and interesting to our readers.



Yuji Yamadori
Director
Research & International Affairs

CURRENT STATE OF THE PC MARKET IN JAPAN

— PC TRENDS IN JAPAN —

Isao Matsuoka
Computer Journalist

SPECIAL CHARACTERISTICS OF JAPANESE PCs

Development Of The PC Market In Japan

In today's world, when we talk about a standard for the personal computer (PC) market, we are referring to the architecture based on the IBM PC/AT. PC markets in the United States and Europe, as well as in the rapidly progressing newly industrialized economies (NIES) revolve around this standard architecture.

Of all the PC markets in the world right now, only Japan's is developing along unique lines. This phenomenon overlaps with the special nature of the market for general-purpose computers (mainframe computers) here.

At any rate, IBM is by no means the leading player in Japan. But just how does the Japanese PC market differ then, you ask? The following general explanation of the growth of PCs in Japan should make this clear.

The first really popular machine in Japan was the PC-8001 announced by Nippon Electric Corporation (NEC) in May 1979. This was an 8-bit PC equip-

ped with a Z80 central processing unit (CPU), which ran Microsoft's BASIC software. The PC-8001 was an immediate hit with computer enthusiasts. Other popular Japanese 8-bit PCs brought out about that time were the MZ-80 by Sharp Corporation and the Basic Master by Hitachi Limited. The Apple Computer Co.'s Apple II also arrived in Japan about then. This was the start of the first PC boom in Japan.

At this stage of their development in Japan, although a few business packages could be found around, PCs were still considered primarily game machines.

In 1981, in the midst of Japan's first PC boom, IBM entered the PC market in the United States with its IBM PC. This machine attracted a lot of attention as the first 16-bit business PC to go on the market. Following IBM's lead, Mitsubishi Electric Corporation came out with the MULTI16, and NEC announced its PC-9800 series of 16-bit machines in October 1982.

This started a trend in Japan, and before long every PC maker here was coming out with new 16-bit machines to replace their old 8-bit PCs. Nevertheless, the machines that exhibited the steadiest growth were the PC-9800 series.

NEC's PC-9800 series of 16-bit PCs are built around Intel Corporation's i8086 CPU, and support the Japanese-language DISK BASIC operating system (OS), as well as CP/M-86 and MS-DOS. The biggest selling point of the PC-9800 machines was that they were compatible with the DISK BASIC OS used in the 8-bit PC-8000 series, which convinced a lot of PC-8000 users to upgrade to PC-9800 machines. The 16-bit PC-9800 machines were also capable of processing work in the Japanese-language. The enhanced, Japanese-language processing capabilities of PC-9800 machines opened the door to PC use in business in Japan.

Another aspect of NEC's PC operations that deserves special mention here was the company's efforts to expand its PC distribution network and its third-party software scheme. NEC was quick to establish a network of PC direct sales outlets, beginning with a chain of stores called Bit-inn. And in the area of PC software, NEC did not attempt to develop all of its software in-house, but rather opted for an open market approach to software development and sales which left the whole process up to third-party software houses. This third-party scheme heralded the start of the packaged software market here in Japan.

While other PC manufacturers continued to develop their own software programs in-house, NEC's third-party software strategy began to pay off. NEC learned that if it could sell the hardware, the software would sell, too. But more importantly, it learned that the more software was available for its PCs, the

better the hardware sold.

The incorporation of Microsoft's MS-DOS OS in the IBM PC had a considerable impact on PC markets around the world. The development of application software packages based on MS-DOS was undertaken here in Japan as well, and NEC's PC-9800 series was greatly expanded to take full advantage of MS-DOS capabilities.

Just as the PC-9800 series was breaking new ground in Japan, IBM Japan announced its IBM Multistation 5550 family of PCs here in 1983. This new series of PCs by IBM featured Japanese-language word processing functions, plus spreadsheet and communications functions. IBM Japan employed the catch phrase "three functions in one machine" in its sales campaign for the Multistation 5550, strengthening the image of the PC as a business machine. The introduction of the IBM Japan Multistation 5550 series into the Japanese PC market kicked off the PC-as-business-machine trend here.

The Multistation 5550 series of PCs were not based on the IBM PC or PC/AT architectures, but rather were a uniquely Japanese family of machines. This was because IBM Japan had developed the 5550 series specifically for the Japanese market, and its entire sales strategy was aimed at the Japanese user.

It was about this time that IBM came out with its IBM PC/AT. The PC/AT architecture attracted large numbers of peripheral makers and software houses, resulting in a very powerful third-party support base. This encouraged the rapid development of PC/AT compatibles,

which made their appearances one right after the other. Add to these Apple's unique line of PCs and you have the workhorses of the American PC market, i.e. IBM PCs, their clones and Apple computers.

Concurrent with its release of the 5550 family of business PCs, IBM Japan started entering into exclusive agent contracts with Japanese dealers. By this time, NEC was already well on its way to creating a network of dedicated sales outlets and third party software houses. IBM Japan's decision to distribute its 5550 PCs via a network of exclusive agents was made in part based on the realization that it couldn't compete with NEC in the dedicated outlet/third-party software house arena.

As you can see, the major factors contributing toward the development of the PC market in Japan up to this point were the huge impacts of the pioneering features and distribution strategy of the NEC 9800 series and the introduction of the IBM Japan 5550 series.

Naturally, the Japanese PC market wasn't built on the efforts of NEC and IBM Japan alone. Fujitsu Limited, Hitachi Limited, Toshiba Corporation, Mitsubishi Electric Corporation, Seiko-Epson Corporation and other leading Japanese PC manufacturers came out with their own lineups of 16-bit business PCs, raising the competition in this market to cutthroat levels.

When it came to market shares, however, NEC remained the most powerful force in the PC market, followed by Fujitsu, IBM Japan, Seiko-Epson and

Toshiba. No other place in the world will you find so many leading PC makers vieing so fiercely with one another for bigger shares of the same market. Each of these manufacturers are fighting desperately to establish their own sales networks as they strive to increase the number and variety of off-the-shelf software packages capable of running on their machines. In addition, they are all required to provide extensive after-sales service and maintenance. Through all this, NEC has not once in the past six years relinquished its premier position in this market.

There is one other major factor that has contributed toward making the PC market in Japan unique, and that is the Japanese language itself. Japanese users who had been seeking Japanese-language processing capabilities in large-scale computers from early on also demanded such capabilities in their PCs. Foreign PC makers just were not equipped to meet these demands in a timely fashion.

PC Usage In Japan

What factors have contributed toward making NEC's 9800 series of 16-bit PCs the best selling machines in Japan? As mentioned earlier, the first and foremost factor contributing to the success of these machines has been the abundance of software available for them. At present, there are an estimated 6,000 software packages on the market specifically written for use on the machines in the NEC PC-9800 series. The number of

software programs available for the IBM PC is said to be somewhere in the range of 50,000 packages, making the software market for the PC 9800 series pale by comparison. But if we limit our discussion to the Japanese software market only, which means mostly Japanese-language programs, then the number of software packages available for the PC-9800 series stands out dramatically from the rest of the crowd. The second largest number of software programs written for a specific series of Japanese PCs comes to roughly 1,300 programs available for Fujitsu's FMR series.

Based on this abundance of software, PC-9800 series' machines steadily increased their share of the market. The main use to which these machines have been put is word processing. In this arena, the best-selling word processing package is a Japanese-language program called "Ichitaro." Ichitaro is equipped with functions that provide 9800 series machines with word processing capabilities on a par with those of dedicated word processing machines. The third-party software house that developed and markets Ichitaro for use on 9800 machines, Just Systems, has ridden the wave of this program's popularity to become the number one PC software maker in Japan.

From about last year, when use of 9800 series PCs for word processing had taken firm root, suddenly the spotlight focused on spreadsheet programs. Right now, Microsoft's Multiplan and Lotus' 1-2-3 are the two most sought after programs for use on PC-9800 machines. Besides Japanese-language word process-

ing and spreadsheet programs, PC-9800 PCs are steadily being used to run card-based database, relational database and computer-aided design software as well.

In addition to these types of general-purpose software packages, there are also a large number of job-specific software programs that have been written for the 9800 series. In fact, the largest percentage of the 6,000 packages available for use on PC-9800 machines are dedicated software programs. Although they are not as exciting as the general-purpose packages, these dedicated job-specific software programs have without a doubt become the basis of the 9800 series strength in the Japanese market.

NEC's PC-9800 series of 16-bit machines has thus become the overwhelmingly strongest selling PC in Japan, and can be found on desks in corporate business offices as well as in private shops throughout Japan. These machines have also gained popularity as home computers.

Meanwhile, Fujitsu has been attempting to rival the PC-9800 series with its FM series of 16-bit PCs. In addition to expanding its offerings of general-purpose software packages written to run on its FM machines, Fujitsu is also clearly shooting to establish a place for these machines as network terminals, using something called a micro-mainframe link that enables FM series machines to be hooked up to the company's popular general-purpose mainframe computers.

IBM Japan's sales strategy has concentrated from the beginning on the market for workstations by enabling

its 5550 series of machines to link up to the company's Systems Network Architecture (SNA) and to serve as man-machine interface terminals with IBM's System Applications Architecture (SAA). This approach has convinced large corporate IBM users to go with that company's PCs as well.

There is the possibility that the use of PCs as both stand-alone machines and as terminals in computer networks will grow in future.

Issues Surrounding PC Growth

What are some of the issues that will have to be dealt with in future concerning the PC market in Japan? A PC is just a machine, and doesn't really become a salable product until it has software to run and has been outfitted with the requisite peripheral equipment to achieve a workable computer system. The first PC-related issue I would like to raise here then has to do with software availability and system conformity.

The recent advancements made in PC hardware have been truly remarkable. As examples of this progress there is the ultra-fast processing speeds made possible with 32-bit microprocessors; the greatly enlarged storage capacities resulting from one megabit RAM and the spread of hard disks; and the space savings made possible with portable PCs and laptop machines. And the pace of technological innovations has greatly accelerated during the past several years.

However, software development has failed to keep pace with the rapid pro-

gress being made in the hardware arena. If Japanese PC manufacturers hope to increase and expand their user bases, effective measures designed to close this hardware-software gap are going to have to be formulated and implemented in a hurry. The kinds of measures I am referring to here should include those aimed at pursuing man-machine interfaces and enhanced ease of use, i.e. more user friendly PCs.

Another major issue related to the future growth of the PC market in Japan has to do with its internationalization. No matter how much a PC is upgraded and improved, if the information processed on that machine is limited in nature, then no real benefits are achieved. Today, information is truly an international commodity, and has become the fourth major resource of the corporate world, right after people, property and money.

As I have stressed above, the unique aspects of the Japanese PC market originate largely from the rapid progress, distribution networks and third-party software schemes of Japanese PC manufacturers, plus the emphasis on Japanese-language processing capabilities. However, these things have all been aimed at creating a domestic PC market. An issue sure to grow increasingly important in future will be just how this domestic Japanese PC market can be linked up with the international markets for PCs and "information."

TRENDS IN JAPAN'S PC MARKET

PC Shipments

According to the results of a recent survey done by the Japan Electronics Industry Development Association (JEIDA), total shipments of PCs during fiscal 1987 worked out to roughly 1,976,000 units. This was the first time that overall shipments of PCs had ever dropped on a year to-year basis. If we look at figures for the most recent four-year period as given in Figure 1, we see that PC shipments remained about the

same each year, hovering around the two million systems per year level. In addition to showing how shipments of PCs on a volume basis have stabilized in recent years, Figure 1 also indicates that these same shipments have steadily increased when calculated on a value basis. In fact, although year-to-year growth actually dropped on a volume basis during fiscal 1987, total PC shipments for that period were valued at 738 billion yen, exhibiting a roughly 16% growth by value over the previous year's shipments (See Table 1). This growth by value over the previous year for fiscal 1987 shipments was especially marked for domestic

Table 1. PC Shipments for Fiscal 1987 (April '87 - March '88)

By Value

(Units: in 100 millions of yen)

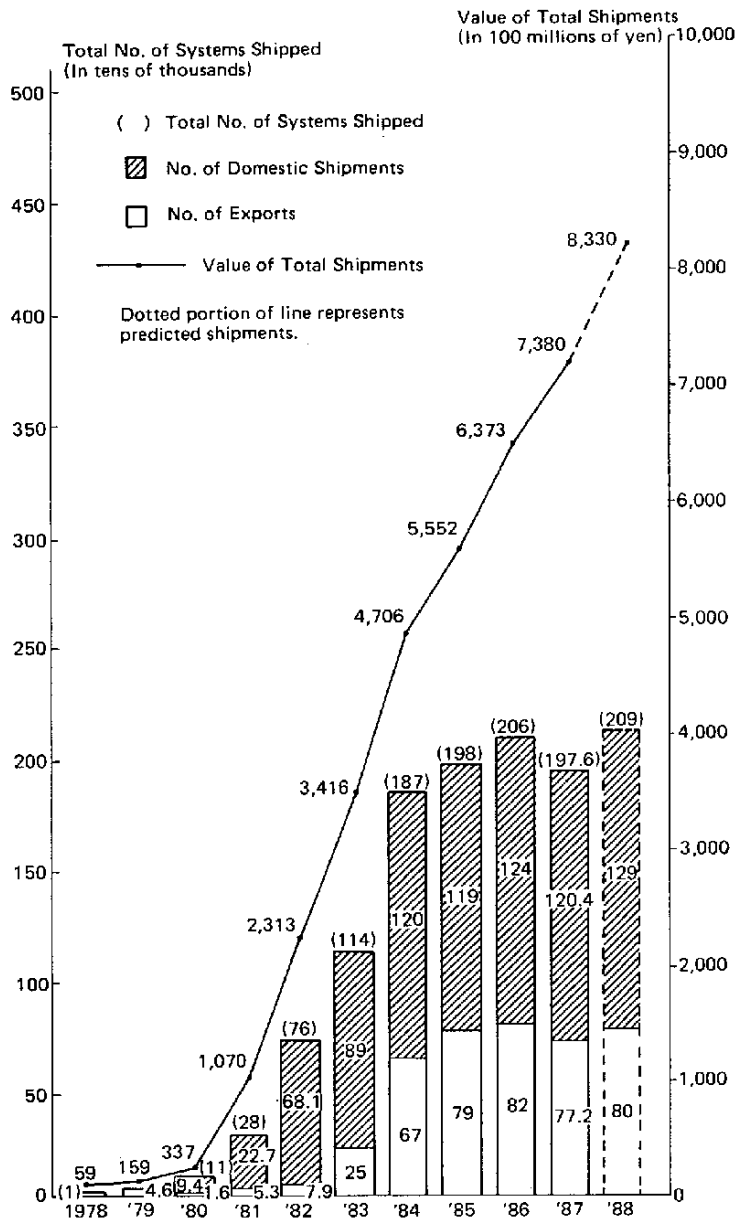
	Fiscal 1986	Fiscal 1987			Growth Rate
		First Half	Second Half	For The Year	Year-to-Year Growth
Total Shipments	6,373	3,443	3,937	7,380	116%
Domestic Shipments	4,319	2,488	2,775	5,263	122%
Exports	2,054	955	1,162	2,117	103%

*includes peripheral equipment

By Volume

(Units: in thousands of systems)

	Fiscal 1986	Fiscal 1987			Growth Rate
		First Half	Second Half	For The Year	Year-to-Year Growth
Total Shipments	2,060	905	1,071	1,976	96%
Domestic Shipments	1,236	532	672	1,204	97%
Exports	824	373	399	722	94%



(Note): When studying the predicted figures given above, remember:

1. Values given for both actual and predicted shipments reflect PC system (main unit plus peripherals) prices;
2. MSX and laptop computers are included in the calculations, but not pocket-sized computers and game machines;
3. Total actual shipments were calculated based on statistics received from 17 firms in fiscal '82, 20 firms in fiscal '83 and 24 firms in fiscal '84-'87.

Source: Based on figures derived from JEIDA's March 1988 "Survey of Personal Computer Shipments."

*This figure contains the latest statistics published in the 1988 edition of JIPDEC's "Informatization White Paper."

Figure 1. Shipments of Japanese PCs Between 1978-87 and Predicted Shipments for 1988.

PC shipments, working out to an increase of approximately 22%.

Of course, the reason why shipments by volume can remain relatively the same from year to year while the value of these shipments steadily increases is because the unit prices for PCs are rising.

If we break down the volume of domestic shipments of PCs during fiscal 1987 by size of CPU, we see that in the category of 16-bit PCs (this category includes 32-bit machines as well), a total of 777,000 units were shipped (up 41% over previous year figures), while shipments of 8-bit machines worked out to just 427,000 units (down 38% from the previous year). On a value basis, this worked out to roughly 259.1 billion yen worth of 16/32-bit PCs (up 34% over the previous year) and 234 billion yen worth of 8-bit machines (down 44% from the previous year). As these figures clearly indicate, there is a distinct move inside Japan away from 8-bit PCs and toward the higher end 16/32-bit machines.

Exports of 16/32-bit PCs on a volume basis for fiscal 1987 came to 496,000 systems (down 21% from the previous year), while exports of 8-bit machines totalled 276,000 systems (up 39% over the previous year). On a value basis, these exports worked out to 67.6 billion yen for 16/32 bit PCs (down 15% from the previous year) and 10.8 billion yen for 8-bit PCs (up 63% over the previous year).

The very latest data available regarding shipments of PCs during the first quarter of fiscal 1988 is presented in Table 2. As you can see, overall shipments during

this period reached 491,000 systems by volume, up roughly 15% over the figure recorded for the first quarter of fiscal 1987. On a value basis, this worked out to 181.8 billion yen worth of PCs, an increase of 17% over the same period the previous year. Even shipments of the PC main units only (minus keyboards, CRTs and other peripherals) totalled 93.6 billion yen, which was an increase of 17% over the figure recorded for the same period during fiscal 1987. The two-digit growth by volume of 15% exhibited during the first quarter of fiscal 1988 can be attributed in large part to the favorable growth in exports of PCs to Europe, which came to 81,000 systems in all, or roughly 30% more PCs than were exported to Europe the previous year during the same first quarter period. Domestic shipments of PCs by volume during the first quarter of fiscal 1988 were only up 6% over the previous year. PC exports to North American markets remained about the same during the first quarter of fiscal 1988 as they were for the first quarter of fiscal 1987, working out to roughly 66,000 systems in all.

Domestic shipments by volume during the first quarter of fiscal 1988 totalled 281,000 systems (up 6% over the previous year). Shipments of PC main units alone within Japan worked out to 74.0 billion yen by value, up around 20% over similar shipments recorded the previous year. Domestic shipments of PC systems (main units with peripherals) came to 134.6 billion yen, or roughly 17% more than the figure recorded the previous year.

Table 2. PC Shipments During First Quarter of Fiscal 1988 (Apr – Jun)

(By Value)

(Units: in 100 millions of yen)

	First Quarter Fiscal '87	First Quarter Fiscal '88	* Growth Over Same Period Previous Year
Total Shipments	1,558	1,818	117%
Domestic Shipments	1,152	1,346	117%
Exports	405	472	117%

(*includes peripheral equipment)

(By Volume)

(Units in thousands of systems)

	First Quarter Fiscal '87	First Quarter Fiscal '88	Growth Over Same Period Previous Year
Total Shipments	428	491	115%
Domestic Shipments	266	281	106%
Exports	162	210	130%

Shipments by Price Brackets

(Units: in thousands of systems; %: growth over previous year)

	Domestic Shipments		Exports	
Up to 100 thousand yen	30	60%	86	159%
Between 100 – 200 thousand yen	22	57%	15	65%
Between 200 – 500 thousand yen	158	123%	86	113%
Between 500 thousand – 1 million yen	59	164%	22	269%
Over 1 million yen	12	98%	0.2	200%

By Bit Size

(Units: in thousands of systems; %: growth over previous year)

	Domestic Shipments		Exports	
32-bit	8.9		10.3	
16-bit	218.7	132%	119.5	105%
8-bit	53.4	57%	80	211%
Laptop	35.4		71.4	

The increase of 16/32-bit PC shipment, and the steady growth of domestic demand leads me to believe that overall shipments for fiscal 1988 will exceed the 1.29 million systems (7.5% growth over fiscal 1987) forecast by JEIDA.

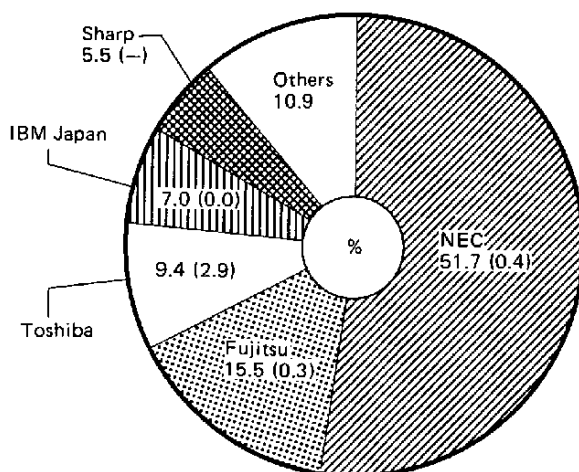
By fiscal 1990, then, the PC industry in Japan can be expected to reach the one trillion yen level.

Market Shares By PC Maker/Model

It is extremely difficult to determine the shares of the Japanese PC market accounted for by the different PC manufacturers and their respective models of PCs based on JEIDA's study of PC shipments alone. For this reason, this section cites results obtained from a number of different studies for a multi-faceted look at market shares.

Figure 2 presents the percentages of domestic output of PCs accounted for by the various manufacturers during 1987. These figures were obtained from the Nihon Keizai Shimbun Inc.'s annual study of Japan's leading one hundred PC models.

The data presented in Figures 3 and 4 were obtained from user studies, and give an idea of the various makers' respective shares of the PC market. Figure 3 gives percentages of PC installations by manufacturer as determined by a nationwide PC user survey conducted by Nikkei Computer magazine (April 25th edition), which is published by the Nikkei Business Publications, Inc. This survey randomly selected 30,000 Japanese companies from among 173,000 firms nationwide that appear on a list of companies with annual sales between 500 million and 10 billion yen contained in the Teikoku



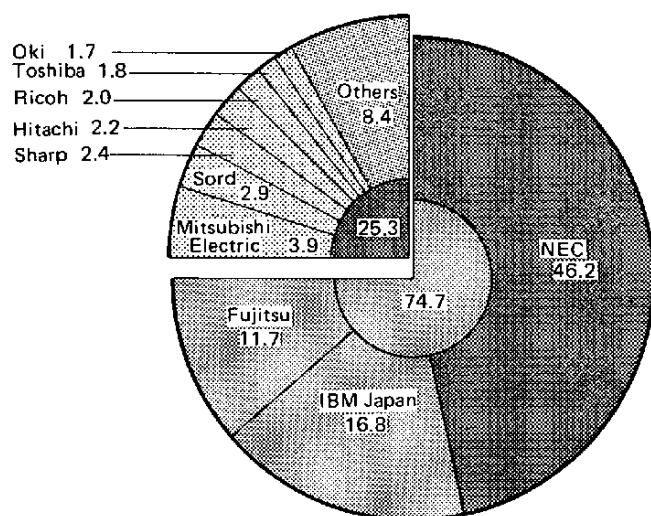
(Figures in parentheses indicate percentage of growth/decline over previous year)

Source: Taken from June 16, '88 edition of The Nikkei Industrial Daily.

Figure 2. PC Output by Manufacturer for 1987

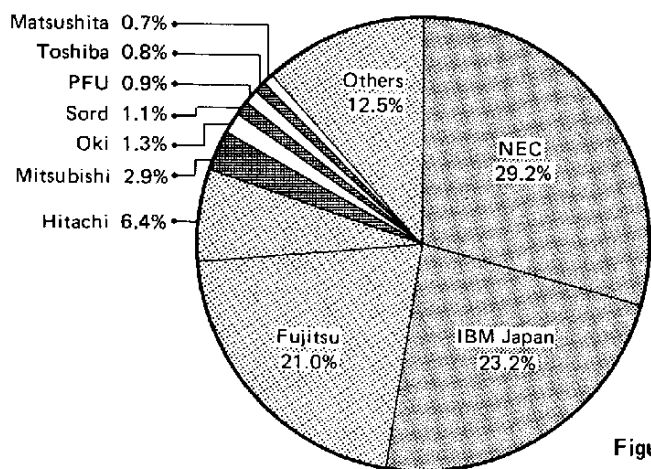
Data Bank, Ltd. Questionnaires were sent out in February 1988, and the results of the responses received in connection with those questionnaires were compiled and analyzed by the end of March 1988. A total of 4,430 companies in all gave valid responses to the questionnaire. Similarly, the data presented in Figure 4 was based on a survey of in-house PC utilization conducted by Nikkei Personal Computing (March 28 edition),

also published by Nikkei BP. The Nikkei Personal Computing survey sent questionnaires out to a random sampling of 3,000 firms (1,000 of which were listed on the Tokyo Stock Exchange) from a corporate database maintained by the Nihon Keizai Shimbun Inc. The survey was carried out during January–February 1988, and a total of 1,125 companies provided valid responses.



Source: Taken from the April 25, '88 edition of "Nikkei Computer" magazine

Figure 3. Percentage of Installed PCs by Manufacturer



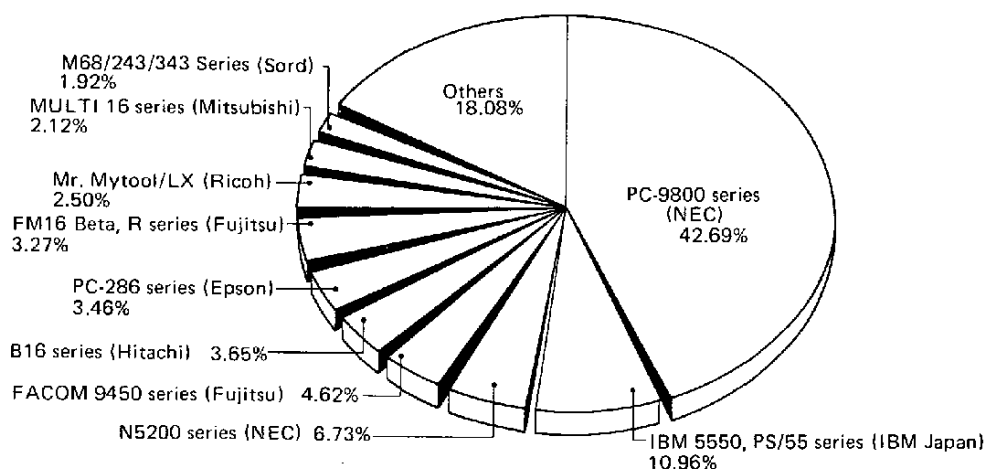
Source: Taken from March 28, '88 edition of "Nikkei Personal Computing" magazine

Figure 4. Shares of PC Market Held by Various Manufacturers

The data put forth in both Figures 3 and 4 are based on surveys targetted at companies, and are therefore very much business oriented, i.e. reflect usage of PCs as business machines. As is evident from looking at both figures, the different approaches used in the two surveys resulted in slightly different percentages. However, both surveys indicate that NEC, IBM Japan and Fujitsu Limited, in that order, hold the top three shares of the PC market in Japan. Remember, NEC has occupied the top position in this market since PCs were first commercialized here. Since there have been no surveys targetted at determining the respective shares of the home PC market held by the various manufacturers, I was not able to include this kind of data in this report. If such data were available, however, NEC's share of the overall market (both business and home use) would more than likely work out to somewhere around 70-80%.

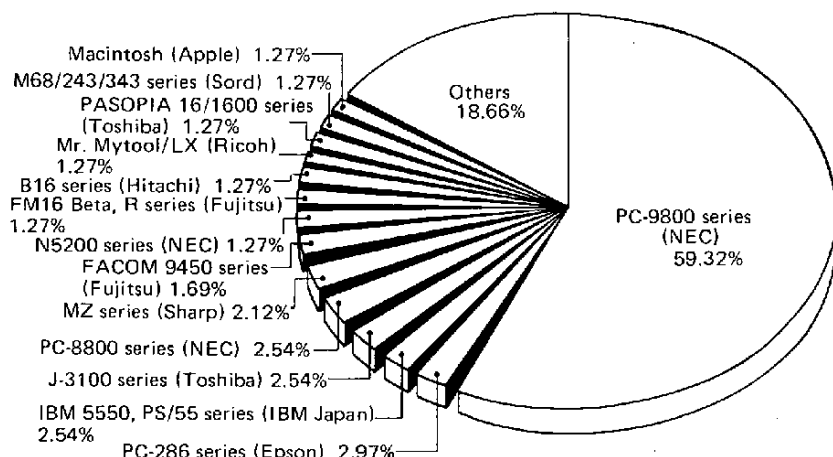
Next, let's look at the results of a survey of individual users designed to determine the percentages of the PC market accounted for by the various models of PCs currently being sold in Japan.

Figures 5 and 6 provide data on the shares of the PC market held by various makers and models of PCs used by individual users both at work (Figure 5) and at home (Figure 6) as determined via a survey of business PC users conducted by the monthly magazine OA Personal Computers (October edition), published by Dempa Shimbun Co. This survey was directed at readers of OA Personal Computers, and was carried out between the months of July and August, 1988. A total of 355 readers provided valid responses to the survey, answering questions about both office and home use of PCs. From the data presented in both figures it is obvious that NEC's PC-9800 series of 16-bit machines has an over-



Source: October edition of "OA Personal Computers" magazine

Figure 5. Percentage of PC Utilization at the Workplace by Make/model of PC



Source: October edition of "OA Personal Computers" magazine

Figure 6. Percentage of PC Utilization in the Home by Make/model of PC

whelmingly large share of both the office and home markets. According to Figure 5, second, third and fourth places in the office use category go to the IBM Japan 5550 PS/55 series, NEC's N5200 series and Fujitsu's FACOM 9450 series, respectively, all of which are workstation type PCs. The most noteworthy finding presented in Figure 6 is the second-place share of the home-use market occupied by Seiko-Epson's PC-286 series, which are NEC PC-9801-compatible machines.

The market shares of various leading models of PCs as determined via a survey of corporate users are shown in Figure 7. The data presented in Figure 7 was obtained from a survey of PCs used by various companies conducted by the magazine Nikkei Personal Computing (March 28 edition) introduced earlier. This survey of corporate users indicated that the PS/55 series, the FACOM 9450 series and the N5200 series of workstations occupy the top shares of this

portion of the PC market.

As the various graphs presented above indicate, the three leading PC manufacturers in Japan are NEC, IBM Japan and Fujitsu, in that order. However, Seiko-Epson, with its PC-9801-compatible machines and Toshiba with its J-3100 series of laptop PCs are challenging the leaders for larger shares of the market, and in so doing, are increasing the level of competition in this market.

Recent Trends Among Popular PCs

PC-9800 series

As I said at the beginning of this report, the history of PCs in Japan has centered around the development of NEC's PC-9800 series. Just as Fujitsu is confronting IBM in the market for mainframe computers in Japan, NEC has built up a strong position for itself in the PC market here. In fact, it

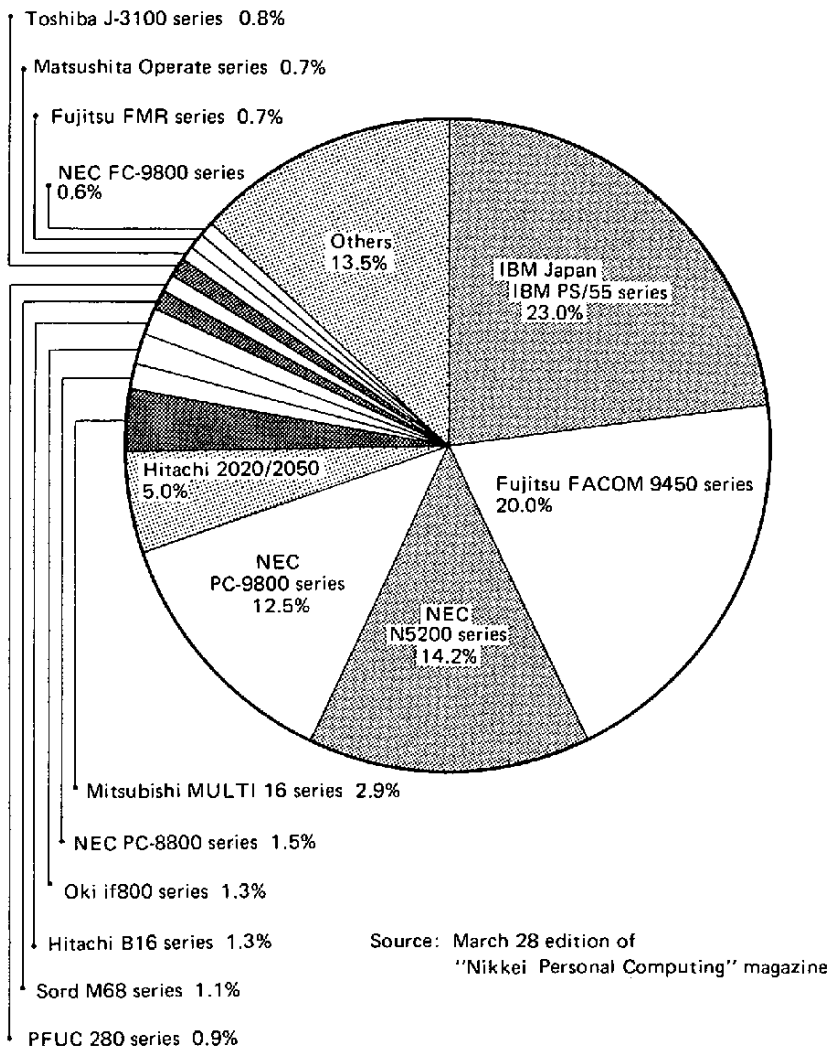


Figure 7. Shares of Business Market Held by Make/model of PC (Corporate Survey)

wouldn't be overstating the case to say the NEC PC-9800 series is representative of the special nature of the Japanese PC market.

Since it first went on the market back in 1982, the PC-9801 has been upgraded and expanded numerous times, and as of the end of August 1988, a total of 1.69 million systems had been shipped.

Figure 8 presents the current lineup of PC-9800 series machines, and their ranking in relation to one another. The number one best selling machine in the PC-9800 series is the PC-9801VX (Shown in Photo 1). Right from the very first PC-9801, on through to the 9801F, 9801M, 9801VM and 9801VX, these machines have all been best sellers.

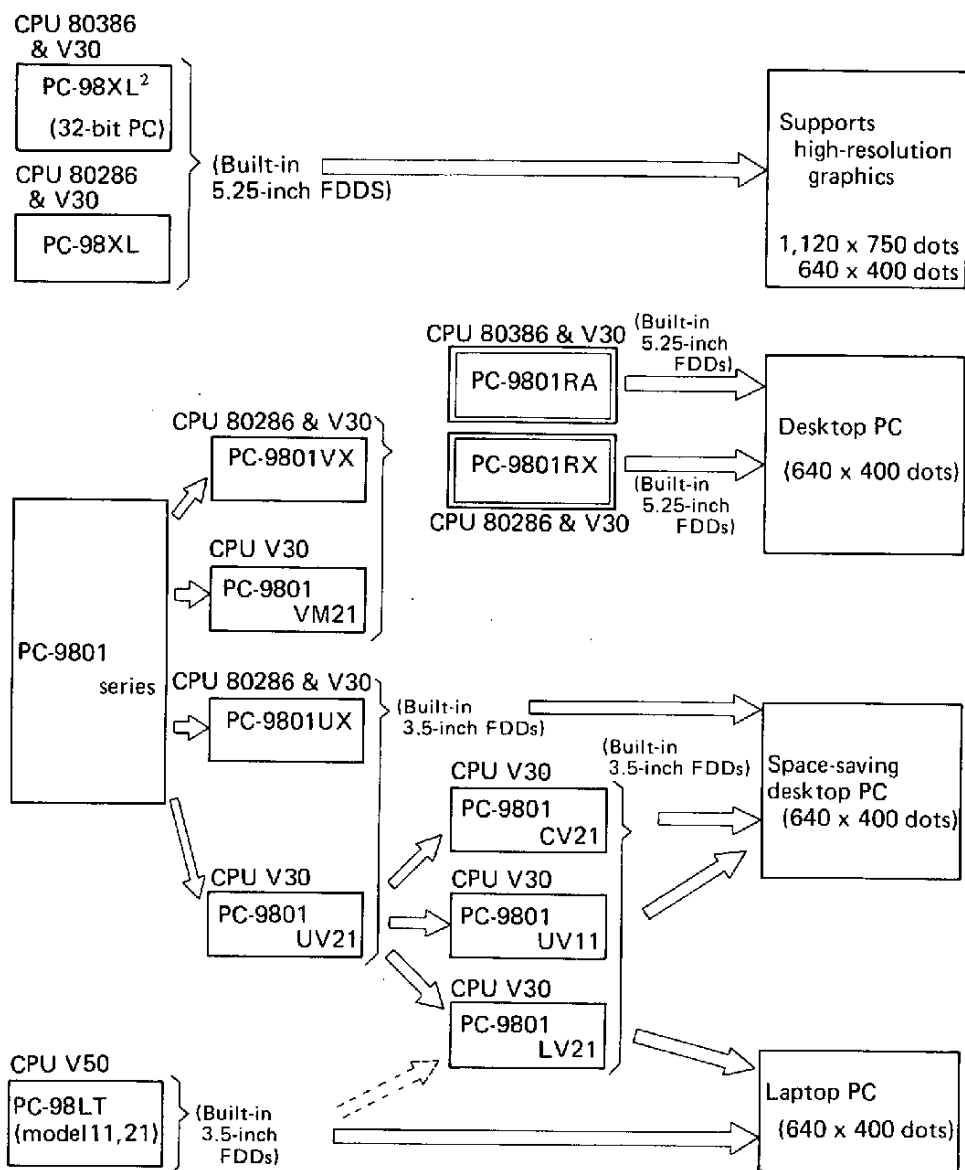


Figure 8. NEC's Lineup for PC-9800 Series Machines



Photo 1. NEC PC-9801VX

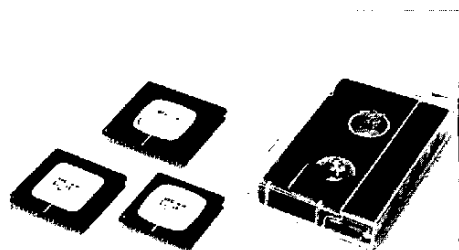


Photo 3. New Custom-made LSI from NEC

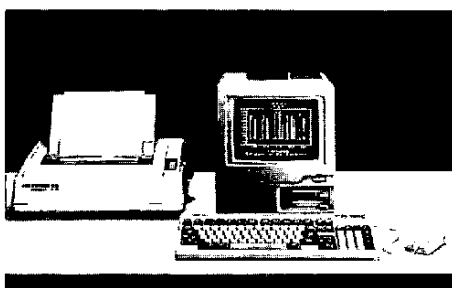


Photo 2. NEC PC-9801CV21



Photo 4. NEC PC-9801RA

In February of this year, NEC announced its new lineup of PC-9801 series machines, which included the laptop model PC-9801LV21, the desktop model UV11 with a main unit the size of an 8"x11" book, and the all-in-one model CV21 with built-in color CRT (See Photo 2). All of these new PCs come with one megabyte 3.5-inch floppy disk drives (FDDs), and are designed to increase the company's share of the 3.5-inch-drive machine market. The LV21 closely resembles Toshiba's J-3100 and Seiko-Epson's PC-286L, while the CV21 looks a lot like the Macintosh by Apple Computer. The realization of space-saving machines such as these was accomplished in large part due to NEC's newly developed custom LSI chip that controls input/

output, interrupt, text and graphics displays (See Photo 3).

In July 1988, NEC also announced its new PC-9801RA (See Photo 4), a 32-bit high-end version of the VX that sells for less than 500,000 yen (main unit only). The RA comes equipped with two CPUs: the 80386 and the V30. The 80386 is a 32-bit microprocessor with a 16MHz clock, making it very fast. This provides the RA with high-speed processing capabilities, enabling this machine to be used not only for office automation applications, but also for scientific and technological computations. The RA also comes equipped with an enhanced graphics charger (EGC) that speeds up its graphics operations. By combining the 80386 CPU with the EGC, NEC has produced a PC that can

handle applications in the area of graphics processing as well.

The V30 CPU is a 16-bit microprocessor that enables the RA to utilize all the software written for other PC-9800 series machines to date. This V30 CPU serves as a horizontal link among the various models in PC-9800 series, enabling software compatibility. The clock in the V30 operates at 8MHz. A dip switch is built into the front of the RA's main unit to enable the user to switch from the 80386 to the V30 and vice versa. The architecture used in the RA is representative of all current PC-9800 series PCs. For a more detailed look at the hardware specifications for this machine, refer to Table 3.

Most conventional 16-bit PCs feature a maximum of 640 kilobytes of user memory. When the 80286 CPU was employed, memory space in excess of the normal 640 kilobytes became available, but this was via a RAM disk. The new RA features something called an expanded memory specification (EMS) function, which provides it with user memory in excess of 640 kilobytes. NEC simultaneously announced two operating systems (OS) especially designed to handle the additional user memory freed up by the EMS. These OSs are the Japanese-language version of MS-DOS V3.3 and the Japanese-language MS OS/2 V1.0. The MS OS/2 is attracting particular attention for its multi-tasking functions. Some examples of the software programs that have been announced for use on the RA to make the most of its various functions and performance capabilities include the

Japanese-language MS-WINDOWS/386, the Japanese-language MS-WINDOWS V2.0 and PC-UX/VR3.0, among a wide selection of others.

The latest addition to NEC's lineup of PC-9800 machines is the PC-9801 RX brought out in September 1988 as the successor to the bestselling PC-9801VX. The RX is intended as a spruced-up version of the bestselling VX. The new RX resembles the RA in size and shape, but is equipped with the no-wait 80286 CPU with a 12MHz clock, making it roughly 1.2 times faster than the VX. Like the RA, the RX also comes equipped with the V30 CPU for software continuity, and employs three custom-designed VLSI chips. The RX comes in two models: the RX2, with built-in dual 5.25-inch FDDs, and the RX4, which comes equipped with a 3.5-inch 20-megabyte hard disk drive (HDD) and two built-in one-megabyte 5.25-inch FDDs. The price tag on the RX2 main unit (minus peripherals) is 398,000 yen, while the RX4 main unit sells for 566,000 yen. This makes the RX2 and RX4 models about 10 percent cheaper than their predecessors, the VX21 and VX41.

To date, the PC-9800 series has been upgraded and/or undergone model changes on an average of once every six months to one year. Although this fast-paced cycle has not exactly met with the approval of many users, when it comes to having something for just about everyone, no other lineup of PCs on the market today can compare to NEC's PC-9800 series.

Table 3. Specifications Sheet for the PC-9801RA

CPU		80386 with 16MHz clock V30 (mPD70116) with 8MHz clock (CPUs are user selectable via a built-in dip switch)
Memory	ROM	96K bytes for BIOS and N88-BASIC
	RAM	1.6MB of user memory. This is expandable to a maximum 12.6MB using dedicated memory slot (32-bit bus with up to 3MB of memory) and an expansion slot (16-bit bus with up to 8MB of memory expansion)
	VRAM	12KB of VRAM for text storage 256KB of VRAM for graphics
Display Functions	Text Display (alphanumerics and kana)	80 chars x 25 lines; 80 chars x 20 lines 40 chars x 25 lines; 40 chars x 20 lines Reverse, print, secret, 8 colors (character types selectable)
	Graphics (color)	640 x 400 dots (2 screens) 640 x 200 dots (4 screens) 16 of 4,096 colors can be displayed at a time (in analog RGB mode) 8 of 8 colors can be displayed (in digital RGB mode)
	(Black & white)	640 x 400 dots (8 screens) 640 x 200 dots (16 screens)
	Screen Synthesis	Possible (graphics and text screens)
	Kanji Display	Kanji ROM comes as standard equipment Displays 7,600 standard kanji (JIS 1 and 2) 188 user-definable characters 16 x 16 dot 40 chars x 25 lines; 40 chars x 20 lines Both text and graphics screens can be displayed *Kanji text can only be displayed with special resolution display
Input Devices	Keyboard (sculptured)	Keys arranged according to JIS standards Numeric keys, control keys, 15 function keys, HELP, COPY, BS, INS, DEL, XFER and NFER keys, CAPS and kana lock is software controllable Keyboard is separate from main unit (connectable via cable)
Auxiliary Storage	FDDs	Two built-in 5.25-inch FDDs with 1MB of storage capacity each Built-in interface for third and fourth FDDs *Can read/write to 640KB 5.25-inch floppy disks
	HDDs	RA2: Can be equipped with 40MB 3.5-inch HDD (PC-9801RA-35) RA5: Built-in interface for additional 40MB 3.5-inch HDD
Interfaces	Mouse interface	Built-in for connectable mouse (PC-9872U)
	Printer interface	8-bit parallel interface (14-pin type built to Centronics standards)
	Serial interface	1 channel RS-232C interface built-in (expandable to 2 channels via RS-232C expansion interface port)
Calendar/clock		Battery back-up
Expansion Slots		Four slots built in (expandable using I/O expansion unit)
Power		AC 100 volts \pm 10%, 50/60HS
Ambient Conditions		10–35 degrees Centigrade, 20–80% humidity (but must not be used where dew forms)
Dimensions		Main unit: 380 (W) x 335 (D) x 150 (H) mm Keyboard: 435 (W) x 180 (D) x 34 (H) mm
Weight		Main unit: RA2 – 9.4 kg keyboard 1.2 kg RA5 – 10.8 kg
Power Consumption		RA2: 100W (Max 170W) RA5: 125W (Max 170W)
Principal Accessories		Power cable, guidebook, introduction to N88-Japanese BASIC (86), Kanji/kana input guide, N88-Japanese BASIC (86), user's manual, N88-Japanese BASIC (86) reference manual, N88-Japanese BASIC (86) systems disk and user registration card and warranty.

In future, NEC plans to expand its lineup of high-end 32-bit machines, and enhance the functions and capabilities available in its laptop PCs. However, the architecture employed in the PC-9800 series to date is proving a stumbling block to the new 32-bit machines. It appears that one of the biggest problems facing NEC now is how best to revise this architecture while still maintaining software compatibility.

IBM PS/55 series

IBM commands an overwhelming share of the worldwide market for general-purpose mainframe computers, and boasts an equally large share of the world market for PCs. The only major market that IBM is really forced to do battle in anywhere in the world is the Japanese market.

To date, IBM Japan's strategy for the PC market in Japan has been to introduce machines specially configured to conform to the particular needs of the Japanese user. These have included the Multistation 5550 family of business PCs, as well as the JX, a PC for home use. The company deemed this approach necessary

since its popular IBM PC/XT and /or AT models can't speak Japanese.

However, the drawback to designing PCs specifically for the Japanese market is that these machines are then incapable of using the ample supplies of software packages and expansion cards readily available for the IBM PC/XT and AT the world over. This means that IBM Japan hasn't been able to take advantage of its parent company's real strength, the defacto standard established by the "IBM culture."

For this reason, beginning in May 1987, IBM Japan started marketing the Personal System (PS)/55 series of PCs, and followed this up in April of this year (1988) by announcing its 5550-S/T (See Photo 5) and 5570-T (See Photo 6) model PCs. The latter three PCs were developed by integrating them with the parent company's PS/2 (See Figure 9). As indicated in Figure 10, the PS/55 is an extension of the PS/2, and as such, is capable of running all the software available for the PS/2.

The new 5550-S, 5550-T and 5570-T PCs come in a total of seven (7) different configurations. All of these PCs are equipped with 3.5-inch FDDs with 1.44

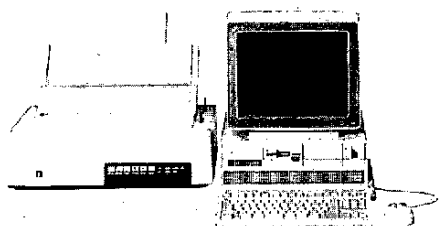


Photo 5. IBM Japan PS/55 Model 5550-S/T

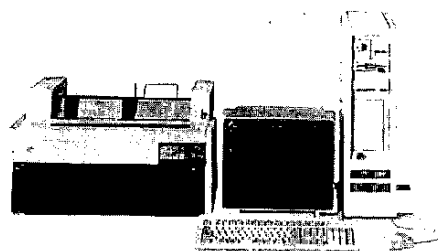


Photo 6. IBM Japan PS/55 Model 5570-T

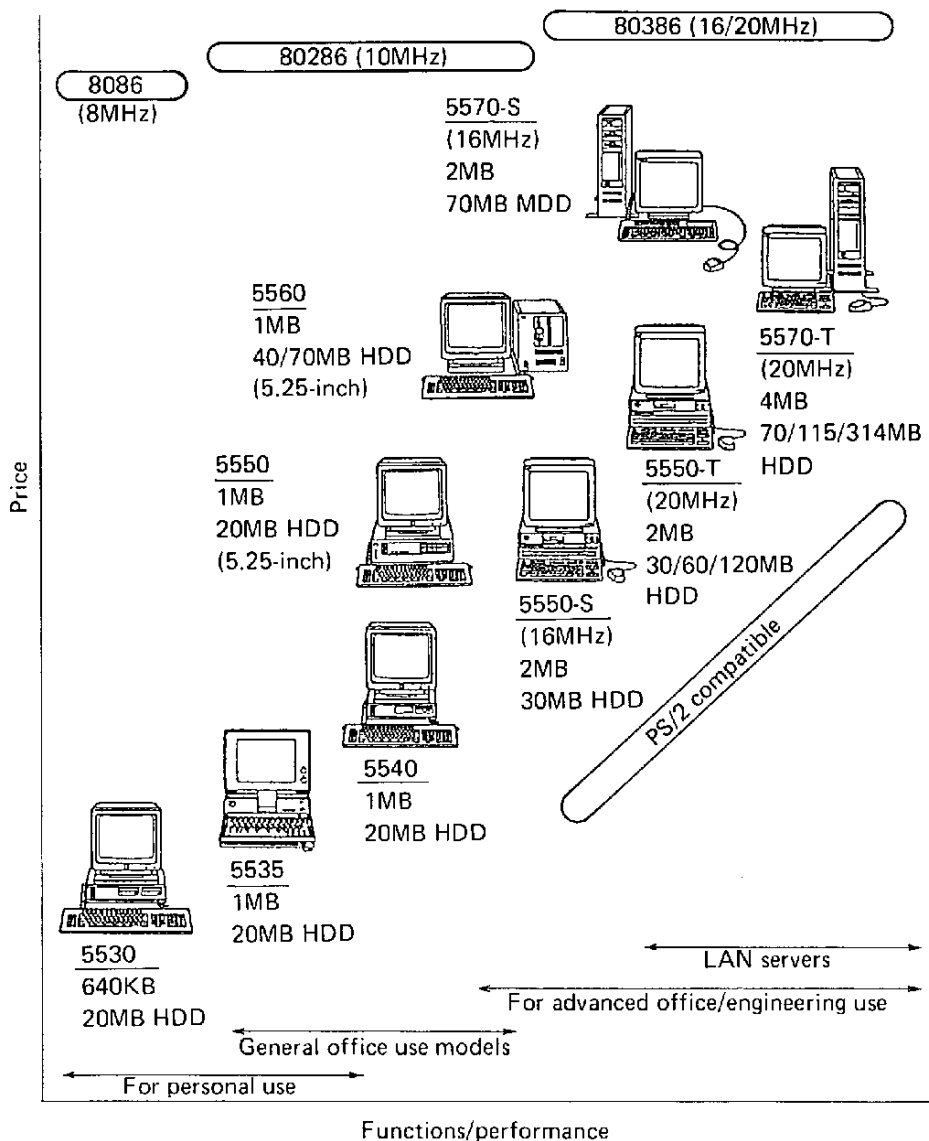
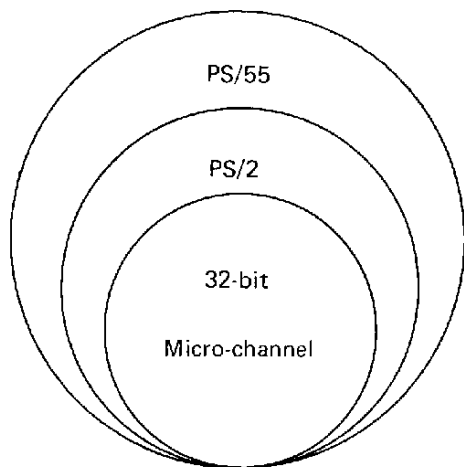


Figure 9. IBM Japan's Lineup of PS/55 Series Machines



**Figure 10. PS/55 PCs' Position
in Relation to PS/2**

megabyte of memory, and feature IBM's conventional 1024 X 768 dot resolution monitors, the color versions of which can simultaneously display 256 of a possible 260,000 colors. While the old 5550 family of business PCs came with either a color or monochrome monitor, these new machines feature monitors that can be used in either the color or monochrome mode. In addition to the yellow or green monochrome monitors used with the 5550 family of PCs, the new models also feature a paper white monochrome monitor.

The floor stand model 5570-T is equipped with such standard features as a 20MHz 80386 CPU, and either a built-in 4, 70, 115 or 314 megabyte HDD. This machine has excellent expansion capabilities, having been designed with enough space to house a second HDD or an optical disk drive onboard. The TOB and TOC configurations of this new PC also come with an 80387 num-

ber-crunching processor as standard equipment, and have six (6) optional microchannel slots.

The desktop 5550-S and 5550-T models are also outfitted with the 32-bit 80386 CPU, with either a 16MHz or 20MHz clock. Although these machines do not have the expandability of the 5570-T, the TOB version is a desktop machine with a 120 megabyte HDD built in as standard equipment.

The OSs capable of being used with these machines include the Japanese-language IBM OS/2 version J1.0, basic version J1.1, expanded version J1.1, Japanese-language DOS versions K3.3 and K3.4, as well as the English-language IBM OS/2SE version 1.0 and PC-DOS 3.3.

In addition to employing a 20MHz 80386 CPU, OS/2 and microchannels, the PS/55 features a 1.44 megabyte 3.5-inch FDD and 1024 X 768 dot graphics capabilities. The graphics on this machine are Video Graphics Array (VGA) compatible, rounding out the points of integration with the PS/2.

IBM Japan has set the price tag for the smallest models of the 5550-S/T at 820,000 yen. Since even these machines come with built-in 30 megabyte HDDs, this price is bound to have a profound impact on the market for 32-bit PCs here. Furthermore, these machines will be marketed on an OEM basis. The Ricoh Corporation has been newly signed on as an exclusive agent, and the core versions of the PS/55 series are being marketed under the Ricoh brand name.

In the past, each time IBM has come up with a new approach to the market

for business PCs here it has generally resulted in a new trend. And it appears that IBM's current PC strategy is on the verge of a major change.

FMR series

Fujitsu Limited is the largest computer manufacturer in Japan. However, in the PC arena, this giant is forced to take a back seat to NEC. Anticipating the day when PCs will form the basis for computer networks, Fujitsu is convinced it must make up the distance between itself and NEC now while it still has a chance.

The PC that Fujitsu is counting on to help narrow the gap with NEC is its FMR series. As shown in Figure 11, Fujitsu is expanding its lineup of these machines to rival NEC's offerings in each category. There is the FMR-70HD, a high-end 32-bit PC (See Photo 7); the FMR-50, which serves as the core of the company's 16-bit machines; the laptop FMR-50LT; and the FMR-30HX (See Photo 8), Fujitsu's

transportable PC (See Table 4). During fiscal 1987, Fujitsu sold approximately 100,000 FMR series PCs. However, this still only amounted to a fraction of the 460,000 units of PC-9800 series machines sold by NEC during that same fiscal year. But Fujitsu's strategy of using PCs as terminals in its popular general-purpose mainframe and/or small business computer (SBC) systems, and selling them as components of these systems seems to be starting to pay off.

To date, Fujitsu has relied primarily on its FACOM 9450 series of PCs to serve as terminals for its mainframe computers. However, the company has recently embarked on an all-out campaign that calls for its nationwide network of branch offices and dealers to push the FMR series of PCs as workstations in mainframe computer systems. As part of this campaign, in July 1988, Fujitsu began shipping top-of-the-line 32-bit machines equipped with the Japanese-language MS OS/2 operating system designed specifically to give these machines an edge in

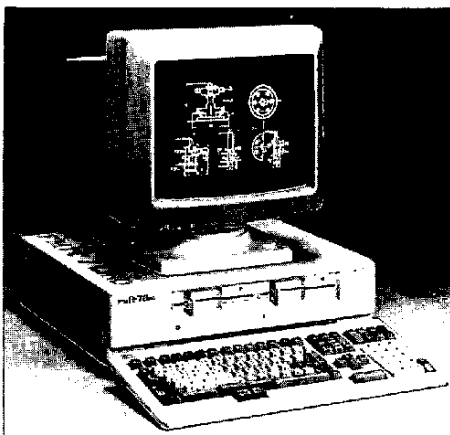


Photo 7. Fujitsu FMR-70HD

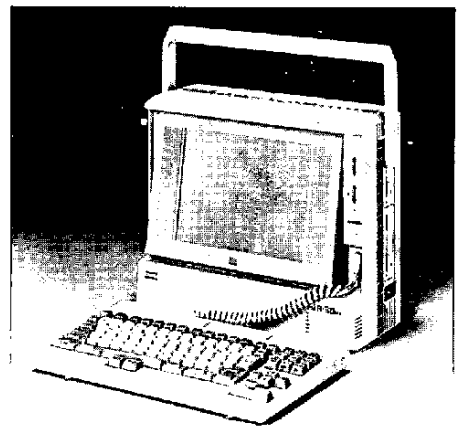


Photo 8. Fujitsu FMR-30HX

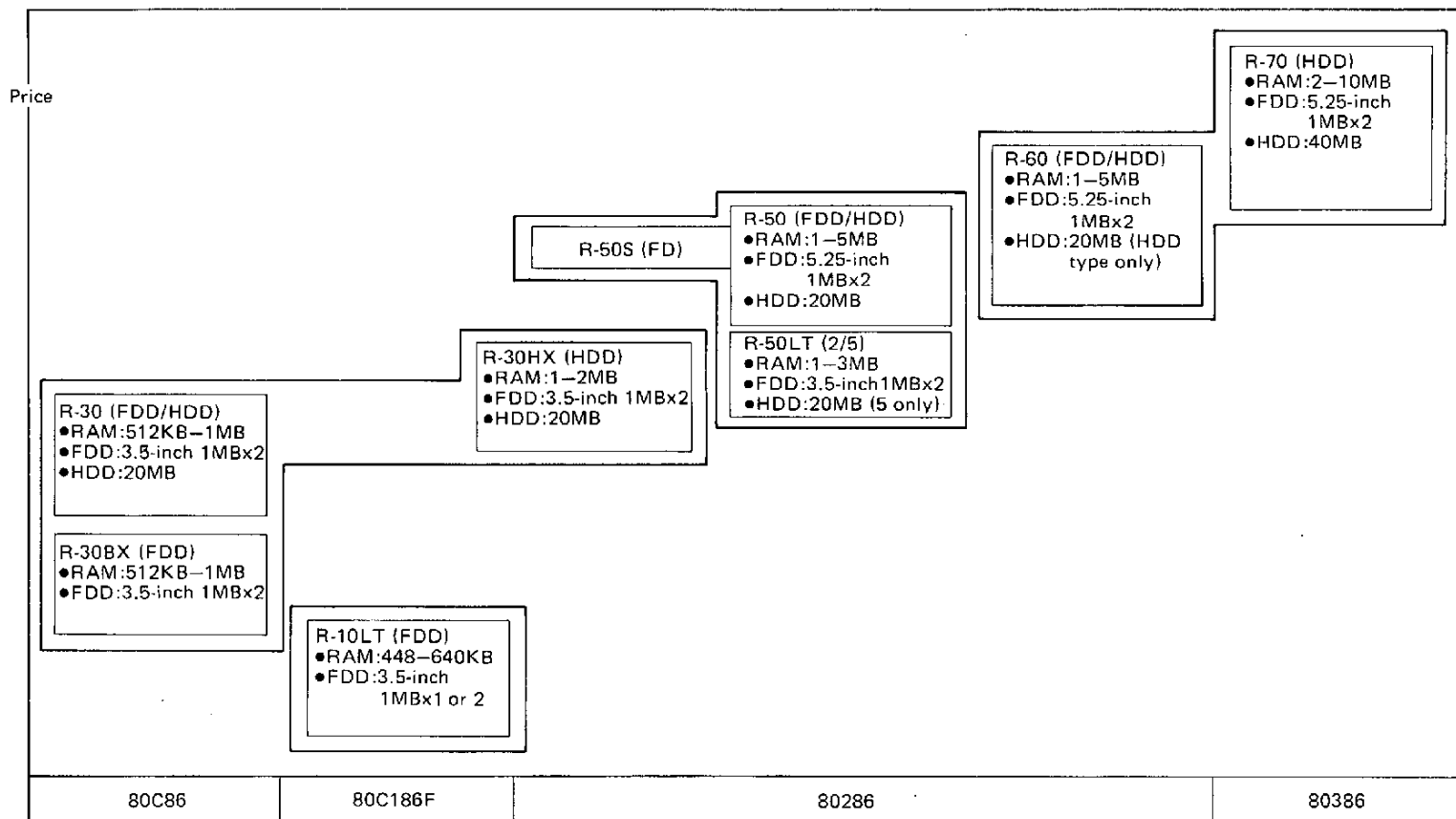


Figure 11. Fujitsu's Lineup of FMR Series Machines

Table 4. Functions and Specifications of FMR Series PCs

Model	FM R-70	FM R-60	FM R-50	FM R-50LT	FM R-50S	FM R-30	FM R-30BX	FM R-30HX	FM R-10LT
Features	<ul style="list-style-type: none"> • New generation high-speed 32-bit PC • CPU: 80386 • RAM: 2MB 	<ul style="list-style-type: none"> • High-definition 24-dot kanji display • CPU: 80286 • 1120x750 dot display 	<ul style="list-style-type: none"> • Improved functions • CPU: 80286 • 640x400 dot display 	<ul style="list-style-type: none"> • R-50 compatible laptop • CPU: 80286 • 640x400 dot display 	<ul style="list-style-type: none"> • Aimed at educational market • CPU: 80286 • Equipped for AV use 	<ul style="list-style-type: none"> • Space-saving desktop model • CPU: 80C86 • Equipped with large LCD with backlight 	<ul style="list-style-type: none"> • High-performance transposable PC • CPU: 80C86 • Large-sized LCD with backlight 	<ul style="list-style-type: none"> • High-speed, large capacity transportable PC • CPU: 80L286 • Large-sized LCD with backlight 	<ul style="list-style-type: none"> • Laptop PC with built-in batteries • CPU: 80C186F • LCD employs reflection techniques and backlight
Type	HD	FD/HD	FD/HD	LT2/LT5	FD	FD/HD	FD	FD/HD	FD
C P U	80386 (16MHz)	80286 (8MHz)	80286 (8MHz)	80286 (8MHz)	80286 (8MHz)	80C86 (8MHz)	80C86 (8MHz)	80L286 (8MHz)	80C186F (10MHz)
Main RAM	2MB (Expandable to 10MB)	2MB (Expandable to 5MB)	2MB (Expandable to 5MB)	1MB (Expandable to 3MB)	1MB (Expandable to 3MB)	512KB (Expandable to 1MB)	512KB (Expandable to 1MB)	1MB (Expandable to 2MB)	448KB (Expandable to 640KB)
Graphics display	1120x750 dots	1120x750 dots	640x400 dots	640x400 dots	640x400 dots	640x400 dots	640x400 dots	640x400 dots	640x400 dots
Built-in FDD	5.25-inch 1MBx2	5.25-inch 1MBx2	5.25-inch 1MBx2	3.5-inch 1MBx2	3.5-inch 1MBx2	3.5-inch 1MBx2	3.5-inch 1MBx2	3.5-inch 1MBx2	3.5-inch 1MBx1 or 2
Built-in HDD	40MB	20MB	20MB	20MB (LT5)	—	20MB	—	20MB	—
Expansion Slots (I/O)	3 slots	3 slots	3 slots	2 slots	2 slots	2 slots	1 slot	2 slots	1 slot
Dimensions (WxDxH)	470x385x125	420x386x125 (FD) 470x385x125 (HD)	420x385x125 (FD) 470x385x125 (HD)	310x370x96	380x460x390	330x239x262 (FD) 330x267x262 (HD)	330x118x305 (FD)	360x170x305	310x335x80
Weight (Main unit)	18 kg	15 kg (FDD model) 17 kg (HDD model)	15 kg (FDD model) 17 kg (HDD model)	7.5 kg (LT2) 7.6 kg (LT5)	25 kg	5.7 kg (FDD model) 7.0 kg (HDD model)	7.5 kg	9 kg	5 kg

the business field. The company was so concerned with getting these MS OS/2 PCs on the market before NEC did, that it sacrificed incorporating MS-DOS compatible capabilities into the first batches of these machines. Having been beaten to the start by NEC in the 16-bit PC race, Fujitsu wants very badly to take an early lead in the new OS/2 market.

One major stumbling block facing Fujitsu in its efforts to compete with NEC's PC-9800 series is its lack of non-computer-dedicated sales outlets, i.e. stores and/or shelf space at retail outlets serving the general public. It is these types of sales outlets that hold the key to increasing Fujitsu's share of the PC market in Japan. Realizing this, Fujitsu has devised a scheme for linking up with Matsushita Electric Industries Co., Ltd., Japan's largest electrical appliance manufacturer. Matsushita would like to enter the PC market and Fujitsu needs increased access to the general market for these machines. Fujitsu is therefore providing Matsushita with data on the basic I/O system (BIOS) employed in its FMR series of PCs, as well as the other technical information that firm needs to develop a PC that is compatible with the FMR series. By creating an alliance of this sort with Matsushita, Fujitsu hopes to be able to concentrate on its area of specialty, mainframe computer systems with PCs as terminals, and the development of value-added resellers (VARs), while Matsushita uses its huge retail network to target its FMR-compatible PCs at the personal, home and general user markets.

There are presently about 1,300 software packages on the market for the FMR series. The Fujitsu-Matsushita alliance will thus be able to make use of this software asset as its third leg in a three-legged race with NEC. To strengthen this software "wild card" even further, the FMR series has recently begun to support the best-selling word processing package Ichitaro. This fact, combined with a lineup of other popular software packages, should enable the FMR series to hold its own even with the PC-9800 series in this regard. Moreover, Fujitsu is also reportedly working on a dynamic strategy that calls for the integration of the FACOM 9450 series with the FMR series of PCs.

PC-286 series

The PC-286 series of PCs marketed by the Seiko-Epson and Epson Corporations has been causing quite a stir in the PC market here recently, and continues to steadily pile up sales. The PC-286 is compatible with NEC's PC-9800, the defacto standard in Japan, and is thus capable of running all of the very large selection of software programs available for NEC's top selling machines.

The PC-286 was brought out in April 1987, and almost immediately got embroiled in a copyrights battle with NEC. NEC sued Epson to stop the latter from manufacturing and marketing any more of these machines, and effectively halted the sales of those PCs that had already been shipped. However, by November 1987, Epson and NEC had

reached an amicable settlement, and the sales battle began in earnest.

As of the end of August 1988, the PC-286 series had sold a total of 110,000 systems. This figure reflects the cumulative sales of this machine over the little less than one-year period from October 1987, when Epson finally extricated itself from the NEC lawsuit, until the end of August 1988. Since entering the current fiscal year (which began April 1, 1988), the average monthly output of PC-286 machines has topped 10,000 units, and the company is aiming at manufacturing between 180,000 and 200,000 units for the year. This can be taken as proof that Epson's strategy of developing a PC-9800 clone is succeeding.

This being the case, it wouldn't be surprising to see a whole slew of new PC-9800 clones make their appearance and create a world-wide market for these machines comparable to the one already in existence for IBM PC/AT clones. However, up until now, Epson has been the only company to devise such a strategy. This can be attributed in large part to the fact that NEC hasn't made the PC-9800 architecture public, and is taking a hard stance regarding the intellectual property rights related to this series of machines. From where NEC stands, it doesn't want to give any late comers a free ride and then have to compete against them in the PC-9800 market that it has single-handedly worked so hard to build up. For example, NEC feels that even allowing a portion of its PC-9800's basic software to be reproduced, like Fujitsu did for Matsushita with the

BIOS, for instance, would open the door to participation in this market by other Japanese computer manufacturers, as well as numerous makers from the various newly industrializing economies (NIES). Not wishing to have to compete with other firms in a market that it created on its own, NEC quite naturally felt compelled to come down as hard as it could on the PC-286 challenge from Epson.

The breakthrough for Epson's PC-286 series came as a result of that company's decision to go with a strategy of low prices, and its development of the PC-286L (See Photo 9), a laptop machine that is compatible with NEC's earlier announced PC-9801UV. Initial production of the PC-286L had a hard time getting off the ground, and Epson couldn't seem to come up with an effective sales offensive. This machine nevertheless accounted for just under 40,000 of the total 110,000 units of PC-286 series machines sold as of the end of August 1988. NEC brought out the PC-9801LV21 as its answer to the PC-286L,

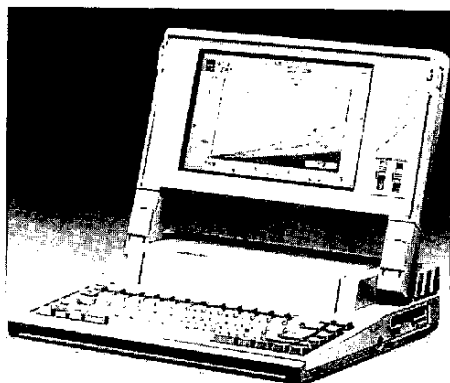


Photo 9. Seiko Epson PC-286L

but the latter's use of an easy-to-read white liquid crystal display (LCD) seems to have given it an edge over the NEC machine.

In September 1988, Epson announced the development of two new PC-286 series' machines: the PC-286X (See Photo 10), and the PC-286VE, further strengthening its line up for these PCs. The PC-286X represents this series' top-of-the-line machine, and is equipped with a 16MHz no-wait 80286 CPU and 2 FDDs, and sells for 438,000 yen. The PC-286VE comes with a 12MHz no-wait 80286 CPU and is priced at 298,000 yen, making it roughly 100,000 yen cheaper than NEC's comparably equipped PC-9801RX2. Another distinctive feature of these two new machines is that they can be equipped with 20- or 40-megabyte cartridge-type HDDs. This allows the user himself to install the HDD of his choice in his machine.

Epson's PC-286 series is currently solidifying its position in the PC market here. Right now everyone is waiting to

see just what kind of 32-bit PC Epson intends to develop for this series. It will be very interesting to see how Epson competes with the PC-9800 series in Future.

J-3100 series

The laptop computer has opened the door to a new trend in business PCs. And Toshiba Corporation's hi-tech laptop, the J-3100, fits this trend to a tee.

In order to understand the success of the J-3100, we must first take a close look at the T-3100, that Toshiba laptop PC that has taken the U.S. and European markets by storm. The J-3100 is the Japanese-language version of the T-3100. Both come equipped with the 80286 CPU and can hold their own with any conventional desktop PC when it comes to functions and storage capacity. The display devices employed on these machines make use of plasma display technology, and they are both extremely compact in size for the ultimate in space savings. Although it is not obvious from their exteriors, starting with their IC packaging technology, the T-3100 and J-3100 laptop PCs are truly hi-tech machines.

The biggest feature of any laptop PC has to be its space saving size. But it is hard to believe that the T-3100 sold over 200,000 units in the U.S. and Europe based on its compact size alone. Rather, the single biggest selling point of the T-3100 is the fact that it is IBM PC/AT compatible. No matter how advanced a PC's hardware is, that alone is not enough to make it a top seller. It is the

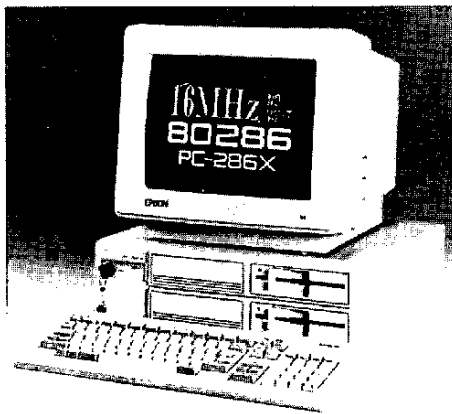


Photo 10. Seiko Epson PC-286X

software available for that machine that determines its success or failure on the market.

If we include clones in our calculations, there are presently an estimated 20 million PC/AT machines in operation worldwide, and somewhere around 50,000 software programs that are capable of running on these machines. Any computer maker that can introduce a first-rate laptop PC into that market has got to have a winner. The T-3100 is proof of this statement.

However, as pointed out earlier, the Japanese PC market is characterized by its requirement for Japanese-language processing capabilities. It is for this reason that the PC/AT architecture has not been able to make a real dent in the market here. It was under these conditions that Toshiba came out with the J-3100. This laptop PC features all the advanced hardware capabilities of the T-3100, plus has already had about 500 Japanese-language programs written to run on it. These two characteristics have combined to earn the J-3100 number one status among existing laptop PCs in Japan. Because it is a PC/AT compatible machine like the T-3100, the J-3100 has already attracted large numbers of Japanese IBM users. What the J-3100 has to do now is cut out a new niche in Japan's PC market for itself. With this in mind, Toshiba has put together a lineup consisting of four (4) differently configured machines, ranging from the low end J-3100SL to the 32-bit J-3100SGT equipped with the 80386 CPU (See Photo 11). The top-of-the-line model



Photo 11. Toshiba J-3100SGT

features a built-in 100-megabyte HDD.

Toshiba has thus taken the initiative in the laptop market. Even though there are a number of other firms that are coming out with laptop machines to compete in this market, the J-3100, both in name and reality, is truly the "King of Laptops."

AX machines

Thus far we have limited our discussion to the latest trends among popular PCs on the Japanese market. However, there is another class of PCs, which, although they have yet to record any significant sales, are nevertheless in the process of creating a new market for PCs here, and on a scale never before seen in Japan. These are the AX machines, PCs based on the defacto PC/AT global standard, but with Japanese-language processing capabilities. Numerous Japanese computer manufacturers are planning to develop and market AX machines

with common specifications.

In spring 1987, America's Microsoft Corporation brought together representatives from a number of companies in various fields to form a society for the study of Japanese-language PC/ATs. This original study society developed into the "Preparatory Committee for the AX Council," and by the end of October 1987, 19 companies had banded together to officially inaugurate the "AX Council." This AX Council is not comprised of PC manufacturers alone, but rather consists of firms from a variety of different fields, to include computer component manufacturers, software houses and even trading firms. As of October 1, 1988, membership in the AX Council had reached 230 firms.

AX stands for architecture extended. All AX machines are based on the IBM PC/AT architecture. As stated previously, there are roughly 50,000 software packages available for the PC/AT, and there are an abundance of peripheral equipment and adaptors capable of being used with this PC and/or its clones. AX machines feature both English and Japanese modes. In the English mode, these machines are compatible with the PC/AT; in the Japanese mode, they operate on AX specifications developed in common by all participating companies. AX machines are not compatible with either the IBM PS/2 or IBM Japan's PS/55 machines.

AX machines have the following characteristics:

1. Standardized Operations

Since all AX machines, regardless of what manufacturers produce them, have standardized user interfaces, i.e. keyboards, displays, etc., users will no longer have to worry about learning a new set of operating procedures each time they change machines.

2. System Interconnectability

Since AX machines are PC/AT compatible, they are readily interconnectable to general-purpose mainframes and local area networks (LANs), and thus capable of meeting large corporate users' requirements.

3. Software and Data Compatibility

Since AX machines are hardware compatible with one another, they should also be capable of sharing the same software programs and data.

4. System Expandability

AX machines are equipped with a standard PC/AT compatible expansion bus, which means that the peripheral equipment presently being marketed by various U.S. manufacturers for the PC/AT should be readily interconnectable to AX machines as well.

5. International

Not only are AX machines capable of running all the PC/AT software now on

the market in the U.S. and elsewhere, but software written in Japan for use on AX machines operating in the English mode can also be exported to the U.S.

Next let's summarize the main technological features of AX machines.

First, since AX machines are based on the defacto world standard PC/AT, they can effectively make use of the abundant software and hardware assets available overseas. One thing that should be kept in mind when considering AX machines, however, is the fact that they have both English and Japanese modes. It is in the English mode that AX machines are compatible with PC/AT; in the Japanese mode, AX machines operate on their own original specifications. Therefore, when we say that AX machines can run software written overseas for the PC/AT, we are talking about English mode AX machine use, i.e. these software programs can only be used in the English language. If Japanese users don't mind working in English, they can use their AX machines to run an abundance of high-quality U.S. software. The superiority of U.S.-produced software is apparent from the large numbers of U.S. software packages that have been translated into Japanese and are currently very popular in Japan.

Second, because AX machines are equipped with either 80286 or 80386 CPUs, they are capable of extremely high speed processing.

The third technological feature of AX machines is their high resolution displays. AX display devices are equipped with the same VGA standard em-

ployed on the PS/2, that is, they have 640 X 480 dot high resolution display capabilities. And since these machines are based on EGA, they are also capable of high-speed graphics. Both VGA and EGA are color graphics standards used by IBM on the PC/AT and PS/2. In the Japanese-language mode, AX machines are equipped with Japanese Enhanced Graphics Adapter (JEGA), a mode that has the same 640 X 480 dot resolution as VGA, but which is not compatible with VGA.

Fourth, since AX machines feature shift JIS codes as their internal codes, they are capable of high-speed text display. Also, because these machines offer 19-dot characters, you can have 80 characters per line and 25 lines per screen. And these are lined screens. Display resolution on most Japanese PCs like the PC-9800 series is 640 X 400 dots. However, if the user wants 25 lines of 16-dot Kanji characters per screen, he winds up with almost no space between characters, making it very difficult to read the text displayed on the screen. Furthermore, Japanese PC displays do not feature lined screens or underline capabilities. The vertical display resolution on AX machines is generally 480 dots, which leaves plenty of space between characters. However, when it comes to horizontal display resolution, AX machines, like the PC-9800 series, are equipped with 640 dot display capabilities.

The fifth technological advantage of AX machines is their 101-key keyboards (just like those used on PC/ATs), which

maintain their compatibility with higher-end machines. Because AX machines are equipped with 101-key keyboards, they offer uniform operability whether the user is running a Japanese-language applications program or a foreign-produced English-language applications package. AX keyboards feature the same key alignment as PC/AT keyboards, but have been expanded to incorporate kanji, kanji conversion and non-conversion keys, thus providing Japanese-language input capabilities. PC/AT users will find AX machines easy to operate because of the similarity of the keyboards; only a portion of the AX keyboard differs from the PC/AT keyboard.

Lastly, AX machines employ the same control codes as those found on IBM graphics printers, which enables users to print-out data processed using overseas applications programs. Moreover, since AX printer control codes are compatible with the Japanese-language ESC/P printer control code standard advocated by Epson, AX machines are compatible with the printer output control codes of most application packages that employ Japanese-language ESC/P.

The first AX machines commercialized

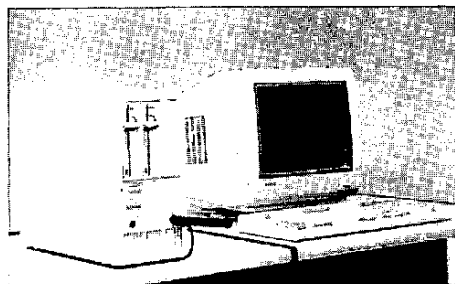


Photo 12. Sanyo MBC-17J

in Japan were the MBC-17J series of PCs (See Photo 12) put on the market by Sanyo Electric Corporation in February 1988. This series consists of the MBC-17LTJ family of laptop PCs; the MBC-17WJ series of desktop PCs; and MBC-18J series of 32-bit AX machines. Laptops in the MBC-17LTJ series are built around the 80286 CPU, feature backlit LCDs and dual 3.5-inch FDDs, and sell for 400,000 yen. There is also an MBC-17LTJ laptop with a 20 megabyte HDD built in. The MBC-18J series of 32-bit machines are equipped with 80386 CPUs, have dual 5.25-inch FDDs and come with 40 megabyte HDDs as onboard equipment. These machines sell for around 700,000 yen.

Mitsubishi Electric Corporation has come out with a laptop AX machine it has nicknamed MAXY. Officially known as the M3201-A20 (See Photo 13), this PC is built around the 80286 CPU, features an LCD complete with backlight and has two built-in 3.5-inch FDDs capable of 1.44 megabytes of storage capacity per drive. This machine carries a price tag of 448,000 yen. The M3201-

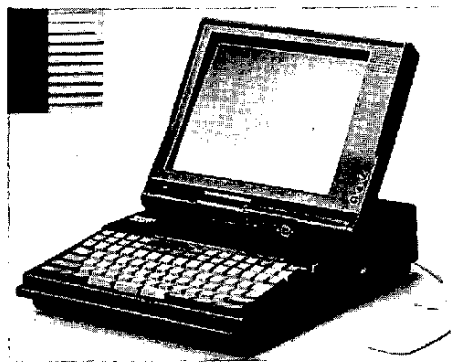


Photo 13. Mitsubishi M3201-A20

A12 version of this laptop sells for 588,000 yen and comes with one built-in FDD and a built-in 3.5-inch HDD with 20 megabytes of memory. Mitsubishi Electric also has a space saving desktop model called the M3201-M12, which replaces the LCD on the A20 model with a 14-inch color monitor and is priced at 573,000 yen.

Sharp Corporation is selling its 80386-based AX386 series for 860,000 yen. These machines come with dual 3.5-inch 1.44-megabyte FDDs onboard.

ACER Inc. of Taiwan, that country's largest PC manufacturer, is also marketing an AX machine in Japan via its subsidiary ACER Japan Corp. This machine comes in two models: the Acer 1100/20X (900,000 yen), equipped with a 20MHz 80386 CPU, 2-megabytes of internal memory, plus a built-in 5.25-inch FDD and an onboard 40-megabyte HDD; and the Acer 915X (335,000 yen), which is built around the 80286 CPU and comes with two onboard 5.25-inch FDDs. ACER Inc., a multinational corporation based out of Taiwan, is known for its IBM PC compatible machines. This is the first example of a NIES company introducing an AX machine on the Japanese market. However, the ACER Group doesn't fit with the NIES image of low-priced goods; rather it is aiming at establishing a place for itself here based on product performance and after-sales service.

A subsidiary of Mitsui & Co., Ltd., Bussan Digital Co., which is developing a network of value-added reseller (VAR) outlets, has announced its VAR-MATE

series of AX machines, a lively addition to existing AX PCs.

In September 1988, Mitsubishi Electric, Canon Corporation, Sharp and Sony Corporation announced new AX machines. Mitsubishi Electric, Canon and Sony all announced 32-bit machines, all of which utilize the popular 16MHz 80386 SX CPU.

Mitsubishi Electric's new AX machine is called the M3205, and is the follow-up to the M3201 series of MAXY laptops. This PC supports the AX versions of MS-DOS V3.21 and MS-WINDOWS 2.0. The B12 model, equipped with one FDD and a 20-megabyte HDD built in, runs for 650,000 yen. Mitsubishi Electric plans to start shipping this new machine in January 1989.

Canon has announced four models of AX machines, consisting of the portable DX-20P and DX-10P PCs and the desktop DX-20 (see Photo 14) and DX-10 machines. The DX-20P and DX-20 models are equipped with the 20MHz 80386 CPU and come with 32 kilobytes of cache memory. The DX-10P and DX-10 models utilize the 80386 SX CPU. The portable models employ four-gradient plasma displays. The DX-20P sells



Photo 14. Canon DX-20

for 1,098,000 yen, and the DX-10P is priced at 598,000 yen. The DX-20 and DX-20P are scheduled to be shipped starting in February 1989, while the first batches of the DX-10 and DX-10P models are to be shipped in May 1989.

Sony's AX machine is slightly different from those put out by Mitsubishi Electric and Canon. The Quarter-L (See Photo 15) is a new PC that comes equipped with a built-in CD-ROM drive. The CD-ROM drive used in this machine adheres to the XA format, an open-ended CD-ROM format co-developed by Sony, the Philips Corporation of Holland and Microsoft Corporation of the United States. Sony's Quarter-L brandishes the AX logo on the front of the main unit, and utilizes the 80386 SX CPU. This PC is therefore completely different from the NEWS workstations that Sony has been pushing. Samples of the Quarter-L are being shipped with a price tag of 750,000 yen on them. Shipments are scheduled to start in earnest next spring

(1989).

Following on the heels of its 32-bit AX 386, Sharp has come out with a laptop machine called the AX 286L (See Photo 16). This PC is equipped with a 10MHz 80286 CPU, and features an 8-gradient white double-super-twist LCD, enabling truly sharp display capabilities. This laptop AX can also be linked up and used with Sharp's PA-7000 electronic memorizer and WV-500 notebook-sized word processor. By incorporating this PC in with its popular array of electronic instruments, Sharp has indicated its intention to employ a bottom-up sales strategy. This approach might also be viewed as an attempt at new applications. The AX 286L with dual FDDs is priced at 428,000 yen. This machine is scheduled for shipment beginning December 15, 1988.

The development and marketing of AX machines isn't limited to the leading Japanese computer manufacturers alone. Kyocera Corporation, for example, ex-



Photo 15. Sony Quarter-L



Photo 16. Sharp AX286L

hibited two AX machines at the annual Data Show held in Tokyo in September 1988. One of these was a 32-bit desktop model which employs a 20MHz 80386 CPU, and the other was a 32-bit laptop PC equipped with a 16MHz 80386 SX CPU. Casio Co., Ltd. also displayed AX desktop and laptop PCs at the Data Show, the former equipped with the 80386 SX CPU, and the latter using a 12MHz 80286 CPU. Oki Electric Industries Co., Ltd. has announced a 32-bit laptop AX PC, too. The array of AX machines available in Japan is thus steadily growing. At present, there are over 20 different models of AX machines being readied for the market, and, including those from overseas, there are more than 500 software programs now available to run on these machines.

This rather detailed discussion of AX machines was designed to make the reader aware of the huge impact these machines are having on the Japanese PC market now, and to impress upon you the fact that the success or failure of these machines could well change the direction that market is developing in. It will be interesting to see how the AX machine goes about leveling the dominant position currently held by the PC-9800 series in the Japanese market. The AX's battle to build up a solid position for itself in this market has only just begun.

KEY TECHNOLOGIES

32-Bit Machines

The 32-bit microprocessor is essential

to the realization of faster processing capabilities and mass storage capacities in PCs. In fact, the incorporation of 80386 CPUs in business PCs is becoming the norm.

The first 32-bit PCs marketed in Japan included the PC-98XL² by NEC; the FMR-70HD by Fujitsu; the PS/55 Model 5570 by IBM Japan; and the B16HX Model 386 by Hitachi. All of these machines are equipped with the 80386 CPU, come with 1 or 2 megabytes of internal memory as standard, have either 40 or 70 megabyte HDDs, and without exception support graphic displays at the 1,000 dot level. With features such as these, and price tags marked at under 1 million yen, the turf battle among these machines has continued to grow.

Following these early 32-bit PCs, NEC came out with its PC-9801RA2 priced at just 498,000 yen, and IBM Japan countered by announcing its low-priced PS/55 Model 5550 equipped with a 20MHz 80386 CPU. Next came the AX machines described above. New model AX PCs are being brought out one right after the other, and include those equipped with the inexpensive 16MHz 80386SX CPU, which are expected to form the core of the PC market in future.

However, as it stands now, the only advantage of 32-bit PCs is a roughly two-fold increase in processing speed. In other words, PCs that use microprocessors with 32-bit word size have simply made their appearance on the market.

If this is the case, then what is the primary selling point of these 32-bit

machines? The answer to that question is the new operating systems that have been developed, including the Japanese-language version of OS/2, BTRON (The Real-time Operating system Nucleus (TRON) for Business use (BTRON)) and UNIX, plus the applications software that is being written for these OSs. Also, considerable attention is being paid to bus and computer architectures capable of making the most of the power inherent in 32-bit PCs.

A good example of this can be seen in IBM's sales strategy. That is, IBM has incorporated the OS/2 into its SNA and SAA, network and applications architectures, respectively, and is employing a new bus architecture, called the micro channel architecture (MCA), in its 32-bit PCs. By first establishing its basic architectures and software environments like this, IBM is ensuring that its 32-bit PCs assume a central position in systems technologies and products.

In the not too distant future, someone will probably come out with a 32-bit machine for the ordinary user, a real personal 32-bit computer. But for the time being, these PCs are best suited for use in the business office, which, in Japan, means as section machines (one PC per section). As 32-bit PCs become the focus of computer network architectures, the time will come when lower-end desktop and laptop machines will also be linked up to these networks. The age of the 32-bit PC is just now beginning to unfold.

Laptop Machines

The first Japanese laptop PC capable of rivaling the desktop machines of its day was the J-3100 developed and marketed by Toshiba in October 1986. It was the J-3100 that set the stage for the appearance of other laptop machines here. When the J-3100GT, an upgraded version of the original J-3100, was brought out in July 1987, it immediately assumed the role model for laptop development projects by the other Japanese computer manufacturers.

The J-3100GT is 311 mm wide, 360 mm deep and 80 mm tall, and weighs in at 6.8 kilograms. These dimensions and weight remained the same even when Toshiba incorporated an HDD into the machine, leading everyone to assert that this is what laptop machines are all about. Thus, laptop PCs marketed by other Japanese makers following the J-3100GT have almost all had about the same dimensions, and weight, between 6--8 kilograms. What differences there are stem primarily from the various manufacturers' component packaging technologies, their use of different resolution LCD or plasma displays, and the presence or absence of built in FDDs, HDDs or a combination of the two.

The most compact and lightweight laptops currently on the market here are NEC's PC-98LT, Fujitsu's FMR-10LT and Toshiba's J-3100SL. However, the PC-98LT and FMR-10LT are not completely compatible with their respective desktop series, whereas Toshiba's J-3100SL is fully compatible with all of the com-

panies other J-3100 models.

When we speak of space-saving PCs, we are generally referring only to these machines' compact size and light weight. However, space-saving machines must also be able to offer a certain fixed level of functions, as well as full compatibility. If significant advances in technology are made in future, we may see the appearance someday of high-tech super space-saving PCs that resemble the handheld computers marketed awhile back, i.e. about the size of an 8 X 11 in. book, and weighing between 3—4 kilograms.

Be that as it may, at present, there is a tendency to think of personal-use desktop machines when we refer to space-saving portable PCs. In that sense as well, however, laptop PCs stand a good chance of dominating the market for desktop machines in future. The remainder of this section deals with the functions built into laptop PCs.

CPUs

Toshiba has released a 32-bit laptop machine called the J-3100SGT. The J-3100SGT comes in two models: the 041 and 101. The former is equipped with a 16MHz 80386 CPU, while the latter features a 20MHz 80386 CPU. These machines are attempting to get a jump on the market for 32-bit PCs, which has finally started to pick up for desktop machines.

The most often used CPU in today's laptop machines is the 16-bit 80286. This is so for Toshiba's J-3100GX and Mitsubishi Electric's M3201-A20/12

laptops, all of which utilize the high-end 12MHz clock frequency.

Two popular personal use laptops in Japan now are the PC-9801LV21 by NEC and the PC-286L by Epson, both of which are equipped with 10MHz V30 CPUs. These machines are contributing toward the popularization of laptop PCs in Japan.

Storage capacity

Practically all desktop PCs on the market today measure their internal storage capacities in megabytes: laptop machines do likewise. Most laptops come equipped with 1—2 megabytes of internal storage as standard, with certain models being capable of expanding their storage capacities to a maximum of 6 megabytes.

Display devices

The major difference in the man-machine interface capabilities of desktop and laptop machines is in their display devices.

Whereas desktop PCs are equipped with cathode ray tubes (CRTs) that serve as their display devices, laptop machines make use of flat display devices. At present, laptop PCs are pretty evenly divided between those that use LCDs and those that employ plasma displays.

The contrast on plasma displays is clearer than on LCDs, making for easier viewing. However, plasma display devices consume more electricity and are thus more expensive to operate. The higher costs of operating plasma displays are

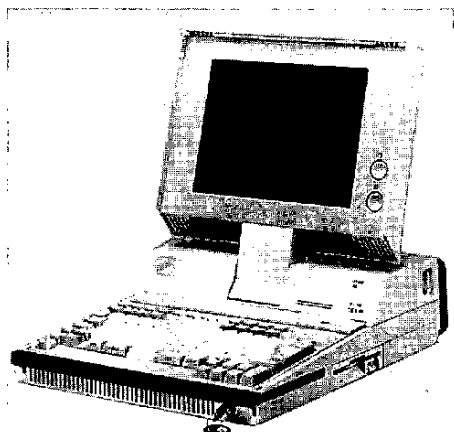


Photo 17. IBM Japan PS/55 Model 5535

also reflected in their price tags. Just how much the price of these displays can be lowered will depend on the mass production technologies used to produce them. For their part, LCDs now come with built-in backlights, making them much brighter than they were when they were first marketed. Nevertheless, from the user's standpoint, it is less a matter of LCDs being sufficiently easy on the eyes, than it is a feeling of whether or not one can stand using them. Of those LCDs in use on laptop PCs, the white screen versions (NTN LCDs) used on Epson's PC-286L and IBM Japan's PS/55 Model 5535 (See Photo 17) are being given high points. The black and white contrast on these LCDs is quite sharp, and the PC-286L display also enables the user to adjust the illumination level.

In order to handle software that displays data in color, most of the display devices employed on laptop machines are equipped with color gradation capabilities. Among these, NEC's PC-

9801LV21, Hitachi's B16LX/LXS, Mitsubishi Electric's M3201, Sanyo Electric's MBC-17LTJ and Sharp's AX286L all feature 8-gradient color display capabilities. The plasma display devices on Matsushita's Panacom M353 and Fujitsu's FMR-50LT provide 16-gradient color displays. Compatibility with higher-end desktop PCs and the capability of displaying data in color are significant features of laptop PCs. However, the 8- and 16-gradient color display capabilities currently available on these machine's LCD and plasma display devices, respectively, still lack sufficient contrast. It looks like we will have to wait a while longer for a truly practical color LCD.

When it comes to resolution, the LCD and plasma displays on laptop machines are designed primarily to satisfy the 640 X 400 dot output requirements of most software programs rather than to achieve high resolution. Recently, we have begun to see more laptops with 640 X 480 dot resolution, especially those machines that meet AX specifications. However, it will take some time before these displays are equipped with resolution capabilities at the 1,000 dot level.

3.5-inch FDD/HDD

To conserve space, manufacturers are building 3.5-inch FDDs and HDDs into their laptop PCs. Even desktop PCs, which have generally been equipped with 5.25-inch disk drives, have suddenly begun to favor the 3.5-inch size drives.

At present, the laptop FDD with the

largest storage capacity is the 1.44 megabyte drive employed by IBM. This FDD has already been incorporated into IBM Japan's PS/55 Model 5535, as well as such AX machines as the M3201 by Mitsubishi Electric, the MBC-17LTJ by Sanyo and the AX286L by Sharp.

When it comes to HDDs, most laptop machines are equipped with 20–40 megabyte drives. Equipping laptop PCs with built-in HDDs has been one of the conditions necessary for enabling these machines to rival the performance of higher end desktop models. We have recently witnessed the appearance of laptop PCs such as Toshiba's J-3100SGT-101, which comes with a built-in 100 megabyte HDD. The access time for this machine has also been reduced to just 25 milliseconds.

Power sources

Laptop PCs can generally be powered either by AC or batteries. AC powered laptops use ordinary household electric outlets, and, quite naturally, if these machines are not equipped with built-in batteries, they are not designed for portable use. Most AC-powered laptops operate on 100 volts of electric power, but Mitsubishi Electric's M3201 is equipped with a voltage selection switch that enables the user to operate his machine from the 220–240 volt power sources prevalent overseas. The main point to keep in mind with laptop PCs featuring built-in batteries is how long they can be operated continuously without recharging the batteries.

Use as terminals

Laptop PCs are generally viewed as personal machines designed for the specific use of one person. However, the spread of computer-to-computer communications capabilities has stimulated demand for laptop PCs with communications functions. IBM Japan's PS/55 Model 5535, NEC's N5200 Model 03L and Fujitsu's FACOM 9450LTmkII are all designed to serve as terminals on their respective manufacturers' computer systems. In fact, Toshiba made its J-3100 series of laptops compatible with the IBM PC/AT to appeal to IBM users. AX machines such as Mitsubishi Electric's M3201 offer the same compatibility, and for the same reason.

Laptops are not only designed for use as terminals in large-scale computer systems, but are now also being equipped with hardware and software functions that enable them to be linked up to telecomputing (PC communications) networks and local area networks (LANs). Laptop PCs thus have the potential for becoming individual communications tools.

Japanese-language OS/2

Since being unveiled by IBM and Microsoft in April 1987, the OS/2 operating system has attracted considerable attention as the next industry standard OS for PCs, replacing MS-DOS. IBM began shipping the basic OS/2 version 1.0 in December, 1987, and IBM Japan started shipping in March 1988 a Japa-

nese-language version of this OS aimed at end users in Japan.

The OS/2 resulted from a joint development project undertaken by IBM and Microsoft, the latter of which is supplying this OS to computer manufacturers other than IBM under the brand name MS OS/2. MS OS/2 has the same source code as the basic version of OS/2. However, it differs from one company to the next as to the respective device drivers, languages and other specifications used. The enhanced versions of the OS/2 will become IBM proprietary software.

The biggest feature of the OS/2 is the multi-tasking environment it provides. It also greatly expands real memory up to a maximum of 16 megabytes. Although the OS/2 was originally designed to get the most out of the functions available with the 80286 CPU, it will also serve as a bridge to the 32-bit 80386 microprocessor. These factors make the OS/2 best suited for use in high-end PCs, and built-in HDDs are a must.

IBM Japan wasted no time in commencing shipments of the Japanese-language version of OS/2, thus making this OS the first of the company's SAA-oriented products. IBM Japan has also come out with the SMART series of integrated software, applications software specially written for the OS/2.

As for the Japanese-language version of Microsoft's MS OS/2, NEC has already released a version of this OS that runs on its PC-9800 series, and Fujitsu has released an FMR series version. Toshiba also has plans to release a version of this OS for its J-3100 series before the year

is out.

So the trend appears to be from MS-DOS to OS/2. This can be inferred also from the fact that the OS/2 is being equipped with an MS-DOS compatible mode. It will be awhile yet, however, before we know what software packages will be run on the MS-DOS compatible mode. But one thing seems pretty certain at this point, and that is that it is unlikely that the OS/2 will replace MS-DOS in lower end popular PCs.

In future, the OS/2 will be enhanced by the Presentation Manager, a piece of OS software that will plug into the OS/2 to provide users with a multi-window environment. OS/2 will also be expanded for use in LANs, micro-mainframe links (MMLs) and public database systems. In this sense, then, OS/2 will play a vital role in enabling PCs to be utilized in a broad range of workstation applications.

PC APPLICATIONS

Business Use

Nihon Office Management Association (NOMA) recently surveyed 1,794 listed private companies and 209 local government organizations to determine the degree of PC utilization in business and administrative tasks. Based on responses received from 108 private companies and 56 local government organizations, NOMA learned that PC utilization exceeded 90%. In other words, PCs are being used in practically all private businesses and local government offices in Japan.

Other data reflecting the use of PCs in business applications in Japan can be found in a survey done in December 1987 by the Japan Institute of Office Automation (JIOA). The results of this survey are contained in a report titled "88 Office Automation Survey Report," from which Figures 12 and 13 are taken. The JIOA survey targetted both corporate and individual users, and received responses from 340 listed and unlisted major companies, plus 257 individuals users from 24 key corporations.

Figure 12 compares the numbers of office automation (OA) equipment, including PCs, in use at the time of the survey with those recorded the previous year. JIOA only targetted corporations having an average of 2,000 employees, so the data gleaned via its survey did not include medium- and small-sized businesses. Another point that should be made clear is the fact that the respondents were allowed to use their own definitions of what constituted a workstation.

As can be seen from reviewing the figures given in Figure 12, on average, there is one PC installed for every 10 employees at major corporations in Japan. Now, since the ideal utilization ratio is one PC per employee, there is the potential, at any rate, for a ten-fold increase in PC utilization at major Japanese firms.

Figure 13 provides information indicating how these PCs are being used by the 10 employees for whom they were installed. A few points should be cleared up here. For example, in segment [5] of Figure 13, which attempts to predict what PC OS will be most popular in three

years time, we should assume that the OS/2 is included in the column marked MS-DOS. Also, according to the figures given in segment [2], 84.1% of all PCs installed at major Japanese firms are hooked up online to host computers. However, what this segment fails to tell us is just how many PCs we are talking about. And lastly, with regard to segment [10], which deals with the trend towards introducing PCs and/or installing additional PCs, it should be noted that the percentage of corporations considering increasing the number of PCs installed in-house between 5-10% is actually closer to the 80% plus level.

There was also another survey done in early 1988 by an organization called the Central Research Services (CRS). The result of this survey were published in the "Office Equipment '88 Report," and indicated that as of February 1988, PCs were installed at 19.5% of all Japanese firms. Now this survey targetted private companies with five or more employees, and received valid responses from 2,611 of the companies it surveyed. The CRS survey can thus be taken as a good indicator of PC utilization at small- and medium-sized companies.

From the results of the JIOA and CRS surveys, it would seem that whereas PC utilization is becoming a matter of course at large-size Japanese companies, the use of PCs at small- and medium-size firms is just starting to get off the ground.

As for the applications to which PCs are being put in the workplace, major corporations are using these machines in everything from finance and other opera-

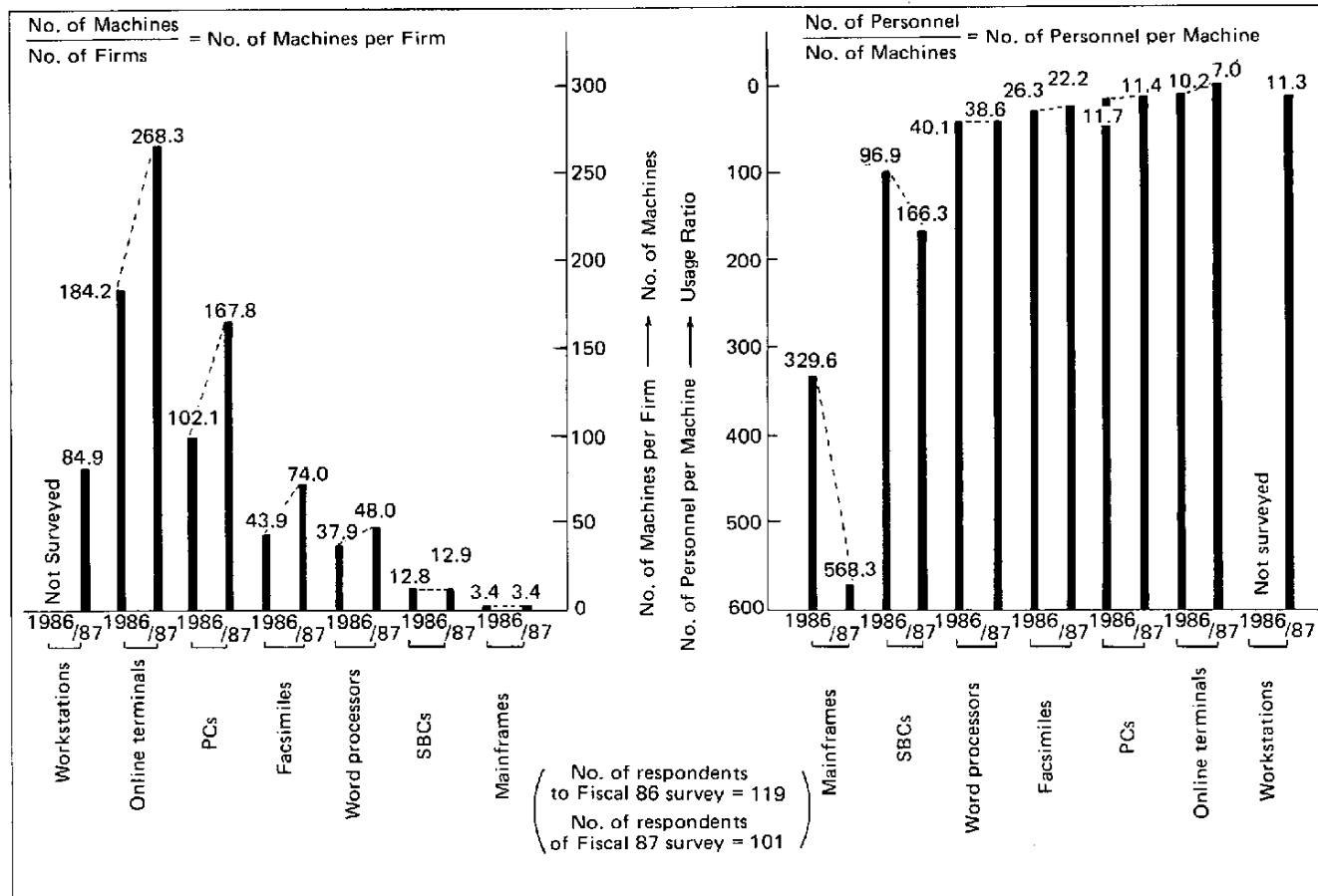


Figure 12. Utilization of OA Equipment Including PCs

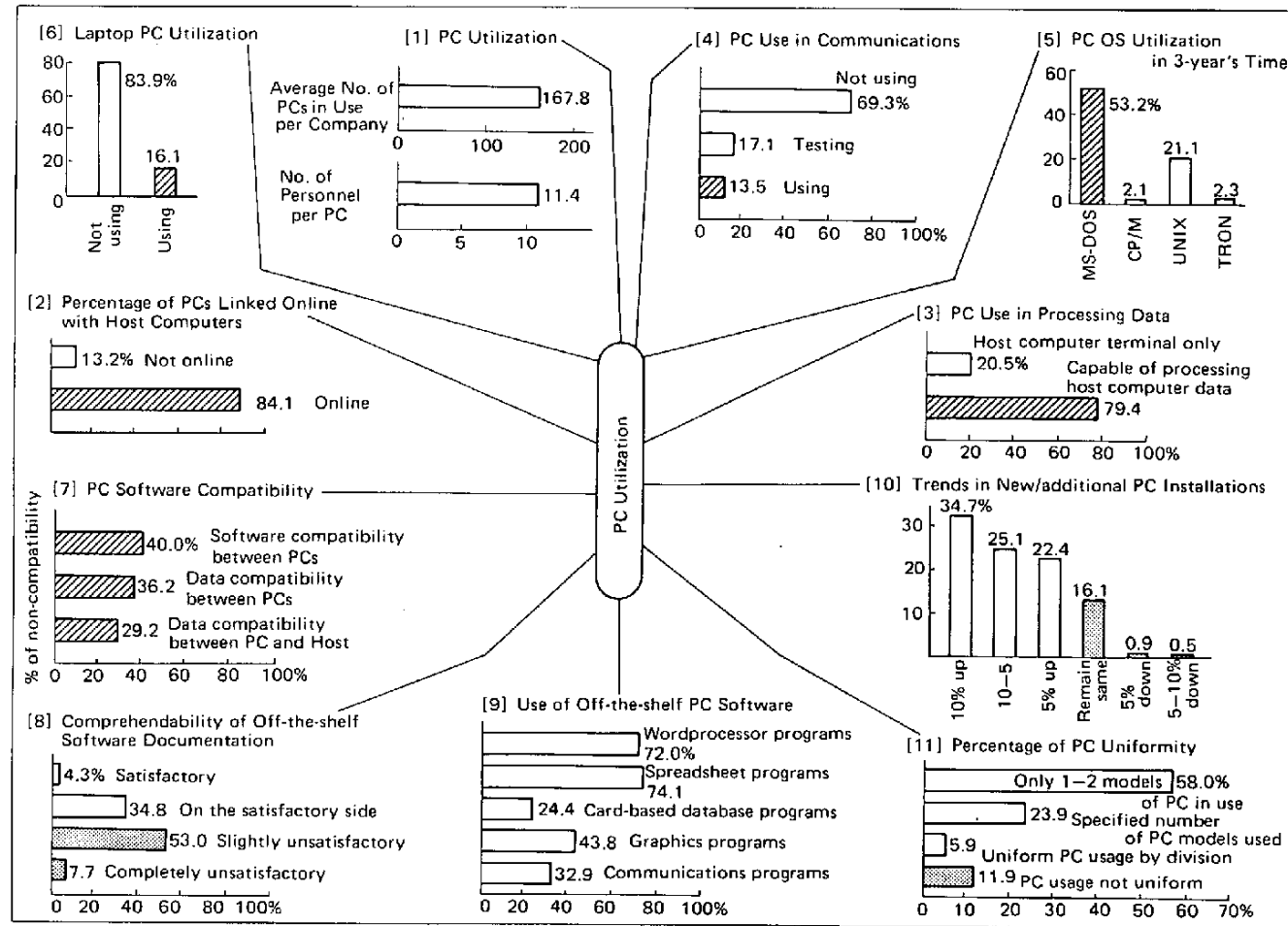


Figure 13. PC Utilization

tional applications, to the LANs and value-added networks (VANs) they are constructing, sales management and even as management-level decision-support machines. PCs for use in electronic mail systems are also spreading quite rapidly. At the small- and medium-size Japanese firms, however, this is not the case. These smaller business users can't keep pace with the large corporate users, and

are still relying on their own knowhow and off-the-shelf software to process their work. This situation will probably continue until the value-added resellers (VARs) get into full swing.

Personal Use

The best-selling PC-9800 series is being used primarily to perform business-

Table 5. MSX Specifications

Item		MSX	MSX ₂	MSX ₂ +
CPU/speed		Z80/3.58 MHz	←	←
Main Memory Capacity (RAM) (Range)		16KB 8KB~64KB)	64KB (64KB~4MB)	64KB~ ←
Systems Program Capacity (ROM)		32KB (MSX BASIC Ver 1.0)	48KB (MSX BASIC Ver 2.0)	96KB (MSX BASIC Ver 3.0)
DOS Program Capacity (ROM)		16KB	← 48KB (DOS 2)	← ←
Display Functions	Video Memory Capacity (VRAM)	16KB	128KB	←
	Maximum Screen Resolution (Horizontal x vertical)	256x192	512x424	←
	Maximum No. of Colors Displayed Simultaneously	16	256	19,268
	Vertical Scroll Function	No	Yes	←
	Horizontal Scroll Function	No	No	Yes
Audio Functions		PSG	PSG MSX-AUDIO (Optional)	← ← MSX-MUSIC (Optional)
Japanese-language Processing	Kanji Display ROM	(Optional)	←	JIS 1 Standards
	Kanji Display Functions	By application	←	Maximum 40 chars x 24 lines
	Kanji Input Functions	By application	←	Single Kanji Conversion Standard — MSX-JE
Communications Functions	RS-232C	(Optional)	←	←
	Modem (300/1200BPS)	(Optional)	←	←

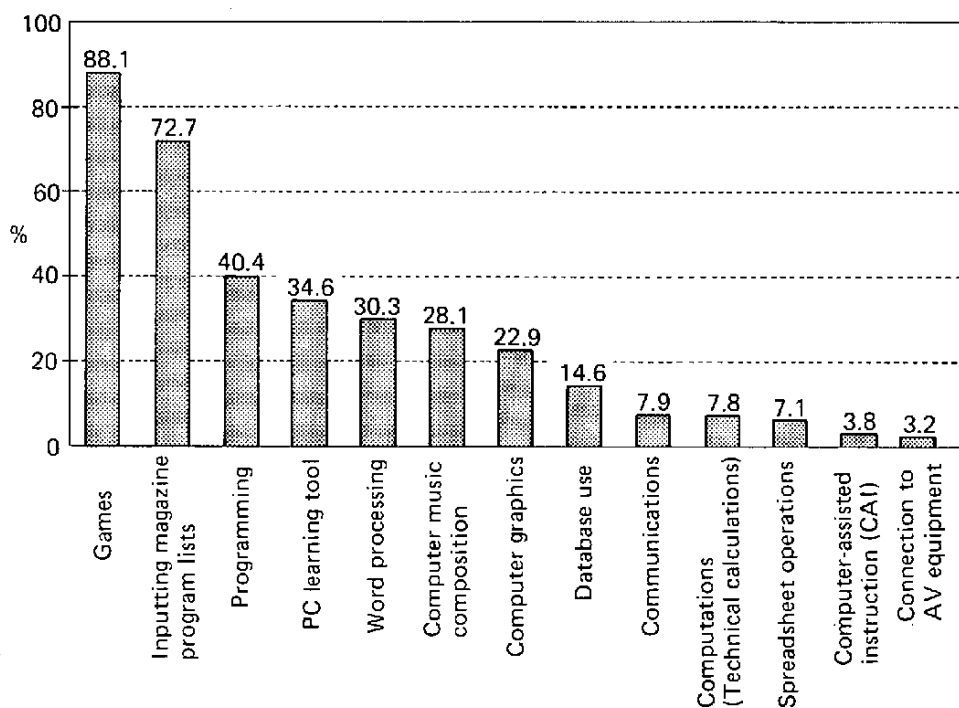
related work. But the machines in this series are also being counted on to fill the role of home computers for personal use as well in future.

When we speak of home- or personal-use PCs, we are still talking for the most part about 8-bit machines, such as NEC's PC-8800 series, Fujitsu's FM77AV series, Sharp's X1 series and the MSX machines.

MSX machines are based on standardized specifications advanced by ASCII Corporation for 8-bit home computers. To date the original MSX machines have been upgraded twice to create the MSX2 and MSX2+ models. The leading manufacturers of MSX machines are Matsushita and Sony, who are engaged in a fierce

battle for dominance in this market. The original MSX specifications, as well as those of the two enhanced versions of these machines are shown in Table 5. According to figures put together by ASCII, total shipments of MSX machines to date have reached 2.9 million units, of which 1.8 million machines were shipped domestically and the remaining 1.1 million units went to overseas markets. On a volume basis, this puts MSX machines at the top of this market category.

The uses to which MSX machines are being put in Japan are shown in Figure 14. Other personal-use PCs in this class are most likely being used in the same



Source: Results of 1988 ASCII-PCIS study

Figure 14. MSX Applications

ways as the MSX machines.

New Applications

The hottest new PC application around is desktop publishing (DTP). The field of DTP was pioneered in the United States by Apple Computer, Inc. when it decided to mate its Macintosh to a laser printer, thus enabling ordinary users to produce high-quality printed documents right at their own desks. This application is closely related to word processing, and seems to hold considerable potential for future demand.

DTP pioneer Apple has finally come up with a printer that speaks Japanese, the Laser Writer II NTX-J, and is using this together with Kanji Pagemaker 2.0 by America's Aldus Corporation and the Japanese version of Adobe Systems, Inc.'s page description language Postscript to make an all-out assault on the DTP market in Japan. Sony, who is leading the low-priced workstation field with its NEWS series, has been quick to jump on the DTP wagon with a NEWS-based DTP system. NEC, Fujitsu, Matsushita and Ricoh, Inc. have all entered into licensing agreements with Adobe Systems for the use of Postscript, and are expected to come out with their own DTP systems built around their respective PCs and laser printers.

Another area where PC demand is expected to grow in Japan is the field of education.

Beginning in fiscal 1993, a new curriculum will be introduced into some

11,000 secondary schools nationwide. This new curriculum, called "Basics of Information," will require that large numbers of PCs with standardized specifications be installed at these schools for use as teaching and learning tools.

The Center for Educational Computing (CEC), a satellite organization of the Ministry of International Trade and Industry (MITI) and the Ministry of Education (MOE), both of which are advocating the standardization of educational PCs, announced in March 1988 its selection of nine (9) prototype educational PCs developed by a total of 11 Japanese PC manufacturers. These prototypes are currently undergoing a variety of tests, including on-site testing at a number of junior high schools. The OS specified by CEC for use in these standardized educational PCs is the BTRON, one of the TRON architectures advocated by Associate Professor Ken Sakamura of Tokyo University. This gives us two new trends to keep an eye on: PCs designed specifically for use in education and TRON machines.

New PC applications such as those just mentioned are being created one right after the other. Furthermore, PCs are rapidly evolving from stand-alone machines to integral man-machine interfaces for use in MMLs, LANs, telecomputing and even integrated services digital networks (ISDN). The demand for PCs for use as home computers is also expected to grow rapidly in future. The potential applications for these versatile machines are almost unlimited.

The Business of Networking in Japan PAST, PRESENT and the FUTURE

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PAST

Before April 1985, public message exchange and communication network services were prohibited in Japan. Only databases and TSS (Time Sharing Services) systems that contained data processing capabilities were officially permitted.

There were, however, a number of "experimental" attempts at using computer networks to communicate and exchange messages. These attempts were not officially recognized or allowed.

Some of these experimental systems were heavily influenced by American computer networks. People who had used network services in the U.S. often started similar systems of their own after returning to Japan. These people often used American BBS (Bulletin Board

System) software packages that could run on Apple or IBM personal computers. These programs allowed their personal computers to act as host systems. Other people wrote their own software to host similar systems. The majority of these networks ran on a grassroots level.

The early users of these experimental networks were called "maniacs" in Japan, a term that refers to computer buffs who could write their own communication software. The information that they exchanged with one another was usually of a technical nature. Only a few systems concentrated on business and more general topics. For example, "JALNET" by Japan Airlines, and "The Board" by Epson were public-oriented systems offered to these companies' customers as an extension of their customer service facilities.

Number of Network Users in Japan
(estimated)

Year	No. of Users
'83	100
'84	1,000
'85	15,000
'86	30,000
'87	60,000
'88	100,000

Number of Network Services in Japan
(as of Oct 1988)

Year	Commercial Networks	BBS
'83	none	one
'84	none	10
'85	4 (test)	30
'86	10 (in service)	300
'87	15	1,000
'88	20	1,500

Beginning: In came the 'normal' people... from 'Databases' to 'Communications'

In Japan, personal computer network (PC network) services first took shape in 1985. In April 1985, the government deregulated the use of computer/data communications on public telephone lines, and Nippon Telegraph and Telephone Public Corporation (NTT), then the monopoly common carrier, was privatized, finally giving the opportunity for telecom services to expand and take off.

After deregulation, like water flooding over a broken dam, the widespread use of computer networks began. Major software/magazine publishers such as ASCII, PC World and Telestar started their own networks for their readers. A major private television network, Fuji TV, also started an experimental system.

NTT, a common carrier itself, began using 'JUST-PC' a 4800/2400 bps error-correction protocol. In April 1985, Nippon Electric Corporation (NEC), the largest personal computer vendor in Japan, started the experimental stage of PC-VAN, their own network service.

Booming

All of a sudden, PC networks became one of the most popular subjects in the personal computing world in Japan. Many articles were written about networking in general and business-oriented magazines, as well as computer magazines. TV broadcasts and newspapers also

covered this new field extensively.

The emphasis of this coverage was on the human side of communications. Networks allowed people to meet new acquaintances and make new friends. It freed people from the limitations of space and time. It also freed them from being socially limited by their professions, company affiliations, names, genders and the like.

Eventually the early users found that human communications using PC networks could be very exciting and full of unexpected exchanges. These people found it was more fun as well as useful to interact with people, often times total strangers, than to merely exchange data and information between machines.

This was a very important discovery since most of the network services in Japan at that time were trying to offer information as a commodity to be sold commercially to users, when in fact, the users' real interests lied in the two-way, open communications that was available over the PC network.

PC networkers were not happy about having information gathered and provided to them by the press, and/or academic and government institutions. Rather, they enjoyed sharing their own information with other similar-minded citizens. They helped each other in time of need, and gradually created an online community. These users were not interested in being passive consumers of ready-made information.

Major Network Services in Japan

(as of Oct 1988)

Network	Vendor	No. of Users	Date Started	Features
PC-VAN	NEC	46,000	Apr 86	Inexpensive rate, many local users, GENIE link
NIFTY-Serve	Fujitsu/ Nissho-Iwai	28,000	Apr 87	CompuServe link Forums, InfoQue DB
ASCII ACS	ASCII Corp	2,800	Jun 87	Limited 'club'/community
ASCII PCS	ASCII Corp	12,000	May 85	PDS, many PC users
TeleStar	Kogakusha/ Telestar Inc	12,000	Mar 85	Inexpensive, graphics, on-line shopping
EYE-Net	Fujimic	6,000	Sep 85	Tie with TV, young users
JAL NET	Japan Airlines	5,000	Apr 86	JAL flight tickets, tour info, on-line shop
NTT PC Com.	NTT PC	5,000	Nov 86	JUST, business appl.
Nikkei MIX	Nikkei- MacGraw-Hill	4,500	Aug 86	CoSy conferencing 'matured' users
Space Com.	Space Net	4,000	Sep 86	PARTI, business people
Master Net	Master Net/ Meiji Milk	3,000	May 87	New venture, JUST high security
MDB (My Data Base)	Diamond publ.	2,000	Apr 86	Tie with biz magazine
COARA	COARA (non-profit)	900	May 85	Own CC, very active, Local/Global access
TWICS	IEC	500	Apr 86	Global access, PARTI

Coara: A First Success

No one was more successful in taking into account the needs and desires of the ordinary user than COARA (Communication of Oita Amateur Research Association), then still a small regional network in Oita prefecture, some 1,000 miles away from the central part of Japan.

COARA was established as a regional network in Oita in May of 1985 with some 30 start-up members. The founders were mostly business people led by local Junior Chamber of Commerce members.

From the very beginning, COARA users wanted to avoid having too many computer maniacs, and aimed to serve more ordinary people.

COARA publishes highlights of their online communications in a monthly newsletter called "Album COARA." The group also holds regular monthly off-line member meetings. The newsletter and meeting are designed to boost human interaction and communications, so as not to confine members to online communications only. This approach became one of the major reasons for COARA's success.

Oita Prefecture Governor Hiramatsu, the most famous and creative governor in Japan, also saw the potential for communications inherent in COARA and became a serious advocator and participant himself!

Extensive media coverage in magazines, newspapers and TV made COARA very famous throughout the nation, and more and more 'outside' people joined the group. Today, COARA is international in scope, with members signing in from Holland, Switzerland and the U.S. Membership now exceeds 1000, the majority of whom are 'outsiders,' i.e. people not residing in Oita. This is very rare for a local networking group in Japan, and shows how popular COARA has become in just three years.

PRESENT

Profile of Major Networks

There are at least 20 commercial service networks operating nationwide in Japan today. More and more companies are preparing to penetrate this market, and competition is very fierce.

Right now, two major networks and more than a dozen smaller systems are fighting for a piece of the market.

NEC PC-VAN: The largest network

NEC PC-VAN is the largest PC network in Japan both in terms of the number of users and the number of local access points operated by NEC. PC-VAN now has some 46,000 members, the

average age of whom is 37. This system has 91 local access points with a total of some 500 telephone ports.

PC-VAN started out as an experimental service in April 1985, and began full commercial operation in April 1986. Its inexpensive pricing strategy and numerous local access points accounted for its large membership which is currently increasing at a rate of 2,000 a month. At this rate, membership will soon reach 50,000, but the group's goal is over 100,000 members. PC-VAN's key strategy is to keep the number one share of the market.

Demographically-speaking, membership is adult-oriented, with 20.8% being in their 20s, 42.9% in their 30s, 18.8% in their 40s, and 7.6% over 50s. Ninety-eight percent of the users are male with only 2% being female. This is representative of the current situation of PC networks in Japan.

Almost 50% of all PC-VAN members live in the greater Tokyo metropolitan area, showing a heavy concentration in central Japan. Some 55% are business people, 5% are civil servants, 7.5% are students, and 7.4% are self-employed. A total of 86.7% of the users employ NEC computers to access the network. Considering NEC's share of the PC market in Japan (roughly more than 50%, similar to IBM's situation in the PC market in the U.S.), this figure is not surprising, but it is significant.

Most PC-VAN usage is concentrated in SIG (Special Interest Group) services which are operated by volunteer SIGOPs (SIG Operators). There are about 120

SIGs in PC-VAN, these include electronic conferencing, electronic mail, chat (on-line real-time communications), PDS (Public Domain Software) exchange and mini-databases.

The most popular PC-VAN SIGs are the various user (groups for NEC personal computers and softwares, the "Global Village" and the "Ojisan Hiroba (Uncle's Plaza)", the latter two both promoting human communications in general. Other popular SIG topics include education, music, motorcycles, stock markets investments, the disabled and horse racing.

Besides SIGs, PC-VAN also offers news wire service horse racing odds and information, and other database services. But the access volume for these services is much lower than that of the SIGs.

PC-VAN is affiliated with GENie, a U.S. public network service offered by GE Information Service Co., and is planning to offer a gateway to this system in the near future.

PC-VAN is a part of a larger network service called C&C VAN, which is also offered by NEC. It is a broader, nationwide VAN, and has provided the infrastructure for PC-VAN. This has proven to be a very strong advantage for NEC.

NIFTY-Serve: Number two is catching up

The second largest PC network service in Japan is called NIFTY-Serve, and is operated by a company called NIF. NIF is a joint business venture by Fujitsu and Nissho-Iwai, making it a computer and

trading combination.

NIFTY-Serve owes most of its concept and technology to CompuServe, the largest U.S. consumer service network, from which it has licensed the host software and the service know-how.

NIFTY-Serve uses the FENICS VAN service run by Fujitsu, which has 75 access points nationwide with a total of some 200 telephone ports. Unlike NEC's PC-VAN, however, NIFTY-Serve's operator, NIF, is a separate and independent entity from Fujitsu, and as such bears all of the network costs.

Although NIFTY-Serve was one-year behind PC-VAN in entering the market, it is rapidly catching up to PC-VAN. NIFTY-Serve began service in April 1987, and now has close to 30,000 members. Membership is increasing at a rate of 2,000 members a month and is expected to reach 40,000 on the service's second anniversary. NIF hopes to expand membership to 80,000 by 1990. NIFTY-Serve does not publish detailed profiles of its users, but the majority of these users are business people in their 30s, 60% of whom live in greater metropolitan areas. An estimated 5% of NIFTY-Serve members are female.

NIFTY-Serve's main features are its CompuServe link and its 'Forums,' which are similar to PC-VAN's SIGs. The distinction is that NIFTY-Serve pays back a portion of users' online usage fees to Forum operators, who are called SYSOP (system operators), while PC-VAN does not. This has resulted in NIFTY-Serve generally offering more well-organized forum services.

The more popular forums in NIFTY-Serve are cooking, railroads, space, handicrafts, HAM and radio operations, religions, poems, and health. Compared to PC-VAN SIGs, NIFTY-Serve forums offer many more non-technical and non-computer oriented subjects. NIFTY-Serve also offers a range of CUGs (Closed User Groups), which give certain groups use of separate, closed network services. Some corporations and professional groups are using this CUG feature to setup their own private networks.

A unique feature recently made available through NIFTY-Serve is its FAX delivery service. This service allows the user to send a message to a facsimile machine by entering the number of the FAX machine as the address of an electronic mail message. The system then automatically calls the specified facsimile machine and delivers the stored message.

NIFTY-Serve also recently opened a new gateway service to U.S. network services, including CompuServe and Info-Que. This gateway service is connected to the EasyNet Database system.

Sixty percent of NIFTY-Serve users access the system more than once a month, and average usage time is 15 minute per month. Big forums can include up to 2,000 members and total 10,000 calls a month. NIFTY-Serve also offers online shopping services, among which a book sales service is the most popular.

ASCII Net and Telestar: The pioneers

Another of the pioneer network services is ASCII Net, operated by ASCII Corporation, the largest publisher of personal computer software and related books and magazines in the field. ASCII Net's main rival is TeleStar, run by another software/magazine publisher called Kogakusha.

Both ASCII Net and TeleStar have similar user profiles composed mainly of young computer enthusiasts. For example, although 38.6% of ASCII Net's users are in their 30s, 35.9% are in their 20s and 12.1% are teenagers. Only 9.3% are in their 40s, and just 3.8% are over 50.

ASCII Net has three different services: ASCII ACS, ASCII PCS and MSX Net. ASCII ACS has 2,800 members and aims at users in the higher income brackets to create an online club-like community. ASCII PCS, with 12,000 members, is cheaper and attracts more general PC users. The third network service, MSX Net, is primarily an MSX-standard computer users group aimed at lower-end home computers in Japan. Although ASCII Net offers several news services via these systems, its main area of focus is two-way communications.

TeleStar has 12,000 members, and in addition to regular text transmissions, offers a graphics communication protocol. It has also been experimenting with online shopping and database gateways from the very early days of its development.

Medium-sized system

From a marketing point of view, medium-sized networks with memberships in the thousands have difficulty surviving.

Nikkei Mix, originally based on U.S. Byte magazine's BIX, seems to be in a fairly stable business situation. Nikkei Mix is operated by Nikkei Business Publications (BP), a Nihon Keizai Shimbun (a Japanese-language daily economic newspaper) subsidiary, that publishes computer and business magazines. Subscribers to Nikkei BP constitute the user base for Nikkei Mix. With higher rates and more professional members than other networks, Nikkei Mix tends to set higher standards for its online discussions, as well as for participation from hardware and software vendors. Nikkei Mix runs a Japanese version of CoSy, a conferencing software system originally developed by the University of Guelph in Canada.

EYE-Net is another medium-sized network system operated by FujiMic, a thinktank subsidiary of the Fuji-Sankei Group. Fuji Sankei is a large TV/newspaper conglomerate. With 6,000 members and a close relationship with the Fuji television broadcasting network, Eye-Net has been focusing on attracting more users from the general public vice the computer enthusiasts. Popular young television personalities can be "Talked" to online via EYE-Net, making it very popular among young people.

NTT also offers a medium-sized PC network system called PC Communications. This system was developed by NTT

in cooperation with Logic System International, an entrepreneurial company specializing in PC hardware and peripherals. From the beginning, NTT PC Communications has concentrated on business applications, trying to attract large corporate users.

Despite considerable marketing efforts, the number of NTT PC Communications' users and the volume of usage has not reached projected figures. One special feature of this system is its adoption of the JUST-PC standard protocol, an 'error-free' high-speed protocol. However, the extra cost, limited compatibility and the dedicated hardware necessary to connect JUST-PC equipment to the phonelines has prevented this protocol from attaining wide-spread use.

Space Communications is another entrepreneurial PC network services venture. This system uses PARTI, one of the best selling conferencing software packages in the U.S. Space Communications originally directed its marketing efforts towards individuals users, but low growth in that market area has convinced the operators to target corporate applications by offering tailored CUG services.

A rather unique mid-sized PC network service is MDB (My Data Base) operated by the Diamond Publication Company. MDB has a small user base, but offers much more than just network services. It sells hardware, books, and specially prepared tools, such as an "electronic study" package. This service also has a gateway service to DELPHI, an American system, and DIALOG, an online database service.

JAL NET has 5,000 members and is owned and marketed by Japan Air Lines, Japan's national flag carrying airlines company. JAL NET offers domestic flight reservations and ticketing information, as well as international travel information, online shopping for overseas goods and other travel-related services.

Meiji Milk Corporation has started a medium-sized PC network service called Master Net. Although the business plans for this service are ambitious, due primarily to delays in getting started and inadequate network software performance, Master Net has failed to attract the number of members needed to meet its original terms. This service boasts a highly secure system thanks to the JUST-PC protocol that it uses and an originally-developed modem call-back procedure that requires a built-in ID and password with the modem to prevent possible break-ins.

In 1987, securities firms began to offer online trading and information services to their customers. This year, they introduced a system to allow Family Computers (originally a game computer) with specially designed adapters to access their networks. Currently four major security firms are involved in developing such services, and the number of users is rapidly increasing. Most users employ the information services; the online trading services have yet to gain much usage. This is due mainly to the fact that people have to interact on a personal level with their regular sales agents when making buying or selling decisions.

Other nation-wide medium-sized commercial PC Network services include the JR (Japan railways) service and the Japan Horse Racing Association's service. Neither of these are fully operational yet, however.

REGIONAL NETWORKS

Generally speaking, local governments and local business communities have a higher interest and concern for the 'information age' than urban areas. With the recent trend toward greater centralization of the economy, information and other aspects of society, people in outlying areas are afraid of being left out in the rapidly approaching information society. This is one of the driving forces behind local projects aimed at achieving new technologies and communications media.

Following the successful example of COARA, and guided by the central government's incentive policies, quite a few regional PC network projects are being planned throughout the nation. To date, the only other fully operational system is COMNET Sendai. But non-profit and experimental systems are sprouting up everywhere from the northernmost island of Hokkaido, to Okinawa, the southernmost island. According to a survey done by the Ministry of Home-Affairs, there are approximately 50 local PC networking projects aimed at establishing third-sector companies.

Some of these firms intend to offer only communication services, while others will include either local database

services or links with videotex and CATV networks.

In addition, there are an estimated 1,500 or more private BBSs are in operation in almost every prefecture and major city in Japan. As most of them are either completely free of charge or require minimal membership fees, and are within the reach of local call areas, these BBSs are playing a vital role in providing an inexpensive foundation for the beginning network user.

COMNET Sendai

Located some 300 miles north of Tokyo, Sendai is one of the major cities of northern Japan. COMNET Sendai is a third-sector company established in December 1986 by the Sendai City Government, the Sendai Chamber of Commerce, the Miyagi Prefectural Government, a leading local bank, an electric power company and some 120 other major companies based in the region. COMNET is short for COMMunity NETWORK, one of the first large-scale regional computer network service companies backed by a local government. The network service was established in July 1987, with about 500 paid members, and a new host system which can support several thousand users, computer conferencing, databases and online transactions.

USER APPLICATIONS

Business: Skeptical at first, but getting more serious

There is a relatively high level of interest in computer conferencing (CC) in Japan, much more so than in electronic mail or BBSs. The business community in particular has shown interest in the applications for CC, but it has been viewed with suspicion as well. Yet recently, after each of the major ministries separately established official policy study groups for PC networks in late 1987, the attitude of large corporations towards PC networks has begun to change.

According to a recent mail-survey by MITI (Ministry of International Trade and Industry), some 70% of the companies surveyed responded that they are either trying to use PC networks or have high interest in using them in the near future for business communications purposes.

A number of large organizations have begun experimenting with communications networks internally. Recruit Corporation is among the largest of these companies, followed by the Mitsui Group, Dai-ichi-Kangyo Group, Nivea-Kao, Dentsu (an advertising agency), Fujitsu, Matsushita, Tokyo Electric Power, Asahi-Kasei, and MITI.

Recruit Corporation: The first intra-company communication network in Japan

Japan's first intra-company communication network, 'Aishiteru I' ('I love you' in Japanese), was started last June by Recruit Corporation. Recruit is one of Japan's largest information service companies, publishing a number of recruiting and job finding magazines, as well as several real estate and tour information magazines. The company is currently trying to diversify, and has begun to penetrate the telecommunications market by re-selling dedicated telephone and data line networks to other companies.

'Aishiteru I' was installed to improve communications within the organization, to achieve a more creative working environment, to gather knowledge and wisdom beyond conventional organizational systems or regional barriers and to help employees communicate across conventional top, middle and bottom management barriers.

The subjects available on Aishiteru I vary, ranging from very serious strategical discussions to casual, day-to-day matters. With the success of the first trial system, Recruit's management has decided to provide 500 laptop computers for middle managers and to expand the network company-wide in 1989.

International Connectivity: Japan and Beyond

Most of the PC network services in

Japan concentrate on building a Japanese userbase. One system, however, the TWICS BeeLINE, concentrates on international connectivity and communications. Japanese users only constitute about 50% of the total number of TWICS Bee LINE users, the other 50% accessing the system from the US, the UK, Canada, W. Germany, France, the USSR, South Africa and other countries via numerous international access methods. TWICS Bee LINE runs on a MicroVAX II and supports computer conferencing (PARTI), real-time communications as well as an x.400 mail. The system was established by Sakakoh (A fish produce company), and is now owned and run by IEC (a large English education foundation).

THE FUTURE

Waiting

To sum up, while the initial 'boom' seems to be cooling off, a new direction in PC networking seems to be taking shape — corporate applications. The merits of networking for individual users have become well known, most PC networks being widely used for hobby purposes, SIGs, and professional networking.

The majority of business people have yet to engage in computer networking but most are highly interested in the business applications made possible by such networks.

In 1987, several government agencies (MITI, MPT, the Ministry of Home Affairs, and the Science and Technology

Agency) started up study groups to conduct research on PC networking with an eye toward experimentation and policy making.

Current obstacles

Two major obstacles to increased PC networking are keyboard phobia, and a fear of the computer hardware and software. Another fear that is hindering this field is that the free and smooth flow of information will ruin existing organizational structures and systems.

Opportunities

The technology for PC networking is available now, and sooner or later people will use it. Large organizations are facing the challenges inherent in change; but unless they acquire network technology, they have little chance of surviving.

The best scenario for the future is one in which companies, government agencies and individuals begin using networks as frequently as mail and telephone today. The worst case scenario for the future is one in which people do not feel comfortable with electronic communications and interactions, and go back to face to face means of communicating with one another. In this scenario, only a few highly "network-literate" people would continue to use the medium, while the rest of the people lose interest.

NOTE:

This article was written based on a presentation titled, "The Business of Networking in Japan — PAST, PRESENT and the FUTURE" given by the author at the Electronic Networking Association's conference "Beyond Electronic Mail" in Philadelphia, May 13, 1988.

REFERENCES

Biographical Data

The author of the preceding article, Izumi Aizu, is Principal of the Institute for Networking Design. Born in 1952, he has experience in the area of printing, translation, international advertising, public relations and marketing. Mr. Aizu has also been active in technical writing, especially in the field of Japanese language for personal computers and word processors. He is currently serving as the secretary general of the Networking Forum Organizing Committee and is a member of government study groups on computer networks at MITI, MPT, and the Ministry of Home Affairs.

In May of 1988, Mr. Aizu received ENA (Electronic Networking Association)'s first award, the David Rodale Award, for his contribution to building global communities.

Mr. Aizu's works include:

"Hajimete no Apple (My first Apple)", an original introductory manual for Apple IIc computer. (1984)

"The Complete Guide to Writing Computer Software Manuals" (Translation, 1985)

"Report on Personal Computer Networks in U.S.A." (1985)

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CURRENT NEWS

COMMO EQUIPMENT OUTPUT GROWING FAVORABLY

The value of communications equipment manufactured in Japan is expected to achieve double-digit growth again this fiscal year. The main factors contributing to this growth are Nippon Telegraph and Telephone (NTT) Corporation's investments in digitalization, and an increase in exports of facsimile machines. Influenced by this activity, Japanese manufacturers of communications equipment have all invested in plants and equipment, and there is a big rush to increase the numbers of software development personnel needed for the development of digital network equipment for integrated services digital networks (ISDN).

As stated above, the growth in facsimile output is the result of increased exports, primarily to the United States and Europe. Facsimile machines are exhibiting a two-fold increase by value and a three-fold increase by volume over exports recorded the previous year. Demand for these machines is spreading domestically as well, especially at private offices and stores. The value of facsimiles manufactured in Japan between January and

July of this year worked out to 257,867 million yen, a roughly 29.4% increase in output over the same period the year before. The major makers of these machines have all established production facilities in foreign countries, but the procurement of parts in those countries is proving a problem. This is preventing them from locally manufacturing the numbers of facsimiles necessary to meet demand.

In addition to the increased volume of communications equipment being produced this year, we are also witnessing some changes in the quality of these machines. The reasons for these changes can be attributed to the construction of corporate data communications networks and the digitalization of communications equipment. Increased communications traffic and correspondingly lower communications costs are convincing major corporations and other companies to push forward with the construction of leased line networks. Thusfar, over 4,000 high-speed leased digital communications lines have been introduced into the communications networks of Japanese corporations. The demand for private branch exchanges (PBX) that utilize in-house communications lines is also on the rise.

NTT commenced offering ISDN services here in April, 1988, and has been steadily expanding the geographical areas to which it provides these services. This fact, combined with the progress being made on standardizing the machines and equipment used in line with ISDN services, is leading the experts to predict that the value of communications equipment output in Japan will continue to exhibit favorable growth in future as well.

FLOOD OF APPLICANTS FOR JOINT RESEARCH PROJECTS

There have been a flood of applications from research teams the world over interested in participating in a joint project advertised by the Japanese Government in line with its "Human Frontier Science Program," a basic research program to be undertaken on a cooperative basis with other countries around the globe.

This joint project, which is designed to conduct basic research on higher order mental functions and the recognition of and response to these functions at the molecular level, is the first of a number of such endeavors to be carried out as part of the large-scale cooperative research concept being implemented by Japan, the United States and Europe under the auspices of the Human Frontier Science Program. Japan began advertising for research teams interested in taking part in this project in July, 1988. The only condition for applying to participate in this project is that the team must be international in nature, i.e. must consist

of researchers from three or more countries, including Japan.

A maximum of 30 million yen will be allotted for each team of researchers taking part in this project, and the Ministry of International Trade and Industry (MITI)'s Electrotechnical Laboratory, which is serving as the secretariat for the project, advertised for 5 teams. To date, a total of 42 teams have applied.

Of these 42 teams, 23 applied to do research on brain functions and the remaining 19 want to do work at the molecular level. Broken down by country, there are Japan-U.S.-U.K. teams, Japan-U.S.-German teams and Japan-U.S.-Canadian teams. Outside of teams with Japanese researchers, those with American researchers were overwhelmingly numerous.

MITI, MOE GOING ALL OUT FOR COMPUTER EDUCATION

The Ministry of Education (MOE) has decided to significantly increase its subsidization of computer facilities and equipment at public elementary and secondary schools in preparation for the introduction of computer education programs into these schools in 1992. MOE has established a special facilities subsidization system for the development of educational teaching methods, and up until now has assisted in the procurement of computers at public schools by subsidizing one half of the cost of these machines. In its request for budgetary funds for 1989, MOE decided to increase

its subsidies for computers and related equipment at public schools from 2.9 to 3.8 billion yen. Furthermore, this ministry included the establishment of computer rooms as part of its subsidization system for large-scale improvements, which to date has been limited to subsidizing the construction costs involved in improving school buildings and grounds. An estimated 10 billion yen, or roughly 10% of the total improvement budget of 100 billion yen, is expected to be set aside for the establishment of computer rooms.

The Ministry of International Trade and Industry (MITI) has decided to cooperate with MOE fully in this endeavor in hopes of strengthening the education system for computer engineers in Japan. MITI and its Center for Educational Computing (CEC) are busily working to develop standards for educational computers and to create a system whereby they can introduce these computers into selected test schools by the latter half of 1989. These efforts are aimed at improving computer education at Japanese public elementary and secondary schools, which lag far behind their counterparts in the U.S. and Europe in this area.

JAPAN TELECOM TO MERGE WITH RAILWAY TELECOMMUNICATION

The Japan Telecom Co., Ltd. is working out last minute details for its merger with the Railway Telecommunication Corp. in December 1988. Both Japan

Telecom and Railway Telecommunication are new common carriers (NCC) affiliated with the various Japan Railways (JR) companies.

Japan Telecom was founded in October 1984, six months prior to the privatization of Nippon Telegraph and Telephone Public Corporation (NTT), with financing received from JR East, JR Tokai, JR West, Mitsui & Co., Ltd. and Sumitomo Corporation. The company is capitalized at 9 billion yen and employs 650 personnel.

Railway Telecommunication was established in April 1987 in line with the breakup and privatization of the Japanese National Railways Corporation (JNR), and is basically the incorporated successor to JNR's railway telephone operations. Railway Telecommunication is capitalized at 3.2 billion yen and has 570 employees on its payroll.

Japan Telecom is providing telephone services via its optical fiber cable, which parallels the Tokaido Shinkansen (Bullet Train) line. For its part, Railway Telecommunication operates a 7,030-kilometer network of microwave circuits that interconnect key cities throughout Japan, and is using this network to provide leased line and broadband group telephone services to the various JR companies and their subsidiaries and affiliates.

By merging together, these two companies will become the largest of the NCCs created following the deregulation of the telecommunications business in Japan in April 1985. This move is designed to enable the new firm to compete

on a more equal basis with NTT.

PRC ORDERS HUGE LIBRARY INFORMATION NETWORK FROM NEC

The People's Republic of China (PRC) recently submitted an order to Nippon Electric Corporation (NEC) for a mainframe-based library information network system that will be the largest the world has ever seen.

Two (2) ACOS System 630 general-purpose mainframe computers and 270 PC-9800 series personal computers (PCs) will comprise this huge network system. The ACOS System 630 mainframes will serve as the host computers, and will be used to store the Peking National Library's book management database. The PC-9800s will function as the terminals. This system is valued at 900 million yen.

The Peking National Library is the second largest library in the world after the United States' Library of Congress. The computer system ordered from NEC will be used to manage the 14 million

books maintained at this library, and will be equipped with terminals and laser printers capable of handling the 32,000 Chinese characters recently designated by the PRC as forming the basis for the written Chinese language, as well as the printed word from 60 different countries, including the United States, France, Germany, and the Soviet Union. Users of this library information network system will be able to operate the terminals to retrieve book-based information in 61 languages.

NEC is scheduled to deliver the computer system by February 1989, and after that will work together with the Peking National Library to develop a database system that can be used to efficiently manage and retrieve library information. This system isn't scheduled to go into fullscale operation until 1991.

The exporting of computers to COMBLOC countries is strictly controlled by COCOM. The system ordered from NEC for the Peking National Library is the largest possible within the framework laid down by COCOM.

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